Goliath Gold Project Water Addendum

Goliath Gold Project
Treasury Metals Inc.

Prepared for:

Treasury Metals Inc.

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GOLIATH GOLD PROJECT WATER ADDENDUM

W1 Introduction

In April of 2018, Treasury Metals submitted a revised version of the Environmental Impact Statement (EIS) for the proposed Goliath Gold Project (the Project) to the Canadian Environmental Assessment Agency (the Agency) for consideration under the Canadian Environmental Assessment Act (CEAA), 2012. The Agency reviewed the submission and informed Treasury Metals that the requirements of the EIS Guidelines for the Project were met and that the Agency would issue a series of information requests to Treasury Metals regarding the technical review of the EIS and supporting appendices (referred to herein as the Round 2 information requests). The Round 2 information requests were issued to Treasury Metals from July 6th, 2018 to July 27th, 2018 and included questions from the Agency, other Federal and Provincial reviewers, Indigenous communities and interested stakeholders.

In April of 2018, Treasury Metals submitted a revised version of the Environmental Impact Statement (EIS) for the proposed Goliath Gold Project (the Project) to the Canadian Environmental Assessment Agency (the Agency) for consideration under the Canadian Environmental Assessment Act (CEAA), 2012. The Agency reviewed the submission and informed Treasury Metals that the requirements of the EIS Guidelines for the Project were met and that the Agency would issue a series of information requests to Treasury Metals regarding the technical review of the EIS and supporting appendices (referred to herein as the Round 2 information requests). The Round 2 information requests were issued to Treasury Metals from July 6th, 2018 to July 27th, 2018 and included questions from the Agency, other Federal and Provincial reviewers, Indigenous communities and interested stakeholders.

Based on the review of the Round 2 information requests, it was clear that there was an emphasis from the reviewers on potential changes to water quality, fish and fish habitat, and the follow-up program presented in the revised EIS (April 2018). To effectively capture any changes to these aspects of the Project and to provide a consolidated, fulsome response to the Round 2 information requests, the following four (4) addendums have been prepared to accompany the Round 2 information request responses:

- Goliath Gold Project Water Addendum (this document);
- Goliath Gold Project Fish Addendum;
- Goliath Gold Project Follow-up Program Addendum; and
- Goliath Gold Project Preliminary Environmental Monitoring Program.

W1.1 Integrated Water Model

As described in Section 6.8.2 of the revised EIS (April 2018), the model used for evaluating the effects of the Project on surface water quality is an integrated model that combines existing conditions, releases and discharges from the Project, seepage from the Project, and changes in surface water flow as a result of the Project. Schematic figures showing the basis of this integrated model were provided in the revised EIS (April 2018) as Figures 6.8.2.4-2 and 6.8.2.6-1, for the operations and post-closure phases, respectively. As described in Section 6.8.2 of the revised EIS (April 2018), the Project will not result in releases to the environment during either the site preparation and construction, or closure phases. As such, an integrated model for surface water quality was not considered necessary for either the site preparation and construction, or closure phases.

A number of the Round 2 information requests asked for evaluations of the effects of seepage on surface water quality, and ultimately fish and fish habitat, using a seepage model. There was no individual seepage water quality model used to evaluate the effects of the Project on groundwater, seepage, surface water quality, and ultimately the effects on fish and fish habitat from changes to surface water quality. The following models were relied on to evaluate the effects of seepage on the receiving environment are summarized as follows:

- **Groundwater Model;** The groundwater model used for the Goliath Gold Project was used to characterize the transport of seepage from the WRSA and TSF, as well as the rate of inflow into the open pit and underground mine workings. The current groundwater model was reviewed in support of the Round 2 process, and is consistent with the responses to the issues raised in GW(2)-01B through GW(2)-05.

- **Geochemical Models**; The quality of seepage from the WRSA and TSF as well as the resulting water quality in the pit lake was determined as part of the geochemical analyses presented in Section 6.3 of the revised EIS (April 2018), Section 5 of Appendix JJ (The Water Report) of the revised EIS, as modified by any changes required in support of the Round 2 process as described in MW(2)-01 though MW(2)-12.

- **Surface Water Model**; The surface water model, described herein, was used for evaluating the effects of the Project on surface water quality is an integrated model that combines existing conditions, releases and discharges from the Project, seepage from the WRSA and TSF, and changes in surface water flow as a result of the Project.

A number of the Round 2 information requests explored elements of the integrated surface water quality model and requested an update to the water quality assessment provided in the revised EIS (April 2018) to reflect possible changes in response to the request. Rather than looking at small incremental changes in response to questions regarding individual components of the integrated model, Treasury Metals has rerun the integrated model for surface water quality to capture all the issues raised regarding the water quality predictions as part of the Round 2 information request process and associated technical meeting with the Agency and their technical reviewers.

W1.2 Valued Components and Indicators

As described in Section 6.1.3.7 of the revised EIS (April 2018), the evaluation of effects of the Project on surface water quality used a single valued component (VC), "surface water quality". This section of the revised EIS (April 2018) also identified the 24 chemical parameters that were used as indicators for the surface water quality VC. These parameters were selected on the basis of their expected presence in the effluent from the Project, their known presence in the existing environment, and the availability of relevant water quality criteria against which the modelled parameters could be compared.

The list of chemical parameters used as indicators for surface water quality have been expanded as part of the Round 2 information request process and are described in Section W2.1.

W1.3 Round 2 Information Requests

As stated, there were a number of Round 2 information requests that explored elements of the integrated surface water quality model and requested updates to reflect possible changes in the model, model inputs and the overall water assessment. Table W1-1 provides a listing of the individual Round 2 information request components regarding effects to water quality, along with a summary of the specific information request, the potential effect to water quality, and whether the request had resulted in an update to the information presented in the revised EIS (April 2018). As part of the Round 2 process, focused technical meetings were held with the Agency and their technical reviewers to help clarify the information regarding the Project and identify additional information required. Based on the Round 2 information requests and the associated technical meetings, the issues raised can be broken into the following general categories:

- Changes to the configuration of the model:
  - Expand the list of indicators included in the modelling results; and
  - Inclusion of seepage offsite during operations.
- The sources of baseline water quality used as inputs to the model:
  - Expand the baseline data from the 2012–2013 used in the modelling to support the revised EIS (April 2018) to include all of the baseline data collected during the 2010–2013 period.
- Quality of the effluent from the Project during operations, including:
  - Effluent quality for chemical parameters not identified as indicators in the revised EIS;
  - The management of possible ARD affected water during operations; and
  - Ability of the water treatment facility to achieve Treasury Metals commitment that effluent during operations will meet PWQO, or background, if background is higher than the PWQO.
- Quality of water in the pit lake following closure, including:
  - The relative importance of the influent sources to the pit lake;
  - The ability of the proposed batch treatment during filling, if required, to achieve Treasury Metals commitment that the water quality in the pit lake will meet PWQO, or background, if background is higher than the PWQO, prior to discharge to Blackwater Creek;
  - How water quality in the pit lake will be maintained following flooding to achieve Treasury Metals commitment that the water quality in the pit lake will be maintained at a level suitable for discharge; and
  - Possible stratification of the pit lake in the long-term.
- Changes to the quantity and fate of seepage from the Project:
  - The amount of seepage through the TSF liner, including liner performance and possible degradation over time;
  - The importance of the runoff and seepage collection ditches around the TSF in contributing to surface water quality;
  - The lining of the seepage and runoff collection ditches, and whether seepage from the ditches was an important source of seepage from the Project;

Table W1-1: Listing of Round 2 Information Requests Related to Water Quality

TMI Identifier	Agency Identifier	Components	Paraphrase	Outcome
TMI_884-SW(2)-01	SW(2)-01	—	Superseded	—
TMI_885-SW(2)-02	SW(2)-02	—	Superseded	—
TMI_887-SW(2)-04	SW(2)-04	Parts A, B, C and D	Clarify if the water quality parameters of the process effluent discharge as used to estimate the water quality of seepage from the TSF and whether this incorporates the potential of ARD. Provide the water quality of the open pit from the TSF during post-closure.	Greater detail provided regarding the pit lake inflow volumes during filling
TMI_888-SW(2)-05	SW(2)-05	Parts A and B	If some exposure of tailings to the atmosphere is anticipated, describe the changes in water quality from ARD, dust, and metal leaching.	No Changes to the Models Required
TMI_889-SW(2)-06	SW(2)-06	Parts A, B and C	Assess the potential for methylmercury production in wetlands in Blackwater Creek due to sulphate levels from the open pit and from seepage from the TSF and WRSA. Update the surface water quality model in Blackwater Creek to reflect this.	Provided an assessment of the potential for methylmercury production in Blackwater Creek
TMI_890-SW(2)-07	SW(2)-07	Parts A, B, C and D	Include the concentrations of chloride, mercury and phosphorus in the modeled long-term post-closure open pit water quality and update the monitoring program to include an assessment of both total and dissolved metals in pit lake water quality sampling or provide a rationale	Chloride, mercury and phosphorus were added to the pit lake water quality model
TMI_891-SW(2)-08	SW(2)-08	Parts A, B and C	In the event that the pit lake become meromictic, provide a revised estimate of the water quality of the seepage that is expected to enter the surrounding waterbodies from the pit lake. Update the surface water quality model to reflect this.	No Changes to the Models Required
TMI_894-FFH(2)-03	FFH(2)-03	Part B	Provide an assessment of changes to water quality of Blackwater Creek Tributary 2 diversion channel, considering its proximity to the TSF.	No Changes to the Models Required
TMI_897-MW(2)-01	MW(2)-01	Parts A, B and C	Provide an estimate for the length of time required to consolidate the tailings and implement the dry or wet covers. Assess the potential for ARD for the time it would take to consolidate the tailings. Incorporate these findings into the groundwater and surface water quality models.	No Changes to the Models Required
TMI_898-MW(2)-02	MW(2)-02	Part A, B, C, D, E and F	Provide a multi-year water cover analysis to substantiate the viability of the wet cover on the TSF using appropriate climate data (including climate change). Provide a sensitivity analysis that examines the robustness of the system. Incorporate these findings into the groundwater and surface water quality models.	Provided a multi-year water cover analysis of the wet cover along with a sensitivity analysis.
TMI_899-MW(2)-03	MW(2)-03	Parts A, B, C and D	Provide details about the design of the dry cover over the TSF and examine the possible causes that may contribute the failure of the dry cover. Update the surface water quality model to reflect this. Incorporate these findings into the groundwater and surface water quality models.	No Changes to the Models Required
TMI_900-MW(2)-04	MW(2)-04	Part A, B, C and D	If a clay liner is not used under the HDPE liner for the TSF, what is the seepage rate leading the surrounding waterbodies? Also assess the potential degradation of the liner over time and the implications on seepage. Update the surface water quality model to reflect this.	Provided a sensitivity analysis for an order of magnitude seepage increase due to degradation of the TSF HDPE liner
TMI_901-MW(2)-05	MW(2)-05	Part A, B and C	Reassess the rate of seepage emanating from the TSF based on progressive degradation of the TSF liner, base of the TSF, and wet or dry cover for the TSF. Incorporate these findings into the groundwater and surface water quality models.	Provided a sensitivity analysis for an order of magnitude seepage increase due to degradation of the TSF HDPE liner
TMI_902-MW(2)-06	MW(2)-06	Part A, B, C and H	Update the geochemical characterizations to reflect the areas of uncertainty raised in the "Context and Rationale" section and provided a reassessment of the ARD and its onset. Incorporate these findings into the groundwater and surface water quality models.	No Changes to the Models Required
TMI_903-MW(2)-07	MW(2)-07	Part A, B, C and H	Provide spatial distribution and timing of excavation of different rock types and distribution of sulphides and carbonates that may affect proportional exposure in waste rock fines. Explain how geochemical testing was used to characterize ore to understand the composition and variability of the tailings.	No Changes to the Models Required
TMI_904-MW(2)-08	MW(2)-08	Part A, B and C	Revise the assumption made in the revised EIS for the ARD onset time to match the data collected in kinetic testing	No Changes to the Models Required
TMI_905-MW(2)-09	MW(2)-09	Part A and B	Provide the Sulphur Block Model and describe how it was used to determine mine rock cut-off criteria and management plans	No Changes to the Models Required

Table W1-1: Listing of Round 2 Information Requests Related to Water Quality (continued)

TMI Identifier	Agency Identifier	Components	Paraphrase	Outcome
TMI_906-MW(2)-10	MW(2)-10	Part A and B	Describe how the high sulphide zones identified in the acid-base accounting (ABA) analysis were considered in the calculation of ARD onset time	No Changes to the Models Required
TMI_907-MW(2)-11	MW(2)-11	Part A, B and C	Would runoff and seepage collection ditches remain in the post-closure and where would this water report to? Describe the water quality in the seepage collection ditches before the ditches are decommissioned. Update the surface water quality model to reflect this.	No Changes to the Models Required
TMI_908-GW(2)-01	GW(2)-01	Part D	Superseded	—
TMI_909-GW(2)-02	GW(2)-02	Part A, B, C, D and E	Substantiate the ability of the cap on WRSA to reduce ARD by providing an analysis of the conceptual design and materials that will be used for construction and describe how the assessment has taken into consideration that a greater percentage of the mine rock may be PAG. Incorporate these findings into the groundwater and surface water quality models.	No Changes to the Models Required
TMI_910-GW(2)-03	GW(2)-03	Part A, B and C	Consider a reasonable range of porosity estimates for bedrock and provide an assessment of seepage behaviour. Incorporate the findings into the revision of seepage water quality assessment	No Changes to the Models Required
TMI_911-GW(2)-04	GW(2)-04	Part B	Provide a particle tracking figure for the dewatered pit scenario and reconsider the conclusion that all of the seepage bypass during the operations phase would be captured by the open pit drawdown force. Incorporate the findings into the seepage water quality assessment	Particle tracking was completed for the TSF and WRSA
TMI_912-GW(2)-05	GW(2)-05	Part A and B	Provide an assessment of whether the finger drain has the potential to increase seepage from the TSF. If seepage is expected to increase, update the groundwater and surface water quality models.	No Changes to the Models Required
TMI_947-MW(2)-012	MW(2)-012	Part A, B, C and D	Assess the potential for ARD and metal leaching from exposure of ore in the LGO stockpile to the atmosphere. Update the surface water quality model to reflect this.	No Changes to the Models Required
TMI_948-SW(2)-01B	SW(2)-01B	Part E	How were 2010/2011 baseline surface water quality data incorporated into the baseline surface water quality assessment? Provide a assessment of seasonal variation between 2010/2011 and 2012/2013 sampling data and update the water quality assessment to reflect this data.	Statistical analysis of the baseline 2010/2011 and 2012/2013 was included along with an analysis of the seasonal variations
TMI_949-SW(2)-02B	SW(2)-02B	Part A, B, C and D	Predict the residual hydrocarbon and ammonia concentrations in the effluent and provided the threshold concentration for treatment of effluent. Update the surface water quality assessment to reflect this.	No Changes to the Models Required
TMI_951-GW(2)-01B	GW(2)-01B	Part A, B, C and D	Update the groundwater model that address the concerns raised in the "Context and Rationale" section. Incorporate these findings into the groundwater and surface water quality models.	No Changes to the Models Required

- The amount of seepage from the WRSA;
- Whether the open pit will be a source of offsite seepage following closure, or whether the open pit will be a sink for groundwater inflow;
- Quantity and quality of seepage from the minewater pond during operations; and
- The fate of seepage from the onsite structures (e.g., WRSA and TSF) to offsite receiving waters.

- Changes to the quality of seepage from the Project:
  - Geochemistry of the WRSA, including the viability and performance of proposed multi-layer, low-permeability, dry cover;
  - Geochemistry of the TSF, including:
    - the viability and performance of the water cover during operations to inhibit the onset of acid rock drainage (ARD);
    - the ability to implement the proposed TSF closure options (wet or dry cover) prior to the onset of ARD; and
    - the viability and long-term performance of the closure options (wet or dry cover) to inhibit ARD in perpetuity.
- Completion of sensitivity runs to provide assurance regarding uncertainties related to the predicted effects of the Project.

W1.4 Water Addendum Structure

The presentation of the predicted effects of the Project in the revised EIS (April 2018) was organized by discipline areas; therefore, issues relevant to the predicted surface water quality effects appeared in the following sections of the revised EIS (April 2018):

- Section 6.3: geology and geochemistry;
- Section 6.8: surface water quality;
- Section 6.9: surface water quantity;
- Section 6.10: groundwater quality; and
- Section 6.11: groundwater quantity.

As described in Section 6.8.2 of the revised EIS (April 2018), the model used for evaluating the effects of the Project on surface water quality is an integrated model that combines existing conditions, releases and discharges from the Project, seepage from the Project, and changes in surface water flow as a result of the Project. Therefore, the geochemistry (Section 6.3), surface water quantity (Section 6.9), groundwater quality (Section 6.10) and groundwater quantity (Section 6.11) information relevant for accurately describing the potential effects of the Project on surface water quality were reflected within the results presented in Section 6.8 of the revised EIS (April 2018). Given that the Round 2 information requests deal with all of these issues collectively, the Goliath Gold Project Water Addendum has been structured in the following manner:

- Section W2: changes to the configuration of the model;
- Section W3: sources of baseline water quality used as inputs to the model;

- Section W4: quality of effluent from the Project during operations;
- Section W5: closure of the TSF;
- Section W6: pit lake quality following closure;
- Section W7: quantity and fate of seepage from the Project;
- Section W8: quality of seepage from the Project;
- Section W9: revised predictions of surface water quality;
- Section W10: residual effects on water quality;
- Section W11: sensitivity analysis to explore the uncertainty associated with the water quality predictions; and
- Section W12: references.

As shown in the above list, there are no specific discussions included in the Goliath Gold Project Water Addendum related to effects, mitigation measures, residual effects or follow-up programs for fish and fish habitat. The issues related to fish and fish habitat, which were raised as part of the Round 2 information request process, are discussed within the Goliath Gold Project Fish Addendum.

W2 Changes to Water Model to Address Round 2 IRs

W2.1 List of Indicators

As described above, and in Section 6.1.3.7 of the revised EIS, chemical parameters were selected as indicators for the surface water quality VC on the basis of their expected presence in the effluent from the Project, their known presence in the existing environment, and the availability of relevant water quality criteria against which the modelled parameters could be compared. As detailed in the response provided to TMI_887-SW(2)-04, the only parameters within the modelled supernatant water for the TSF (see Table 3.8.8-1 of the revised EIS [April 2018]), that was not included as an indicators, and for which relevant water quality criteria are available, are ammonia and sulphate.

Both total and un-ionized ammonia has been added as indicators in the revised modelling. However, the available Provincial Water Quality Objectives (PWQO) for ammonia applies to the un-ionized form of ammonia that is pH and temperature dependant. Therefore, the results of the modelling should be interpreted carefully, and consideration needs to be given for the fraction of the total ammonia modelled that will be in the un-ionized form. For the range of temperatures and pH values possible in the receiving waters around the Project, the maximum percentage of total ammonia likely in the un-ionized form is 3.8%.

The revised modelling was also expanded to include sulphate as an indicator. Although no relevant Provincial Water Quality Objectives are available for protecting aquatic life, aesthetic criteria for sulphate (500 mg/L) were available through Health Canada. Recent literature (Ullrich, 2001; Jeremiason et al., 2006) has suggested that, in the presence of organic materials, the production of methylmercury varies with the concentrations of sulphate present in the environment. The literature indicates that when sulphate concentrations are in the range of 20 to 50 mg/L, the rate of mercury methylation is enhanced by the presence of sulphate-reducing bacteria. Therefore, Treasury Metals has set an effluent commitment of 20 mg/L for sulphate.

The following represents the updated list of 27 indicators used in the revised water quality modelling:

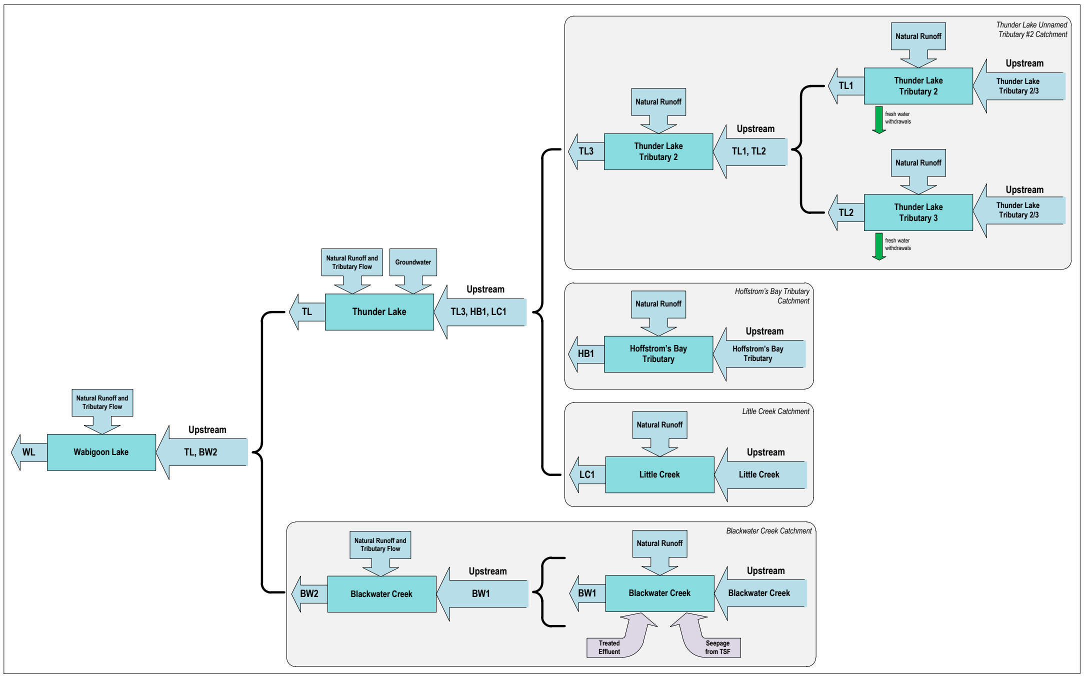
- Aluminum (Al);
- Ammonia, total (NH_3, as N);
- Ammonia, un-ionized (NH_3, as N);
- Antimony (Sb);
- Arsenic (As);
- Beryllium (Be);
- Boron (B);
- Cadmium (Cd);
- Chloride (Cl);
- Chromium (Cr);
- Cobalt (Co);
- Copper (Cu);
- Cyanide (CN);
- Iron (Fe);
- Lead (Pb);
- Mercury (Hg);
- Molybdenum (Mo);
- Nickel (Ni);
- Nitrate (NO_3);
- Phosphorus (P);
- Selenium (Se);
- Silver (Ag);
- Sulphate (SO_4^{2-});
- Thallium (Tl);
- Uranium (U);
- Vanadium (V); and
- Zinc (Zn).

W2.2 Inclusion of Seepage During Operations

In the revised EIS (April 2018); it was assumed that, during operations, all seepage that bypasses the seepage collection systems will be captured by the drawdown zone created by the dewatering of the open pit and underground mine and will report to the open pit. This was addressed in the response prepared for TMI_911-GW(2)-04. Specifically conducted model runs were undertaken to explore, among other items, the potential for seepage to escape the drawdown zone during operations, and report to the receiving environment rather than the dewatered open pit. Under conservative conditions, the groundwater model identified that during operations, as much as 6% of the seepage through the liner of the TSF escapes the operations area and reports to Blackwater Creek. The proportion that escapes the operations area to report to Blackwater Creek occurs along the eastern perimeter of the TSF. As stated in the responses to TMI_900-MW(2)-04 and TMI_901-MW(2)-05, the estimated seepage rate of 3.13 m^3/day through the TSF liner represents the approximate upper bound estimate for a properly installed HDPE geomembrane underlying mine tailings (Kerry Rowe et al., 2016), that is independent of the soil characteristics underneath the TSF liner.

As described in the response to TMI_951-GW(2)-01B, the HPDE liner would be placed during the initial construction activities and would cover the floors and walls of the initial of the TSF construction, shown as Stage 1 on Figure 3.7.2-3 of the revised EIS (April 2018). This figure has been updated as TMI_951 GW(2) 01B_Attachment_1 to reflect the inclusion of the HPDE liner material, as well as the soil cover material over the HPDE liner to protect it until covered by tailings. The subsequent stages of the TSF construction (Stages 2 through 4) would be constructed using clay on the inboard slope to limit the potential for seepage through the walls of the TSF, with HPDE material placed on the inboard side of the vertical drains for each lift. The floor and initial walls of the TSF (Stage 1) covered with the original HPDE liner material represents 97% of the TSF basin, while the vertical areas above the crest of the Stage 1 dam (i.e., the 6 vertical metres of dam comprising the Stage 2, 3 and 4 lifts) represents just 3% of the TSF basin. The effect on the wall areas above the original HPDE liner on the overall seepage rates from the TSF would be relatively small, possibly increasing the overall seepage for the later stages of the operations from the original estimate of 2.4 m^3/d to as much as 3.13 m^3/d. Therefore, the volume of seepage that reaches Blackwater Creek during operations would be 0.188 m^3/d. Although this volume is negligible compared to the flow in Blackwater Creek (~7,000 m³/d), it has been included in the updated water model for completeness. As a result of the inclusion of the seepage from the TSF to Blackwater Creek during operations, Figure 6.8.2.4-2 of the revised EIS has been updated and is provided herein as Figure 2-1.

Figure 2-1: Revised Surface Water Quality Model, Operations Phase



As described respectively in the responses to TMI_911-GW(2)-04 and Part A of TMI_951-GW(2)-01B, none of the seepage from the uncapped WRSA or minewater pond will escape the drawdown during operations to leave the site and have an effect on surface water quality.

W3 Baseline Water Quality used in Modelling

As part of the Round 2 information request process, questions were raised regarding the use of only the 2012–2013 baseline data in the water quality modelling, when data were also collected for the 2010–2013 period, and included questions related to the possible differences between the available data sets and their ability to capture seasonal effects. The revised surface water quality modelling includes all of the data from both the 2010–2011 and 2012–2013 sampling programs. As described in the response to TMI_948-SW(2)-01B, there were no statistical differences between the data sets. The reader is directed to the detailed analysis of available baseline water quality information presented in the response to TMI_948-SW(2)-01B.

W4 Project Effluent During Operations

W4.1 Effluent Quality for Additional Chemical Parameters

As described in the revised EIS (April 2018), all excess water not required in the process will be treated, prior to discharge into Blackwater Creek through an engineered structure. Treasury Metals has committed that final effluent water quality from the treatment plant will meet PWQO values (CCME values where no

PWQO value exists), or background when the background is greater than the PWQO. In the case of mercury, Treasury Metals has committed to discharge at or below a concentration of 0.00002 mg/L (based on an average upstream background concentration in Blackwater Creek). The commitment by Treasury Metals related to mercury is 10 times more stringent than the PWQO.

As part of the Round 2 information requests (TMI_887-SW(2)-04), the Agency requested final effluent quality also be provided for all of the chemical parameters listed in Table 3.8.8-1, and compared to relevant water quality criteria, where available. Table 3.8.8-1 of the revised EIS (April 2018) provides a listing of the modelled supernatant water quality within the tailings storage facility (TSF). However, many of the parameters in Table 3.8.8-1 do not have available water quality.

Table W4-1 provides a tabulation of the of the applicable water quality criteria for all of the parameters listed in Table 3.8.8-1, along with Treasury Metals commitment to the final effluent quality. The final effluent commitment is primarily to meet the PWQO values (CCME values where no PWQO value exists), or background when the background is greater than the PWQO. In the cases where there were no applicable surface water criteria, the commitment for final effluent quality is the background water quality of water within Blackwater Creek.

The updated modelling of surface water quality presented in this addendum is based on the assumption that effluent from the Project will be at the final effluent commitment levels. Treasury Metals recognizes that their commitment to final effluent quality will likely be a condition of the environmental assessment process. The updated surface water quality modelling presented in this addendum only includes those parameters for which regulatory water quality criteria are available.

W4.2 Ability to Meet Discharge Commitments

Although modelling of the final effluent concentrations from the water treatment plant is a task typically conducted in detailed design and engineering phases, when detailed vendor quotes are provided, Treasury Metals has approached possible venders to provide assurances that their committed effluent quality (Table W4-1) can be achieved. The range of performances provided by venders were used as inputs to the final modelled effluent concentrations as provided in Table W4-2. In modelling the effluent quality from the Project, consideration was given to the sources of influent to the treatment plant.

A summary of the contributions to the treatment plant influent by source, is provided in W4-3. On average, the TSF supernatant water, the minewater pond, and the runoff collection ponds represent 7%, 84%, and 9%, respectively of the influent feed. However, it is possible that during the month of April of a 1:20 wet year that the influent to the treatment plant will be composed 40%, 60%, and 0% of TSF supernatant water, the minewater pond, and the runoff collection ponds, respectively. The worst case influent to the treatment plant (April on a 1:20 wet year) is presented in Table W4-4. As described in the response to Part A of TMI_951-GW(2)-01B, the quality of water within the minewater pond includes considerations of water that would come in contact with potentially ARD affected rock in the WRSA and mined out areas of the open pit.

Table W4-1: Treasury Metals Commitments to Final Effluent Concentrations

Parameter [1]	Water Quality Criteria (mg/L)					Overall Background Blackwater Creek (mg/L)	Treasury Metals Commitment (Cmt_034) to Effluent Quality (mg/L)
	PWQO	MMER	CCME Freshwater Aquatic		Applicable Regulatory Criteria		
			Short Term	Long Term			
Aluminum	0.075	—	—	0.005	0.075	0.27350	0.2735
Ammonia (un-ionized) [2]	0.02	—	—	0.04	0.02	—	0.02
Ammonia (total) [2]	—	—	—	—	— [4]	0.03150	— [2]
Antimony	0.02	—	—	—	0.02	0.00060	0.02
Arsenic	0.10	0.50	—	0.0050	0.10	0.00100	0.1
Barium	—	—	—	—	— [4]	0.01100	0.011 [4]
Beryllium	0.011	—	—	—	0.011	0.00100	0.011
Bismuth	—	—	—	—	— [4]	0.00100	0.001 [4]
Boron	0.2	—	29	1.5	0.2	0.05000	0.2
Cadmium	0.0002	—	0.001	0.00009	0.0002	0.00009	0.0002
Calcium	—	—	—	—	— [4]	15.60000	15.6 [4]
Carbonate	—	—	—	—	— [4]	—	— [6]
Chromium	0.0089	—	—	0.0089	0.0089	0.00100	0.0089
Chloride	—	—	640	120	120	1.03500	120
Cobalt	0.0009	—	—	—	0.0009	0.00055	0.0009
Copper	0.005	0.3	—	0.002	0.005	0.00110	0.005
Cyanide	0.005	1	—	0.005	0.005	0.00200	0.005
Iron	0.3	—	—	0.3	0.3	1.49500	1.495
Lead	0.005	0.2	—	0.001	0.005	0.00100	0.005
Lithium	—	—	—	—	— [4]	0.05000	0.05 [4]
Magnesium	—	—	—	—	— [4]	4.18000	4.18 [4]
Manganese	—	—	—	—	— [4]	0.13200	0.132 [4]
Mercury	0.0002	—	—	0.000026	0.0002	0.00010	0.00002 [7]
Molybdenum	0.04	—	—	0.073	0.04	0.00100	0.04
Nickel	0.025	0.5	—	0.025	0.025	0.00200	0.025
Nitrate (as N)	—	—	550	13	13	0.03000	13
pH [3]	6.5 - 8.5	6.0 - 9.5	—	6.5 - 9.0	6.5 - 8.5	7.16000	7.16
Phosphorus	0.03	—	—	—	0.03	0.03040	0.0304
Potassium	—	—	—	—	— [4]	1.08000	1.08 [4]

Table W4-1: Treasury Metals Commitments to Final Effluent Concentrations (continued)

Parameter [1]	Water Quality Criteria (mg/L)					Overall Background Blackwater Creek (mg/L)	Treasury Metals Commitment (Cmt_034) to Effluent Quality (mg/L)
	PWQO	MMER	CCME Freshwater Aquatic		Applicable Regulatory Criteria		
			Short Term	Long Term			
Selenium	0.1	—	—	0.001	0.1	0.00500	0.1
Silicon	—	—	—	—	— [4]	4.52000	4.52 [4]
Silver	0.0001	—	—	0.00025	0.0001	0.00010	0.0001
Sodium	—	—	—	—	— [4]	2.03500	2.035 [4]
Strontium	—	—	—	—	— [4]	0.03460	0.0346 [4]
Sulphates	—	—	—	500 [5]	500	1.65000	500
Sulphur	—	—	—	—	— [4]	—	— [6]
Thallium	0.0003	—	—	0.0008	0.0003	0.00030	0.0003
Tin	—	—	—	—	— [4]	0.00100	0.001 [4]
Titanium	—	—	—	—	— [4]	0.01185	0.01185 [4]
Uranium	0.005	—	0.033	0.015	0.005	0.00500	0.005
Vanadium	0.006	—	—	—	0.006	0.00125	0.006
Zinc	0.03	0.5	—	0.03	0.03	0.00330	0.03

Notes:
(1) The parameters listed in this table match the list of parameters provided in Table 3.8.8-1 (Process Effluent Discharge Qualities) of the revised EIS (April 2018).
(2) The PWQO for ammonia applies to the un-ionized ammonia only.
(3) While pH criteria are available, no water quality predictions were made for pH.
(4) No applicable water quality criteria available. Background water quality in Blackwater Creek was used for the effluent commitment.
(5) Health Canada objectives for drinking water aesthetics of 500 mg/L for sulphate.
(6) No commitment has been made for either carbonate or sulphur as there are no applicable criteria or background data available.
(7) For mercury, Treasury Metals has committed to effluent that meets the upstream background concentrations in Blackwater Creek (0.00002 mg/L).

Table W4-2: Modelled Final Effluent Concentrations (average conditions)

Parameter (1)	Treatment Plant Influent Quality (mg/L)	Treatment Efficiency (%)	Modelled Effluent Quality (mg/L)	Treasury Metals Commitment to Effluent Quality (mg/L)
Aluminum	19.69142	99.00%	0.19691	0.2735
Ammonia (un-ionized) (2)	1.02627	99.00%	0.01026	0.02
Ammonia (total) (2)	27.00723	99.00%	0.27007	— (2)
Antimony	0.00106	99.00%	0.00001	0.02
Arsenic	0.01138	99.00%	0.00011	0.1
Barium	0.02822	99.00%	0.00028	0.011
Beryllium	0.00232	99.00%	0.00002	0.011
Bismuth	0.00148	99.00%	0.00001	0.001
Boron	0.09063	99.00%	0.00091	0.2
Cadmium	0.00185	99.00%	0.00002	0.0002
Calcium	37.39750	99.00%	0.37398	15.6
Carbonate	14.54165	99.00%	0.14542	— (4)
Chromium	0.00181	99.00%	0.00002	0.0089
Chloride	13.64855	99.00%	0.13649	120
Cobalt (5)	0.17380	99.90%	0.00017	0.0009
Copper	0.06598	99.00%	0.00066	0.005
Cyanide	0.07337	99.00%	0.00073	0.005
Iron	61.35428	99.00%	0.61354	1.495
Lead	0.05504	99.00%	0.00055	0.005
Lithium	0.07267	99.00%	0.00073	0.05
Magnesium	8.01728	99.00%	0.08017	4.18
Manganese	0.23145	99.00%	0.00231	0.132
Mercury	0.00016	99.00%	0.000002	0.00002 (6)
Molybdenum	0.00145	99.00%	0.00001	0.04
Nickel	1.31990	99.00%	0.01320	0.025
Nitrate	0.59079	99.00%	0.00591	13
pH (3)	5.84492	—	—	—
Phosphorus	0.03529	99.00%	0.00035	0.0304
Potassium	2.94744	99.00%	0.02947	1.08
Selenium	0.00197	99.00%	0.00002	0.1
Silicon	6.43240	99.00%	0.06432	4.52
Silver	0.00014	99.00%	0.00000	0.0001
Sodium	6.97032	99.00%	0.06970	2.035
Strontium	0.07560	99.00%	0.00076	0.0346
Sulphate	23.69954	99.00%	0.23700	500
Sulphur	20.96665	99.00%	0.20967	— (4)
Thallium (5)	0.04597	99.90%	0.00005	0.0003
Tin	0.00157	99.00%	0.00002	0.001
Titanium	0.01207	99.00%	0.00012	0.01185
Uranium	0.03057	99.00%	0.00031	0.005
Vanadium	0.00286	99.00%	0.00003	0.006
Zinc	0.78583	99.00%	0.00786	0.03

Notes:
(1) The parameters listed in this table match the list of parameters provided in Table 3.8.8-1 of the revised EIS (April 2018).
(2) The PWQO for ammonia applies to the un-ionized ammonia only.
(3) While pH criteria are available, no water quality predictions were made for pH.
(4) No effluent commitment for either carbonate or sulphur as there are no applicable criteria or background data.
(5) Venders have identified that activated alumina polishing may be necessary for cobalt and thallium removal (90% efficiency, in series).
(6) For mercury, Treasury Metals has committed to effluent that meets the upstream background concentrations in Blackwater Creek (0.00002 mg/L).

Table W4-3: Contributions to Treatment Plant Influent

Period and Influent Source	Treatment Influent Volumes (m^3/d) (1)(2)											
	January	February	March	April	May	June	July	August	September	October	November	December
Average Year												
Transfer from TSF	0 (0%)	0 (0%)	0 (0%)	1,180 (33%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	147 (7%)	0 (0%)
Transfer from mine dewatering pond	715 (100%)	799 (100%)	1,276 (100%)	2,376 (67%)	924 (100%)	1,558 (100%)	918 (69%)	871 (68%)	2,079 (79%)	1,861 (88%)	1,758 (90%)	749 (100%)
Transfer from runoff collection ponds	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	416 (31%)	407 (32%)	557 (21%)	263 (12%)	58 (3%)	0 (0%)
Dry Year												
Transfer from TSF	0 (0%)	0 (0%)	0 (0%)	504 (20%)	—	—	—	—	—	0 (0%)	0 (0%)	0 (0%)
Transfer from mine dewatering pond	689 (100%)	747 (100%)	1,078 (100%)	2,043 (80%)	—	—	—	—	—	264 (100%)	1,514 (100%)	713 (100%)
Transfer from runoff collection ponds	0 (0%)	0 (0%)	0 (0%)	0 (0%)	—	—	—	—	—	0 (0%)	0 (0%)	0 (0%)
Wet Year												
Transfer from TSF	0 (0%)	0 (0%)	0 (0%)	1,842 (40%)	0 (0%)	417 (8%)	0 (0%)	0 (0%)	700 (16%)	447 (13%)	403 (15%)	0 (0%)
Transfer from mine dewatering pond	740 (100%)	850 (100%)	1,474 (100%)	2,708 (60%)	2,103 (71%)	2,696 (55%)	2,424 (62%)	2,091 (65%)	2,426 (55%)	2,123 (63%)	1,893 (70%)	785 (100%)
Transfer from runoff collection ponds	0 (0%)	0 (0%)	0 (0%)	0 (0%)	842 (29%)	1,812 (37%)	1,492 (38%)	1,122 (35%)	1,325 (30%)	792 (24%)	424 (16%)	0 (0%)

Notes: (1) The values in parentheses represent the relative percentage of the treatment plant influent.
(2) The data in the above table correspond to the water balance for the Project presented in Tables 3.8.6-1, 3.8.6-2, and 3.8.6-3 of the revised EIS (April 2018).

Table W4-4: Modelled Final Effluent Concentrations (worst case conditions)

Parameter (1)	Treatment Plant Influent Quality (mg/L)	Treatment Efficiency (%)	Modelled Effluent Quality (mg/L)	Treasury Metals Commitment to Effluent Quality (mg/L)
Aluminum	13.98094	99.00%	0.13981	0.2735
Ammonia (un-ionized) (2)	0.80807	99.00%	0.00808	0.02
Ammonia (total) (2)	21.26492	99.00%	0.21265	— (2)
Antimony	0.00138	99.00%	0.00001	0.02
Arsenic	0.01437	99.00%	0.00014	0.1
Barium	0.02358	99.00%	0.00024	0.011
Beryllium	0.00175	99.00%	0.00002	0.011
Bismuth	0.00117	99.00%	0.00001	0.001
Boron	0.06870	99.00%	0.00069	0.2
Cadmium	0.00202	99.00%	0.00002	0.0002
Calcium	28.57287	99.00%	0.28573	15.6
Carbonate	15.88000	99.00%	0.15880	— (4)
Chromium	0.00121	99.00%	0.00001	0.0089
Chloride	9.86091	99.00%	0.09861	120
Cobalt (5)	0.12453	99.90%	0.00012	0.0009
Copper	0.05306	99.00%	0.00053	0.005
Cyanide	0.40691	99.00%	0.00407	0.005
Iron	43.49161	99.00%	0.43492	1.495
Lead	0.06806	99.00%	0.00068	0.005
Lithium	0.05755	99.00%	0.00058	0.05
Magnesium	6.09047	99.00%	0.06090	4.18
Manganese	0.18287	99.00%	0.00183	0.132
Mercury	0.00075	99.00%	0.00001	0.00002 (6)
Molybdenum	0.00132	99.00%	0.00001	0.04
Nickel	0.94264	99.00%	0.00943	0.025
Nitrate	2.92229	99.00%	0.02922	13
pH (3)	5.95840	—	—	—
Phosphorus	0.04419	99.00%	0.00044	0.0304
Potassium	2.66042	99.00%	0.02660	1.08
Selenium	0.00150	99.00%	0.00002	0.1
Silicon	4.15140	99.00%	0.04151	4.52
Silver	0.00011	99.00%	0.00000	0.0001
Sodium	5.26288	99.00%	0.05263	2.035
Strontium	0.06380	99.00%	0.00064	0.0346
Sulphate	41.04453	99.00%	0.41045	500
Sulphur	22.94000	99.00%	0.22940	— (4)
Thallium (5)	0.26054	99.90%	0.00026	0.0003
Tin	0.00122	99.00%	0.00001	0.001
Titanium	0.00820	99.00%	0.00008	0.01185
Uranium	0.02318	99.00%	0.00023	0.005
Vanadium	0.00334	99.00%	0.00003	0.006
Zinc	0.57034	99.00%	0.00570	0.03

Notes:
(1) The parameters listed in this table match the list of parameters provided in Table 3.8.8-1 of the revised EIS (April 2018).
(2) The PWQO for ammonia applies to the un-ionized ammonia only.
(3) While pH criteria are available, no water quality predictions were made for pH.
(4) No effluent commitment for either carbonate or sulphur as there are no applicable criteria or background data.
(5) Venders have identified that activated alumina polishing may be necessary for cobalt and thallium removal (90% efficiency, in series).
(6) For mercury, Treasury Metals has committed to effluent that meets the upstream background concentrations in Blackwater Creek (0.00002 mg/L).

As shown in Table W4-2 and W4-4, the modelled effluent for the Project, using preliminary vendor information, shows that the Treasury Metals commitments to effluent quality can be achieved. To restate, Treasury Metals remains committed that final effluent water quality from the treatment plant will meet PWQO values (CCME values where no PWQO value exists), or background when the background is greater than the PWQO. In the case of mercury, Treasury Metals has committed to discharge at or below a concentration of 0.00002 mg/L. All excess water not required in the process will be treated prior to discharge into Blackwater Creek through an engineered structure.

At this stage of the design process, Treasury Metals is planning to use a reverse osmosis treatment system (or equivalent) to achieve their commitments to effluent quality. The reverse osmosis treatment system is considered one of the most stringent treatment methods for mine water. The reverse osmosis system is designed with consideration of customizable and modular vendor packages, which includes multimedia filtration prior to reverse osmosis (as is typical of a reverse osmosis treatment system), treatment is not expected to be ineffective under normal operation. Reverse osmosis treatment systems can be designed to have capacity for worst-case surface water quality scenarios and be operated such that discharge does not occur during a water quality upset. These systems operate optimally when maintained under constant pressure, and typically are designed with sufficient equalization capacity to do so. This also results in increased capacity to attenuate treatment upsets.

The effectiveness of treatment for a reverse osmosis system is typically based on removal rates. In reverse osmosis systems, multiple membrane trains are utilized in parallel, with one train always offline for periodic cleaning and another as a back-up. Each membrane train is monitored for changes in removal rates of key parameters. When removal rates decrease significantly or when back-pressure increases significantly, this membrane train is flagged for cleaning and is taken offline for the subsequent cleaning cycle. This periodic cleaning regiment extends the life cycle of the membrane and prevents irreversible fouling and loss of treatment capacity. Should a membrane irreversibly foul, the back-up system comes online, and the foul membrane discarded and replaced. Should the back-up system fail, the flow per train is increased by a factor of N/(N-1) to make up the hydraulic demands of the system. These built-in redundancies and back-up systems provide sufficient contingency for the treatment system.

As described in Section 3.8.9 of the revised EIS (April 2018), the initial component of the water treatment plant will be a transfer tank. Excess water will be pumped from the transfer tank to a three-chamber multimedia filtration system, operating in parallel, via three multimedia filter feed pumps. The transfer tank may also be used to capture any out-of-compliance reverse osmosis permeate water which can be diverted from discharge. In addition, this tank could be utilized as a temporary short-term storage volume for the diversion of reverse osmosis reject water in order to continue operation of the reverse osmosis system while other areas of the facility are shut-down for routine repair or maintenance. Additionally, only the excess water not required in the process will need to be sent to the treatment plant, and ultimately discharged. Therefore, Treasury Metals has the capability of managing water onsite within the TSF supernatant pond, the runoff collection ponds and within the minewater pond in the event that the water treatment plant is temporarily unavailable.

W5 Closure of the TSF

As described in the revised EIS (April 2018), following the end of operations, the TSF will be closed using a final closure cover. Two separate closure cover options (wet and dry closure covers) were presented in the revised EIS (April 2018). The surface water quality modelling presented in the revised EIS (April 2018) demonstrated that both the wet and dry cover closure options would result in surface water quality being largely unchanged as a result of the Project, with resulting water quality being the same as, or slightly improved from the existing condition for most parameters. In the situation where the water quality is predicted to the higher than existing condition, the resulting water quality in the receiving environment remains below the PWQO for the protection of aquatic life. However, the wet cover closure option was demonstrated to result in slightly cleaner surface water quality. In accordance with the EIS Guidelines for the Project, the wet cover closure option was identified as the appropriate mitigation measure for surface water quality during post-closure, and residual adverse effects and significance determined for the wet cover closure option only.

Through the Round 2 process, as well as during both the December 18, 2018, and the January 10, 2019 meetings with the Agency and their technical reviewers, a number of technical questions and issues have been raised regarding the selection of the closure cover options for the TSF. During the January 10, 2019 technical meeting with the Agency and their technical reviewers, it was agreed that the final decision regarding the selection of the closure cover option is part of the final closure planning process (MENDM O.Reg. 240/00), which is independent and separate to the federal EA process. To provide confidence to the regulators regarding the viability and potential effects associated with both closure cover options, this addendum has included predictions for both the wet and dry cover closure options.

The issues raised during the Round 2 process regarding the closure cover options include the following, which are discussed in more detail below:

- The ability of the selected cover option to limit ARD within the tailings;
- The ability to place the closure covers before the onset of ARD;
- The long-term viability of the wet cover to be maintained, especially with consideration of climate change is incorporated; and
- The stated preference of various Indigenous communities for a dry cover closure option.

W5.1 Ability to Limit the Onset of ARD within the Tailings

The intent of the wet cover closure for the TSF is to ensure tailings are in a saturated condition in perpetuity, thus effectively preventing ARD. Water covers are a well-proven method of limiting ARD formation in tailings that is accepted as the best means of preventing ARD. This position was confirmed by NRCAN reviewers in their feedback on the draft responses and during both the December 18, 2018, and the January 10, 2019 meetings with the Agency and their technical reviewers.

With the dry cover closure options for the TSF, there will be tailings within the TSF that are not fully saturated and thus susceptible to the onset of ARD. The intent of the low-permeability dry cover for the closure of the TSF is to limit the infiltration of water and oxygen into the tailings and thus slow the rate of ARD onset and limit the quantity of tailings that would be subject to the onset of ARD. The analysis of pit lake water quality (Section W6), seepage quality (Section W8) and ultimately surface water quality (Section W9) associated with the dry cover closure option include acidic loads from and active layer of unsaturated tailings located beneath the dry cover, as described in Section 6.3.2.2 of the revised EIS (April 2018).

W5.2 Ability to Place the Closure Cover before the Onset of ARD

The original plan for the closure of the TSF involved the withdrawal and treatment of the supernatant, placement of a granular layer to physically isolate the tailings and closure with either a wet cover of dry, low-permeability cover. The current plans for closure have been modified to physically isolate the tailings by placing a layer of sand and silt over the tailings using the existing mill infrastructure. This layer would be placed prior to the withdrawal of the supernatant water and would not require the tailings to trafficable. The following provides updated details of the times required to place both the dry and wet cover options for the closure of the TSF.

The placement of a dry cover closure option for the TSF will be implemented in 4 main phases, a detailed discussion and justification of timelines for each are provided below:

- **Placement of Isolating Layer:** Prior to removal of the operating pond a layer of material (silt and sand) will be deposited over the tailings surface to physically isolate the tailings. It is anticipated that this layer will be deposited utilizing the existing mill infrastructure and tailings deposition pipeline. An initial layer thickness of at least 1 m is considered reasonable to protect against the potential onset of ARD during cover construction. Total volume of this layer will be approximately 618,000 m3 (475,000 tonnes) and will take approximately 200 days to deposit at the planned mill throughput.
- **Withdrawal and Treatment of Supernatant Water:** Following the end of mining operations, the supernatant water present in the tailings storage facility (TSF) at closure will be withdrawn, treated, and used to help fill the open pit. The estimated amount of supernatant water present in the TSF at closure is predicted to be 970,000 m^3 (TMI_887 SW(2)-04_Table_3). Treasury Metals is confident that the volume of water present in the TSF at closure can be withdrawn and treated to a level suitable for discharge to the open pit as it is filling within a period of 4-6 months. The water removal would be planned so that the drawdown is completed immediately prior to winter (i.e., October 31). If required, Treasury Metals will bring in commercially available packaged treatment units to augment the existing water treatment capacity.
- **Placement of Granular Material and Consolidation of the Tailings:** A pioneering layer of granular free draining fill (approximately 0.5 m thick) would be spread over the impoundment surface once the water pond has been removed and the isolating layer allowed to partially consolidate, dry and/or freeze. The placement would be planned to take place during the winter season in order to take advantage of freezing conditions. It is expected that the 0.5 m thick layer (approximately 309,000 m^3) can be completed within a single winter construction window of January 1 through March 31 at a rate 3,400 m^3/day for 90 days. However, should the central portion area not be sufficiently trafficable, a second construction season may be required.
- **Placement of the Final Dry Cover Layer:** Placement of the final dry cover layer would take place the following summer (June through August) and include placement of a 0.5 m thick layer of low permeability clay layer. Following the placement of the low-permeability clay layer, a 0.5 m thick layer of overburden would be placed to protect the underlying clay. These layers would be placed at a rate of approximately 3,400 m^3/day.

It is understood that the schedule provided above is contingent on normal weather conditions and could be negatively impacted by an abnormally warm winter or wet summer. The placement of a dry cover is anticipated to take approximately 20 to 34 months, depending largely on the trafficability of the isolating layer. It should be noted that the first step (placement of the isolating layer) will occur while the TSF is still flooded and ARD not possible. Additionally, the TSF will be covered with water for much of the second step (withdrawal and treatment of supernatant water). Once the low-permeability clay layer is placed, the potential for ARD will be largely eliminated. Therefore, the period of time when the TSF is susceptible to the onset of ARD during closure ranges from 8 to 21 months, which is less that the predicted time of 2 years required for the onset of ARD (see response to TMI_902-MW(2)-06).

The placement of the wet cover closure option will be implemented in 3 main phases. A detailed discussion and justification of timelines for each are provided below:

- **Placement of Isolating Layer:** Prior to removal of the operating pond a layer of material (silt and sand) will be deposited over the tailings surface to physically isolate the tailings. It is anticipated that this layer will be deposited utilizing the existing mill infrastructure and tailings deposition pipeline. An initial layer thickness of at least 1 m is considered reasonable to protect against the potential onset of ARD during cover construction. Total volume of this layer will be approximately 618,000 m3 (475,000 tonnes) and will take approximately 200 days to deposit at the planned mill throughput.
- **Withdrawal and Treatment of Supernatant Water:** Following the end of mining operations, the supernatant water present in the tailings storage facility (TSF) at closure will be withdrawn, treated, and used to help fill the open pit. The estimated amount of supernatant water present in the TSF at closure is predicted to be 970,000 m^3 (TMI_887 SW(2)-04_Table 3). Treasury Metals is confident that the volume of water present in the TSF at closure can be withdrawn and treated to a level suitable for discharge to the open pit as it is filling within a period of 4-6 months. If required, Treasury Metals will bring in commercially available packaged treatment units to augment the existing water treatment capacity.
- **Placement of Water Cover:** In the wet cover scenario, the TSF will be covered with a layer of non-process water of sufficient depth to ensure a water cover is maintained during drought conditions. The volume of non-process water required to close the TSF is 300,000 m^3 (Attachment JJ-1 to Appendix JJ of the revised EIS [April 2018]). At closure, there will be 320,000 m^3 of water available in the minewater pond and collection ponds (Section 3.8.11 of the revised EIS [April 2018]) to be used as water cover for closure of the TSF. Treasury Metals would augment their available pumping capacity, as required, to transfer the required water to the TSF within 4 months.

The placement of a wet cover option for closure of the TSF is anticipated to take approximately 17 months. However, the first step (placement of the isolating cover material) will occur while the TSF is still flooded and ARD not possible. Additionally, the TSF will be covered with water for much of the second step (withdrawal and treatment of supernatant water). Therefore, the period of time when the TSF is not fully covered by water and thus has susceptible to the onset of ARD is approximately 6 months, which is less that the predicted time of 2 years required for the onset of ARD (see response to TMI_902-MW(2)-06). Therefore, the wet cover closure option can be completed prior the onset of ARD.

During the meetings with the Agency and their technical reviewers on December 18, 2018 and the January 10, 2019, concerns were raised regarding the potential for rapid onset of ARD during the closure of the TSF. During those meetings, Treasury Metals indicated they would consider placing a benign layer of tailings during the final year or two of operations to help delay the onset of ARD during closure, if required. There are a number of options for the benign tailings layer, including the addition of lime to the tailings, de-sulphurizing the tailings or mixing a caustic material with the tailings. Final details with regards to the placement of this benign tailings layer will be established as part of the final closure plan process in accordance with MENDM O.Reg. 240/00. With the implementation of a benign tailings layer, the onset of ARD should be delayed sufficiently to allow the construction of either the dry and wet cover closure options, prior to the early onset of ARD in the tailings.

W5.3 Long-term Viability of the Wet Cover Closure Option

As part of the Round 2 process, including the as well as during the meetings with the Agency and their technical reviewers on December 18, 2018 and the January 10, 2019, a number of technical questions were raised regarding the long-term viability of the wet cover closure option for the TSF. Although a multi-year water cover model was provided as part of the draft response to TMI_989-MW(2)-02, Environment and Climate Change Canada (ECCC) had a number of modifications they wished to see incorporated into a revised version of the model, including the following features:

- The use of actual climate data for a long-period instead of the average precipitation and evaporation data so as to capture potential large variations from year to year;
- Modify the actual climate data for a long-period to reflect climate change, including the effects of higher evaporation rates in the future associated with increased temperatures; and
- Include potential losses arising from snow sublimation during winter months.

A detailed description of the updated multi-year water cover model has been provided as part of the final responses to TMI_989-MW(2)-02. The results of the updated multi-year water cover model indicated the following:

- For the 'base case" seepage rates (seepage rates of 3.13 m^3/d through the floor and walls of the TSF), the water cover over the TSF could be maintained in perpetuity without the need of mitigation to supplement the water cover.
- For the "degraded liner case" (seepage rates of 31.3 m^3/d through the floor and walls of the TSF), the water cover over the TSF could be maintained in perpetuity without the need of mitigation to supplement the water cover for the "ensemble forecast", the RCP 2.6 forecast, and the RCP 4.5 forecasts. For the RCP 8.5, high carbon future forecasts, the water cover for the "degraded liner case" could be maintained over the long-term with the addition of 89 m^3/d (61.8 L/min) of supplemental water pumped from the flooded pit lake. The multi-year water cover model indicates that pumping of supplemental water would not be required to maintain the water cover until approximately 2223, assuming that the initial installation of the liner was performing at the degraded rate of 31.3 m^3/d, and the rate of climate changes is consistent with the high carbon (RCP 8,5) scenario identified by the IPCC. However, literature (Robert M. Koerner et al., 2011) suggests that unexposed HDPE geomembranes will have an expected service life in excess of 400 years; therefore, it is expected that the liner will have a seepage rate of 3.13 m^3/d (the upper bound estimate from literature), for the expected service life of 400 years. At that point, the HPDE liner is expected to undergo a gradual degradation given it will be placed beneath the TSF, where it will be isolated from the degrading effects of sunlight and high temperatures.
- For the "no liner case" (seepage rates of 200 m^3/d through the floor and walls of the TSF), supplemental water pumped from the pit lake would be required for all of the future climate scenarios. The rate of supplemental water requirements to maintain the water cover over the TSF varies by scenario to as much as 301 m^3/d (208 L/min) for the high carbon (RCP 8,5) scenario. It should be noted that the TSF will be constructed with a geosynthetic liner (HPDE or equivalent), and the seepage rates from the floor and walls of the TSF would not reach a levels of 200 m^3/d until the HPDE liner has completely disintegrated with time. Based on evidence from landfill sites, it would take between 1,000 and 10,000 years for the HPDE liner to completed degrade to the point where it provided no mitigation to the rates of seepage from the TSF.

W5.4 Indigenous Communities Preference for a Dry Cover Closure Option

As part of the overall EA process, Treasury Metals have been engaged with Indigenous communities to solicit feedback and input from the community members that can be incorporated as part of the Round 2 process. As part of this process, several communities have stated a preference for the dry cover closure option to the wet cover closure option.

W6 Pit Lake Water Quality Following Closure

As described in the revised EIS (April 2018), following closure, equipment, chemicals and fuel present in the open pit will be removed and the open pit prepared for flooding. Dewatering activities will cease and the open pit and underground mine will be allowed to fill with water. The water to fill the pit will come from a combination of site runoff, water from the TSF that will be treated and used to help fill the open pit, and the inflow of groundwater. It is expected to take between 5 and 8 years to fully flood the open pit, depending on weather conditions. It is expected to take less time for the underground mine to fill with water as a much smaller volume of water is required to fill the underground void spaces. At closure, all site drainage will be directed towards the open pit to aid in filling it with water. Groundwater modelling indicates that the rate of inflow to the open pit will decrease as the open pit fills with water, but there will continue to be an inflow of groundwater to the open pit after the pit lake is fully flooded as a result of the topography of the site (i.e., the spillway elevation is lower than elevation of the ground beneath the WRSA).

As the pit lake is filling, the sources of water into the pit lake include the following:

- Direct precipitation;
- Runoff from the reclaimed landscape;
- Treated supernatant water withdrawn from the TSF, treated and used to help fill the open pit;
- Inflow groundwater;
- Seepage from the lined TSF; and
- Seepage from the WRSA.

The relative percentages of the influent water to the open pit (while filling), by source, are provided in Table W6-1.

Table W6-1: Source of Pit Lake Influent During Filling

Source	Volume (m^3)	Fraction of Inflow
Direct precipitation	798,929	10.0%
Runoff from the reclaimed landscape	4,378,518	54.7%
Treated supernatant water withdrawn from the TSF, treated and used to help fill the open pit	970,000	12.1%
Inflow groundwater;	1,659,700	20.7%
Seepage from the TSF	7,421	0.1%
Seepage from the WRSA.	195,230	2.4%

As stated in the revised EIS (April 2018), and reaffirmed in the response to TMI_887-SW(2)-04, Treasury Metals has identified the following mitigation measure, which has been proven on comparable mining projects across Canada, to manage the quality of the water within the open pit as it is filling:

- The pit lake will be monitored as it is filling to determine whether batch treatment with lime addition or other caustic material will be required to ensure the water meets PWQO, or background if background levels exceed the PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek (Mit_024).

Once the open pit is filled, there will continue to be an inflow of water from following sources:

- Direct precipitation;
- Runoff from the reclaimed landscape;
- Inflow groundwater;
- Seepage from the lined TSF;
- Excess water from the wet cover over the TSF; and
- Seepage from the WRSA.

The relative percentages of the influent water to the open pit (following the filling of the open pit), by source, are provided in Table W6-2

Table W6-2: Source of Pit Lake Influent Once Filled

Source	Volume (m^3)	Fraction of Inflow
Direct precipitation	212,697	24.1%
Runoff from the reclaimed landscape	549,506	62.2%
Inflow groundwater	36,500	4.1%
Seepage from the TSF	1,142	0.1%
Seepage from the WRSA	7,300	0.8%
Excess water from the TSF wet cover	76,521	8.7%

The quality of water in the open pit was modelled as part of the revised EIS (April 2018), and has been updated to reflect changes raised as part of the Round 2 information request process. The resulting pit lake water quality has been provided in Table W6-3, which includes the predicted quality prior to treatment, and the quality following treatment. Table W6-3 includes predictions for the pit lake quality for both the wet and dry cover scenarios. Treasury Metals is confident that a wet cover closure option can be viable over the long-term. However, in response to questions raised as part of the Round 2 process, predictions associated with the dry cover closure option have been included. During the January 10, 2019 technical meeting with the Agency and their technical reviewers, it was agreed that the final decision regarding the selection of the closure cover option is part of the final closure planning process (MENDM O.Reg. 240/00), which is independent and separate to the federal EA process. As stated in the revised EIS (April 2018), and reaffirmed in the response to TMI_887-SW(2)-04, Treasury Metals has identified the following mitigation measure, which has been proven on comparable mining projects across Canada, to manage the quality of the water within the open pit:

- Once the pit lake is flooded, it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment with lime addition may be required to ensure the water released from the pit lake meets effluent release limits (Mit_124).

Table W6-3: Pit Lake Water Quality

Parameter [(1)]	Modelled Wet Cover Pit Lake Water Quality (mg/L)		Modelled Dry Cover Pit Lake Water Quality (mg/L)	
	Untreated	Treated [(2)]	Untreated	Treated [(2)]
Aluminum	0.84190	0.27350	0.81358	0.27350
Ammonia (un-ionized)	0.00388	0.00388 [(3)]	—	0.02000 [(4)]
Ammonia (total)	0.10198	0.10198 [(3)]	—	0.52632 [(4)]
Antimony	0.00113	0.00113 [(3)]	0.00117	0.00117 [(3)]
Arsenic	0.00144	0.00144 [(3)]	0.00167	0.00167 [(3)]
Beryllium	0.00103	0.00103 [(3)]	0.00103	0.00103 [(3)]
Boron	0.05140	0.05140 [(3)]	0.05136	0.05136 [(3)]
Cadmium	0.00010	0.00010 [(3)]	0.00221	0.00020
Chloride	1.57667	1.57667 [(3)]	—	120.00000 [(4)]
Chromium	0.00097	0.00097 [(3)]	0.00096	0.00096 [(3)]
Cobalt	0.00744	0.00090	0.00727	0.00090
Copper	0.00390	0.00390 [(3)]	0.02651	0.00500
Cyanide	0.00314	0.00314 [(3)]	—	0.00500 [(4)]
Iron	2.77757	1.49500	2.49764	1.49500
Lead	0.00300	0.00300 [(3)]	0.02053	0.00500
Mercury	0.00002	0.00002 [(3)]	—	0.00002 [(4)]
Molybdenum	0.00101	0.00101 [(3)]	0.00099	0.00099 [(3)]
Nickel	0.05472	0.02500	0.04887	0.02500
Nitrate	0.07425	0.07425 [(3)]	—	13.00000 [(4)]
Phosphorus	0.05421	0.03040	0.08911	0.03040
Selenium	0.00095	0.00095 [(3)]	0.00101	0.00101 [(3)]
Silver	0.00010	0.00010 [(3)]	0.00010	0.00010 [(3)]
Sulphate	59.28552	20.00000	53.46865	20.00000
Thallium	0.00033	0.00030	0.00031	0.00030
Uranium	0.00586	0.00500	0.00604	0.00500
Vanadium	0.00104	0.00104 [(3)]	0.00113	0.00113 [(3)]
Zinc	0.03513	0.03000	1.08350	0.03000

Notes:
(1) Only those parameters that have available water quality parameters were modelled.
(2) The treated water quality within the pit lake is consistent with the Treasury Metals commitment to effluent quality (see Table W4-1).
(3) Where the modelled untreated pit lake water quality was the same or lower than the Treasury Metals commitment, the lower untreated pit lake quality was used in the modelling.
(4) Where untreated quality was not available, the treated quality was set to the Treasury Metals commitment.

As described in Section 3.14 of the revised EIS (April 2018), the flooded pit will form a long, narrow pit lake comprised of three basins. The lake will be shallower in the west and increase in depth to the east, as a result of the waste rock backfill placed in the west and central basins of the open pit. The west basin will be shallow (i.e., 2 to 3 m) and well within the euphotic zone for primary productivity. The east basin will be deep (i.e., 140 m) while the central basin depth will provide a transition zone. The central and east basins are expected to undergo thermal stratification. Experience with similar mine pit lakes suggests that it is possible for the eastern basin of the pit lake to become meromictic. Over time it is expected that water quality of surface inflows will improve, and thus a concentration density difference between surface and water at depth could develop to a point that could maintain permanent stratification. The net result of the stratified lake is that the surface water quality is expected to be driven primarily by background run-off water quality and this could represent a substantial improvement over a fully mixed pit lake. For the purpose of the updated modelling of surface water quality, the pit lake has been assumed to have the conservatively high concentrations associated with a fully mixed pit lake. A further possible benefit of a meromictic pit lake is the formation of reducing conditions at depth that may lower metal and acidity content by precipitation of sulphide minerals. Regardless of the conditions that form at depth within the eastern pit, the groundwater modelling indicates that groundwater will continue to discharge into the pit lake after it is fully flooded.

W7 Quantity and Fate of Seepage from the Project

W7.1 Quantity Seepage from the TSF and TSF Liner

As part of the Round 2 information request process, Treasury Metals addressed a number of questions regarding the quantity and fate of seepage from the Project. The most important source of seepage discussed as part of Round 2 is the seepage from the TSF. As described in the response to TMI_900-MW(2)-04, the entire TSF basin will be lined with a geosynthetic liner (HDPE, or equivalent). As stated in the responses to TMI_900-MW(2)-04 and TMI_901-MW(2)-05, the estimated seepage rate of 2.4 m^3/day through the TSF liner represents the approximate upper bound estimate for a properly installed HDPE geomembrane underlying mine tailings (Kerry Rowe et al., 2016), that is independent of the soil characteristics underneath the TSF liner.

As described in the response to TMI_951-GW(2)-01B, the HPDE liner would be placed during the initial construction activities and would cover the floors and walls of the initial of the TSF construction, shown as Stage 1 on Figure 3.7.2-3 of the revised EIS (April 2018). This figure has been updated as TMI_951 GW(2) 01B_Attachment_1 to reflect the inclusion of the HPDE liner material, as well as the soil cover material over the HPDE liner to protect it until covered by tailings. The subsequent stages of the TSF construction (Stages 2 through 4) would be constructed using clay on the inboard slope to limit the potential for seepage through the walls of the TSF, with HPDE material placed on the inboard side of the vertical drains for each lift. The floor and initial walls of the TSF (Stage 1) covered with the original HPDE liner material represents 97% of the TSF basin, while the vertical areas above the crest of the Stage 1 dam (i.e., the 6 vertical metres of dam comprising the Stage 2, 3 and 4 lifts) represents just 3% of the TSF basin. The effect on the wall areas above the original HPDE liner on the overall seepage rates from the TSF would be relatively small, possibly increasing the overall seepage to as much as 3.13 m^3/d.

Literature (Robert M. Koerner et al., 2011) suggests that unexposed HDPE geomembranes will have an expected service life in excess of 400 years; therefore, it is expected that the liner will have a seepage rate of 3.13 m^3/d (the upper bound estimate from literature), for the expected service life of the liner. At that point, the HPDE liner is expected to undergo a gradual degradation given it will be placed beneath the TSF, where it will be isolated from the degrading effects of sunlight and high temperatures. Exactly how long the HPDE liner will beneath the TSF to continue to provide some level of protection against seepage is a function of how long it will take for the HPDE material fully degrade. Based on evidence of plastics within landfills, the HPDE liner should take between 1,000 and 10,000 years to fully degrade.

Although it is expected that seepage through the TSF liner will remain at the rate of 3.13 m^3/d, as assessed in the revised EIS (April 2018), for the expected service life of the liner (~400 years), and that this rate represented the upper bound estimate from literature, the reviewers remain concerned on the sensitivity of the surface water model to the rate of seepage through the liner. To address this concern, the revised surface water quality model was run for the following three (3) separate seepage scenarios:

- A base scenario with seepage through the floor and walls of the TSF of 3.13 m^3/d, which represents the upper bound estimate from literature for a properly installed HPDE liner, which is expected to have a service life of approximately 400 years.
- A degraded liner case with seepage through the floor and walls of the TSF liner of 31.3 m^3/d. This unrealistic estimate of potential seepage through the TSF liner, uses a seepage rate that is an order of magnitude higher than the upper bound seepage rate identified from literature. This seepage rate is not expected to occur for a properly installed liner, and has been included to test the sensitivity of surface water quality predictions to changes in the liner performance. Degradation of the TSF liner is not expected to occur until after the service life of approximately 400 years.
- A no liner case with seepage through the floor and walls of the TSF of 200 m^3/d. This seepage rate is expected through the floor of the TSF in the absence of any liner, as predicted by the groundwater model presented in Appendix M to the revised EIS (April 2018). It should be restated that, the TSF will be constructed with a liner (geosynthetic liner or equivalent). For seepage rates to reach a levels of 200 m^3/d, the HPDE liner will have to have completely disappeared, which based on evidence from landfill sites could be between 1,000 and 10,000 years.

The results are discussed in Section W9 of the Goliath Gold Water Addendum.

W7.2 Runoff and Seepage Collection Ditches

As part of the Round 2 information request process, concerns were raised that the runoff and seepage collection ditches could act as conduits for enhanced seepage to either the pit lake or the receiving environment. The Round 2 information requests pondered whether ditches would allow for seepage to bypass the mitigation measures implemented as part of the Project (e.g., the TSF liner), and thus result in greater impacts to surface water quality than predicted in the revised EIS (April 2018).

As described in the response to TMI_900-MW(2)-04, TMI_901-MW(2)-05, TMI_907-W(2)-11 and TMI_951-GW(2)-01B, only a small volume of seepage (3.13 m^3/d) will pass through the TSF liner, of which a percentage will be captured by the runoff and seepage collection ditches. The volume of seepage from the TSF captured in these ditches represents 34% of the seepage from the TSF. The water in the seepage collection ditches around the TSF will be a combination of runoff from the reclaimed areas on the outer slopes of the TSF and the small volume of seepage escaping the TSF. Given the average precipitation rates in the region, the seepage from the TSF that is captured in the perimeter ditches will represent 0.09% of the average content of water in the ditches, while the remaining 99.91% of the water in the perimeter ditches will be comprised of collected rainfall (with quality comparable to the baseline water quality in Blackwater Creek). Therefore, the water conveyed to the open pit through the perimeter seepage collection ditches would not be distinguishable from the runoff in any of the other reclaimed areas of the site.

There are no plans to line the diversion ditches, and non-contact water ditches; however, these ditches will include erosion control measures. As detailed in the response to TMI_886-SW(2)-03, ditches carrying contact water would be lined using a geosynthetic liner (HDPE or similar material) and/or slush grout depending on the conditions along the ditch alignment to minimize seepage from the ditches. Riprap and non-woven geotextile would be placed over the geosynthetic liner (or equivalent) for erosion protection.

As described in Section 3 of the revised EIS (April 2018) and in the response to TMI_902-MW(2)-06, the perimeter ditches would be left in place following closure (see response to TMI_907 MW(2) 11) to aid in the collection, and direction of runoff towards the open pit.

Given the above, the runoff and collection ditches will not act as conduits for enhanced seepage to either the pit lake or the receiving environment. Therefore, there are no changes to the predicted surface water quality from that presented in the revised EIS (April 2018) as a result of runoff and seepage collection ditches.

W7.3 Quantity Seepage from the WRSA

The quantity of seepage from the WRSA will be different depending on whether the WRSA is uncapped or capped. The uncapped WRSA scenario will only exist during operations and for a short period of time during closure when a multi-layer, low-permeability dry cover will be constructed over the WSRA.

Uncapped WRSA

The seepage from the uncapped WRSA is a function of relative hydraulic resistances of infiltration that enters the underlying overburden and bedrock, to the infiltration that travels laterally to the perimeter of the WRSA (TMI_909-GW(2)-02). An assumed infiltration rate of 100-200 mm/year was used in the revised surface water modelling, which represents the rate of infiltration from the uncapped WRSA into the underlying overburden and bedrock and not the infiltration rate into the WRSA itself. As the waste rock in the WRSA will have a large amount of connected void space, it is assumed that most of the precipitation will infiltrate into the WRSA. The infiltration into the WRSA will either infiltrate into the underlying overburden and bedrock, or drain laterally through the WRSA to the perimeter to be captured by the perimeter ditches. The amount of infiltration that either enters the underlying overburden and bedrock, or travels laterally to the perimeter of the WRSA depend on the relative hydraulic resistances (c). The hydraulic resistances were calculated as follows:

- $c = \frac{flow\ length\ L}{hydraulic\ conductivity\ K}$)
- Infiltration that enters underlying bedrock and overburden: Based on the data collected from 2012–2014, the hydraulic conductivity of the shallow bedrock is 1×10^{-6} m/s (Section 5.6.5 of the revised EIS [April 2018]). Assuming 1 m of vertical saturated infiltration into the underlying bedrock, the hydraulic resistance is: $c = \frac{1\ m}{1\times10^{-6}\ m/s} = 1 \times 10^{6}\ s$.
- Infiltration that travels laterally to the perimeter of WRSA: The hydraulic conductivity of the waste rock is likely to be in the range of 1×10^{-2} m/s, given the large amount of connected void space in a WRSA. Freeze and Cherry (1979) give the hydraulic conductivity of a gravel in the range of 1×10^{-3} m/s to greater than 1×10^{-1} m/s. Assuming less than 300 m of lateral travel to the perimeter of the WRSA, the hydraulic resistance is: $c = \frac{300\ m}{1\times10^{-2}\ m/s} = 3 \times 10^{4}\ s$.

The hydraulic resistance for infiltration that enters the underlying overburden and bedrock (1×10^{6} s) is about two (2) orders of magnitude higher than the hydraulic resistance for the infiltration that travels laterally to the perimeter of the WRSA (3×10^{4} s). Therefore, most of the infiltration into the WRSA is likely to take the path of least resistance and travel laterally to the perimeter of the WRSA to be captured by the perimeter ditches. Vertical infiltration into the underlying bedrock and overburden would only become significant if there was a potential for water to pond (e.g., being trapped in a topographic basin). As the

WRSA is located on a topographic high next to the open pit, the potential for ponding and the build-up of a significant water table within the WRSA is very limited.

Based on the relative hydraulic resistances, it can be inferred that it is 33 times (1×10^6 / 3×10^4 s) more likely that infiltration into the WRSA will travel laterally to the perimeter of the WRSA than will enter the underlying overburden and bedrock. Given that the annual precipitation rate in the Dryden area is 719.7 mm/year, and assuming all of the precipitation infiltrates into the WRSA, in can be inferred that 698.5 mm/yr of this infiltration travel laterally to the perimeter of the WRSA, and the remaining 21.2 mm/yr would enter the underlying overburden and bedrock. Therefore, the assumed infiltration rate from the from the uncapped WRSA into the underlying overburden and bedrock of 100-200 mm/year is conservative. As detailed in the response to TMI_911-GW(2)-04), groundwater seepage from the uncapped WRSA during operations will be captured by the open pit, and will not reach the receiving environment.

Capped WRSA

During closure, a multi-layer low permeability cover will be placed over the WRSA. The purpose of the multi-layer, low permeability dry cover over the WRSA is not to reduce ARD, but rather to reduce the rate of infiltration into the WRSA and thus the rate of seepage from the WRSA into the underlying overburden and bedrock. The design and construction of low permeability covers on waste rock and landfills are well understood and covers that can achieve significant infiltration reductions (e.g., >95%) are well documented. The exact design of the cap for the WRSA will be determined during detailed design, but would likely include a compacted clay layer, which can reliably achieve hydraulic conductivities of less than 1×10^{-9} m/s (Hauser et al., 2001). If sufficient clays of suitable quality are not available on site, Treasury Metals will obtain the necessary materials from other sources to ensure the cap over the WSRA achieves the designed performance. The performance of the multi-layer, low permeability dry cover over the WRSA was determined to be 30 mm/yr, based on hydraulic conductivity for the clay layer of 1×10^{-9} m/s. The US EPA HELP model was used to validate the predicted infiltration rate of 30 mm/yr (this is equivalent to 30 m^3/d). Based on refined groundwater modelling, the seepage from the capped WRSA reports to the pit lake (20 m^3/d) and Thunder Lake (10 m^3/d). This seepage, which is assumed to be impacted by ARD/ML, was incorporated into the surface water quality and model for pit lake quality.

Discussions regarding the efficacy of the dry cover over the WRSA to perform as indicated by literature and the US EPA HELP model were had during both the December 18, 2018, and the January 10, 2019 meetings with the Agency and their technical reviewers. As discussed in the response to TMI_909-GW(2)-02, an additional sensitivity run has been included as part of Section W11 where the infiltration rate into the WRSA was increased to 50% of the precipitation (i.e., 329 mm/year) to describe the effects to the surface water quality resulting from uncertainties associated with the performance of the multi-layer low permeability cover over the WRSA. In order for 329 mm/yr to infiltrate into the WRSA, the multi-layer low permeability dry cover over the WRSA would need to have an effect hydraulic conductivity in the range of 10^{-4} to 10^{-5} m/s. Of 329 mm/year of precipitation that infiltrates into the WRSA, 75 mm/year of which is assumed to infiltrate into the underlying overburden and bedrock, and the remaining 254 mm/year would drain laterally through the WRSA to the perimeter to be captured by the perimeter ditches and ultimately report to the open pit.

W7.4 Quantity of Seepage from Pit Lake

As part of the Round 2 information requests, concerns were raised regarding the potential seepage from the open pit, especially in situations where the open pit may stratify (TMI_891-SW(2)-08). Groundwater modelling indicates that the rate of inflow to the open pit will decrease as the open pit fills with water, but the open pit will remain a sink for groundwater inflow once fully flooded.

W7.5 Quantity of Seepage from the Minewater Pond

As described in the response to TMI_911-GW(2)-04, refined particle tracking completed for the Project identified that all of the seepage from the WRSA would be captured by the drawdown created by the dewatering activities, and would report to the open pit during operations. Additionally, the refined particle tracking identified that 94% of the seepage from the TSF would also be captured by the drawdown and report to the open pit. Only a small amount of seepage from the eastern edge of the TSF (6% of the total seepage through the floor and walls of the TSF) would escape the drawdown and leave the site during operations. Based on this modelling, and the proximity of the minewater pond to the open pit, all of the seepage from the minewater pond is expected to be captured by the drawdown and report to the open pit. None of the seepage from the minewater pond is expected to leave the site, have an effect on surface water quality, including Blackwater Creek, or have an effect on fish and fish habitat.

W7.6 Quantity of Seepage from the LGO Stockpile

As part of the Round 2 process questions were raised regarding the potential for the material in the low-grade ore (LGO) stockpile to experience ARD and potential affect off-site water quality. As described in the response TMI_947-MW(2)-12, during operations 2.5×10^6 tonnes of low grade, gold-containing material will be placed in the LGO stockpile during open pit mining (years 1 through 4). The material in the LGO stockpile will be gradually be depleted over the remaining operating mine life (years 4 through 12) as material from the LGO stockpile will be blended with the high-grade ore from the underground mineralized rock to provide a consistent feed to the mill. Since the LGO will be in the stockpile for a maximum of 12 years, and 93% of the material on the site has been characterized as PAG, there is a risk of ARD onset. Given there is a risk of ARD developing in the LGO stockpile. the LGO stockpile area will be lined and equipped with runoff collections system and perimeter ditching to protect the soil beneath and adjacent from effects. The runoff collection system will be directed to a small collection pond where the water will be tested and treated (if required) with batch lime addition before incorporation into the water management system. The LGO stockpile is located within the operations area, which will be surrounded by a perimeter ditch and seepage collection to ensure effects are isolated within the operations area. During operations, dewatering of the open pit and underground mine workings will create a drawdown zone that will collect virtually all of the seepage from the operations area, and direct it towards the open pit where it will be pumped and used in the water management system and undergo treatment. Therefore, no seepage from the LGO stockpile will escape the site during operations to report to surface water bodies.

Given the material is gold-containing, it is expected that all of the material in the LGO stockpile will be processed through the mill prior to the end of operations; therefore, no material is expected to remain in the LGO stockpile at closure. At the end of operations, the LGO stockpile will be decommissioned. Any materials that remain in the LGO stockpile at closure will be re-located to the mined-out areas of the open pit and isolated once the pit lake forms. As the pit lake fills the water quality will be monitored and treated (as required) with batch lime addition.

Therefore, there will be no seepage from the LGO stockpile during operations or closure.

W7.7 Quantity of Seepage from TSF and WRSA to Offsite Receiving Waters

The groundwater modelling presented in Appendix M of the revised EIS (April 2018) described where seepage from the onsite structures (e.g., TSF and WRSA) would report during operations and post-closure.

During operations, updated groundwater modelling identified that the majority (94%) of the seepage through the TSF will be collectively captured by the open pit, perimeter ditches and minewater pond. The remaining 6% (0.14 m^3/d) of the seepage from the TSF during operations would report to Blackwater Creek. The updated groundwater modelling described in TMI_911-GW(2)-04, confirms that all of the seepage from the WRSA would report to the open pit. Table W7-1 presents the quantities of seepage from the WRSA and the TSF that reach receiving waterbodies during operations.

Table W7-1: Quantities of Seepage to Receiving Waterbodies (operations)

Waterbody Receiver	Volume of Seepage (m^3/day)	
	Uncapped WRSA	Lined TSF
Thunder Lake	0	0
Thunder Lake Tributary 3	—	0
Hoffstrom's Bay Tributary	—	0
Blackwater Creek	—	0.19
Open Pit (1)	100–200	2.94
Total Seepage (m^3/day)	**100–200**	**3.13**

Note: (1) It is assumed that all of the precipitation that falls on the uncapped WRSA (654 mm/year) will infiltrate into the WRSA. Only 100–200 m/year is assumed to infiltrate into the underlying overburden and bedrock, and ultimately report to the open pit. The majority of the precipitation that infiltrates into the uncapped WRSA will travel laterally through the WRSA and discharge at the toe where it will be collected buy the perimeter ditches and directed to a segregated runoff collection pond. The water quality in the pond will be tested, and the runoff treated, if required, before being incorporated into the water management system.

During post-closure, when groundwater recovers to near pre-development levels, updated groundwater modelling confirms that 0.8 m^3/d of seepage from the TSF is estimated to leave the Project and reach Blackwater Creek. The remaining 1.6 m^3/d of seepage from the TSF during post-closure is estimated to report to the open pit. Additionally, trace quantities of post-closure seepage from the TSF may also reach Thunder Lake Tributary 3, Hoffstrom's Bay Tributary, and Thunder Lake. Following the placement of the multi-layer, low permeability cap over the WRSA, the refined groundwater modelling confirms that the post-closure seepage from the WRSA (30 m^3/d) will report to the open pit (20 m^3/d) and Thunder Lake (10 m^3/d). Table W7-2 presents the quantities of seepage from the WRSA and the TSF that reach receiving waterbodies during operations.

The quantity of seepage that reaches receiving waterbodies during operations and post-closure has been incorporated into the updated surface water quality modelling presented herein.

Table W7-2: Quantities of Seepage to Receiving Waterbodies (post-closure)

Waterbody Receiver	Volume of Seepage (m^3/day)	
	Capped WRSA (multi-layer, low permeability cover)	Lined TSF with wet cover
Thunder Lake	10	0.1
Thunder Lake Tributary 3	—	0.1
Hoffstrom's Bay Tributary	—	0.1
Blackwater Creek	—	0.83
Open Pit	20	20
Total Seepage (m^3/day)	**30**	**3.13**

W8 Quality of Seepage from the Project

W8.1 TSF Seepage Quality

During operations, the TSF will be operated in a manner ensure protection of the environment. This will include maintaining the tailings in a saturated condition to limit the onset of acidification. The majority of the TSF will be maintained under a water cover (Mit_021). Continuous management of the tailings deposition will be utilized to maximize placement of tailings below water cover and minimize exposure at tailings beaches. Frequent covering of exposed beaches with fresh tailings will also aid in keeping the tailings in a saturated condition, to avoid exposure to the atmosphere. Water covers are a common method of preventing ARD formation in tailings by limiting exposure of tailings to the atmosphere. Wet covers are accepted as the best means of preventing ARD. Therefore, ML/ARD conditions will not occur within the TSF during operations. Therefore, the seepage and porewater within the TSF during operations would be comparable to the quality of the supernatant water as presented in Table 3.8.8-1 of the revised (April 2018).

As described in the revised EIS (April 2018), two closure options for the TSF (i.e., wet cover and dry cover) were evaluated. In accordance with the EIS Guidelines, residual adverse effects were identified as those that remain after the implementation of practical mitigation measures. The wet cover option was identified as the appropriate mitigation measure for mitigating potential effects on post-closure water quality based on the wet cover resulting in less residual effects of lower concentrations than were predicted for the dry cover. Therefore, the wet cover option is the closure alternative for which Treasury Metals identified residual effects in the revised EIS (April 2018).

As described in Section W5, a number of technical questions and issues have been raised regarding the selection of the closure cover options for the TSF during the Round 2 process, as well as during both the December 18, 2018, and the January 10, 2019 meetings with the Agency and their technical reviewers. To provide confidence to the regulators regarding the viability and potential effects associated with both plausible closure cover options, this addendum has included predictions for both the wet and dry cover closure options. However, it was agreed during the January 10, 2019 technical meeting with the Agency and their technical reviewers that the final decision regarding the selection of the closure cover option and details for the closure design are part of the final closure planning process (MENDM O.Reg. 240/00), which is independent and separate to the federal EA process.

Section W5.2 describes the refined process considered for the placement of both the wet and dry covers so they can be placed before the onset of ARD is expected within the tailings. Additionally, Treasury Metals indicated they would consider placing a benign layer over the tailings during the final year or two of operations to help delay the onset of ARD during closure, if required. As a result, the tailings within the TSF would not be subject to the onset of ARD during the closure process.

The wet cover closure is intended to maintain a layer of water overlying the tailings in perpetuity, insuring the tailings remain saturated and isolated from oxidation conditions. Water covers are a well-proven method of limiting ARD formation within tailings, this practice is accepted as of the best means of preventing ARD. Therefore, the seepage and porewater within the TSF during post closure would continue to be comparable to the quality of the supernatant water as presented in Table 3.8.8-1 of the revised (April 2018). As described in Section W5.3, the wet cover would be viable in the long-term so long as the liner beneath the tailings were placed. In the far future, mitigation of the effects of climate change may be necessary by the pumping of supplemental water from the pit lake once the material of the liner completely disintegrates.

With the dry cover closure options for the TSF, there will be tailings within the TSF that are not fully saturated and thus susceptible to the onset of ARD. The intent of the low-permeability dry cover for the closure of the TSF is to limit the infiltration of water and oxygen into the tailings and thus slow the rate of ARD onset and limit the quantity of tailings that would be subject to the onset of ARD. The analysis of pit lake water quality (Section W6), seepage quality (Section W8) and ultimately surface water quality (Section W9) associated with the dry cover closure option include acidic loads from and active layer of unsaturated tailings located beneath the dry cover, as described in Section 6.3.2.2 of the revised EIS (April 2018).

Table W8-1 lists the seepage quality from the TSF for both the wet and dry cover closure options.

Table W8-1: Seepage Quality from the TSF and WRSA

Parameter [(1)]	TSF Seepage Quality (mg/L)		WRSA Seepage Quality (mg/L)
	Wet Cover	Dry Cover	
Aluminum	0.19900	5.14387	85.24533
Ammonia (un-ionized)	0.22800	0.07224	0.00000
Ammonia (total)	6.00000	1.90100	0.00000
Antimony	0.00200	0.00241	0.00107
Arsenic	0.01800	0.01601	0.03801
Beryllium	0.00050	0.00118	0.00495
Boron	0.02000	0.05885	0.12022
Cadmium	0.00200	0.10241	0.00735
Chloride	15.88000	0.00000	1.81450
Chromium	0.00010	0.00059	0.00210
Cobalt	0.00400	0.05026	0.75566
Copper	0.01800	1.11235	0.27122
Cyanide	1.00000	0.00000	0.00000
Iron	0.35800	6.88596	265.72775
Lead	0.08200	0.86516	0.21064
Mercury	0.00180	0.00000	0.00005
Molybdenum	0.00100	0.00029	0.00053
Nickel	0.02100	0.16008	5.75745
Nitrate	7.07000	0.00000	0.00000
Phosphorus	0.06000	1.76563	0.53368

Table W8-1: Seepage Quality from the TSF and WRSA (continued)

Parameter (1)	TSF Seepage Quality (mg/L)		WRSA Seepage Quality (mg/L)
	Wet Cover	Dry Cover	
Selenium	0.00050	0.00406	0.00270
Silver	0.00005	0.00006	0.00011
Sulphate	68.67000	203.04768	6,120.69537
Thallium	0.03000	0.00084	0.00058
Uranium	0.00500	0.02089	0.11257
Vanadium	0.00400	0.00589	0.00552
Zinc	0.04000	50.73249	3.39940

W8.2 WRSA Seepage Quality

The seepage from the waste rock storage area was assumed to be affected by the onset of ARD; therefore, seepage quality from the WRSA was derived directly from the results of the humidity cell data for waste rock. This assumption is based on the following:

- Amount of PAG rock present: The revised EIS was based on the assumption that 93% of the waste rock was assumed to be PAG, and no segregation of mine rock is planned. The current management plan for waste rock materials at the Goliath Gold Project is to treat it all as PAG material. This value (93%), was used in the development of models for seepage quality from the uncapped and capped WRSA, and pit lake water quality.
- ARD onset time for waste rock: For waste rock, the humidity cells reached a pH of < 6 (indicating the onset of ARD) within a period of 62–65 weeks. Considering the adjustments to the rate of ARD onset to reflect actual temperatures in the field as described with the Arrhenius Equation the time to acid onset for waste rock was estimated to be 158 weeks, but conservatively assumed to be 2 years.
- Potential for ARD in waste rock: Waste rock from the open pit mining operations will be placed in either the WRSA, or in the mined-out areas of the open pit. Much of the material present in the WRSA at closure will have been there since the early stages of mining activities (i.e., for longer than 10 years). Given 93% of the waste rock is assumed to be PAG, and the rate of ARD was conservatively predicted to be 2 years the analysis of seepage from the WRSA is based upon the assumption that ARD has occurred, and will continue to occur, and the seepage/runoff from the WRSA will be managed accordingly.
- Cover to the WRSA: During operations, the WRSA will remain uncapped from a geochemical perspective. At closure, a multi-layer, low-permeability dry cover will be constructed over the WSRA. The purpose of the cover over the WRSA is to reduce the rate of infiltration into the WRSA and thus the rate of seepage from the WRSA. The analysis of seepage from the WRSA assumed no reduction in the rate of ARD generation as a result of the cover.

Given the above, the estimates of seepage and runoff from the WRSA remain consistent with the assumptions used in the revised EIS (April 2018). These assumptions were used in the updated water quality modelling presented herein.

Table W8-1 also lists the seepage quality from the WRSA.

W8.3 Seepage Quality from the Minewater Pond

The minewater pond will be used during operations to manage the water from the open pit and will be used as a source of water to support the extraction process. The quality of the water within the minewater pond is a function of the quantity and quality of the sources of water. Table W8-2 provides a listing of the sources of water that will ultimately contribute the water quality within the minewater pond.

Table W8-2: Sources of Water to the Minewater Pond

Source	Volume (m^3/day)	Fraction of Inflow
Groundwater dewatering	1,320.0	49.89%
Seepage through the base of uncapped WRSA (ARD affected)	150.0	5.67%
Seepage from the toe of uncapped WRSA (batch treated) (1)	569.7	21.53%
Rainfall on portions of open pit with waste rock (ARD affected)	402.2	15.20%
Rainfall on portions of open pit without waste rock	201.1	7.60%
Seepage from the TSF to the open pit (including ditches)	2.5	0.09%
Seepage from TSF to the minewater pond	0.4	0.02%
Total Volume of the Open Pit	**2,646**	—

Note: The runoff from the toe of the WRSA will be collected in a segregated collection pond, tested and treated, if necessary, using batch lime addition prior to the integration into the water management system.

It should be noted that some of the contributions to the minewater pond listed in the above table include the potential effects of ARD (seepage from the uncapped WRSA and rainfall on portions of open pit with waste rock). In the case of the seepage from the toe of the waste rock storage area, this water will be collected in perimeter ditches around the WRSA and directed to a segregated runoff collection pond where the water will be tested and treated (as required) using batch lime addition prior to being integrated in the water management system, as discussed during the December 18, 2018 and January 10, 2019 technical meetings. The resulting water quality within the minewater pond, including the contributions of ARD, were included in the calculations of water treatment plant influent quality values presented in TMI_887-SW(2)-04. Any seepage from the minewater pond would have the same quality as the water within the minewater pond, as detailed in Table W8-3.

Table W8-3: Minewater Pond Water Quality and Seepage Quality

Parameter	Source	Ground Water Inflow	ARD Affected Rainwater on Open Pit	Clean Rainfall on open pit	WRSA Seepage	WRSA Runoff	TSF Seepage to Open Pit (including ditches)	TSF Seepage to Minewater Pond	Resulting Minewater Pond Quality
	Volume (m^3/d)	1,320	402	201	150	570	2.48	0.43	
Aluminum (mg/L)		0.01470	85.24533	0.68267	85.24533	0.27350	0.19900	0.19900	17.90991
Ammonia (unionized) (mg/L)		0.00316	2.83022	2.83241	2.83022	2.83022	0.22800	0.22800	1.41718
Ammonia (total) (mg/L)		0.08308	74.47938	74.53716	74.47938	74.47938	6.00000	6.00000	37.29426
Antimony (mg/L)		0.00074	0.00107	0.00130	0.00107	0.00107	0.00200	0.00200	0.00092
Arsenic (mg/L)		0.00248	0.03801	0.00134	0.03801	0.03801	0.01800	0.01800	0.01747
Barium (mg/L)		0.04099	—	0.01067	—	—	0.01200	0.01200	0.03693
Beryllium (mg/L)		0.00204	0.00495	0.00106	0.00495	0.00495	0.00050	0.00050	0.00320
Bismuth (mg/L)		0.00197	—	0.00089	—	—	0.00050	0.00050	0.00182
Boron (mg/L)		0.11971	0.12022	0.04111	0.12022	0.12022	0.02000	0.02000	0.11384
Cadmium (mg/L)		0.00004	0.00735	0.00005	0.00735	0.00020	0.00200	0.00200	0.00161
Calcium (mg/L)		59.57917	—	7.32556	—	—	7.15000	7.15000	52.58320
Carbonate (mg/L)		—	—	—	—	—	15.88000	15.88000	15.88000
Chromium (mg/L)		0.00200	0.00210	0.00171	0.00210	0.00210	0.00010	0.00010	0.00202
Chloride (mg/L)		22.76542	—	1.37667	—	—	0.78000	0.78000	19.90078
Cobalt (mg/L)		0.00156	0.75566	0.00067	0.75566	0.00090	0.00400	0.00400	0.15874
Copper (mg/L)		0.00564	0.27122	0.00128	0.27122	0.00500	0.01800	0.01800	0.06062
Cyanide (mg/L)		0.00200	—	0.00302	—	—	1.00000	1.00000	0.00404
Iron (mg/L)		0.26671	265.72775	1.76556	265.72775	1.49500	0.35800	0.35800	56.04967
Lead (mg/L)		0.00197	0.21064	0.00095	0.21064	0.00500	0.08200	0.08200	0.04618
Lithium (mg/L)		0.09950	—	0.03875	—	—	0.02400	0.02400	0.09134
Magnesium (mg/L)		12.76458	—	1.60222	—	—	1.44000	1.44000	11.26987
Manganese (mg/L)		0.36046	—	0.05504	—	—	0.06300	0.06300	0.31958
Mercury (mg/L)		0.00004	0.00005	0.00002	0.00005	0.00002	0.00180	0.00180	0.00004
Molybdenum (mg/L)		0.00233	0.00053	0.00101	0.00053	0.00053	0.00100	0.00100	0.00147

Table W8-3: Minewater Pond Water Quality and Seepage Quality (continued)

Parameter	Source	Ground Water Inflow	ARD Affected Rainwater on Open Pit	Clean Rainfall on open pit	WRSA Seepage	WRSA Runoff	TSF Seepage to Open Pit (including ditches)	TSF Seepage to Minewater Pond	Resulting Minewater Pond Quality
	Volume (m^3/d)	1,320	402	201	150	570	2.48	0.43	
Nickel (mg/L)		0.00535	5.75745	0.00200	5.75745	0.02500	0.02100	0.02100	1.20987
Nitrate (mg/L)		0.08496	—	0.11000	—	—	7.07000	7.07000	0.10162
pH (mg/L)		—	—	5.82000	—	—	6.16000	6.16000	5.82486
Phosphorus (mg/L)		—	—	0.03334	—	—	0.06000	0.06000	0.03372
Potassium (mg/L)		4.31917	—	0.94611	—	—	1.78000	1.78000	3.86918
Selenium (mg/L)		0.00236	0.00270	0.00117	0.00270	0.00270	0.00050	0.00050	0.00241
Silicon (mg/L)		—	—	6.93333	—	—	0.09900	0.09900	6.83572
Silver (mg/L)		0.00020	0.00011	0.00009	0.00011	0.00010	0.00005	0.00005	0.00015
Sodium (mg/L)		11.11292	—	1.38667	—	—	1.16000	1.16000	9.81035
Strontium (mg/L)		0.11640	—	0.01786	—	—	0.03200	0.03200	0.10323
Sulphate (mg/L)		31.37708	—	2.12000	—	—	68.67000	68.67000	27.58743
Sulphur (mg/L)		—	—	—	—	—	22.94000	22.94000	22.94000
Thallium (mg/L)		0.00060	0.00058	0.00027	0.00058	0.00030	0.64200	0.64200	0.00121
Tin (mg/L)		0.00198	—	0.00112	—	—	0.00050	0.00050	0.00186
Titanium (mg/L)		0.00699	—	0.02217	—	—	0.00300	0.00300	0.00898
Uranium (mg/L)		0.00803	0.11257	0.00400	0.11257	0.00500	0.00500	0.00500	0.02889
Vanadium (mg/L)		0.00205	0.00552	0.00161	0.00552	0.00552	0.00400	0.00400	0.00349
Zinc (mg/L)		0.00720	3.39940	0.01136	3.39940	0.03000	0.04000	0.04000	0.72045

As described Section W7.5 and in the response to TMI_911-GW(2)-04, refined particle tracking completed for the Project identified that all of the seepage from the WRSA would be captured by the drawdown created by the dewatering activities, and would report to the open pit during operations. Additionally, the refined particle tracking identified that 94% of the seepage from the TSF would also be captured by the drawdown and report to the open pit. Only a small amount of seepage from the eastern edge of the TSF (6% of the total seepage through the floor and walls of the TSF) would escape the drawdown and leave the site during operations. Based on this modelling, and the proximity of the minewater pond to the open pit, all of the seepage from the minewater pond is expected to be captured by the drawdown and report to the open pit. None of the seepage from the minewater pond is expected to leave the site, have an effect on surface water quality, including Blackwater Creek, or have an effect on fish and fish habitat.

The current conceptual design for the closure of the Project includes the decommissioning of the minewater pond and the grading of that portion of the site to drain towards the open pit.

W9 Revised Predictions of Surface Water Quality Effects

The model used for updating the assessment of effects of the Project on surface water quality is an integrated model that combines existing conditions, releases and discharges from the Project, seepage from the Project, and changes in surface water flow as a result of the Project. The Project will not result in releases to the environment during either the site preparation and construction, or closure phases. As such, an integrated model for surface water quality was not considered necessary for either the site preparation and construction, or closure phases. The water quality model has been updated to include the following changes to capture issues raised as part of the Round 2 information request process:

- Expand the list of indicators used in the model to include all parameters in Table 3.8.8-1 of the revised EIS (April 2018) for which regulatory criteria were available (Section W2);
- Consideration of the small quantity of seepage through the lined TSF predicted to reach Blackwater Creek during operations (Section W2);
- Inclusion of the full 2010–2013 baseline data (Section W3);
- Updated final effluent commitments are used as inputs to the model (Section W4); and
- Updated pit lake predictions to include all parameters in Table 3.8.8-1 of the revised EIS (April 2018) for which regulatory criteria were available (Section W5).

The results of the revised surface water quality modelling are provided in the following tables:

- Table W9-1: Operation Phase Water Quality Predictions by Station;
- Table W9-2: Post-Closure Phase Water Quality Predictions by Station for the Wet Cover Closure Option; and
- Table W9-3: Post-Closure Phase Water Quality Predictions by Station for the Dry Cover Closure Option.

W10 Revised Predictions of Residual Surface Water Quality Effects

As described in Section 6.8 of the revised EIS (April 2018), residual adverse effects for surface water quality were identified to be those situations when the predicted concentration of the indicator compounds as a result of the Project are higher than the concentrations for existing conditions. The resulting residual adverse effects predicted for surface water quality modelling are provided in the following tables:

- Table W10-1: Operation Phase Residual Water Quality Effects by Station;
- Table W10-2: Post-Closure Phase Residual Water Quality Effects (wet cover) by Station; and
- Table W10-3: Post-Closure Phase Residual Water Quality Effects (dry cover) by Station.

It should be noted that none of the predicted residual adverse effects of the Project on surface water quality presented in Table W10-1 (operations), Table W10-2 (post closure, wet cover), and Table W10-3 (post-closure, dry cover) exceed the respective water quality criteria established to protect aquatic life. To state that another way, the updated surface water quality modelling continues to indicate that surface water quality will be largely unchanged as a result of the Project, with resulting water quality being the same as, or slightly improved from the existing condition for most parameters. In the situation where the water quality in the receiving environment is predicted to the higher than existing conditions, the resulting water quality in the streams remains below the PWQO for the protection of aquatic life.

Tables W10-4 compares the number of predicted residual adverse effects during operations predicted in the revised EIS (April 2016) to the number of residual adverse effects predicted with the updated modelling to reflect the Round 2 responses. Table W10-5 compares the number of residual adverse effects predicted during post closure using a wet cover to the number during post-closure using a dry cover (see Tables W10-2 and W10-3). The table includes the number of chemical parameters evaluated to reflect the increased number of indicators used in the revised modelling. As stated above, all of the predicted residual water quality effects remain below their respective water quality criteria.

W11 Results of the Sensitivity Analysis

As discussed in Sections W7.1 and W7.3, the revised surface water quality modelling completed to support the Round 2 information process also considered three (3) additional surface water quality scenarios to test the sensitivity of the model to key inputs and to test absolute worst case upset scenarios, as requested by the reviewers. Specifically, the modelling included the following scenarios:

- A degraded liner case with a with seepage through the TSF liner of 31.3 m^3/d. This unrealistic estimate of potential seepage through the TSF liner, uses a seepage rate that is an order of magnitude higher than the upper bound seepage rate identified from literature. This seepage rate is not expected to occur for a properly installed liner and has been included to test the sensitivity of surface water quality predictions to changes in the liner performance. The post-closure modelling was completed with both a wet and dry closure option.
- A no liner case with seepage through the floor of the TSF of 200 m^3/d. This seepage rate is expected through the floor of the TSF in the absence of any liner, as predicted by the groundwater model presented in Appendix M to the revised EIS (April 2018). This level of seepage would only be possible for the wet cover option

Table W10-4: Comparison of Predicted Surface Water Residual Effects During Operations

Modelling Node (Location)	Modelled Operations Phase Residual Adverse Effects					
	Revised EIS (April 2018)			Revised Water Quality Modelling		
	Average	Wet	Dry	Average	Wet	Dry
BW1: Blackwater Creek (downstream of Project)	16 of 24	16 of 24	16 of 24	20 of 27	20 of 27	20 of 27
BW2: Blackwater Creek (discharge to Wabigoon Lake)	16 of 24	16 of 24	16 of 24	20 of 27	20 of 27	20 of 27
HB1: Hoffstrom's Bay Tributary (at Thunder Lake)	0 of 24	0 of 24	0 of 24	0 of 27	0 of 27	0 of 27
TL1: Thunder Lake Tributary #2 (downstream of pond)	0 of 24	0 of 24	0 of 24	0 of 27	0 of 27	0 of 27
TL2: Thunder Lake Tributary #3 (downstream of pond)	0 of 24	0 of 24	0 of 24	0 of 27	0 of 27	0 of 27
TL3: Thunder Lake Tributary #2 (at Thunder Lake)	0 of 24	0 of 24	0 of 24	0 of 27	0 of 27	0 of 27
LC1: Little Creek (at Thunder Lake)	0 of 24	0 of 24	0 of 24	0 of 27	0 of 27	0 of 27
Thunder Lake: Thunder Lake	0 of 24	0 of 24	0 of 24	0 of 27	0 of 27	0 of 27
Wabigoon Lake: Wabigoon Lake	2 of 24	4 of 24	1 of 24	2 of 27	5 of 27	1 of 27

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Table W10-5: Comparison of Predicted Surface Water Residual Effects During Post-Closure

Modelling Node (Location)	Modelled Post-Closure Phase Residual Adverse Effects					
	Wet Cover			Dry Cover		
	Average	Wet	Dry	Average	Wet	Dry
BW1: Blackwater Creek (downstream of Project)	13 of 27	13 of 27	13 of 27	14 of 27	14 of 27	14 of 27
BW2: Blackwater Creek (discharge to Wabigoon Lake)	13 of 27	13 of 27	13 of 27	14 of 27	14 of 27	14 of 27
HB1: Hoffstrom's Bay Tributary (at Thunder Lake)	0 of 27	0 of 27	3 of 27	3 of 27	2 of 27	5 of 27
TL1: Thunder Lake Tributary #2 (downstream of pond)	0 of 27	0 of 27	0 of 27	0 of 27	0 of 27	0 of 27
TL2: Thunder Lake Tributary #3 (downstream of pond)	0 of 27	0 of 27	0 of 27	2 of 27	2 of 27	4 of 27
TL3: Thunder Lake Tributary #2 (at Thunder Lake)	0 of 27	0 of 27	0 of 27	1 of 27	1 of 27	2 of 27
LC1: Little Creek (at Thunder Lake)	0 of 27	0 of 27	0 of 27	0 of 27	0 of 27	0 of 27
Thunder Lake: Thunder Lake	5 of 27	5 of 27	5 of 27	6 of 27	6 of 27	6 of 27
Wabigoon Lake: Wabigoon Lake	0 of 27	0 of 27	0 of 27	2 of 27	4 of 27	1 of 27

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- A case where the infiltration into the capped WRSA during post-closure was increased to 50% of the precipitation falling on the WRSA.

The water quality predictions and residual adverse effects for the “degraded liner case” are presented in the following tables:

- Table W11-1: Degraded Case Operation Phase Water Quality Predictions by Station;
- Table W11-2: Degraded Case Operation Phase Residual Effects by Station;
- Table W11-3: Degraded Case Post-Closure Phase Water Quality Predictions (wet cover) by Station;
- Table W11-4: Degraded Case Post-Closure (wet cover) Phase Residual Effects by Station;
- Table W11-5: Degraded Case Post-Closure Phase Water Quality Predictions (dry cover) by Station; and
- Table W11-6: Degraded Case Post-Closure Phase (dry cover) Residual Effect by Station.

The results of the sensitivity modelling show that changes in the TSF seepage rates and closure cover option will affect the predicted concentration in the receiving environment, the number of residual effects, and where those effects occur. The lowest number of residual effects are during operations and post-closure with a wet cover closure option for the TSF, where only thallium is predicted in excess of the PWQO value. It should be noted there were no predicted concentrations in excess of the PWQO value during average or 1:20 wet years, and the PWQO value for thallium that was used in the comparison is more than 2 orders of magnitude lower than the current MECP aquatic protection threshold of 40 µg/L (0.04 mg/L). The predicted residual effects do not exceed the MECP aquatic protection value for thallium, therefore it is not likely that the predicted concentrations of thallium in surface water would result in adverse effects to aquatic receptors within the surface water bodies. The results of the sensitivity modelling show that there are more residual adverse effects (parameters and locations) when the dry cover is selected for the closure of the TSF.

The water quality predictions and residual adverse effects for the “no liner case” are presented in the following tables:

- Table W11-7: No Liner Case Operation Phase Water Quality Predictions by Station;
- Table W11-8: No Liner Case Operation Phase Residual Effects by Station;
- Table W11-9: No Liner Case Post-Closure Phase Water Quality Predictions (wet cover) by Station;
- Table W11-10: No Liner Case Post-Closure Phase (wet cover) Residual Effects by Station;

The results of the sensitivity modelling of the no liner case show that there are more residual adverse effects (parameters and locations) in the absence of a TSF liner.

As described in Section W7.3, the “increased WRSA infiltration” scenario allows for 50% of the precipitation (i.e., 329 mm/year) to infiltrate through the multi-layer low permeability cover over the WRSA, to be potentially affected by the ARD/ML conditions within the WRSA. Of the 329 mm/year of precipitation that infiltrates into the WRSA, 75 mm/year is assumed to infiltrate into the underlying overburden and bedrock, with 50 mm/yr of this seepage reporting to the open pit and 25 mm/yr projected to leave the site and report to Thunder Lake. The remaining 254 mm/year of infiltration into the WRSA would drain laterally through the WRSA to the perimeter to be captured by the perimeter ditches and ultimately report to the open pit. As a result, it is expected that the quality of water within the pit lake will be influenced by the addition of ARD/ML affected water. As described in the revised EIS (April 2018), and listed in the Goliath Gold Project Mitigation, Monitoring , and Commitments List, monitoring and treatment of the pit lake will occur during the period when the pit lake is filling, and is expected to continue after the pit lake is fully flooded as described below:

- "The pit lake will be monitored as it is filling to determine whether batch treatment will be required to ensure the water meets PWQO, or background concentrations if background levels are greater than PWQO, prior to the discharge from the pit lake to a tributary of Blackwater Creek." (MMC-7.14)
- "Once the pit lake is fully flooded it is expected that the monitoring of the water quality in the pit lake will continue for a period of time to determine whether additional batch treatment may be required to ensure the water released from the pit lake meets effluent release limits." (MMC-7.15)

Table W11-11 provided the predicted untreated and treated water quality values for the pit lake. As stated above, the pit lake will continue to be monitored and treated as necessary, therefore, the treated pit lake water quality values W11-11 were used and inputs into the predictions of surface water quality. It should be noted that the untreated pit lake water quality for this scenario met the PWQO, or background, for more than 50% of the parameters. The water quality predictions and residual adverse effects for the "increased WRSA infiltration" are presented in the following tables:

- Table W11-12: Increased WRSA Infiltration Post-Closure Phase Water Quality Predictions (wet cover) by Station; and
- Table W11-13: Increased WRSA Infiltration Post-Closure (wet cover) residual Effects by Station.

The results of the sensitivity modelling of the increased infiltrations rate through multilayer low permeability cap on the WRSA, show that there are no residual effects in exceedance of the PWQO value.

W12 Follow Up Program for Water Quality

As part of the Round 2 information request process, Treasury Metals received a number of questions regarding the Follow-Up Program. As a result, Treasury Metals has prepared the Goliath Gold Project Follow-Up Program Addendum to capture the responses to these issues and provide a consolidated update to the Follow-Up Program. The updated surface water quality modelling continues to indicate that surface water quality will be largely unchanged as a result of the Project, with resulting water quality being the same as, or slightly improved from the existing condition for most parameters. For those parameters where the Project is predicted to result in concentrations above the existing conditions, the resulting concentrations remain below the PWQO for the protection of aquatic life. However, modifications have been made to the surface water components of the Follow-Up Program to more clearly define what parameters will be included, and how those parameters will be used to confirm the findings of the revised EIS, as updated with the Goliath Gold Project Water Addendum.

W13 References

Canadian Council of Ministers of the Environment. 2003. Canadian water quality guidelines for the protection of aquatic life: Inorganic mercury and methylmercury. In: Canadian environmental quality guidelines, 1999. Canadian Council of Ministers of the Environment, Winnipeg.

Jeremiason J.D., Engstrom D.R., Swain E.B., Nater E.A., Johnson B.M., Almendinger J.E., Monson B.A., Kolka R.K. Sulfate addition increases methylmercury production in an experimental wetland Environ Sci Technol, 40 (2006), pp. 3800-3806

Ullrich, S. M. (2001). Mercury in the Aquatic Environment: A Review of Factors Affecting Methylation. Critical Reviews in Environmental Science and Technology, 31(3):241-293.

Table W9-1: Operation Phase Water Quality Predictions by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.27350	0.27350	0.27349	0.27350	0.27350	0.27350	0.07805	0.07805	0.07805	0.07730	0.07730	0.07730	0.07730	0.07730	0.07730	0.07730	0.07730	0.07730	0.54750	0.54750	0.54750	0.02566	0.02652	0.02481	0.39112	0.39040	0.39180
Ammonia (un-ionized)	0.00534	0.00552	0.00459	0.00386	0.00397	0.00335	0.00076	0.00076	0.00076	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00076	0.00076	0.00076	0.00076	0.00076	0.00076	0.00089	0.00091	0.00088
Ammonia (total)	0.14059	0.14518	0.12091	0.10148	0.10441	0.08825	0.02000	0.02000	0.02000	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02000	0.02000	0.02000	0.02007	0.02006	0.02007	0.02351	0.02400	0.02305
Antimony	0.00487	0.00505	0.00408	0.00334	0.00346	0.00281	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00062	0.00064	0.00060
Arsenic	0.02279	0.02373	0.01877	0.01498	0.01558	0.01228	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00111	0.00119	0.00102
Beryllium	0.00320	0.00330	0.00280	0.00241	0.00247	0.00214	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00101	0.00102	0.00100
Boron	0.08302	0.08443	0.07692	0.07118	0.07209	0.06709	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05016	0.05029	0.05004
Cadmium	0.00011	0.00012	0.00011	0.00011	0.00011	0.00010	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009
Chloride	27.22367	28.34406	22.39138	17.83459	18.55100	14.59093	0.38500	0.38500	0.38500	0.26000	0.26000	0.26000	0.26000	0.26000	0.26000	0.26000	0.26000	0.26000	0.71000	0.71000	0.71000	3.66034	3.66167	3.65901	2.93858	3.03438	2.84938
Chromium	0.00274	0.00281	0.00242	0.00212	0.00216	0.00190	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00115	0.00115	0.00115	0.00100	0.00100	0.00100	0.00101	0.00102	0.00100
Cobalt	0.00062	0.00063	0.00061	0.00060	0.00060	0.00059	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Copper	0.00196	0.00200	0.00180	0.00165	0.00167	0.00155	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00150	0.00150	0.00150	0.00117	0.00117	0.00117	0.00149	0.00149	0.00149
Cyanide	0.00269	0.00270	0.00264	0.00244	0.00245	0.00240	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00201	0.00200
Iron	1.49497	1.49498	1.49489	1.49498	1.49499	1.49493	0.36500	0.36500	0.36500	0.86150	0.86150	0.86150	0.86150	0.86150	0.86150	0.86150	0.86150	0.86150	1.04500	1.04500	1.04500	0.14888	0.14717	0.15059	0.54074	0.54614	0.53558
Lead	0.00188	0.00192	0.00173	0.00157	0.00159	0.00146	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00101	0.00100
Mercury	0.00008	0.00008	0.00009	0.00009	0.00009	0.00009	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00010	0.00010	0.00010	0.00001	0.00001	0.00001	0.00010	0.00010	0.00010
Molybdenum	0.00959	0.00995	0.00800	0.00651	0.00674	0.00544	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00104	0.00108	0.00101
Nickel	0.00706	0.00728	0.00613	0.00525	0.00539	0.00462	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00202	0.00205	0.00201
Nitrate	2.88533	3.00742	2.35889	1.86165	1.93971	1.50826	0.10050	0.10050	0.10050	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.03000	0.03000	0.03000	0.03822	0.03816	0.03828	0.04409	0.05563	0.03332
Phosphorus	0.03040	0.03040	0.03040	0.03040	0.03040	0.03040	0.01055	0.01055	0.01055	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.04635	0.04635	0.04635	0.00828	0.00834	0.00822	0.02408	0.02411	0.02404
Selenium	0.02591	0.02681	0.02205	0.01842	0.01899	0.01582	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00500	0.00500	0.00500	0.00101	0.00102	0.00100	0.00499	0.00507	0.00491
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	5.69127	5.86333	4.95055	4.24240	4.35243	3.74502	0.78000	0.78000	0.78000	2.08500	2.08500	2.08500	2.08500	2.08500	2.08500	2.08500	2.08500	2.08500	1.47500	1.47500	1.47500	2.74279	2.73631	2.74927	1.83608	1.85142	1.82179
Thallium	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
Uranium	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00230	0.00234	0.00210	0.00192	0.00195	0.00179	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00165	0.00165	0.00165	0.00100	0.00100	0.00100	0.00110	0.00111	0.00110
Zinc	0.00918	0.00943	0.00810	0.00707	0.00723	0.00634	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00440	0.00440	0.00440	0.00300	0.00301	0.00300	0.00303	0.00306	0.00301

Table W9-2: Post-Closure Phase Water Quality Predictions (wet cover) by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.27349	0.27350	0.27348	0.27349	0.27350	0.27348	0.07806	0.07805	0.07807	0.07730	0.07730	0.07730	0.07730	0.07730	0.07731	0.07730	0.07730	0.07730	0.54750	0.54750	0.54750	0.02854	0.02941	0.02768	0.39105	0.39024	0.39177
Ammonia (un-ionized)	0.00190	0.00198	0.00220	0.00165	0.00171	0.00188	0.00077	0.00077	0.00081	0.00078	0.00078	0.00078	0.00078	0.00078	0.00080	0.00078	0.00078	0.00079	0.00076	0.00076	0.00076	0.00076	0.00076	0.00076	0.00088	0.00088	0.00087
Ammonia (total)	0.05009	0.05219	0.05795	0.04351	0.04508	0.04942	0.02034	0.02020	0.02123	0.02050	0.02050	0.02050	0.02062	0.02057	0.02092	0.02055	0.02053	0.02068	0.02000	0.02000	0.02000	0.02007	0.02007	0.02007	0.02309	0.02324	0.02298
Antimony	0.00074	0.00075	0.00079	0.00069	0.00070	0.00073	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.00111	0.00113	0.00116	0.00107	0.00108	0.00111	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Beryllium	0.00101	0.00101	0.00101	0.00101	0.00101	0.00101	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Boron	0.05035	0.05040	0.05048	0.05023	0.05026	0.05032	0.05000	0.05000	0.04999	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000
Cadmium	0.00009	0.00009	0.00009	0.00009	0.00009	0.00009	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009
Chloride	1.17494	1.19243	1.22909	1.12515	1.13814	1.16568	0.38589	0.38552	0.38818	0.26000	0.26000	0.26000	0.26031	0.26018	0.26110	0.26013	0.26008	0.26046	0.71000	0.71000	0.71000	3.65784	3.65918	3.65649	2.81103	2.80048	2.82075
Chromium	0.00099	0.00099	0.00099	0.00099	0.00099	0.00099	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00115	0.00115	0.00115	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Cobalt	0.00064	0.00065	0.00067	0.00060	0.00061	0.00063	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00053	0.00053	0.00053	0.00050	0.00050	0.00050
Copper	0.00182	0.00191	0.00209	0.00156	0.00163	0.00176	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00150	0.00150	0.00150	0.00118	0.00118	0.00118	0.00149	0.00149	0.00149
Cyanide	0.00239	0.00238	0.00270	0.00226	0.00226	0.00249	0.00206	0.00203	0.00221	0.00200	0.00200	0.00200	0.00202	0.00201	0.00207	0.00201	0.00200	0.00203	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200
Iron	1.49489	1.49494	1.49466	1.49492	1.49496	1.49474	0.36500	0.36500	0.36500	0.86150	0.86150	0.86150	0.86149	0.86149	0.86146	0.86150	0.86150	0.86149	1.04500	1.04500	1.04500	0.15820	0.15648	0.15991	0.54164	0.54771	0.53621
Lead	0.00152	0.00158	0.00172	0.00133	0.00138	0.00149	0.00100	0.00100	0.00102	0.00100	0.00100	0.00100	0.00100	0.00100	0.00101	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00101	0.00101	0.00101	0.00100	0.00101	0.00100
Mercury	0.00008	0.00008	0.00007	0.00009	0.00008	0.00008	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00010	0.00010	0.00010	0.00001	0.00001	0.00001	0.00010	0.00010	0.00010
Molybdenum	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Nickel	0.00788	0.00865	0.01006	0.00579	0.00636	0.00741	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00219	0.00219	0.00219	0.00204	0.00207	0.00202
Nitrate	0.04198	0.04316	0.04758	0.03777	0.03865	0.04199	0.10090	0.10073	0.10193	0.08950	0.08950	0.08950	0.08964	0.08958	0.08999	0.08956	0.08953	0.08971	0.03000	0.03000	0.03000	0.03826	0.03820	0.03833	0.03030	0.03037	0.03027
Phosphorus	0.03040	0.03040	0.03041	0.03040	0.03040	0.03041	0.01055	0.01055	0.01056	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.04635	0.04635	0.04635	0.00830	0.00836	0.00824	0.02408	0.02412	0.02404
Selenium	0.00396	0.00383	0.00358	0.00433	0.00423	0.00405	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00500	0.00500	0.00500	0.00101	0.00102	0.00100	0.00488	0.00487	0.00488
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	6.34957	6.96052	8.09616	4.67413	5.12716	5.97866	0.78391	0.78228	0.79395	2.08500	2.08500	2.08500	2.08632	2.08577	2.08970	2.08555	2.08532	2.08696	1.47500	1.47500	1.47500	2.94523	2.93871	2.95175	1.84748	1.87252	1.83432
Thallium	0.00030	0.00030	0.00031	0.00030	0.00030	0.00031	0.00030	0.00030	0.00031	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
Uranium	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00120	0.00119	0.00118	0.00122	0.00121	0.00120	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00165	0.00165	0.00165	0.00100	0.00100	0.00100	0.00110	0.00110	0.00110
Zinc	0.01013	0.01102	0.01266	0.00770	0.00836	0.00958	0.00300	0.00300	0.00301	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00440	0.00440	0.00440	0.00312	0.00312	0.00311	0.00304	0.00308	0.00302

Table W9-3: Post-Closure Phase Water Quality Predictions (dry cover) by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.27394	0.27375	0.27489	0.27383	0.27369	0.27457	0.07834	0.07822	0.07909
Ammonia (un-ionized)	0.00580	0.00656	0.00755	0.00421	0.00473	0.00552	0.00076	0.00076	0.00077
Ammonia (total)	0.15263	0.17272	0.19880	0.11070	0.12441	0.14525	0.02011	0.02006	0.02039
Antimony	0.00074	0.00076	0.00079	0.00069	0.00071	0.00073	0.00060	0.00060	0.00060
Arsenic	0.00117	0.00119	0.00123	0.00111	0.00113	0.00116	0.00100	0.00100	0.00100
Beryllium	0.00101	0.00101	0.00101	0.00101	0.00101	0.00101	0.00100	0.00100	0.00100
Boron	0.05033	0.05039	0.05046	0.05022	0.05026	0.05031	0.05000	0.05000	0.05000
Cadmium	0.00013	0.00013	0.00016	0.00011	0.00011	0.00014	0.00002	0.00002	0.00004
Chloride	30.11703	34.96554	41.12871	20.04525	23.35612	28.28423	0.38498	0.38499	0.38492
Chromium	0.00099	0.00099	0.00099	0.00099	0.00099	0.00099	0.00100	0.00100	0.00100
Cobalt	0.00064	0.00065	0.00068	0.00061	0.00061	0.00064	0.00050	0.00050	0.00051
Copper	0.00215	0.00227	0.00273	0.00180	0.00187	0.00224	0.00106	0.00104	0.00123
Cyanide	0.00273	0.00286	0.00301	0.00248	0.00256	0.00269	0.00200	0.00200	0.00200
Iron	1.49548	1.49528	1.49654	1.49536	1.49521	1.49619	0.36538	0.36522	0.36634
Lead	0.00206	0.00219	0.00259	0.00170	0.00178	0.00211	0.00105	0.00103	0.00118
Mercury	0.00008	0.00008	0.00007	0.00009	0.00008	0.00008	0.00001	0.00001	0.00001
Molybdenum	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Nickel	0.00764	0.00857	0.00980	0.00569	0.00632	0.00730	0.00201	0.00201	0.00203
Nitrate	3.20064	3.72924	4.40119	2.10257	2.46353	3.00083	0.10049	0.10050	0.10048
Phosphorus	0.03056	0.03049	0.03089	0.03052	0.03047	0.03078	0.01065	0.01061	0.01091
Selenium	0.00403	0.00386	0.00366	0.00436	0.00425	0.00409	0.00100	0.00100	0.00100
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	6.15392	6.89402	7.89173	4.59573	5.10070	5.89746	0.79166	0.78678	0.82156
Thallium	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
Uranium	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00122	0.00122	0.00121	0.00123	0.00123	0.00122	0.00100	0.00100	0.00100
Zinc	0.01438	0.01352	0.02674	0.01095	0.01026	0.02058	0.00592	0.00470	0.01342

Parameter	TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.07730	0.07730	0.07730	0.07740	0.07736	0.07766	0.07734	0.07732	0.07745
Ammonia (un-ionized)	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078
Ammonia (total)	0.02050	0.02050	0.02050	0.02054	0.02052	0.02063	0.02052	0.02051	0.02056
Antimony	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Beryllium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Boron	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000
Cadmium	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
Chloride	0.26000	0.26000	0.26000	0.25999	0.26000	0.25998	0.26000	0.26000	0.25999
Chromium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Cobalt	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Copper	0.00100	0.00100	0.00100	0.00102	0.00101	0.00108	0.00101	0.00101	0.00103
Cyanide	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200
Iron	0.86150	0.86150	0.86150	0.86162	0.86157	0.86192	0.86155	0.86153	0.86168
Lead	0.00100	0.00100	0.00100	0.00102	0.00101	0.00106	0.00101	0.00100	0.00103
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Nickel	0.00200	0.00200	0.00200	0.00200	0.00200	0.00201	0.00200	0.00200	0.00200
Nitrate	0.08950	0.08950	0.08950	0.08950	0.08950	0.08949	0.08950	0.08950	0.08950
Phosphorus	0.01125	0.01125	0.01125	0.01128	0.01127	0.01137	0.01126	0.01126	0.01130
Selenium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	2.08500	2.08500	2.08500	2.08898	2.08731	2.09917	2.08666	2.08597	2.09092
Thallium	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
Uranium	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Zinc	0.00300	0.00300	0.00300	0.00400	0.00358	0.00658	0.00342	0.00324	0.00450

Parameter	LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.54750	0.54750	0.54750	0.02855	0.02941	0.02768	0.39102	0.39023	0.39177
Ammonia (un-ionized)	0.00076	0.00076	0.00076	0.00076	0.00076	0.00076	0.00090	0.00093	0.00088
Ammonia (total)	0.02000	0.02000	0.02000	0.02007	0.02006	0.02007	0.02366	0.02442	0.02323
Antimony	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Beryllium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Boron	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000
Cadmium	0.00009	0.00009	0.00009	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009
Chloride	0.71000	0.71000	0.71000	3.65782	3.65916	3.65648	2.97217	3.13043	2.89088
Chromium	0.00115	0.00115	0.00115	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Cobalt	0.00050	0.00050	0.00050	0.00053	0.00053	0.00053	0.00050	0.00050	0.00050
Copper	0.00150	0.00150	0.00150	0.00118	0.00118	0.00118	0.00149	0.00150	0.00149
Cyanide	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00201	0.00200
Iron	1.04500	1.04500	1.04500	0.15820	0.15648	0.15992	0.54188	0.54784	0.53628
Lead	0.00100	0.00100	0.00100	0.00101	0.00101	0.00101	0.00101	0.00101	0.00100
Mercury	0.00010	0.00010	0.00010	0.00001	0.00001	0.00001	0.00010	0.00010	0.00010
Molybdenum	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Nickel	0.00200	0.00200	0.00200	0.00219	0.00219	0.00219	0.00204	0.00207	0.00202
Nitrate	0.03000	0.03000	0.03000	0.03825	0.03819	0.03832	0.04794	0.06640	0.03794
Phosphorus	0.04635	0.04635	0.04635	0.00830	0.00836	0.00824	0.02408	0.02412	0.02404
Selenium	0.00500	0.00500	0.00500	0.00101	0.00102	0.00100	0.00488	0.00487	0.00488
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	1.47500	1.47500	1.47500	2.94537	2.93885	2.95189	1.84751	1.87256	1.83438
Thallium	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
Uranium	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00165	0.00165	0.00165	0.00100	0.00100	0.00100	0.00110	0.00110	0.00110
Zinc	0.00440	0.00440	0.00440	0.00317	0.00317	0.00316	0.00307	0.00311	0.00305

Table W10-1: Operation Phase Residual Water Quality Effects by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ammonia (un-ionized)	0.00534	0.00552	0.00459	0.00386	0.00397	0.00335	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ammonia (total)	0.14059	0.14518	0.12091	0.10148	0.10441	0.08825	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Antimony	0.00487	0.00505	0.00408	0.00334	0.00346	0.00281	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00064	—
Arsenic	0.02279	0.02373	0.01877	0.01498	0.01558	0.01228	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00111	0.00119	—
Beryllium	0.00320	0.00330	0.00280	0.00241	0.00247	0.00214	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boron	0.08302	0.08443	0.07692	0.07118	0.07209	0.06709	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	0.00011	0.00012	0.00011	0.00011	0.00011	0.00010	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chloride	27.22367	28.34406	22.39138	17.83459	18.55100	14.59093	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3.03438	—
Chromium	0.00274	0.00281	0.00242	0.00212	0.00216	0.00190	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cobalt	0.00062	0.00063	0.00061	0.00060	0.00060	0.00059	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Copper	0.00196	0.00200	0.00180	0.00165	0.00167	0.00155	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cyanide	0.00269	0.00270	0.00264	0.00244	0.00245	0.00240	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lead	0.00188	0.00192	0.00173	0.00157	0.00159	0.00146	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mercury	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Molybdenum	0.00959	0.00995	0.00800	0.00651	0.00674	0.00544	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00108	—
Nickel	0.00706	0.00728	0.00613	0.00525	0.00539	0.00462	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nitrate	2.88533	3.00742	2.35889	1.86165	1.93971	1.50826	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.04409	0.05563	0.03332
Phosphorus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Selenium	0.02591	0.02681	0.02205	0.01842	0.01899	0.01582	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sulphate	5.69127	5.86333	4.95055	4.24240	4.35243	3.74502	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Thallium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vanadium	0.00230	0.00234	0.00210	0.00192	0.00195	0.00179	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc	0.00918	0.00943	0.00810	0.00707	0.00723	0.00634	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table W10-2: Post-Closure Phase Residual Water Quality Effects (wet cover) by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.02854	0.02941	0.02768	—	—	—
Ammonia (un-ionized)	0.00190	0.00198	0.00220	0.00165	0.00171	0.00188	—	—	0.00081	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ammonia (total)	0.05009	0.05219	0.05795	0.04351	0.04508	0.04942	—	—	0.02123	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Antimony	0.00074	0.00075	0.00079	0.00069	0.00070	0.00073	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Arsenic	0.00111	0.00113	0.00116	0.00107	0.00108	0.00111	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Beryllium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chloride	1.17494	1.19243	1.22909	1.12515	1.13814	1.16568	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chromium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cobalt	0.00064	0.00065	0.00067	0.00060	0.00061	0.00063	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00053	0.00053	0.00053	—	—	—
Copper	0.00182	0.00191	0.00209	0.00156	0.00163	0.00176	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cyanide	0.00239	0.00238	0.00270	0.00226	0.00226	0.00249	—	—	0.00221	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.15820	0.15648	0.15991	—	—	—
Lead	0.00152	0.00158	0.00172	0.00133	0.00138	0.00149	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mercury	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Molybdenum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nickel	0.00788	0.00865	0.01006	0.00579	0.00636	0.00741	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00219	0.00219	0.00219	—	—	—
Nitrate	0.04198	0.04316	0.04758	0.03777	0.03865	0.04199	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Phosphorus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Selenium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sulphate	6.34957	6.96052	8.09616	4.67413	5.12716	5.97866	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2.94523	2.93871	2.95175	—	—	—
Thallium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vanadium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc	0.01013	0.01102	0.01266	0.00770	0.00836	0.00958	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table W10-3: Post-Closure Phase Residual Water Quality Effects (dry cover) by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.02855	0.02941	0.02768	—	—	—
Ammonia (un-ionized)	0.00580	0.00656	0.00755	0.00421	0.00473	0.00552	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00093	—
Ammonia (total)	0.15263	0.17272	0.19880	0.11070	0.12441	0.14525	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.02442	—
Antimony	0.00074	0.00076	0.00079	0.00069	0.00071	0.00073	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Arsenic	0.00117	0.00119	0.00123	0.00111	0.00113	0.00116	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Beryllium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	0.00013	0.00013	0.00016	0.00011	0.00011	0.00014	0.00002	0.00002	0.00004	—	—	—	0.00002	0.00002	0.00002	—	—	0.00002	—	—	—	—	—	—	—	—	—
Chloride	30.11703	34.96554	41.12871	20.04525	23.35612	28.28423	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2.97217	3.13043	—
Chromium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cobalt	0.00064	0.00065	0.00068	0.00061	0.00061	0.00064	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00053	0.00053	0.00053	—	—	—
Copper	0.00215	0.00227	0.00273	0.00180	0.00187	0.00224	0.00106	—	0.00123	—	—	—	—	—	0.00108	—	—	—	—	—	—	—	—	—	—	—	—
Cyanide	0.00273	0.00286	0.00301	0.00248	0.00256	0.00269	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.15820	0.15648	0.15992	—	—	—
Lead	0.00206	0.00219	0.00259	0.00170	0.00178	0.00211	—	—	0.00118	—	—	—	—	—	0.00106	—	—	—	—	—	—	—	—	—	—	—	—
Mercury	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Molybdenum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nickel	0.00764	0.00857	0.00980	0.00569	0.00632	0.00730	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00219	0.00219	0.00219	—	—	—
Nitrate	3.20064	3.72924	4.40119	2.10257	2.46353	3.00083	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.04794	0.06640	0.03794
Phosphorus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Selenium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sulphate	6.15392	6.89402	7.89173	4.59573	5.10070	5.89746	—	—	0.82156	—	—	—	—	—	—	—	—	—	—	—	—	2.94537	2.93885	2.95189	—	—	—
Thallium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vanadium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc	0.01438	0.01352	0.02674	0.01095	0.01026	0.02058	0.00592	0.00470	0.01342	—	—	—	0.00400	0.00358	0.00658	0.00342	0.00324	0.00450	—	—	—	0.00317	0.00317	0.00316	—	—	—

Table W11-1: Degraded Case Operation Phase Water Quality Predictions by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.27348	0.27349	0.27343	0.27349	0.27349	0.27345	0.07805	0.07805	0.07805	0.07730	0.07730	0.07730	0.07730	0.07730	0.07730	0.07730	0.07730	0.07730	0.54750	0.54750	0.54750	0.02566	0.02652	0.02481	0.39112	0.39040	0.39180
Ammonia (un-ionized)	0.00540	0.00555	0.00479	0.00389	0.00399	0.00348	0.00076	0.00076	0.00076	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00076	0.00076	0.00076	0.00076	0.00076	0.00076	0.00089	0.00091	0.00088
Ammonia (total)	0.14201	0.14599	0.12614	0.10239	0.10493	0.09158	0.02000	0.02000	0.02000	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02000	0.02000	0.02000	0.02007	0.02006	0.02007	0.02352	0.02400	0.02306
Antimony	0.00487	0.00505	0.00408	0.00334	0.00346	0.00281	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00062	0.00064	0.00060
Arsenic	0.02280	0.02373	0.01879	0.01498	0.01558	0.01229	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00111	0.00119	0.00102
Beryllium	0.00320	0.00330	0.00279	0.00241	0.00247	0.00214	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00101	0.00102	0.00100
Boron	0.08301	0.08443	0.07690	0.07118	0.07208	0.06707	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05016	0.05029	0.05004
Cadmium	0.00011	0.00012	0.00011	0.00011	0.00011	0.00010	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009
Chloride	27.22722	28.34608	22.40440	17.83686	18.55230	14.59919	0.38500	0.38500	0.38500	0.26000	0.26000	0.26000	0.26000	0.26000	0.26000	0.26000	0.26000	0.26000	0.71000	0.71000	0.71000	3.66034	3.66167	3.65901	2.93859	3.03440	2.84940
Chromium	0.00274	0.00281	0.00242	0.00212	0.00216	0.00190	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00115	0.00115	0.00115	0.00100	0.00100	0.00100	0.00101	0.00102	0.00100
Cobalt	0.00062	0.00063	0.00061	0.00060	0.00060	0.00059	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Copper	0.00196	0.00200	0.00182	0.00165	0.00168	0.00155	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00150	0.00150	0.00150	0.00117	0.00117	0.00117	0.00149	0.00149	0.00149
Cyanide	0.00279	0.00276	0.00302	0.00251	0.00249	0.00265	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00201	0.00200
Iron	1.49470	1.49483	1.49389	1.49481	1.49489	1.49430	0.36500	0.36500	0.36500	0.86150	0.86150	0.86150	0.86150	0.86150	0.86150	0.86150	0.86150	0.86150	1.04500	1.04500	1.04500	0.14888	0.14717	0.15059	0.54074	0.54614	0.53558
Lead	0.00190	0.00193	0.00180	0.00158	0.00160	0.00151	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00101	0.00100
Mercury	0.00008	0.00008	0.00009	0.00009	0.00009	0.00009	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00010	0.00010	0.00010	0.00001	0.00001	0.00001	0.00010	0.00010	0.00010
Molybdenum	0.00959	0.00995	0.00800	0.00651	0.00674	0.00544	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00104	0.00108	0.00101
Nickel	0.00707	0.00728	0.00615	0.00525	0.00539	0.00463	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00202	0.00205	0.00201
Nitrate	2.88701	3.00837	2.36506	1.86273	1.94033	1.51217	0.10050	0.10050	0.10050	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.03000	0.03000	0.03000	0.03822	0.03816	0.03828	0.04410	0.05564	0.03333
Phosphorus	0.03041	0.03040	0.03043	0.03041	0.03040	0.03042	0.01055	0.01055	0.01055	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.04635	0.04635	0.04635	0.00828	0.00834	0.00822	0.02408	0.02411	0.02404
Selenium	0.02591	0.02681	0.02205	0.01841	0.01899	0.01582	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00500	0.00500	0.00500	0.00101	0.00102	0.00100	0.00499	0.00507	0.00491
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	5.70728	5.87244	5.00931	4.25268	4.35827	3.78232	0.78000	0.78000	0.78000	2.08500	2.08500	2.08500	2.08500	2.08500	2.08500	2.08500	2.08500	2.08500	1.47500	1.47500	1.47500	2.74279	2.73631	2.74927	1.83615	1.85150	1.82186
Thallium	0.00031	0.00030	0.00033	0.00031	0.00030	0.00032	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
Uranium	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00230	0.00234	0.00211	0.00192	0.00195	0.00179	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00165	0.00165	0.00165	0.00100	0.00100	0.00100	0.00110	0.00111	0.00110
Zinc	0.00919	0.00943	0.00813	0.00708	0.00723	0.00636	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00440	0.00440	0.00440	0.00300	0.00301	0.00300	0.00303	0.00306	0.00301

Table W11-2: Degraded Case Operation Phase Residual Effects by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ammonia (un-ionized)	0.00540	0.00555	0.00479	0.00389	0.00399	0.00348	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ammonia (total)	0.14201	0.14599	0.12614	0.10239	0.10493	0.09158	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Antimony	0.00487	0.00505	0.00408	0.00334	0.00346	0.00281	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00064	—
Arsenic	0.02280	0.02373	0.01879	0.01498	0.01558	0.01229	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00111	0.00119	—
Beryllium	0.00320	0.00330	0.00279	0.00241	0.00247	0.00214	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boron	0.08301	0.08443	0.07690	0.07118	0.07208	0.06707	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	0.00011	0.00012	0.00011	0.00011	0.00011	0.00010	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chloride	27.22722	28.34608	22.40440	17.83686	18.55230	14.59919	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3.03440	—
Chromium	0.00274	0.00281	0.00242	0.00212	0.00216	0.00190	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cobalt	0.00062	0.00063	0.00061	0.00060	0.00060	0.00059	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Copper	0.00196	0.00200	0.00182	0.00165	0.00168	0.00155	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cyanide	0.00279	0.00276	0.00302	0.00251	0.00249	0.00265	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lead	0.00190	0.00193	0.00180	0.00158	0.00160	0.00151	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mercury	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Molybdenum	0.00959	0.00995	0.00800	0.00651	0.00674	0.00544	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00108	—
Nickel	0.00707	0.00728	0.00615	0.00525	0.00539	0.00463	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nitrate	2.88701	3.00837	2.36506	1.86273	1.94033	1.51217	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.04410	0.05564	0.03333
Phosphorus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Selenium	0.02591	0.02681	0.02205	0.01841	0.01899	0.01582	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sulphate	5.70728	5.87244	5.00931	4.25268	4.35827	3.78232	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Thallium	—	—	**0.00033**	—	—	**0.00032**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vanadium	0.00230	0.00234	0.00211	0.00192	0.00195	0.00179	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc	0.00919	0.00943	0.00813	0.00708	0.00723	0.00636	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table W11-3: Degraded Case Post-Closure Phase Water Quality Predictions (wet cover) by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.27343	0.27346	0.27328	0.27345	0.27347	0.27333	0.07812	0.07809	0.07830
Ammonia (un-ionized)	0.00264	0.00271	0.00356	0.00215	0.00220	0.00284	0.00089	0.00084	0.00123
Ammonia (total)	0.06957	0.07131	0.09361	0.05649	0.05784	0.07481	0.02345	0.02201	0.03229
Antimony	0.00074	0.00076	0.00079	0.00069	0.00070	0.00073	0.00060	0.00060	0.00060
Arsenic	0.00117	0.00118	0.00126	0.00111	0.00112	0.00118	0.00101	0.00101	0.00103
Beryllium	0.00101	0.00101	0.00101	0.00100	0.00101	0.00101	0.00100	0.00100	0.00100
Boron	0.05025	0.05030	0.05030	0.05016	0.05020	0.05019	0.04998	0.04999	0.04994
Cadmium	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00002	0.00002	0.00002
Chloride	1.22249	1.23896	1.31656	1.15686	1.16923	1.22803	0.39393	0.39020	0.41684
Chromium	0.00099	0.00099	0.00098	0.00099	0.00099	0.00099	0.00100	0.00100	0.00100
Cobalt	0.00064	0.00065	0.00068	0.00061	0.00061	0.00064	0.00050	0.00050	0.00051
Copper	0.00187	0.00196	0.00218	0.00159	0.00166	0.00183	0.00101	0.00101	0.00103
Cyanide	0.00324	0.00313	0.00452	0.00284	0.00276	0.00383	0.00229	0.00217	0.00302
Iron	1.49393	1.49441	1.49164	1.49422	1.49456	1.49243	0.36500	0.36500	0.36499
Lead	0.00178	0.00184	0.00220	0.00151	0.00155	0.00183	0.00105	0.00103	0.00117
Mercury	0.00008	0.00008	0.00008	0.00009	0.00009	0.00009	0.00001	0.00001	0.00001
Molybdenum	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Nickel	0.00790	0.00866	0.01011	0.00580	0.00636	0.00745	0.00201	0.00201	0.00204
Nitrate	0.06505	0.06582	0.08977	0.05314	0.05378	0.07204	0.10452	0.10284	0.11482
Phosphorus	0.03043	0.03042	0.03049	0.03042	0.03041	0.03047	0.01058	0.01057	0.01065
Selenium	0.00396	0.00383	0.00357	0.00433	0.00423	0.00404	0.00100	0.00100	0.00100
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	6.40624	6.99188	8.27464	4.71559	5.15050	6.11487	0.81914	0.80277	0.91949
Thallium	0.00033	0.00032	0.00039	0.00032	0.00031	0.00037	0.00032	0.00031	0.00036
Uranium	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00121	0.00120	0.00120	0.00122	0.00122	0.00121	0.00100	0.00100	0.00101
Zinc	0.01016	0.01104	0.01276	0.00772	0.00837	0.00966	0.00302	0.00301	0.00308

Parameter	TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.07730	0.07730	0.07730	0.07732	0.07731	0.07739	0.07731	0.07731	0.07734
Ammonia (un-ionized)	0.00078	0.00078	0.00078	0.00082	0.00081	0.00094	0.00080	0.00079	0.00085
Ammonia (total)	0.02050	0.02050	0.02050	0.02168	0.02119	0.02472	0.02099	0.02079	0.02226
Antimony	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.00100	0.00100	0.00100	0.00100	0.00100	0.00101	0.00100	0.00100	0.00101
Beryllium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Boron	0.05000	0.05000	0.05000	0.04999	0.05000	0.04998	0.05000	0.05000	0.04999
Cadmium	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
Chloride	0.26000	0.26000	0.26000	0.26309	0.26180	0.27102	0.26129	0.26075	0.26460
Chromium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Cobalt	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Copper	0.00100	0.00100	0.00100	0.00100	0.00100	0.00101	0.00100	0.00100	0.00101
Cyanide	0.00200	0.00200	0.00200	0.00210	0.00206	0.00235	0.00204	0.00202	0.00215
Iron	0.86150	0.86150	0.86150	0.86140	0.86144	0.86114	0.86146	0.86148	0.86135
Lead	0.00100	0.00100	0.00100	0.00102	0.00101	0.00106	0.00101	0.00100	0.00102
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Nickel	0.00200	0.00200	0.00200	0.00200	0.00200	0.00201	0.00200	0.00200	0.00201
Nitrate	0.08950	0.08950	0.08950	0.09088	0.09030	0.09442	0.09008	0.08984	0.09156
Phosphorus	0.01125	0.01125	0.01125	0.01126	0.01126	0.01128	0.01125	0.01125	0.01126
Selenium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	2.08500	2.08500	2.08500	2.09818	2.09266	2.13196	2.09051	2.08820	2.10462
Thallium	0.00030	0.00030	0.00030	0.00031	0.00030	0.00032	0.00030	0.00030	0.00031
Uranium	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Zinc	0.00300	0.00300	0.00300	0.00301	0.00300	0.00303	0.00300	0.00300	0.00301

Parameter	LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.54750	0.54750	0.54750	0.02854	0.02941	0.02768	0.39105	0.39024	0.39177
Ammonia (un-ionized)	0.00076	0.00076	0.00076	0.00076	0.00076	0.00076	0.00088	0.00089	0.00088
Ammonia (total)	0.02000	0.02000	0.02000	0.02012	0.02012	0.02013	0.02319	0.02343	0.02305
Antimony	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Beryllium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Boron	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000
Cadmium	0.00009	0.00009	0.00009	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009
Chloride	0.71000	0.71000	0.71000	3.65797	3.65931	3.65662	2.81129	2.80094	2.82091
Chromium	0.00115	0.00115	0.00115	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Cobalt	0.00050	0.00050	0.00050	0.00053	0.00053	0.00053	0.00050	0.00050	0.00050
Copper	0.00150	0.00150	0.00150	0.00118	0.00118	0.00118	0.00149	0.00149	0.00149
Cyanide	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00201	0.00201	0.00200
Iron	1.04500	1.04500	1.04500	0.15820	0.15648	0.15991	0.54164	0.54770	0.53621
Lead	0.00100	0.00100	0.00100	0.00101	0.00101	0.00101	0.00100	0.00101	0.00100
Mercury	0.00010	0.00010	0.00010	0.00001	0.00001	0.00001	0.00010	0.00010	0.00010
Molybdenum	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Nickel	0.00200	0.00200	0.00200	0.00219	0.00219	0.00219	0.00204	0.00207	0.00202
Nitrate	0.03000	0.03000	0.03000	0.03832	0.03826	0.03839	0.03043	0.03059	0.03035
Phosphorus	0.04635	0.04635	0.04635	0.00830	0.00836	0.00824	0.02408	0.02412	0.02404
Selenium	0.00500	0.00500	0.00500	0.00101	0.00102	0.00100	0.00488	0.00487	0.00488
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	1.47500	1.47500	1.47500	2.94583	2.93931	2.95235	1.84784	1.87288	1.83468
Thallium	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
Uranium	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00165	0.00165	0.00165	0.00100	0.00100	0.00100	0.00110	0.00110	0.00110
Zinc	0.00440	0.00440	0.00440	0.00312	0.00312	0.00311	0.00304	0.00308	0.00302

Table W11-4: Degraded Case Post-Closure (wet cover) Phase Residual Effects by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.02854	0.02941	0.02768	—	—	—
Ammonia (un-ionized)	0.00264	0.00271	0.00356	0.00215	0.00220	0.00284	0.00089	0.00084	0.00123	—	—	—	0.00082	—	0.00094	—	—	0.00085	—	—	—	—	—	—	—	—	—
Ammonia (total)	0.06957	0.07131	0.09361	0.05649	0.05784	0.07481	0.02345	0.02201	0.03229	—	—	—	0.02168	—	0.02472	—	—	0.02226	—	—	—	—	—	—	—	—	—
Antimony	0.00074	0.00076	0.00079	0.00069	0.00070	0.00073	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Arsenic	0.00117	0.00118	0.00126	0.00111	0.00112	0.00118	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Beryllium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00002	—	0.00002	—	—	—	—	—	0.00002	—	—	—	—	—	—	—	—	—	—	—	—
Chloride	1.22249	1.23896	1.31656	1.15686	1.16923	1.22803	—	—	0.41684	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chromium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cobalt	0.00064	0.00065	0.00068	0.00061	0.00061	0.00064	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00053	0.00053	0.00053	—	—	—
Copper	0.00187	0.00196	0.00218	0.00159	0.00166	0.00183	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cyanide	0.00324	0.00313	0.00452	0.00284	0.00276	0.00383	0.00229	0.00217	0.00302	—	—	—	—	—	0.00235	—	—	0.00215	—	—	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.15820	0.15648	0.15991	—	—	—
Lead	0.00178	0.00184	0.00220	0.00151	0.00155	0.00183	—	—	0.00117	—	—	—	—	—	0.00106	—	—	—	—	—	—	—	—	—	—	—	—
Mercury	—	—	—	—	—	—	0.00001	0.00001	0.00001	—	—	—	—	—	0.00001	—	—	0.00001	—	—	—	—	—	—	—	—	—
Molybdenum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nickel	0.00790	0.00866	0.01011	0.00580	0.00636	0.00745	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00219	0.00219	0.00219	—	—	—
Nitrate	0.06505	0.06582	0.08977	0.05314	0.05378	0.07204	—	—	0.11482	—	—	—	—	—	0.09442	—	—	—	—	—	—	—	—	—	—	—	—
Phosphorus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Selenium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sulphate	6.40624	6.99188	8.27464	4.71559	5.15050	6.11487	0.81914	—	0.91949	—	—	—	—	—	—	—	—	—	—	—	—	2.94583	2.93931	2.95235	—	—	—
Thallium	**0.00033**	**0.00032**	**0.00039**	**0.00032**	—	**0.00037**	**0.00032**	—	**0.00036**	—	—	—	—	—	**0.00032**	—	—	—	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vanadium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc	0.01016	0.01104	0.01276	0.00772	0.00837	0.00966	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table W11-5: Degraded Case Post-Closure Phase Water Quality Predictions (dry cover) by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.27787	0.27600	0.28737	0.27675	0.27537	0.28422	0.08097	0.07975	0.08846	0.07730	0.07730	0.07730	0.07830	0.07788	0.08087	0.07772	0.07754	0.07879	0.54750	0.54750	0.54750	0.02859	0.02946	0.02773	0.39105	0.39026	0.39179
Ammonia (un-ionized)	0.00580	0.00656	0.00755	0.00420	0.00473	0.00552	0.00076	0.00076	0.00076	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00076	0.00076	0.00076	0.00076	0.00076	0.00076	0.00090	0.00093	0.00088
Ammonia (total)	0.15257	0.17270	0.19874	0.11065	0.12439	0.14519	0.02000	0.02000	0.02000	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02000	0.02000	0.02000	0.02007	0.02006	0.02007	0.02366	0.02442	0.02323
Antimony	0.00074	0.00076	0.00080	0.00069	0.00071	0.00073	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.00116	0.00118	0.00125	0.00111	0.00112	0.00117	0.00101	0.00101	0.00103	0.00100	0.00100	0.00100	0.00100	0.00100	0.00101	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Beryllium	0.00101	0.00101	0.00101	0.00101	0.00101	0.00101	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Boron	0.05033	0.05039	0.05047	0.05022	0.05025	0.05033	0.05001	0.05000	0.05002	0.05000	0.05000	0.05000	0.05000	0.05000	0.05001	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000
Cadmium	0.00021	0.00017	0.00042	0.00018	0.00015	0.00034	0.00008	0.00005	0.00023	0.00002	0.00002	0.00002	0.00004	0.00003	0.00009	0.00003	0.00002	0.00005	0.00009	0.00009	0.00009	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009
Chloride	30.11620	34.96506	41.12606	20.04463	23.35577	28.28218	0.38478	0.38487	0.38421	0.26000	0.26000	0.26000	0.25995	0.25997	0.25982	0.25998	0.25999	0.25992	0.71000	0.71000	0.71000	3.65781	3.65915	3.65646	2.97216	3.13043	2.89087
Chromium	0.00099	0.00099	0.00099	0.00099	0.00099	0.00099	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00115	0.00115	0.00115	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Cobalt	0.00068	0.00067	0.00081	0.00063	0.00063	0.00074	0.00053	0.00052	0.00060	0.00050	0.00050	0.00050	0.00051	0.00051	0.00054	0.00050	0.00050	0.00051	0.00050	0.00050	0.00050	0.00053	0.00053	0.00053	0.00050	0.00050	0.00050
Copper	0.00305	0.00278	0.00558	0.00246	0.00226	0.00444	0.00164	0.00137	0.00328	0.00100	0.00100	0.00100	0.00122	0.00113	0.00178	0.00109	0.00105	0.00133	0.00150	0.00150	0.00150	0.00119	0.00119	0.00119	0.00150	0.00150	0.00150
Cyanide	0.00318	0.00311	0.00443	0.00281	0.00275	0.00378	0.00229	0.00217	0.00302	0.00200	0.00200	0.00200	0.00210	0.00206	0.00235	0.00204	0.00202	0.00215	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00201	0.00201	0.00200
Iron	1.49984	1.49776	1.51035	1.49860	1.49707	1.50686	0.36876	0.36719	0.37840	0.86150	0.86150	0.86150	0.86269	0.86219	0.86575	0.86200	0.86179	0.86328	1.04500	1.04500	1.04500	0.15826	0.15654	0.15998	0.54191	0.54787	0.53631
Lead	0.00275	0.00258	0.00481	0.00222	0.00208	0.00382	0.00150	0.00129	0.00278	0.00100	0.00100	0.00100	0.00117	0.00110	0.00161	0.00107	0.00104	0.00125	0.00100	0.00100	0.00100	0.00102	0.00102	0.00102	0.00101	0.00102	0.00101
Mercury	0.00008	0.00008	0.00007	0.00009	0.00008	0.00008	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00010	0.00010	0.00010	0.00001	0.00001	0.00001	0.00010	0.00010	0.00010
Molybdenum	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Nickel	0.00776	0.00864	0.01020	0.00578	0.00638	0.00762	0.00209	0.00205	0.00232	0.00200	0.00200	0.00200	0.00203	0.00202	0.00211	0.00201	0.00201	0.00205	0.00200	0.00200	0.00200	0.00219	0.00219	0.00219	0.00204	0.00207	0.00202
Nitrate	3.20349	3.73114	4.41368	2.10460	2.46490	3.01011	0.10050	0.10050	0.10050	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.03000	0.03000	0.03000	0.03826	0.03819	0.03832	0.04795	0.06642	0.03796
Phosphorus	0.03196	0.03129	0.03534	0.03156	0.03107	0.03422	0.01156	0.01114	0.01416	0.01125	0.01125	0.01125	0.01160	0.01145	0.01249	0.01140	0.01133	0.01177	0.04635	0.04635	0.04635	0.00832	0.00838	0.00826	0.02409	0.02413	0.02405
Selenium	0.00402	0.00386	0.00365	0.00436	0.00425	0.00408	0.00100	0.00100	0.00101	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00500	0.00500	0.00500	0.00101	0.00102	0.00100	0.00488	0.00487	0.00488
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	6.31669	6.98696	8.40787	4.71671	5.17021	6.29631	0.89662	0.84783	1.19557	2.08500	2.08500	2.08500	2.12477	2.10813	2.22673	2.10162	2.09467	2.14423	1.47500	1.47500	1.47500	2.94717	2.94065	2.95369	1.84859	1.87365	1.83546
Thallium	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
Uranium	0.00501	0.00501	0.00505	0.00501	0.00501	0.00503	0.00501	0.00501	0.00503	0.00500	0.00500	0.00500	0.00500	0.00500	0.00501	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00122	0.00121	0.00122	0.00123	0.00123	0.00123	0.00100	0.00100	0.00101	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00165	0.00165	0.00165	0.00100	0.00100	0.00100	0.00110	0.00110	0.00110
Zinc	0.05538	0.03693	0.15675	0.04142	0.02776	0.12104	0.03225	0.02001	0.10723	0.00300	0.00300	0.00300	0.01304	0.00884	0.03878	0.00720	0.00544	0.01795	0.00440	0.00440	0.00440	0.00362	0.00362	0.00362	0.00335	0.00339	0.00332

Table W11-6: Degraded Case Post-Closure Phase (dry cover) Residual Effect by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	—	—	**0.28737**	—	—	—	—	—	**0.08846**	—	—	—	—	—	—	—	—	—	—	—	—	0.02859	0.02946	0.02773	—	—	—
Ammonia (un-ionized)	0.00580	0.00656	0.00755	0.00420	0.00473	0.00552	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00093	—
Ammonia (total)	0.15257	0.17270	0.19874	0.11065	0.12439	0.14519	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.02442	—
Antimony	0.00074	0.00076	0.00080	0.00069	0.00071	0.00073	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Arsenic	0.00116	0.00118	0.00125	0.00111	0.00112	0.00117	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Beryllium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	**0.00021**	0.00017	**0.00042**	0.00018	0.00015	**0.00034**	0.00008	0.00005	**0.00023**	—	—	—	0.00004	0.00003	0.00009	0.00003	0.00002	0.00005	—	—	—	0.00002	0.00002	0.00002	—	—	—
Chloride	30.11620	34.96506	41.12606	20.04463	23.35577	28.28218	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2.97216	3.13043	—
Chromium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cobalt	0.00068	0.00067	0.00081	0.00063	0.00063	0.00074	0.00053	—	0.00060	—	—	—	—	—	0.00054	—	—	—	—	—	—	0.00053	0.00053	0.00053	—	—	—
Copper	0.00305	0.00278	**0.00558**	0.00246	0.00226	0.00444	0.00164	0.00137	0.00328	—	—	—	0.00122	0.00113	0.00178	0.00109	0.00105	0.00133	—	—	—	—	—	—	—	—	—
Cyanide	0.00318	0.00311	0.00443	0.00281	0.00275	0.00378	0.00229	0.00217	0.00302	—	—	—	—	—	0.00235	—	—	0.00215	—	—	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.15826	0.15654	0.15998	—	—	—
Lead	0.00275	0.00258	0.00481	0.00222	0.00208	0.00382	0.00150	0.00129	0.00278	—	—	—	0.00117	0.00110	0.00161	0.00107	—	0.00125	—	—	—	—	—	—	—	—	—
Mercury	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Molybdenum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nickel	0.00776	0.00864	0.01020	0.00578	0.00638	0.00762	—	—	0.00232	—	—	—	—	—	0.00211	—	—	—	—	—	—	0.00219	0.00219	0.00219	—	—	—
Nitrate	3.20349	3.73114	4.41368	2.10460	2.46490	3.01011	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.04795	0.06642	0.03796
Phosphorus	**0.03196**	—	**0.03534**	—	—	**0.03422**	0.01156	0.01114	0.01416	—	—	—	—	—	0.01249	—	—	—	—	—	—	—	—	—	—	—	—
Selenium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sulphate	6.31669	6.98696	8.40787	4.71671	5.17021	6.29631	0.89662	0.84783	1.19557	—	—	—	—	—	2.22673	—	—	—	—	—	—	2.94717	2.94065	2.95369	—	—	—
Thallium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vanadium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc	**0.05538**	**0.03693**	**0.15675**	**0.04142**	0.02776	**0.12104**	**0.03225**	0.02001	**0.10723**	—	—	—	0.01304	0.00884	**0.03878**	0.00720	0.00544	0.01795	—	—	—	0.00362	0.00362	0.00362	0.00335	0.00339	0.00332

Table W11-7: No Liner Case Operation Phase Water Quality Predictions by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.27337	0.27343	0.27304	0.27342	0.27345	0.27321	0.07805	0.07805	0.07805	0.07730	0.07730	0.07730	0.07730	0.07730	0.07730	0.07730	0.07730	0.07730	0.54750	0.54750	0.54750	0.02566	0.02652	0.02481	0.39112	0.39040	0.39180
Ammonia (un-ionized)	0.00572	0.00573	0.00599	0.00410	0.00411	0.00424	0.00076	0.00076	0.00076	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00078	0.00076	0.00076	0.00076	0.00076	0.00076	0.00076	0.00090	0.00091	0.00088
Ammonia (total)	0.15056	0.15085	0.15752	0.10788	0.10805	0.11149	0.02000	0.02000	0.02000	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02050	0.02000	0.02000	0.02000	0.02007	0.02006	0.02007	0.02356	0.02405	0.02310
Antimony	0.00487	0.00505	0.00409	0.00334	0.00346	0.00282	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00062	0.00064	0.00060
Arsenic	0.02282	0.02374	0.01888	0.01500	0.01559	0.01235	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00111	0.00119	0.00102
Beryllium	0.00320	0.00330	0.00279	0.00241	0.00247	0.00214	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00101	0.00102	0.00100
Boron	0.08297	0.08440	0.07674	0.07115	0.07207	0.06697	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05016	0.05029	0.05004
Cadmium	0.00012	0.00012	0.00012	0.00011	0.00011	0.00011	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009
Chloride	27.24849	28.35818	22.48244	17.85051	18.56006	14.64873	0.38500	0.38500	0.38500	0.26000	0.26000	0.26000	0.26000	0.26000	0.26000	0.26000	0.26000	0.26000	0.71000	0.71000	0.71000	3.66034	3.66167	3.65901	2.93870	3.03450	2.84950
Chromium	0.00274	0.00281	0.00241	0.00211	0.00216	0.00190	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00115	0.00115	0.00115	0.00100	0.00100	0.00100	0.00101	0.00102	0.00100
Cobalt	0.00063	0.00063	0.00063	0.00060	0.00060	0.00060	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Copper	0.00199	0.00201	0.00191	0.00167	0.00168	0.00161	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00150	0.00150	0.00150	0.00117	0.00117	0.00117	0.00149	0.00149	0.00149
Cyanide	0.00351	0.00317	0.00564	0.00297	0.00275	0.00431	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00201	0.00201	0.00200
Iron	1.49307	1.49390	1.48791	1.49376	1.49430	1.49050	0.36500	0.36500	0.36500	0.86150	0.86150	0.86150	0.86150	0.86150	0.86150	0.86150	0.86150	0.86150	1.04500	1.04500	1.04500	0.14888	0.14717	0.15059	0.54073	0.54613	0.53558
Lead	0.00202	0.00200	0.00222	0.00165	0.00164	0.00178	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00101	0.00100
Mercury	0.00009	0.00008	0.00010	0.00009	0.00009	0.00010	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00010	0.00010	0.00010	0.00001	0.00001	0.00001	0.00010	0.00010	0.00010
Molybdenum	0.00959	0.00995	0.00800	0.00651	0.00674	0.00544	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00104	0.00108	0.00101
Nickel	0.00710	0.00730	0.00625	0.00527	0.00540	0.00470	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00202	0.00205	0.00201
Nitrate	2.89710	3.01411	2.40207	1.86920	1.94401	1.53567	0.10050	0.10050	0.10050	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.08950	0.03000	0.03000	0.03000	0.03822	0.03816	0.03828	0.04415	0.05569	0.03338
Phosphorus	0.03045	0.03043	0.03058	0.03043	0.03042	0.03052	0.01055	0.01055	0.01055	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.04635	0.04635	0.04635	0.00828	0.00834	0.00822	0.02408	0.02411	0.02404
Selenium	0.02591	0.02680	0.02203	0.01841	0.01898	0.01581	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00500	0.00500	0.00500	0.00101	0.00102	0.00100	0.00499	0.00507	0.00491
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	5.80330	5.92706	5.36166	4.31427	4.39330	4.00597	0.78000	0.78000	0.78000	2.08500	2.08500	2.08500	2.08500	2.08500	2.08500	2.08500	2.08500	2.08500	1.47500	1.47500	1.47500	2.74279	2.73631	2.74927	1.83662	1.85196	1.82233
Thallium	0.00035	0.00033	0.00049	0.00033	0.00032	0.00042	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
Uranium	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00230	0.00234	0.00212	0.00192	0.00195	0.00180	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00165	0.00165	0.00165	0.00100	0.00100	0.00100	0.00110	0.00111	0.00110
Zinc	0.00924	0.00946	0.00832	0.00711	0.00725	0.00649	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00440	0.00440	0.00440	0.00300	0.00301	0.00300	0.00303	0.00306	0.00301

Table W11-8: No Liner Case Operation Phase Residual Effects by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ammonia (un-ionized)	0.00572	0.00573	0.00599	0.00410	0.00411	0.00424	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ammonia (total)	0.15056	0.15085	0.15752	0.10788	0.10805	0.11149	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Antimony	0.00487	0.00505	0.00409	0.00334	0.00346	0.00282	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00064	—
Arsenic	0.02282	0.02374	0.01888	0.01500	0.01559	0.01235	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00111	0.00119	—
Beryllium	0.00320	0.00330	0.00279	0.00241	0.00247	0.00214	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boron	0.08297	0.08440	0.07674	0.07115	0.07207	0.06697	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	0.00012	0.00012	0.00012	0.00011	0.00011	0.00011	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chloride	27.24849	28.35818	22.48244	17.85051	18.56006	14.64873	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3.03450	—
Chromium	0.00274	0.00281	0.00241	0.00211	0.00216	0.00190	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cobalt	0.00063	0.00063	0.00063	0.00060	0.00060	0.00060	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Copper	0.00199	0.00201	0.00191	0.00167	0.00168	0.00161	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cyanide	0.00351	0.00317	**0.00564**	0.00297	0.00275	0.00431	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lead	0.00202	0.00200	0.00222	0.00165	0.00164	0.00178	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mercury	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Molybdenum	0.00959	0.00995	0.00800	0.00651	0.00674	0.00544	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00108	—
Nickel	0.00710	0.00730	0.00625	0.00527	0.00540	0.00470	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nitrate	2.89710	3.01411	2.40207	1.86920	1.94401	1.53567	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.04415	0.05569	0.03338
Phosphorus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Selenium	0.02591	0.02680	0.02203	0.01841	0.01898	0.01581	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sulphate	5.80330	5.92706	5.36166	4.31427	4.39330	4.00597	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Thallium	**0.00035**	**0.00033**	**0.00049**	**0.00033**	**0.00032**	**0.00042**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vanadium	0.00230	0.00234	0.00212	0.00192	0.00195	0.00180	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc	0.00924	0.00946	0.00832	0.00711	0.00725	0.00649	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table W11-9: No Liner Case Post-Closure Phase Water Quality Predictions (wet cover) by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.27307	0.27326	0.27214	0.27319	0.27333	0.27249	0.07875	0.07846	0.08054	0.07730	0.07730	0.07730	0.07754	0.07744	0.07816	0.07740	0.07736	0.07766	0.54750	0.54750	0.54750	0.02856	0.02942	0.02769	0.39105	0.39024	0.39177
Ammonia (un-ionized)	0.00682	0.00680	0.01124	0.00491	0.00492	0.00824	0.00207	0.00152	0.00543	0.00078	0.00078	0.00078	0.00123	0.00104	0.00238	0.00097	0.00089	0.00145	0.00076	0.00076	0.00076	0.00079	0.00078	0.00079	0.00090	0.00093	0.00089
Ammonia (total)	0.17951	0.17890	0.29569	0.12919	0.12940	0.21695	0.05448	0.04005	0.14286	0.02050	0.02050	0.02050	0.03233	0.02738	0.06267	0.02544	0.02338	0.03812	0.02000	0.02000	0.02000	0.02066	0.02066	0.02066	0.02381	0.02450	0.02342
Antimony	0.00076	0.00077	0.00083	0.00070	0.00071	0.00076	0.00061	0.00060	0.00063	0.00060	0.00060	0.00060	0.00060	0.00060	0.00061	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.00148	0.00148	0.00183	0.00132	0.00132	0.00158	0.00110	0.00106	0.00135	0.00100	0.00100	0.00100	0.00103	0.00102	0.00112	0.00101	0.00101	0.00105	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Beryllium	0.00100	0.00100	0.00099	0.00100	0.00100	0.00099	0.00100	0.00100	0.00099	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Boron	0.04968	0.04973	0.04925	0.04978	0.04982	0.04945	0.04983	0.04990	0.04938	0.05000	0.05000	0.05000	0.04994	0.04997	0.04979	0.04998	0.04999	0.04991	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000
Cadmium	0.00013	0.00013	0.00016	0.00012	0.00012	0.00014	0.00003	0.00002	0.00006	0.00002	0.00002	0.00002	0.00002	0.00002	0.00003	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009
Chloride	1.49090	1.50088	1.81230	1.33446	1.34348	1.57694	0.47434	0.43696	0.70336	0.26000	0.26000	0.26000	0.29091	0.27798	0.37016	0.27292	0.26751	0.30603	0.71000	0.71000	0.71000	3.65926	3.66060	3.65792	2.81280	2.80354	2.82183
Chromium	0.00097	0.00097	0.00095	0.00098	0.00098	0.00097	0.00099	0.00100	0.00098	0.00100	0.00100	0.00100	0.00100	0.00100	0.00099	0.00100	0.00100	0.00100	0.00115	0.00115	0.00115	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Cobalt	0.00066	0.00066	0.00073	0.00062	0.00062	0.00068	0.00052	0.00051	0.00057	0.00050	0.00050	0.00050	0.00051	0.00050	0.00052	0.00050	0.00050	0.00051	0.00050	0.00050	0.00050	0.00053	0.00053	0.00053	0.00050	0.00050	0.00050
Copper	0.00214	0.00222	0.00270	0.00178	0.00184	0.00220	0.00110	0.00106	0.00135	0.00100	0.00100	0.00100	0.00103	0.00102	0.00112	0.00101	0.00101	0.00105	0.00150	0.00150	0.00150	0.00118	0.00118	0.00118	0.00149	0.00150	0.00149
Cyanide	0.00565	0.00446	0.01213	0.00456	0.00373	0.00948	0.00487	0.00367	0.01223	0.00200	0.00200	0.00200	0.00299	0.00257	0.00551	0.00241	0.00224	0.00347	0.00200	0.00200	0.00200	0.00205	0.00205	0.00205	0.00202	0.00203	0.00202
Iron	1.48841	1.49136	1.47426	1.49029	1.49235	1.47953	0.36496	0.36498	0.36486	0.86150	0.86150	0.86150	0.86050	0.86092	0.85795	0.86108	0.86126	0.86002	1.04500	1.04500	1.04500	0.15819	0.15647	0.15990	0.54160	0.54767	0.53617
Lead	0.00249	0.00242	0.00388	0.00199	0.00195	0.00304	0.00147	0.00127	0.00266	0.00100	0.00100	0.00100	0.00116	0.00109	0.00157	0.00107	0.00104	0.00124	0.00100	0.00100	0.00100	0.00102	0.00102	0.00102	0.00101	0.00101	0.00101
Mercury	0.00009	0.00008	0.00010	0.00009	0.00009	0.00010	0.00002	0.00002	0.00005	0.00001	0.00001	0.00001	0.00001	0.00001	0.00002	0.00001	0.00001	0.00002	0.00010	0.00010	0.00010	0.00001	0.00001	0.00001	0.00010	0.00010	0.00010
Molybdenum	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Nickel	0.00799	0.00871	0.01040	0.00586	0.00640	0.00767	0.00211	0.00206	0.00239	0.00200	0.00200	0.00200	0.00204	0.00202	0.00213	0.00202	0.00201	0.00206	0.00200	0.00200	0.00200	0.00219	0.00219	0.00219	0.00204	0.00207	0.00202
Nitrate	0.19526	0.19333	0.32887	0.13924	0.13858	0.24018	0.14068	0.12387	0.24369	0.08950	0.08950	0.08950	0.10331	0.09753	0.13873	0.09527	0.09286	0.11007	0.03000	0.03000	0.03000	0.03895	0.03889	0.03901	0.03117	0.03186	0.03079
Phosphorus	0.03057	0.03049	0.03094	0.03052	0.03047	0.03080	0.01084	0.01072	0.01157	0.01125	0.01125	0.01125	0.01135	0.01131	0.01159	0.01129	0.01127	0.01139	0.04635	0.04635	0.04635	0.00831	0.00837	0.00824	0.02408	0.02412	0.02404
Selenium	0.00393	0.00381	0.00349	0.00431	0.00422	0.00398	0.00100	0.00100	0.00099	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00500	0.00500	0.00500	0.00101	0.00102	0.00100	0.00488	0.00487	0.00488
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	6.73143	7.17183	9.29878	4.94701	5.28082	6.87523	1.17143	1.00766	2.17485	2.08500	2.08500	2.08500	2.21677	2.16163	2.55459	2.14006	2.11702	2.28124	1.47500	1.47500	1.47500	2.95181	2.94529	2.95833	1.84993	1.87498	1.83677
Thallium	0.00047	0.00040	0.00084	0.00042	0.00037	0.00070	0.00047	0.00040	0.00091	0.00030	0.00030	0.00030	0.00036	0.00033	0.00051	0.00032	0.00031	0.00039	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
Uranium	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00126	0.00125	0.00129	0.00126	0.00125	0.00128	0.00102	0.00101	0.00106	0.00100	0.00100	0.00100	0.00101	0.00100	0.00102	0.00100	0.00100	0.00101	0.00165	0.00165	0.00165	0.00100	0.00100	0.00100	0.00110	0.00110	0.00110
Zinc	0.01034	0.01114	0.01332	0.00785	0.00844	0.01008	0.00321	0.00312	0.00376	0.00300	0.00300	0.00300	0.00307	0.00304	0.00326	0.00303	0.00302	0.00311	0.00440	0.00440	0.00440	0.00312	0.00312	0.00312	0.00304	0.00308	0.00302

Table W11-10: No Liner Case Post-Closure Phase (wet cover) Residual Effects by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ammonia (un-ionized)	0.00572	0.00573	0.00599	0.00410	0.00411	0.00424	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ammonia (total)	0.15056	0.15085	0.15752	0.10788	0.10805	0.11149	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Antimony	0.00487	0.00505	0.00409	0.00334	0.00346	0.00282	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00064	—
Arsenic	0.02282	0.02374	0.01888	0.01500	0.01559	0.01235	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00111	0.00119	—
Beryllium	0.00320	0.00330	0.00279	0.00241	0.00247	0.00214	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boron	0.08297	0.08440	0.07674	0.07115	0.07207	0.06697	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	0.00012	0.00012	0.00012	0.00011	0.00011	0.00011	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chloride	27.24849	28.35818	22.48244	17.85051	18.56006	14.64873	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3.03450	—
Chromium	0.00274	0.00281	0.00241	0.00211	0.00216	0.00190	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cobalt	0.00063	0.00063	0.00063	0.00060	0.00060	0.00060	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Copper	0.00199	0.00201	0.00191	0.00167	0.00168	0.00161	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cyanide	0.00351	0.00317	**0.00564**	0.00297	0.00275	0.00431	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lead	0.00202	0.00200	0.00222	0.00165	0.00164	0.00178	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mercury	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Molybdenum	0.00959	0.00995	0.00800	0.00651	0.00674	0.00544	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00108	—
Nickel	0.00710	0.00730	0.00625	0.00527	0.00540	0.00470	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nitrate	2.89710	3.01411	2.40207	1.86920	1.94401	1.53567	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.04415	0.05569	0.03338
Phosphorus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Selenium	0.02591	0.02680	0.02203	0.01841	0.01898	0.01581	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sulphate	5.80330	5.92706	5.36166	4.31427	4.39330	4.00597	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Thallium	**0.00035**	**0.00033**	**0.00049**	**0.00033**	**0.00032**	**0.00042**	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vanadium	0.00230	0.00234	0.00212	0.00192	0.00195	0.00180	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc	0.00924	0.00946	0.00832	0.00711	0.00725	0.00649	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table W11-11: Increased WRSA Infiltration Sensitivity Scenario Pit Lake Water Quality

Parameter [1]	Modelled Pit Lake Water Quality (mg/L)	
	Untreated	Treated [2]
Aluminum	4.98647	0.27350
Ammonia (un-ionized)	0.00377	0.00377 [3]
Ammonia (total)	0.09917	0.09917 [3]
Antimony	0.00116	0.00116 [3]
Arsenic	0.00326	0.00326 [3]
Beryllium	0.00125	0.00125 [3]
Boron	0.05586	0.05586 [3]
Cadmium	0.00045	0.00020
Chloride	1.62200	1.62200 [3]
Chromium	0.00104	0.00104 [3]
Cobalt	0.04418	0.00090
Copper	0.01705	0.00500
Cyanide	0.00306	0.00306 [3]
Iron	15.69287	1.49500
Lead	0.01321	0.00500
Mercury	0.00003	0.00002
Molybdenum	0.00101	0.00101 [3]
Nickel	0.33470	0.02500
Nitrate	0.07221	0.07221 [3]
Phosphorus	0.07881	0.03040
Selenium	0.00106	0.00106 [3]
Silver	0.00010	0.00010 [3]
Sulphate	356.90177	20.00000
Thallium	0.00035	0.00030
Uranium	0.01120	0.00500
Vanadium	0.00128	0.00128 [3]
Zinc	0.20037	0.03000

Notes:
(1) Only those parameters that have available water quality parameters were modelled.
(2) The treated water quality within the pit lake is consistent with the Treasury Metals commitment to effluent quality (see Table W4-1).
(3) Where the modelled untreated pit lake water quality was the same or lower than the Treasury Metals commitment, the lower untreated pit lake quality was used in the modelling.

Table W11-12: Increased WRSA Infiltration Post-Closure Phase Water Quality Predictions (wet cover) by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.27349	0.27350	0.27348	0.27349	0.27350	0.27348	0.07806	0.07805	0.07807
Ammonia (un-ionized)	0.00188	0.00195	0.00216	0.00164	0.00169	0.00185	0.00077	0.00077	0.00081
Ammonia (total)	0.04937	0.05138	0.05697	0.04305	0.04455	0.04876	0.02034	0.02020	0.02123
Antimony	0.00074	0.00076	0.00079	0.00069	0.00071	0.00073	0.00060	0.00060	0.00060
Arsenic	0.00158	0.00165	0.00180	0.00137	0.00143	0.00153	0.00100	0.00100	0.00100
Beryllium	0.00106	0.00107	0.00109	0.00104	0.00105	0.00106	0.00100	0.00100	0.00100
Boron	0.05150	0.05169	0.05204	0.05096	0.05111	0.05137	0.05000	0.05000	0.04999
Cadmium	0.00012	0.00012	0.00013	0.00011	0.00011	0.00012	0.00002	0.00002	0.00002
Chloride	1.18653	1.20554	1.24497	1.13261	1.14672	1.17634	0.38589	0.38552	0.38818
Chromium	0.00101	0.00101	0.00101	0.00101	0.00101	0.00101	0.00100	0.00100	0.00100
Cobalt	0.00064	0.00065	0.00067	0.00060	0.00061	0.00063	0.00050	0.00050	0.00050
Copper	0.00210	0.00223	0.00247	0.00174	0.00184	0.00202	0.00100	0.00100	0.00100
Cyanide	0.00232	0.00233	0.00252	0.00221	0.00222	0.00236	0.00203	0.00202	0.00210
Iron	1.49489	1.49494	1.49466	1.49492	1.49496	1.49474	0.36500	0.36500	0.36500
Lead	0.00203	0.00216	0.00242	0.00166	0.00176	0.00196	0.00100	0.00100	0.00102
Mercury	0.00008	0.00008	0.00007	0.00009	0.00008	0.00008	0.00001	0.00001	0.00001
Molybdenum	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Nickel	0.00788	0.00865	0.01006	0.00579	0.00636	0.00741	0.00200	0.00200	0.00200
Nitrate	0.04146	0.04257	0.04686	0.03743	0.03826	0.04151	0.10090	0.10073	0.10193
Phosphorus	0.03040	0.03040	0.03041	0.03040	0.03040	0.03041	0.01055	0.01055	0.01056
Selenium	0.00399	0.00386	0.00362	0.00435	0.00425	0.00407	0.00100	0.00100	0.00100
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	6.34957	6.96052	8.09616	4.67413	5.12716	5.97866	0.78391	0.78228	0.79395
Thallium	0.00030	0.00030	0.00031	0.00030	0.00030	0.00031	0.00030	0.00030	0.00031
Uranium	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00126	0.00126	0.00126	0.00126	0.00126	0.00126	0.00100	0.00100	0.00100
Zinc	0.01013	0.01102	0.01266	0.00770	0.00836	0.00958	0.00300	0.00300	0.00301

Parameter	TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.07730	0.07730	0.07730	0.07730	0.07730	0.07731	0.07730	0.07730	0.07730
Ammonia (un-ionized)	0.00078	0.00078	0.00078	0.00078	0.00078	0.00080	0.00078	0.00078	0.00079
Ammonia (total)	0.02050	0.02050	0.02050	0.02062	0.02057	0.02092	0.02055	0.02053	0.02068
Antimony	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Beryllium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Boron	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000	0.05000
Cadmium	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002	0.00002
Chloride	0.26000	0.26000	0.26000	0.26031	0.26018	0.26110	0.26013	0.26008	0.26046
Chromium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Cobalt	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Copper	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Cyanide	0.00200	0.00200	0.00200	0.00201	0.00201	0.00204	0.00200	0.00200	0.00201
Iron	0.86150	0.86150	0.86150	0.86149	0.86149	0.86146	0.86150	0.86150	0.86149
Lead	0.00100	0.00100	0.00100	0.00100	0.00100	0.00101	0.00100	0.00100	0.00100
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Nickel	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200
Nitrate	0.08950	0.08950	0.08950	0.08964	0.08958	0.08999	0.08956	0.08953	0.08971
Phosphorus	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125
Selenium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	2.08500	2.08500	2.08500	2.08632	2.08577	2.08970	2.08555	2.08532	2.08696
Thallium	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
Uranium	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
Vanadium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Zinc	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300	0.00300

Parameter	LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	0.54750	0.54750	0.54750	0.03455	0.03541	0.03368	0.39122	0.39042	0.39195
Ammonia (un-ionized)	0.00076	0.00076	0.00076	0.00076	0.00076	0.00076	0.00088	0.00088	0.00087
Ammonia (total)	0.02000	0.02000	0.02000	0.02007	0.02007	0.02007	0.02308	0.02323	0.02298
Antimony	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060	0.00060
Arsenic	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00101	0.00100
Beryllium	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Boron	0.05000	0.05000	0.05000	0.05001	0.05001	0.05001	0.05001	0.05002	0.05000
Cadmium	0.00009	0.00009	0.00009	0.00002	0.00002	0.00002	0.00009	0.00009	0.00009
Chloride	0.71000	0.71000	0.71000	3.65795	3.65929	3.65661	2.81109	2.80061	2.82078
Chromium	0.00115	0.00115	0.00115	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Cobalt	0.00050	0.00050	0.00050	0.00058	0.00058	0.00058	0.00050	0.00050	0.00050
Copper	0.00150	0.00150	0.00150	0.00120	0.00120	0.00120	0.00149	0.00150	0.00149
Cyanide	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200	0.00200
Iron	1.04500	1.04500	1.04500	0.17688	0.17516	0.17860	0.54219	0.54825	0.53675
Lead	0.00100	0.00100	0.00100	0.00102	0.00102	0.00102	0.00101	0.00101	0.00100
Mercury	0.00010	0.00010	0.00010	0.00001	0.00001	0.00001	0.00010	0.00010	0.00010
Molybdenum	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
Nickel	0.00200	0.00200	0.00200	0.00260	0.00260	0.00260	0.00205	0.00208	0.00203
Nitrate	0.03000	0.03000	0.03000	0.03826	0.03819	0.03832	0.03030	0.03036	0.03027
Phosphorus	0.04635	0.04635	0.04635	0.00834	0.00840	0.00828	0.02408	0.02412	0.02404
Selenium	0.00500	0.00500	0.00500	0.00101	0.00102	0.00100	0.00488	0.00487	0.00488
Silver	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010	0.00010
Sulphate	1.47500	1.47500	1.47500	3.37653	3.37001	3.38305	1.86001	1.88505	1.84685
Thallium	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030	0.00030
Uranium	0.00500	0.00500	0.00500	0.00501	0.00501	0.00501	0.00500	0.00500	0.00500
Vanadium	0.00165	0.00165	0.00165	0.00100	0.00100	0.00100	0.00110	0.00110	0.00110
Zinc	0.00440	0.00440	0.00440	0.00336	0.00336	0.00335	0.00305	0.00309	0.00303

Table W11-13: Increased WRSA Infiltration Post-Closure (wet cover) residual Effects by Station

Parameter	BW1: Blackwater Creek (downstream of Project)			BW2: Blackwater Creek (discharge to Wabigoon Lake)			HB1: Hoffstrom's Bay Tributary (at Thunder Lake)			TL1: Thunder Lake Tributary #2 (downstream of resevoir)			TL2: Thunder Lake Tributary #3 (downstream of Tree Nursery Ponds)			TL3: Thunder Lake Tributary #2 (at Thunder Lake)			LC1: Little Creek (at Thunder Lake)			Thunder Lake: Thunder Lake			Wabigoon Lake: Wabigoon Lake		
	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry	Average	Wet	Dry
Aluminum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.03455	0.03541	0.03368	—	—	—
Ammonia (un-ionized)	0.00188	0.00195	0.00216	0.00164	0.00169	0.00185	—	—	0.00081	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ammonia (total)	0.04937	0.05138	0.05697	0.04305	0.04455	0.04876	—	—	0.02123	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Antimony	0.00074	0.00076	0.00079	0.00069	0.00071	0.00073	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Arsenic	0.00158	0.00165	0.00180	0.00137	0.00143	0.00153	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Beryllium	0.00106	0.00107	0.00109	—	—	0.00106	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	0.00012	0.00012	0.00013	0.00011	0.00011	0.00012	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chloride	1.18653	1.20554	1.24497	1.13261	1.14672	1.17634	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Chromium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cobalt	0.00064	0.00065	0.00067	0.00060	0.00061	0.00063	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00058	0.00058	0.00058	—	—	—
Copper	0.00210	0.00223	0.00247	0.00174	0.00184	0.00202	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cyanide	0.00232	0.00233	0.00252	0.00221	0.00222	0.00236	—	—	0.00210	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Iron	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.17688	0.17516	0.17860	—	—	—
Lead	0.00203	0.00216	0.00242	0.00166	0.00176	0.00196	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mercury	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Molybdenum	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nickel	0.00788	0.00865	0.01006	0.00579	0.00636	0.00741	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00260	0.00260	0.00260	—	—	—
Nitrate	0.04146	0.04257	0.04686	0.03743	0.03826	0.04151	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Phosphorus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Selenium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Silver	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sulphate	6.34957	6.96052	8.09616	4.67413	5.12716	5.97866	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3.37653	3.37001	3.38305	—	—	—
Thallium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Uranium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vanadium	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Zinc	0.01013	0.01102	0.01266	0.00770	0.00836	0.00958	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.00336	0.00336	0.00335	—	—	—