



13.0 ENVIRONMENTAL MONITORING PROGRAM

13.1 Introduction

As part of the EA process, Treasury Metals has detailed a number of proposed monitoring programs divisible by discipline as per the CEA Agency request. The monitoring programs outlined below are indicative of those that monitor for environmental effects of the Project. It should be noted that monitoring programs that do not lend themselves to fit into an environmental discipline outlined throughout this EIS, will be created at a later date through permit applications. These monitoring programs could include a dam monitoring program, a health and safety monitoring program, and a traffic monitoring program.

The EA monitoring programs are designed to be adaptive to account for any environmental effects that were not expected, new information that becomes available, or mitigation measures that are found to not to be effective. Therefore, the monitoring programs are subject to changes as the Project is further developed, and as input is received from government agencies, Aboriginal groups, and stakeholders. This inclusive process will allow for all parties involved to have input into the final environmental monitoring program.

Additionally, a number of monitoring programs will be developed in pursuit of environmental approvals and permits, but will be developed at a later date. These specific regulatory monitoring programs require direct input from applicable government agencies, which is historically completed following the approval of the EIS. The monitoring programs provided in this section of the EIS take into consideration input from the Round 1 information requests made by government agencies, Aboriginal peoples and stakeholders, to incorporate concerns made throughout Project engagement.

13.2 Terrain and Soils

13.2.1 Overview and Objectives of Proposed Monitoring

The predicted effects from the Project on terrain and soils have been presented in Section 6.2 of the revised EIS. A singular residual adverse effect will remain of the WRSA on the natural landscape. Through avoidance (Section 6.2.3) and mitigation measures (Section 6.2.5), Treasury Metals is confident that the WRSA will not dramatically alter the natural landscape when viewed from Thunder Lake. Once it has been vegetated, it may be difficult to discern the WRSA from the surrounding area. To confirm this, Treasury Metals will record the views from Thunder Lake over the life of the Project to show how noticeable the WRSA is. The proposed terrain and soils monitoring program will begin once waste rock has begun being deposited in the designated WRSA, and is at the highest elevation and will end in the closure phase when the WRSA will be covered and vegetated.



13.2.2 Proposed Monitoring Program

The proposed terrain and soils monitoring will include:

-) Survey the elevation of the top of the WRSA
 - o Use survey equipment to periodically record the elevation of the top of the WRSA
-) Record photographic views of the WRSA from set locations on Thunder Lake
 - o Establish set locations for recording photographic record of the WRSA (same locations as used in pre-construction visualization)
 - o Annually photograph the WRSA from the set locations on Thunder Lake until the WRSA is at its maximum height, prior to vegetation of the WRSA
 - o Once the WRSA is vegetated, an annual photograph the WRSA will be taken in the mid-summer from the set locations on Thunder Lake until the end of the closure phase

13.2.3 Reporting

Treasury Metals intends to provide confirmation in the Annual Monitoring Report that the terrain and soils avoidance and mitigation measures have been implemented and are effectively minimizing aesthetic effects of the WRSA. This report will be provided to government agencies, Aboriginal peoples and stakeholders. As a minimum, the Annual Monitoring Report would provide a compendium of annual photographs taken from the Thunder Lake reference locations, together with a brief summary of any previous public complaints and follow-up.

If new public complaints were received during the reporting year, regarding Project view, the Annual Monitoring Report would include a summary of any such public complaints, including:

-) Investigation and identification of the noticeable site feature;
-) Actions taken to address the complaint; and,
-) Actions taken to mitigate the source of the complaint, if related to the Project.



13.3 Geology and Geochemistry

13.3.1 Overview and Objectives of Proposed Monitoring

The predicted effects of geology and geochemistry were summarized in Section 6.3 of the revised EIS. A single residual adverse effect on the pit lake water quality VC was identified in the post-closure phase. There were no residual effects predicted during the site preparation and construction, operations, and closure phases. The geochemical monitoring program outlined in Section 13.3.2 provides information to help demonstrate the validity of the EIS predictions and confirm the effectiveness of the mitigation measures proposed. Monitoring of the pit lake water quality as the pit lake is filling will be used to advise Treasury Metals on whether pit lake discharge into Blackwater Creek will meet PWQO, or if further treatment is required prior to the pit lake filling with water. Additionally, it is expected that a comprehensive water quality monitoring program specific to the pit lake will be required as part of the certified closure plan to be developed, filed with MNM prior to the start of construction. Additionally, a regulatory permitting process (i.e., Environmental Compliance Approval [ECA] under the *Environmental Protection Act*) may be required for the releases from the pit lake, before Treasury Metals will be able to release water from the pit lake. The ECA monitoring program will be developed following the closure activities, during the period when the pit lake is filling with water. It is expected that regulatory monitoring would apply to discharges from the pit lake into Blackwater Creek Tributary 1.

Parts of this proposed geochemical monitoring program may need to be modified to reflect the requirements of the subsequent regulatory permitting process. Such changes would aim to harmonize both the regulatory monitoring requirements (i.e., the ECA process) and monitoring to confirm the EIS findings. The proposed monitoring for pit lake water quality would begin in the closure phase, once the dewatering activities cease and the open pit begins to fill with water. It is expected that monitoring of pit lake water quality would continue into the post-closure period until the regulators are satisfied the closure landscape is functioning as intended, at which time they would instruct Treasury Metals that the monitoring can cease.

As part of the process to respond to the Round 1 information requests, Treasury Metals re-evaluated the geochemistry of the rock to be mined at the Project and took a more conservative approach to the time for the onset of acidification as well as the quality of seepage likely to result from the WRSA and the TSF. In recognition of the conservative nature of the revised assessment, additional geochemical monitoring and analyses were recommended to confirm the conservative nature of the analysis presented in Section 6.3, and to better characterize the expected long-term geochemical conditions expected for the Project.

13.3.2 Proposed Monitoring Programs

Pit Lake Monitoring

-) Pit lake water samples will be taken from a safe location on the ramp leading down into the pit using standard surface water sampling procedures.



-) Pit lake monitoring will be conducted following the cessation of groundwater pumping until the open pit is flooded or until released from monitoring by regulatory agencies.
-) Samples will be analyzed for:
 - o Metals (dissolved);
 - o Major anions and cations; and
 - o In-situ field parameters (temperature, reduction-oxidation potential, pH, dissolved oxygen).
-) Data analysis will include long-term tracking of seasonal and annual trends, together with applicable climate and hydrological data necessary to calculate trends in loading criteria.

Pit Lake Discharge Monitoring

-) Water samples will be taken from the discharge location from the pit lake into Blackwater Creek Tributary 1
-) Samples will be analyzed for:
 - o Metals (dissolved)
 - o Major anions and cations
 - o In-situ field parameters (temperature, reduction-oxidation potential, pH, dissolved oxygen)

Geochemical Monitoring

-) Conduct supplemental ML/ARD static testing analysis to assess the potential influence of aged (2009 and 2010) drill core on previous ML/ARD investigations and more completely assess mercury as a contaminant of potential concern, as well as chloride and phosphorus.
-) Continue operation of existing field cells (one for each lithology) and consider initiation of additional field cells using blended lithologies to simulate field conditions.
-) Initiate a supplemental kinetic testing program for waste rock and tailings to address gaps in the current program.



-) Explore mitigation options and possibly further studies on waste rock and tailings covers to support detailed planning and design to minimize the risk of ARD development and to lower potential water treatment costs during operations and work toward eliminating a need for water treatment in the closure and post-closure phases of the Project.
-) Develop a program to identify suitable construction rock for the project that could target previously unsampled regions of the open pits, other potentially low sulphide on-site rock or identification of an off-site source.
-) Continue to update mine rock management planning for all aspects of the Project including underground operations, based on the further and continuing geochemical studies.
-) Develop a pit lake model to predict pit lake water quality during the pit filling and post-closure periods, with such model to identify applicable short-term and long-term water management and treatment requirements. The pit lake model may be periodically updated as new information becomes available.

13.3.3 Reporting

Treasury Metals intends to provide the pit lake water quality monitoring results as part of the Annual Monitoring Report provided to government agencies, Aboriginal peoples and stakeholders on an annual basis following the cessation of groundwater pumping until the open pit has filled or until released from monitoring by regulatory agencies. In the event that the quality of the water as the pit lake was filling with water exceeds the PWQO, thus indicating the potential requirement for batch treatment, the Annual Monitoring Report will also include the following:

-) Timing and nature of the batch treatment undertaken to improve water quality;
-) Confirmation that batch treatment improved the water quality; and,
-) Any updates on pit lake modeling results.

Additionally, the regulatory surface water quality monitoring results will be provided to the applicable government agencies in regulatory reports. The format of this will be determined by those applicable government agencies prior to discharge from the pit lake into the environment.

13.4 Noise and Vibration

13.4.1 Overview and Objectives of Proposed Monitoring

The predicted effects of the Project on noise and vibration were presented in Section 6.4 of the revised EIS. The noise predictions show that, even with the implementation of mitigation measures presented in Section 6.4.5, there will be residual adverse effects of the Project on noise.



However, the results of the conservative noise modelling indicate that residual noise levels would meet the relevant criteria established by MOECC, and thus there would likely be no directly identifiable need for noise monitoring under the regulatory approval process for noise in Ontario (i.e. ECA under the EPA). Additionally, the predicted residual effects of noise and vibration associated with blasting activities are below the precautionary limits identifying the need for noise and vibration monitoring in NPC-119 (MOECC, 1978). Therefore, no noise and vibration monitoring for blasting activities is anticipated to be needed from a regulatory perspective. That stated, it is possible that the MOECC could require Treasury Metals to implement a regulatory noise monitoring program as part of the ECA approval process for the Project.

Notwithstanding the conclusion that noise and vibration monitoring is not likely to be required from a regulatory perspective (pending the MOECC position during the pending ECA process), Treasury Metals have identified three noise and vibration monitoring programs (Ambient Noise, Wildlife Noise, and Blasting Noise and Vibration) that will be implemented to help demonstrate the validity of the EIS predictions and confirm the effectiveness of the mitigation measures proposed. Additionally, the monitoring program will provide information to help address potential complaints from adjacent residents, should they occur.

The noise and vibration monitoring program, outlined in Section 13.4.2, would begin during the site preparation and construction phase. If blasting is not required until the operations phase, that component of the monitoring would not start until the operations phase. Monitoring of blasting noise and vibration would cease at the end of operations, while the other monitoring would continue through the closure phase. There would be no need for noise and vibration monitoring during the post-closure phase as there would be no sources of noise at the site.

13.4.2 Proposed Monitoring Programs

13.4.2.1 Ambient Noise

-) Ambient noise monitoring at selected sensitive receptors, including at selected receptors along East Thunder Lake Road and along Tree Nursery Road.
-) The frequency and duration of ambient noise monitoring campaigns will be in accordance with Provincial approvals. Ambient noise monitoring will be conducted as follows:
 - o Campaign during site preparation and construction activities
 - o Campaign during operations when open pit mining activities are in pit 1 (western most pit) and relatively close to the surface
 - o Campaign during closure activities
 - o If complaints are received, additional campaigns may be considered, as appropriate



-) During the program, noise will be recorded in the following manner:
 - o Hourly, A-weighted equivalent noise levels (L_{eq} , in dBA)
 - o 72-hours of monitoring at each location

13.4.2.2 Wildlife Noise

-) A campaign to identify the extent of the 50 dBA noise contour to identify and confirm areas where noise could affect wildlife.
-) The frequency and duration of wildlife noise monitoring campaigns will be in accordance with Provincial approvals. Wildlife noise monitoring will be conducted as follows:
 - o Campaign during site preparation and construction activities
 - o Campaign during operations.=
-) Although wildlife may not respond in the same manner as humans, the available literature relies of noise thresholds based on A-weighted measurements. During the program, noise will be recorded in the following manner:
 - o Hourly, A-weighted equivalent noise levels (L_{eq} , in dBA); and
 - o A series measurements at varying distance and locations around, and outside the operations area that will be used to develop a spatial distribution of 1-hour equivalent noise readings.

13.4.2.3 Blasting Noise and Vibration

-) Noise and vibration monitoring during blasting at selected sensitive receptors along East Thunder Lake Road.
-) Blasting noise and vibration monitoring will be conducted as follows:
 - o Campaign during operations when open pit mining activities are in pit 1 (western most pit) and relatively close to the surface; and,
 - o If complaints are received, additional campaigns may be considered, as appropriate
-) During the program, noise will be recorded in the following manner:



- Peak sound pressure (in dBA); and,
- Peak particle velocity (cm/s).

13.4.3 Reporting

Treasury Metals intends to provide the noise and vibration monitoring results (ambient noise, wildlife noise, blasting noise and vibration) as part of the Annual Monitoring Report provided to government agencies, Aboriginal peoples and stakeholders. In addition, a summary of noise complaints received by Treasury metals, if any, will also be documented along with steps taken to confirm the reason and or validity of the complaint. For valid complaints, the Annual Monitoring Report will include the following:

-) Results of the investigation to identify the cause of the elevated noise levels;
-) Summary of the actions taken by Treasury Metals to mitigate or resolve the elevated noises, if associated with the Project; and,
-) Confirmation that the remedial actions were successful in addressing the issues.

If no specific noise or vibration monitoring was completed during a particular year, the Annual Monitoring Report would provide a brief summary of results from the preceding year when monitoring was completed.

13.5 Light

13.5.1 Overview and Objectives of Proposed Monitoring

The predicted light effects from the Project are presented in Section 6.5. The light intrusion modelling determined that with the avoidance (Section 6.4.3) and mitigation (Section 6.4.5) measures, light trespass from the Project would not exceed 0 lux outside the operations area during all phases of the Project.

Currently there are no regulatory frameworks that would apply for light and light trespass, therefore, it is not expected there would be any regulatory monitoring requirements for monitoring light.

Treasury Metals has identified a focused light monitoring program that will be implemented to help demonstrate the validity of the EIS predictions and confirm the effectiveness of the mitigation measures proposed. As there will be no permanent lighting during the site preparation and construction phases, the program would not start until operations, when the processing facility and associated infrastructure are fully developed. There will be no permanent lighting sources during the closure and post-closure phases, so there would be no monitoring after operations stop.



13.5.2 Proposed Monitoring Program

Light Trespass:

-) Following the commissioning of the process plant and associated infrastructure, the configuration of the lighting will be used to confirm the lighting system was installed with consideration for the effects avoidance (Section 6.5.3) and mitigation (Section 6.5.5) measures relied on in the assessment. This is to be completed once, following the initial installation of the light system.
-) A focused monitoring campaign to record light trespass levels associated with the commissioned process plant will be conducted once following the completion of major site building infrastructure (i.e. process plant).
-) Document complaints from local residents regarding light trespass from the Project and determine the source of the trespass.

13.5.3 Reporting

Treasury Metals intends to provide confirmation in the Annual Monitoring Reports following the year that the light avoidance and mitigation measures have been implemented. Additionally, the Annual Monitoring Report would provide a brief summary of any public complaints regarding light intrusion. This report will be provided annually to government agencies, Aboriginal peoples and stakeholders.

13.6 Air Quality

13.6.1 Overview and Objectives of Proposed Monitoring

The predicted effects of the Project on air quality, taking into account the avoidance measures incorporated into the Project (Section 6.6.3), are presented in Section 6.6.4. With the consideration of air mitigation measures (Section 6.6.5), residual adverse air quality effects are predicted to remain (Section 6.6.6). These effects would be most notable in the vicinity of the operations area, but will extend into areas where traditional uses of the land could occur, and could extend beyond the property line.

Although there were predicted residual adverse effects on ambient air quality, it was also demonstrated that the Project would be able to achieve compliance with the O.Reg 419/05 point of impingement criteria at the property boundary, which would be required in order to support the regulatory permitting process to obtain an ECA under the EPA in Ontario (see Appendix J-3). Although compliance is demonstrated, regulatory air monitoring requirements could be required by the MOECC as part of the provincial permitting process. The details of a regulatory monitoring program, would therefore be developed as part of the permitting process. This process would also



include the development of a Best Management Practices Plan for Dust (a draft Best Management Practices Plan for Dust is provided in Appendix J-4).

Notwithstanding the potential regulatory monitoring requirements, Treasury Metals has identified an air quality monitoring program as part of the EIS that will be implemented to help demonstrate the validity of the EIS predictions and confirm the effectiveness of the mitigation measures proposed. Additionally, the monitoring program will provide information to help address potential complaints from adjacent residents, should they occur. This proposed EIS air quality monitoring program outlined in the following section is subject to change pending input from the MOECC during the permitting process.

The proposed air quality monitoring program will begin prior to site preparation and construction and would cease once heavy equipment operations cease in the closure phase.

13.6.2 Proposed Monitoring Program

Air quality monitoring will be conducted in the following manner:

- J A continuous air monitoring station will be installed near the security gate, south of the Project, and to the west of Normans Rd.
 - o The station will include analyzers to measure the following: total suspended particulate matter (TSP); particulate matter nominally smaller than 10 μm (PM_{10}); particulate matter nominally smaller than 2.5 μm ($\text{PM}_{2.5}$); and nitrogen dioxide (NO_2).
 - o The analyzers will be capable of recording the concentrations over the following time periods: TSP – 24-hour and annual; PM_{10} – 24-hour; $\text{PM}_{2.5}$ – 24-hour; NO_2 – 1-hour and 24-hour.
- J Passive sampling of NO_2 and SO_2 to the west of the Project on Thunder Lake Rd. and to the south of the Project at Anderson Rd. These samplers would monitor average concentrations over 30-day periods through the year.
- J A meteorological station will be installed in the operations area to record continuous meteorological data. This data will be used in conjunction with the air quality data to determine trends, and will provide support information for ongoing Project engineering.
- J Treasury Metals will record any complaints received regarding air quality associated with the Project.



13.6.3 Reporting

Treasury Metals intends to provide a summary of the air quality monitoring results for all the measured parameters as part of the Annual Monitoring Report provided to government agencies, Aboriginal peoples and stakeholders on an annual basis. The Annual Monitoring Report would also summarize any public complaints regarding air quality, including:

-) Investigation and identification of the sources of emission;
-) Actions taken to address the complaint;
-) Actions taken to mitigate the source of the complaint, if related to the Project; and
-) Summary of annual air quality complaints.

13.7 Climate

13.7.1 Overview and Objectives of Proposed Monitoring

The predicted effects of the Project on climate were presented in Section 6.7, and it was identified that the expected GHG emissions from the Project, based primarily on fuel consumption for the Project, will exceed the 10,000 t/year regulatory reporting threshold outlined in the Ontario Cap and Trade Program (O. Reg. 144/16). However, the Project is predicted to be below the “large emitter of GHGs” threshold of 25,000 t/year, therefore Treasury Metals would not be a direct participant in the cap-and-trade program in the province. The proposed monitoring program for climate is consistent with the regulatory reporting requirements for GHG emissions.

13.7.2 Proposed Monitoring Program

The climate monitoring program would focus on the requirements under the Ontario Cap and Trade Program (O. Reg. 144/16), and would include:

-) Record the annual fuel usage, as stipulated by O. Reg. 144/16 and described in the Greenhouse Gas Management Plan (Section 12.8); and
-) Use the calculation stipulated by O. Reg. 144/16, as set out in the Greenhouse Gas Management Plan (Section 12.8) to calculate the annual Project GHG emissions.

13.7.3 Reporting

As a regulatory requirement under O. Reg. 144/16, Treasury Metals will report the findings of the GHG emissions calculation on an annual basis to the MOECC. In addition, Treasury Metals



intends to provide the GHG calculation results as part of the Annual Monitoring Report provided to government agencies, Aboriginal peoples and stakeholders.

13.8 Surface Water Quality

13.8.1 Overview and Objectives of Proposed Monitoring

The predicted effects to surface water quality from the Project are summarized in Section 6.8.4 of the revised EIS. Even with the avoidance measures described in Section 6.8.3, and mitigation measures outlined in Section 6.8.5, residual adverse effects from the Project on surface water quality will remain. Modelling has determined that the resulting water quality in the receiving environment will be equivalent to existing conditions, or will meet PWQO. The proposed surface water quality monitoring program will help confirm the findings of the EIS and confirm the effectiveness of the mitigation measures. The proposed EIS mentoring program is described in Section 13.8.2).

In addition to the EIS monitoring, it is expected there will be a comprehensive regulatory surface water quality monitoring program developed in cooperation with government agencies, as part of the Project permitting process (under the ECA process governed by the MOECC and under Schedule 5, Part 1 of the MMER). This regulatory program would include requirements for monitoring effluent and water quality of the receiving waterbodies. These monitoring programs will incorporate all surface water quality monitoring that will be required during the life of the Project from a regulatory perspective. The surface water monitoring program outlined below in Section 13.8.2 as a part of the EA process is subject to change upon finalization of the regulatory monitoring program designated by applicable government agencies to allow for a single, harmonized monitoring program that encompasses all surface water quality monitoring.

For consistency with the available data, and the assessment of effects, the proposed program would use receiving water stations used for during the baseline monitoring (Figure 13.8.2-1). The focus of the program will be on those watercourses where potential effects to surface water quality could be seen as a result of the Project. The surface water quality monitoring program, developed for the EA, will begin prior to the site preparation and construction phase of the Project, and will cease once Treasury Metals is released from monitoring by regulatory agencies.

13.8.2 Proposed Monitoring Program

A total of 12 proposed monitoring locations that were used in the baseline report are shown in Figure 13.8.2-1. Treasury Metals intends to carry these locations forward for their surface water quality monitoring program. Each sample location will be analyzed for relevant parameter suites:

-) Metals (dissolved);
-) Cyanide in monitoring wells around TSF (total, free and weak acid dissociable (WAD) for first year, then total and WAD thereafter);



-) Major anions and cations; and
-) In-situ field parameters (temperature, reduction-oxidation potential, pH, dissolved oxygen).

In addition to the above monitoring program, it is recognized that there will be a specific requirement to monitor the effluent discharged from the Project as part of the regulatory monitoring program to support the provincial permitting process (i.e., an ECA under the EPA). The specific details for the effluent monitoring component will be worked out in consultation with the MOECC.

13.8.3 Reporting

It is anticipated that a regulatory surface water quality monitoring program will be developed during the ECA process and other permitting applications, which will stipulate regulatory reporting requirements. These surface water quality monitoring results will be reported to the applicable government agencies at the predetermined reporting frequency.

Additionally, Treasury Metals intends to provide the surface water quality monitoring results as part of the Annual Monitoring Report provided to government agencies, Aboriginal peoples and stakeholders. For any surface water quality monitoring that exceeded the management triggers (see Section 12.3), the Annual Monitoring Report will include the following:

-) Results of the investigation to identify the cause of the elevated readings;
-) Summary of the actions taken by Treasury Metals to mitigate or resolve the elevated readings, if associated with the Project; and
-) Confirmation that the remedial actions were successful in addressing the identified issues.



Treasury Metals
Revised EIS Report
Goliath Gold Project
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Figure 13.8.2-1: Proposed Surface Water Sampling Locations



13.9 Surface Water Quantity

13.9.1 Overview and Objectives of Proposed Monitoring

The predicted effects of the Project on surface water quantity are summarized in Section 6.9.4 of the revised EIS. The predictions show that even with the mitigation measures outlined in Section 6.9.5, there will be residual adverse effects to surface water quantity during the operations phase, and through into post-closure. As the Project will need to obtain permits to take water as part of the mine dewatering activities, as well as for fresh water withdrawals, it is also likely that some form of regulatory monitoring to confirm surface flow patterns will be required.

The proposed surface water quantity monitoring program is designed to validate the predicted effects in the EIS, and confirm the effectiveness of the mitigation measures. To do this, the watercourses potentially affected by the Project will be included in flow monitoring. This program will utilize monitoring locations previously used for establishing baseline conditions for surface water quality (see Figure 13.8.2-1). These locations correspond with the effects predictions, and allows for a more efficient monitoring program. Monitoring will begin prior to site preparation and construction and will continue into post-closure. It is likely the monitoring post-closure will be continued until the regulators are satisfied that the closure landscape is functioning as planned, and Treasury Metals can discontinue monitoring. Treasury Metals will determine what equipment will be used to measure flow rates in the watercourses closer the commencement of monitoring to ensure that industry standard equipment is used.

13.9.2 Proposed Monitoring Program

Blackwater Creek

-) Discrete flow monitoring would be conducted upstream (SW-TL1a) and downstream (SW_JCTa) of the proposed discharge point in Blackwater Creek (see Figure 13.8.2-1).
-) Volume of effluent discharged into Blackwater Creek on a daily basis, per O.Reg 560/90, 561/94, Clean Water Regulation

Thunder Lake Tributaries 2 and 3

-) Two discrete flow measurement stations downstream of the Project area, one on Thunder Lake Tributary 2 (SW-7) and one on Thunder Lake Tributary 3 (SW-8), as shown on Figure 13.8.2-1.
-) In addition, continuous flows will be recorded as water flows into the irrigation ponds on Thunder Lake Tributaries 2 and 3. These readings will be used to determine the flows available in the irrigation ponds available for use a fresh water withdrawals.



Little Creek and Hoffstrom's Bay Tributary

-) Flow readings will be taken periodically in both Little Creek (SW-2) and Hoffstrom's Bay Tributary (SW-9), shown on Figure 12.8.2-1.

13.9.3 Reporting

It is anticipated that a regulatory surface water quantity monitoring program will be created during the ECA process, which will stipulate regulatory reporting requirements including monitoring required for the Permit to Take Water.

Additionally, Treasury Metals intends to provide the surface water quantity monitoring results as part of the Annual Monitoring Report provided to government agencies, Aboriginal peoples and stakeholders.

13.10 Groundwater Quality

13.10.1 Overview and Objectives of Proposed Monitoring

The predicted effects of the Project on groundwater quality are summarized in Section 6.10.4 of the revised EIS. Groundwater quality predictions indicate that with the mitigation measures outlined in Section 6.10.5, no residual effects would remain during the life of the Project. During the operations phase, no groundwater would leave the site due to the drawdown effect from dewatering activities capturing seepage. Although seepage would report to surface watercourse into post-closure when dewatering activities cease and groundwater levels return to near pre-development levels, this was assessed as an effect to surface water quality and presented in Section 6.8. Additionally, extensive groundwater modelling has determined that it is unlikely that seepage in the post-closure would affect drinking water well quality of any of the private wells in the area.

As part of the baseline groundwater quality data collection, Treasury Metals installed a number of groundwater monitoring wells and developed an extensive groundwater quality monitoring program. The EA monitoring program presented in Section 13.10 for groundwater quality is more detailed than many of the other monitoring programs due to the complexity and logistics of developing a groundwater well network for both groundwater quality and groundwater levels, along with the need to fully understand and model the dewatering zone of the Project. Additional wells will be installed as outlined in the following sections prior to the commencement of Project operations. The monitoring program will continue from prior to site preparation and construction into the post-closure phase, stopping when regulators confirm that the closure landscape is functioning as planned and Treasury Metals can stop monitoring.

The groundwater quality monitoring program presented in the following sections will be included as both EA and regulatory monitoring programs. It is therefore subject to change following review



and input from applicable government agencies. That stated, Treasury Metals is comfortable that the plan provided below will effectively capture all groundwater quality effects from the Project.

13.10.2 Proposed Monitoring Program

13.10.2.1 Groundwater Monitoring Wells

Groundwater monitoring wells will be either for groundwater sampling or groundwater level recording, with some wells serving both purposes. The primary horizon for groundwater flow is the shallow bedrock (SBR) horizon and, when present, the basal sand (BS) aquifer that occurs at the base of the fine-grained, clay dominated glaciolacustrine deposits (the dominant overburden of the Project area). Most monitoring wells will be screened within either the SBR or BS, or possibly both depending on ground conditions encountered during drilling. In the vicinity of the TSF, a sand-clay/silt-sand sequence occurs. In this location, wells will be nested to sample the surficial sand (SS) and BS if the sand-clay/silt-sand sequence is encountered (i.e., similar to the existing BH3A Shallow and BH3A Deep). The well screen in the SS will monitor the performance of the seepage collection ditches in collecting shallow horizontal groundwater flow out of the TSF, whereas the well screen in the BS will provide monitoring for vertical seepage out of the base of the TSF.

13.10.2.2 Groundwater Monitoring Installations

It is expected that a total of eight well screens and piezometers (six single-screen wells, one nested well and one nested vibrating wire piezometer [VWP]) of the current groundwater monitoring installations will be used for the future groundwater monitoring network (Figure 13.10.2-1). The locations of the monitoring well network includes:

-) The east-west striking mineralized zone is expected to have elevated bedrock hydraulic conductivities, which could influence the extension of the drawdown cone towards the west. The western VWP nest (TL131121) lies in a strategic location for measuring the groundwater pressure during dewatering around the mineralized zone to the west of open pit.
-) Three of the wells are located around the TSF (BH1A, BH2A and BH3A) and one well close to the WRSA (BH6D) which are suitable for groundwater quality monitoring. BH2A is in an up-gradient location and would provide background groundwater quality data during operation of the TSF.

An additional eight monitoring locations will be installed, as per Figure 13.10.2-1 (proposed new wells for GWM network) to expand coverage of the groundwater quality monitoring network. These will include:



- J Three wells (NW1, NW2 and NW3) are close to the perimeter of the TSF for groundwater quality monitoring. These will be nested with a screen in the SS and the BS/SBR (i.e., top and bottom of sand-clay/silt-sand sequence).
- J Three wells (NW4, NW5 and NW6) with single screens in BS/SBR to the west of the open pit in distal locations to monitor groundwater levels between Thunder Lake and the perimeter of the Treasury property. Two of these will also be used for groundwater quality monitoring of the WRSA (NW4 and NW5).
- J Two wells (NW7 and NW8) with single screens in BS/SBR are required to the south of the open pit in distal locations to monitor groundwater levels along the perimeter of the Treasury property in the direction of Wabigoon.

All the installations of the groundwater monitoring network will be constructed and/or modified where necessary to include protective casings and markings and, if required, a barricade to prevent damage by heavy equipment during mine construction and operation. The groundwater monitoring stations are summarized in Table 13.10.2-1.



Figure 13.10.2-1: Proposed Groundwater Monitoring Network



13.10.2.3 Groundwater Quality Monitoring

There are four single screen and four nested well locations in the groundwater quality monitoring program providing a total of 12 monitoring well screens. These wells are to be screened in the SBR and/or BS with the nested well locations having an additional screen in the SS where sand-clay/silt-sand sequence is present. Groundwater quality wells will be sampled at a frequency of four times per year. Water levels will be taken prior to sampling. Samples will be analyzed for the following parameters suites:

-) Metals (dissolved);
-) Cyanide in monitoring wells around TSF (total, free and weak acid dissociable (WAD) for first year, then total and WAD thereafter);
-) Major anions and cations; and
-) In-situ field parameters (temperature, reduction-oxidation potential, pH, dissolved oxygen).

Several existing wells in the proposed groundwater quality monitoring program have been sampled as part of baseline studies with the earliest sampling dating from June 2013. These wells will continue to be sampled.

As mentioned above, the groundwater quality program sampling frequency will be quarterly for the pre-construction, site preparation and construction, and operation phases. The pre-construction phase will provide for well installation a year before site preparation and construction so as to provide a year of baseline data.

13.10.2.4 Post-Closure

Groundwater quality monitoring would be continued at least until both the TSF and WRSA are capped. Termination of the program would be expected following a satisfactory review of the monitoring data collected during mine closure.

Table 13.10.2-1: Location and Type of Groundwater Quality Monitoring

Well ID	Location	Type	Screened Units	Monitoring Objective
BH1A	West of TSF, Nursery Road	Quality	BS/SBR	Down-gradient water quality of TSF
BH2A	East of TSF, Blackwater Creek	Quality	BS/SBR	Upstream of TSF – background groundwater quality in basal sand/shallow bedrock



Well ID	Location	Type	Screened Units	Monitoring Objective
BH3A-S BH3A-D	South of TSF, Blackwater Tributary 2	Quality	SS BS	Down-gradient water quality of TSF in shallow sand Down-gradient water quality of TSF in basal sand
BH6D	West of Open Pit and WRSA, proximal	Quality and level	BS	Water level proximal to open pit and down-gradient of WRSA
TL13121-S TL13121-D	West of Open Pit, proximal	VWP	IBR – 64 mbg IBR – 223 mbg	Pressure response to dewatering in open pit in intermediate bedrock along mineralized zone
New well #1 (nested)	North of TSF	Quality	SS and BS/SBR	Northern edge of TSF – nested piezometer assuming presence of Sand-Clay/Silt-Sand sequence
New well #2 (nested)	North-west of TSF, Nursery Road	Quality	SS and BS/SBR	Down-gradient water quality – nested piezometer assuming presence of Sand-Clay/Silt-Sand sequence
New well #3 (nested)	South-west of TSF, Nursery Road	Quality	SS and BS/SBR	Down-gradient water quality – nested piezometer assuming presence of sand-clay/silt-sand sequence
New well #4	North-west of Open Pit and WRSA	Quality and level	BS/SBR	Down-gradient water quality of WRSA and water levels distal to open pit, east of Thunder Lake
New well #5	West of Open Pit and WRSA	Quality and level	BS/SBR	Down-gradient water quality of WRSA and water levels distal to open pit, east of Thunder Lake

13.10.3 Reporting

A regulatory groundwater quality monitoring program will be developed during the ECA process, which will stipulate regulatory reporting requirements. Treasury Metals intends to provide the groundwater quality monitoring results as part of the Annual Monitoring Report provided to government agencies, Aboriginal peoples and stakeholders. For any groundwater quality monitoring results that exceed management triggers, the Annual Monitoring Report will include the following:

-) Results of the investigation to identify the cause of the elevated readings;
-) Summary of the actions taken by Treasury Metals to mitigate or resolve the elevated readings, if associated with the Project; and
-) Confirmation that the remedial actions were successful in addressing the issues.



13.11 Groundwater Quantity

13.11.1 Overview and Objectives of Proposed Monitoring

The predicted effects of the Project on groundwater quantity were summarized in Section 6.11.4 of the revised EIS. After implementation of the mitigation measures outlined in Section 6.11.5, a single remaining residual adverse effect is anticipated: decreased flows in Thunder Lake Tributaries 2 and 3. This residual effect would occur once dewatering activities at the site have commenced during operations, and would continue until the open pit is fully flooded in the post-closure phase. This residual effect to groundwater quantity will be monitored as part of the surface water quantity monitoring program outlined in Section 13.9.

A comprehensive groundwater quantity monitoring program will be developed as part of the permitting and approvals process under the MOECC to obtain an ECA. The ECA will include details on monitoring groundwater levels in the drawdown zone as part of a Permit to Take Water from the open pit. In addition, Treasury Metals will conduct groundwater level monitoring in the wells installed for baseline measurements to confirm the predicted location of the drawdown zone from dewatering activities. Section 13.10.2 describes the groundwater monitoring well network that will be used. The groundwater quantity monitoring program will begin prior to the start of dewatering activities, and will cease once the groundwater levels return to near pre-development levels in the post-closure phase.

13.11.2 Proposed Monitoring Program

Groundwater Monitoring Wells

For information on groundwater monitoring wells, please see Section 13.10.2.1.

Groundwater Monitoring Installations

For information on groundwater monitoring well installations, please see Section 13.10.2.2.

Groundwater Level Monitoring

There are nine single screen monitoring wells and one nested VWP in the groundwater level monitoring program with a total of 11 monitoring well screen and piezometers. These are generally completed in the SBR and/or BS where the most drawdown is expected to be observed.

Manual water level measurements will continue on a monthly basis in the existing wells, until the Project advances to a point where the installation of continuous loggers is warranted. However, prior to mining, all wells will be equipped with pressure transducers set to record water levels at least once per day, and downloaded on a quarterly basis. Two of the wells will be equipped with a barologger to allow data correction for barometric effects. A data logger will be obtained for the VWP nested piezometer and a similar recording and downloading frequency will be undertaken



for this installation. Installation of new wells and pressure transducers/loggers will be done a year prior to mine construction.

13.11.3 Reporting

It is anticipated that a regulatory groundwater quantity monitoring program will be developed during the ECA process, which will stipulate regulatory reporting requirements including monitoring required for the Permit to Take Water.

Treasury Metals intends to provide the groundwater quantity monitoring results as part of the Annual Monitoring Report provided to government agencies, Aboriginal peoples and stakeholders. In addition, for any groundwater quantity monitoring that exceed management triggers (see Section 12.3), the Annual Monitoring Report will include the following:

-) Results of the investigation to identify the cause of the altered readings;
-) Summary of the actions taken by Treasury Metals to mitigate or resolve the altered readings, if associated with the Project; and
-) Confirmation that the remedial actions were successful in addressing the issues.

The Annual Monitoring Report will also include a summary of any public complaints regarding groundwater quantity, including:

-) Private groundwater well level complaints;
-) Actions taken to address the complaint; and
-) Actions taken to mitigate the source of the complaint, if related to the Project.

13.12 Wildlife and Wildlife Habitat

13.12.1 Overview and Objective of Proposed Monitoring

The predicted effects of the Project on wildlife and wildlife habitat are summarized in Section 6.12.4 of the revised EIS. The predicted effects to wildlife indicate that even with the mitigation measures outlined in Section 6.12.5, residual effects would remain in terms of the loss of habitat, habitat alteration, and the potential for mortality during the site preparation and construction, operations, and closure phases of the Project. Additionally, in the context of the CEAA, 2012, the offsetting of habitat for SAR species required under the ESA and SARA would be considered mitigation that would offset and mitigate the adverse effects of the Project on these indicators. Therefore, following offsetting there are no residual adverse effects due to the Project related to



habitat loss for SAR species. Refer to Table 6.12.9-1 for predicted effects to each VC during each phase of the Project.

A program to monitor wildlife and wildlife habitat will be implemented for the Project to ensure that effects to wildlife are properly mitigated throughout the Project life. All wildlife monitoring will be based on standard, acceptable survey protocols. Where appropriate, these protocols will be the same as those used during the baseline data collection efforts, so changes in species abundance can be detected. The overriding objectives of the planned monitoring program is as follows:

-) Confirm the amount of direct loss of habitat resulting from Project activities;
-) Identify unanticipated reductions in habitat suitability for species resulting from Project activities such as increased noise levels or levels of artificial light; and
-) Identify whether there is use of alternate habitat with the LSA/RSA by SAR and other species.

Monitoring requirements for wildlife from a regulatory perspective will be required under the SARA and ESA and will only assess SAR species and habitat. Additionally, Treasury Metals will implement a wildlife and wildlife habitat monitoring program to verify the accuracy of the EIS, as well as to verify that the mitigation measures outlined in Section 6.12.5 are effective. This monitoring program will include all VCs presented in Table 6.12.9-1.

13.12.2 Proposed Monitoring Program

Wildlife and Wildlife Habitat:

-) Monitor wildlife species composition and abundance
 - o Using the same protocols as used in baseline data collection so changes in species relative abundance can be detected
 - o To be completed every five years
 - o To be completed for the LSA and RSA
-) Utilization of offset habitat for SAR species
 - o Use the same protocols as used in the baseline data collection to detect SAR species in the offset habitat
 - o To be completed 1 year following the offset habitat construction and at 5 year intervals thereafter



-) Utilization of operations area habitat following closure:
 - o Using the same protocols as used in the baseline data collection to determine if species are utilizing the rehabilitated operations area
 - o To be completed 5 and 10 years following closure

-) Keep log of large wildlife collisions (e.g., moose, deer, etc.) to determine effectiveness of speed limits and to identify areas of high wildlife collision potential in order to apply additional mitigation, and will include the following:
 - o Date of collisions
 - o Time of collisions
 - o Location of collision
 - o Species that was hit

13.12.3 Reporting

Treasury Metals intends to provide the wildlife and wildlife habitat monitoring results as part of the Annual Monitoring Report provided to government agencies, Aboriginal peoples and stakeholders. For any wildlife and wildlife habitat monitoring that exceed the management triggers, the Annual Monitoring Report will also include the following:

-) Results of the investigation to identify the cause of the effects to wildlife;
-) Summary of the actions taken by Treasury Metals to mitigate or resolve the effects to wildlife, if associated with the Project; and
-) Confirmation that the remedial actions were successful in addressing the issues.

If no specific wildlife and wildlife habitat monitoring was completed during a particular year, the Annual Monitoring Report would provide a brief summary of results from the preceding year when monitoring was completed.

Additionally, SARA and ESA would require regulatory monitoring of the SAR species identified within the LSA and RSA. The reporting requirements will be given to Treasury Metals from the MOECC and ECCC once the monitoring program has been developed.



13.13 Migratory Birds

The monitoring for migratory birds has been included in the wildlife and wildlife habitat monitoring program described in Section 13.12.

13.14 Fish and Fish Habitat

13.14.1 Overview and Objectives of Proposed Monitoring

The predicted effects from the Project on Fish and Fish Habitat are summarized in Section 6.14.4 of the revised EIS. Effect predictions indicated that even with the mitigation measures outlined in Section 6.14.5, there would still be a residual effect to potential fish mortality in Blackwater Creek Tributaries 1 and 2, as these tributaries will be permanently removed and overprinted for Project infrastructure. Efforts will be taken to minimize mortality to fish in these tributaries during this time by using best practices to relocate the fish further downstream in Blackwater Creek, but a conservative 50% potential for mortality has been predicted. Additionally, direct loss of fish habitat by overprinting of the Project will be offset by the construction of new fish habitat or by an improvement of fish habitat elsewhere and is therefore not considered to be an adverse effect.

It is expected that regulatory fish and fish habitat effects monitoring will be completed as a requirement of the MMER under the *Fisheries Act*. This will consist of effluent and water quality monitoring that will be harmonized with the surface water quality monitoring program outlined in Section 13.8, as well as biological monitoring studies in the aquatic receiving environment to determine if mine effluent is causing any adverse effects to fish or fish habitat. This fish and fish habitat monitoring program will be developed with the help of a qualified aquatic biologist and submitted to DFO for approval. Additionally, it is expected that monitoring of the fisheries offsetting for the Project will also be required as a condition of the *Fisheries Act* authorization. The nature of this monitoring will be determined when the offsetting measures are finalized.

Notwithstanding anticipated regulatory monitoring requirements, which will be developed with input from Environment Canada, Treasury Metals have identified fish and fish habitat monitoring programs that will be implemented to help demonstrate the validity of the EIS predictions and confirm the effectiveness of the mitigation measures proposed. This monitoring program is subject to change upon completion of the regulatory fish and fish habitat monitoring program that will be approved by federal regulatory agencies. There is also other potential regulatory requirements for fisheries monitoring that will be advanced during the permitting process. The expectation is that the various regulatory programs would be harmonized to simplify monitoring and reporting requirements.



13.14.2 Proposed Monitoring Programs

13.14.2.1 Effluent and Water Quality Monitoring

This monitoring will be encompassed in the surface water quality monitoring program outlined in Section 13.8.2

13.14.2.2 Biological Monitoring

) Effluent:

- Sub-Lethal Toxicity / Acute Toxicity Test of sample taken from end of pipe location will be conducted for benthic invertebrate and fish species

) Blackwater Creek:

- Sub-Lethal Toxicity / Acute Toxicity Test on benthic invertebrate and fish species from a sample taken from the discharge location on Blackwater Creek
- Survey of fish species composition using the same techniques from baseline studies once every three years
- Monitoring of mercury in fish is not expected to be required under the MMER due to low mercury concentrations in effluent ($<0.10\mu\text{g/L}$), pending confirmation of effluent testing

) Thunder Lake Tributaries 2 and 3:

- Survey of fish species composition using the same techniques from baseline studies once every three years
- Monitoring of mercury in fish is not expected to be required under the MMER due to low mercury concentrations in effluent ($<0.10\mu\text{g/L}$), pending confirmation of effluent testing

) Little Creek and Hoffstrom's Bay Tributary:

- Survey of fish species composition using the same techniques from baseline studies once every three years
- Monitoring of mercury in fish is not expected to be required under the MMER due to low mercury concentrations in effluent ($<0.10\mu\text{g/L}$), pending confirmation of effluent testing



) Control Site:

- Sub-Lethal Toxicity / Acute Toxicity Test of sample taken from end of pipe location will be conducted for benthic invertebrate and fish species
- Survey of fish species composition using the same techniques from baseline studies once every three years

13.14.2.3 Fish Habitat Offset Monitoring

) Fish surveys of the constructed habitat offset will be conducted to determine effectiveness:

- Will be conducted using the same sampling techniques from baseline sampling
- To be conducted 1 and 5 years following the construction of the habitat offset

13.14.3 Reporting

It is expected that a regulatory fish and fish habitat monitoring program will be developed during the permitting process, which will stipulate regulatory reporting requirements under applicable Federal and Provincial acts and regulations.

Treasury Metals intends to provide the fish and fish habitat monitoring program results as part of the Annual Monitoring Report provided to government agencies, Aboriginal peoples and stakeholders. For any fish and fish habitat monitoring that exceeded the management triggers, the Annual Monitoring Report will include the following:

-) Results of the investigation to identify the cause of the effect to fish and fish habitat or changes in aquatic species composition;
-) Summary of the actions taken by Treasury Metals to mitigate or resolve the effect to fish and fish habitat, if associated with the Project; and
-) Confirmation that the remedial actions were successful in addressing the issues.

13.15 Wetlands and Vegetation

13.15.1 Overview and Objectives of Proposed Monitoring

The predicted effects from the Project on wetlands and vegetation are summarized in Section 6.15.4 of the revised EIS. Effects predictions have identified that even with the mitigation measures outlined in Section 6.15.5, residual adverse effects will remain in the form of natural wetland area loss as well as alterations in vegetation communities and species composition.



However, this does not take into consideration the habitat that will be constructed and reclaimed following closure, with parts of the open pit and TSF becoming wetland habitat and native species being planted on the reclaimed site.

Through baseline wetland and vegetation studies, no SAR plant species have been identified within the LSA. Therefore, there is no identifiable need for regulatory monitoring of vegetation or wetlands by Treasury Metals.

Treasury Metals have identified wetland and vegetation monitoring programs that will be implemented to help demonstrate the validity of the EIS predictions and confirm the effectiveness of the mitigation measures proposed. Because of the compact nature of the Project footprint, most of the vegetation within the operations area will be cleared. Therefore the monitoring program will focus on the effects to adjacent wetlands, and the vegetation present in those wetlands.

13.15.2 Proposed Monitoring Program

13.15.2.1 Wetlands

-) Wetland extent mapping will be carried out to determine the wetland extent within the LSA, and the 2 m groundwater drawdown zone:
 - o Mapping to be conducted every 5 years beginning just prior to the start of operations
 - o Mapping will be completed using OWES
-) Water level monitoring will be conducted to ensure no impacts to wetland water levels inside the drawdown zone is occurring:
 - o Conducted on wetlands located within the drawdown zone
 - o Water level will be collected and downloaded using water level loggers and barometric pressure loggers

13.15.2.2 Vegetation

-) Monitoring of visual signs to dust accumulation on plant surfaces adjacent to roadways and active mining areas;
-) Monitor whether the mitigation measures outlined in Section 6.15.5 have been properly implemented; and



-) Wetland floral surveys will be conducted to verify that wetland species diversity is maintained:
 - o Conducted on wetlands located within the drawdown zone
 - o Survey will be completed every 5 years beginning just prior to the start of operations
 - o Surveys will be completed using the same procedures as done in the wetland baseline study

13.15.3 Reporting

Treasury Metals intends to provide the wetlands and vegetation monitoring results as part of the Annual Monitoring Report provided to government agencies, Aboriginal peoples and stakeholders on an annual basis. For any wetland and vegetation monitoring that exceeded the management triggers, the Annual Monitoring Report will include the following:

-) Results of the investigation to identify the cause of the effects to wetlands and vegetation;
-) Summary of the actions taken by Treasury Metals to mitigate or resolve the effects to wetlands and vegetation, if associated with the Project; and
-) Confirmation that the remedial actions were successful in addressing the issues.

If no specific wetland or vegetation monitoring was completed during a particular year, the Annual Monitoring Report would provide a brief summary of results from the preceding year when monitoring was completed.

13.16 Land Use

13.16.1 Overview and Objectives of Proposed Monitoring

The predicted effects of the Project on land use were presented in Section 6.16.4 of the revised EIS. The predictions show that, even with the mitigation measures presented in Section 6.16.5, a number of residual adverse effects to land use remained. However, the monitoring of these changes to land use as a result of the Project is effectively captured within other monitoring programs outlined in Section 13 of the revised EIS.

These include:

-) Noise and Vibration Monitoring (see Section 13.4);



-) Light Monitoring (see Section 13.5);
-) Air Quality Monitoring (see Section 13.6);
-) Surface Water Quality Monitoring (see Section 13.8);
-) Groundwater Quality Monitoring (see Section 13.10);
-) Wildlife Monitoring (see Section 13.12); and
-) Social Monitoring (see Section 13.17).

As no new monitoring is required nor recommended for land use effects as a result of the Project, a land use monitoring program was determined to be redundant and no monitoring program has been developed.

13.16.2 Reporting

All of the applicable monitoring programs that encompass land use effects from the Project will be reported on either to government agencies, or within the Annual Monitoring Report that will be provided to government agencies, Aboriginal peoples and stakeholders.

13.17 Social

13.17.1 Overview and Objectives of Proposed Monitoring

The predicted effects of the Project on social aspects of the local and regional study areas were presented in Section 6.17.4 of the revised EIS. The predictions show that, even with the implementation of mitigation measures presented in Section 6.17.5, a number of residual effects will remain to the social dynamics of the local and regional communities. However, some of these residual effects to social aspects are expected to be beneficial to communities in the local and regional study areas. Treasury Metals will develop monitoring programs with input from government agencies, Aboriginal peoples and local stakeholders to verify the effectiveness of the mitigation measures presented in Section 6.17.5, and monitor the extent of the positive and negative residual effects presented in Section 6.17.6. The proposed monitoring programs for social aspects of the Project, which will be developed with engagement with the aforementioned groups, will develop frameworks to measure aspects such as the following:

-) In-migration / out-migration of employees;
-) Local hiring;
-) Training;



-) Housing availability;
-) Real estate values;
-) Crime;
-) Emergency services, and;
-) Traffic accidents related to Project activities.

13.17.2 Reporting

A number of commitments have been made regarding social aspects of the Project in the local and regional study areas, which will require monitoring and reporting through the EA process. These include Treasury Metals' commitments to hire locally (Cmt_003), and purchase locally (Cmt_004). Notwithstanding, Treasury Metals intends to provide the social monitoring results as part of the Annual Monitoring Report provided to government agencies, Aboriginal peoples and stakeholders on an annual basis.

13.18 Economic

13.18.1 Overview and Objectives of Proposed Monitoring

The predicted effects of the Project on the economic climate of the local and regional study areas were presented in Section 6.18.4 of the revised EIS. The predictions show that, even with the implementation of mitigation measures presented in Section 6.18.5, a number of residual effects will remain to the economics of the local and regional communities. However, some of these residual effects to economic aspects are expected to be beneficial to communities in the local and regional study areas. Treasury Metals will develop monitoring programs with input from government agencies, Aboriginal peoples and local stakeholders to verify the effectiveness of the mitigation measures presented in Section 6.18.5, and monitor the extent of the positive and negative residual effects presented in Section 6.18.6. To date, there have been five proposed monitoring programs for the economic effects of the Project, which will be developed following consultation with the aforementioned groups. These proposed monitoring programs include:

-) Employment;
-) Business and contracting opportunities;
-) Training courses;
-) Worker profile (e.g., local vs in-migrant worker); and



) Economic commitments.

13.18.2 Reporting

A number of commitments have been made regarding social aspects of the Project in the local and regional study areas, which will require monitoring and reporting through the EA process. These include Treasury Metals' commitments to hire locally (Cmt_003), and purchase locally (Cmt_004). Notwithstanding, Treasury Metals intends to provide the economic monitoring results as part of the Annual Monitoring Report provided to government agencies, Aboriginal peoples and stakeholders on an annual basis.

13.19 Human Health

Treasury Metals will incorporate monitoring of the COCs identified in the screening level risk assessment (Appendix W to the revised EIS), namely; lead and mercury, into the proposed monitoring programs for the Project. Both compounds will be incorporated in the proposed surface water monitoring programs (see Section 13.8), and can be incorporated into the planned air monitoring as well. The air monitoring for the Project, described in Section 13.6, will be more fully developed as part of the Environmental Compliance Approval (ECA) process for the Project. These COCs will be reported to the required government agencies, as well as Aboriginal peoples and local stakeholders as part of the Annual Monitoring Report.

13.20 Heritage Resources

The archeological assessment (Appendix U to the revised EIS) did not identify the need for follow-up monitoring for archaeological sites. In addition, it was the recommendation of the assessment that the development area did not "exhibit archaeological potential therefore it is recommended that the location does not require further archaeological assessment". That stated, Archeological and Cultural Heritage Resources Management Plan has been developed for the Project (see Section 12.11) that will provide specific policies, procedures, and contact information in the event any heritage resource is uncovered during any phase of the Project.

13.21 Aboriginal Peoples

The predicted effects of the Project on Aboriginal peoples were presented in Section 6.21.4 of the revised EIS. The predictions show that, even with the implementation of mitigation measures presented in Section 6.21.5, a number of residual effects will remain to Aboriginal peoples. However, some of these residual effects are expected to be beneficial to Aboriginal peoples in the local and regional study areas. The monitoring of some of the effects to Aboriginal peoples as a result of the Project is effectively captured within other monitoring programs outlined in Section 13 of the revised EIS. These include:

) Noise and Vibration Monitoring (see Section 13.4);



-) Light Monitoring (see Section 13.5);
-) Air Quality Monitoring (see Section 13.6);
-) Surface Water Quality Monitoring (see Section 13.8);
-) Groundwater Quality Monitoring (see Section 13.10);
-) Wildlife Monitoring (see Section 13.12); and
-) Social Monitoring (see Section 13.17).

Additionally, specific monitoring programs have been proposed to verifying the effectiveness of the mitigation measures presented in Section 6.21.5, and determine the extent of positive and negative residual effects to Aboriginal peoples presented in Section 6.21.6. To date, there have been three proposed monitoring programs for the economic effects of the Project, which will be developed following consultation with Indigenous communities. These proposed monitoring programs include:

-) Aboriginal employment during site preparations and construction, operations, and closure phases of the Project, as well as any employment during the care and control phase of the post-closure phase; and
-) Aboriginal business opportunities site preparations and construction, operations, and closure phases of the Project.

13.21.1 Reporting

All of the applicable monitoring programs that encompass effects to Aboriginal peoples from the Project will be reported on either to required government agencies are regulatory reporting, or within the Annual Monitoring Report that will be provided to government agencies, Aboriginal peoples and stakeholders.

13.22 Summary

A summary monitoring table has been provided below that summarizes the monitoring programs included in the EIS as proposed EA monitoring (Table 13.22-1). These monitoring programs have been developed to verify the effects assessment of the EIS and confirm the effectiveness of the avoidance and mitigation measures proposed. It should be noted that Treasury Metals is aware that regulatory monitoring will be required by government agencies upon EA approval (i.e. ECA monitoring); however, these monitoring programs have not yet been developed and are not included in the summary of EIS monitoring table.



Table 13.22-1: Summary of the EA Monitoring Programs

Discipline	Parameter	Monitoring Method	Project Phases	Location
Terrain and Soils	WRSA Height	Visual from Thunder Lake	Operations Closure	Select locations on Thunder Lake
Terrain and Soils	WRSA Elevation	Survey the elevation of the WRSA	Operations Closure	WRSA
Geology and Geochemistry	Metals (dissolved) In-situ field parameters Major ions (anions and cations)	Water sample will be taken from a safe location as the pit is filling with water.	Post-Closure	Open pit / pit lake
Noise and Vibration (Ambient Noise)	A-weighted equivalent noise levels (L_{eq} in dBA)	24-hour monitoring intervals	Site preparation and construction Operations Closure	Selected sensitive receptors (receptors along east Thunder Lake Road and along Tree Nursery Road)
Noise and Vibration (Wildlife Noise)	A-weighted equivalent noise levels (L_{eq} in dBA)	A series of 1-hour measurements at varying distance	Site preparation and construction Operations Closure	Varying locations around and outside the operations area
Noise and Vibration (Blasting)	Peak sound Pressure (dBA) Peak particle velocity (cm/s)	Measurements taken during blasting events in pit 1	Operations (when open pit mining activities are in pit 1 and relatively close to the surface)	Selected sensitive receptors along east Thunder Lake Road
Light	Configuration of artificial lighting	To be conducted when new artificial lighting is installed at the Project site	Site-preparation and construction Operations Closure	Within the operations area
Air Quality (continuous)	24-hour TSP Annual TSP 24-hour PM_{10} 24-hour $PM_{2.5}$ 1-hour NO_2 24-hour NO_2	Continuous air sampler will be used that is capable of measuring the require parameters	Site preparation and construction Operations Closure	At the security gate south of the Project
Air Quality (passive)	1-hour NO_2 1-hour SO_2	Passive sampling	Site preparation and construction Operations Closure	West of the Project on Thunder Lake Road and east of the Project on Normans Road
Climate (meteorological)	Precipitation Wind speed / direction Temperature Evaporation	Continuous monitoring at a meteorological station	Site preparation and construction Operations Closure	Undetermined
Climate	GHG emissions (t/year)	Annual calculation based on fuel and gas consumption	Site preparation and construction Operations Closure	Operations area



Table 13.22-1: Summary of the EA Monitoring Programs (continued)

Discipline	Parameter	Monitoring Method	Project Phases	Location
Surface Water Quality	Metals (dissolved) Cyanide Major ions (anions and cations) In-situ field parameters	Surface water samples will be taken using industry approved methods	Site preparation and construction Operations Closure Post-closure	Watercourse that have the potential to have surface water quality effects from the Project (see Figure 13.8.2-1)
Surface Water Quality	Discharge (m/s) Channel geomorphology	Flow measurements will be taken using industry approved methods	Site preparation and construction Operations Closure Post-closure	Blackwater Creek Thunder Lake Tributaries 2 and 3 Little Creek and Hoffstrom's Bay Tributary
Groundwater Quality	Metals (dissolved) Cyanide Major ions (anions and cations) In-situ field parameters	Samples will be taken following water level measurements four time a year	Site preparation and construction Operations Closure Post-closure	The monitoring wells described in Section 13.10
Groundwater Quantity	Groundwater elevation	Manual water level measurements on a monthly basis Pressure transducers for once a day measurements with barometric loggers for barometric effects correction	Site preparation and construction Operations Closure Post-closure	The monitoring wells described in Section 13.10
Wildlife and Wildlife Habitat	# of ha of direct habitat loss or disturbed	Assess the amount of habitat that has been overprinted as a result of the Project	Site preparation and construction Operations Closure	Operations area
Wildlife and Wildlife Habitat	Wildlife mortality	Make a log of anytime wildlife is struck by equipment on site	Site preparation and construction Operations Closure	Operations area
Wildlife and Wildlife Habitat	SAR species habitat compensation and utilization	Assess whether the SAR habitat compensation area is being used by SAR species	Site preparation and construction Operations Closure Post-closure	Operations area
Fish and Fish Habitat	Fish species composition	Assess the fish species composition	Site preparation and construction Operations Closure Post-closure	Blackwater Creek Thunder Lake Tributaries 2 and 3 Little Creek and Hoffstrom's Bay Tributary



Table 13.22-1: Summary of the EA Monitoring Programs (continued)

Discipline	Parameter	Monitoring Method	Project Phases	Location
Fish and Fish Habitat	Fish species composition	Assess the fish species composition in the habitat offset location	Operations (once the offset habitat is completed until the DFO determines it is adequate)	Fish habitat offset location
Fish and Fish Habitat	Sub-lethal toxicity / Acute toxicity test	Use industry standard methods for testing	Site preparation and construction Operations Closure	Water from end of pipe effluent
Wetlands	Wetland extent	Mapping of wetland extent in 5-year intervals	Site preparation and construction Operations Closure	Wetlands within the drawdown zone
Wetlands	Water level monitoring	Water level collected using water level loggers and barometric pressure loggers	Site preparation and construction Operations Closure Post-closure	Wetlands within the drawdown zone
Vegetation	Monitor dust deposition on plant surfaces		Site preparation and construction Operations Closure	Varying locations around the Project site
Vegetation	Wetland flora composition	Conduct wetland flora species surveys every 5 years	Site preparation and construction Operations Closure	Wetlands within the drawdown zone
Social	In-migration / outmigration of employees	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders
Social	Local hiring	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders
Social	Training	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders
Social	House availability	TBD upon consultation with Indigenous	TBD upon consultation with Indigenous communities,	TBD upon consultation with Indigenous



Table 13.22-1: Summary of the EA Monitoring Programs (continued)

Discipline	Parameter	Monitoring Method	Project Phases	Location
		communities, government agencies and stakeholders	government agencies and stakeholders	communities, government agencies and stakeholders
Social	Real estate values	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders
Social	Crime	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders
Social	Emergency services	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders
Social	Traffic accidents	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders
Economic	Employment	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders
Economic	Business and contracting opportunities	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders
Economic	Training courses	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders
Economic	Worker profile	TBD upon consultation with Indigenous	TBD upon consultation with Indigenous communities,	TBD upon consultation with Indigenous



Table 13.22-1: Summary of the EA Monitoring Programs (continued)

Discipline	Parameter	Monitoring Method	Project Phases	Location
		communities, government agencies and stakeholders	government agencies and stakeholders	communities, government agencies and stakeholders
Economic	Economic commitments	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders
Aboriginal	Aboriginal employment during operations	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders
Aboriginal	Aboriginal employment during closure	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders
Aboriginal	Aboriginal employment following closure	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders	TBD upon consultation with Indigenous communities, government agencies and stakeholders