Touquoy Gold Project Modifications – Environmental Assessment Registration Document Addendum No. 2

(Part 2 of 2)

December 21, 2022

CONTENTS

St Barbara LIMITED

Attachment 7
Assimilative Capacity Study of Moose River

Touquoy Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge

Final Report

November 18, 2022

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Revision: 2

TOUQUOY GOLD PROJECT ASSIMILATIVE CAPACITY STUDY OF MOOSE RIVER – TOUQUOY PIT DISCHARGE

This document entitled Touquoy Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of Atlantic Mining NS Inc. (the “Client”) to support the regulatory review process for its Environmental Assessment (the “Application”) for the Touquoy Gold Site Modifications (the “Project”). In connection therewith, this document may be reviewed and used by the Nova Scotia Environment and Climate Change participating in the review process in the normal course of its duties. Except as set forth in the previous sentence, any reliance on this document by any other party or use of it for any other purpose is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The information and conclusions in the document are based on the conditions existing at the time the document was published and does not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by the Client or others, unless expressly stated otherwise in the document. Any use which another party makes of this document is the responsibility and risk of such party. Such party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other party as a result of decisions made or actions taken based on this document.

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1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Atlantic Mining NS Inc. (AMNS) to conduct an assimilative capacity study of Moose River for effluent discharge and seepage from the in-pit disposal of tailings as part of the Touquoy Gold Project. The Touquoy Gold Mine is located in Halifax County, Nova Scotia, approximately 60 kilometres northeast of Halifax. The study is focused on the water surplus in the exhausted Touquoy pit (Open Pit) during reclamation/closure phase discharged via a proposed spillway to Moose River at the final discharge point.

The objective of the assimilative capacity study is to define parameters of potential concern for the effluent, characterize the mixing zone for the Touquoy pit effluent and propose the maximum effluent discharge limits for the parameters of potential concern.

1.1 SUMMARY OF REVISIONS

This original Assimilative Capacity Report was completed by Stantec in 2019 and updated in March 2022 to address Nova Scotia Environment and Climate Change (NSECC) and third-party review comments as well as to incorporate further field groundwater investigations and modelling. This update to the assimilative capacity study was conducted to comply with the Industrial Approval update and respond to the IAAC-3-46 information requirement and the May 12 Minister's Letter on the Touquoy Gold Project Modifications Environmental Assessment Registration Document, summarized below:

1. Industrial Approval condition and consistent with requirements outlined in the Minister's Letter:
    a. Use of SW-11 as the background station for water quality. The furthest upstream station SW-11 was used to represent background water quality in the assimilative capacity study to avoid potential downstream effects of mine construction. To augment the SW-11 dataset, another earlier Moose River dataset from 2004 – 2007 at SW-1 and SW-2 was incorporated into a modified baseline. This earlier data was collected nearly 10 years prior to mine construction and was appended to the original mine environmental assessment (CRA 2007). Appendix B presents the water quality results from SW-11, SW1 and SW-2 used to develop the modified baseline water quality of the Moose River in detail.
    b. Propose discharge criteria that will be protective of fish and fish habitat, in all areas of the Moose River. Following Nova Scotia and Atlantic Canada guidance on the development of effluent discharge, the Moose River assimilative capacity study applied the Metal and Dimond Mine Effluent Regulation (MDMER) effluent limits to "end of pipe" or point of discharge to the Moose River receiving environment and the end of the effluent mixing zone is defined by meeting the IA receiving water quality compliance criteria. Section 3.0 of this report discussed the subject of effluent criteria and protection of fish and fish habitat in greater detail.
2. Incorporate Fisheries and Oceans Canada recommendations to determine summer flow conditions. As further described in Section 4.2, the 25% MAF was used to represent low flow conditions.

3. IAAC-3-46 Information Requirement: Assess the mixing model using summer and winter temperatures for the pit water and Moose River. The potential effects of summer and winter temperatures on the dilution ratios and the extent of the mixing zone in Mooser River was run in the assimilative capacity study by adjusting from climate normal temperatures to summer highs and winter lows. In addition, the guideline value for unionized ammonia is temperature dependant and was changed based on temperature for the assimilative capacity. This is discussed in more detail in section 9.0.

May 12 Minister's Letter on the Touquoy Gold Project Modifications requested to complete the assimilative capacity study of Moose River to be compliant with the Industrial Approval which uses SW-11 as the background station for quality and propose discharge criteria that will be protective of fish and fish habitat, in all areas of the Moose River. Incorporate Fisheries and Oceans Canada recommendations to determine summer flow conditions.

The characteristics of the pit were updated in the water quality and quantity modelling to account for waste rock that has been stored in the pit, the seepage mitigation planned for the west pit face, and the most up-to-date pit shape (dated September 2022). The available water and tailings storage volume was reduced from the previous model and Environmental Assessment Registration Document (EARD) from the additional material stored in the pit from the previous model and now represents the "base case" in this assimilative capacity model.

2.0 PROJECT DESCRIPTION

The Touquoy Mine Site in Halifax County, Nova Scotia comprises an area approximately 271 hectares (ha). Site areas associated with major project components include the Mill Facility, Open Pit, Tailings Management Facility (TMF), Waste Rock Storage Area (WRSA), Clay Borrow Area, and ancillary facilities. The Open Pit is located between Moose River on the west and Watercourse # 4 on the east that each flow north to south adjacent to the limits of the Open Pit.

The existing Open Pit is actively dewatered and pumped to the TMF. Water in the TMF is decanted to the effluent treatment plant for treatment. To continue operation of the mill during the permitting phase of the waste rock expansion and the 2.5 m TMF raise, approximately 2.5 million tonnes of waste rock was end dumped in the pit at the lowest pit elevations. The available pit water and tailings storage by elevation, accounting for the reduction in storage from this waste rock, is provided in Figure 2.1. As a result, the waste rock storage expansion is no longer required nor will the water runoff from the expanded area be required to return directly to watercourse no. 4. This material change results in a reduction in tailings and water storage in the pit from what was provided in the EARD and the last version of the assimilative capacity model (Stantec 2022a).

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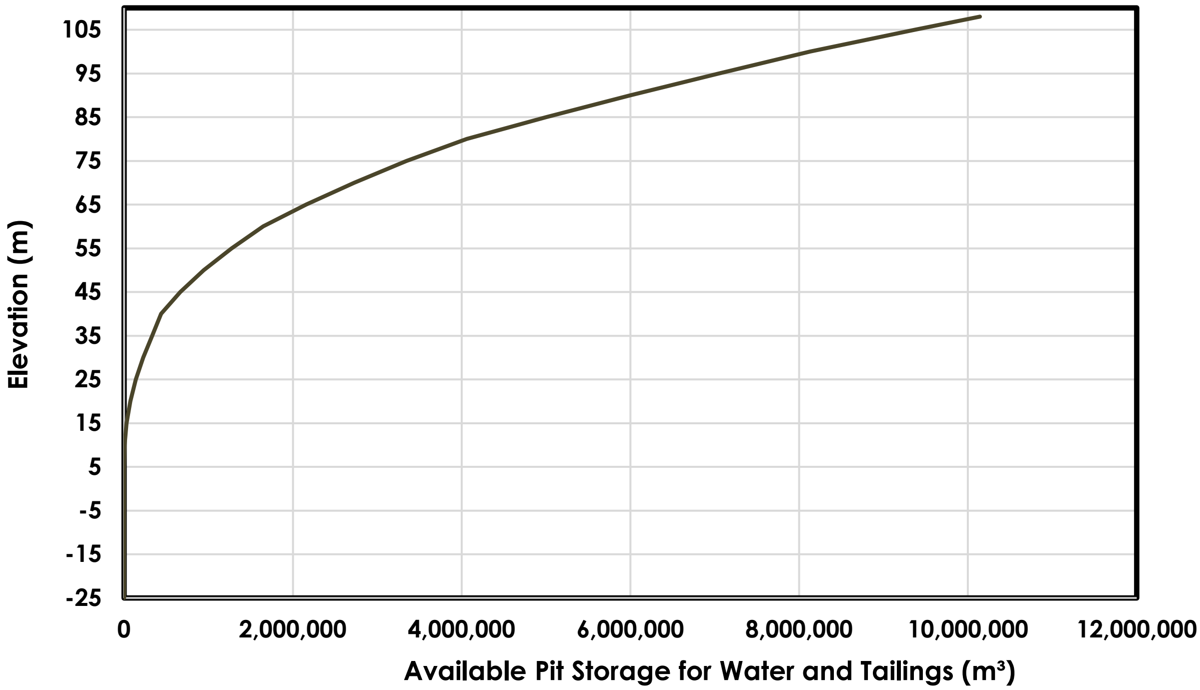
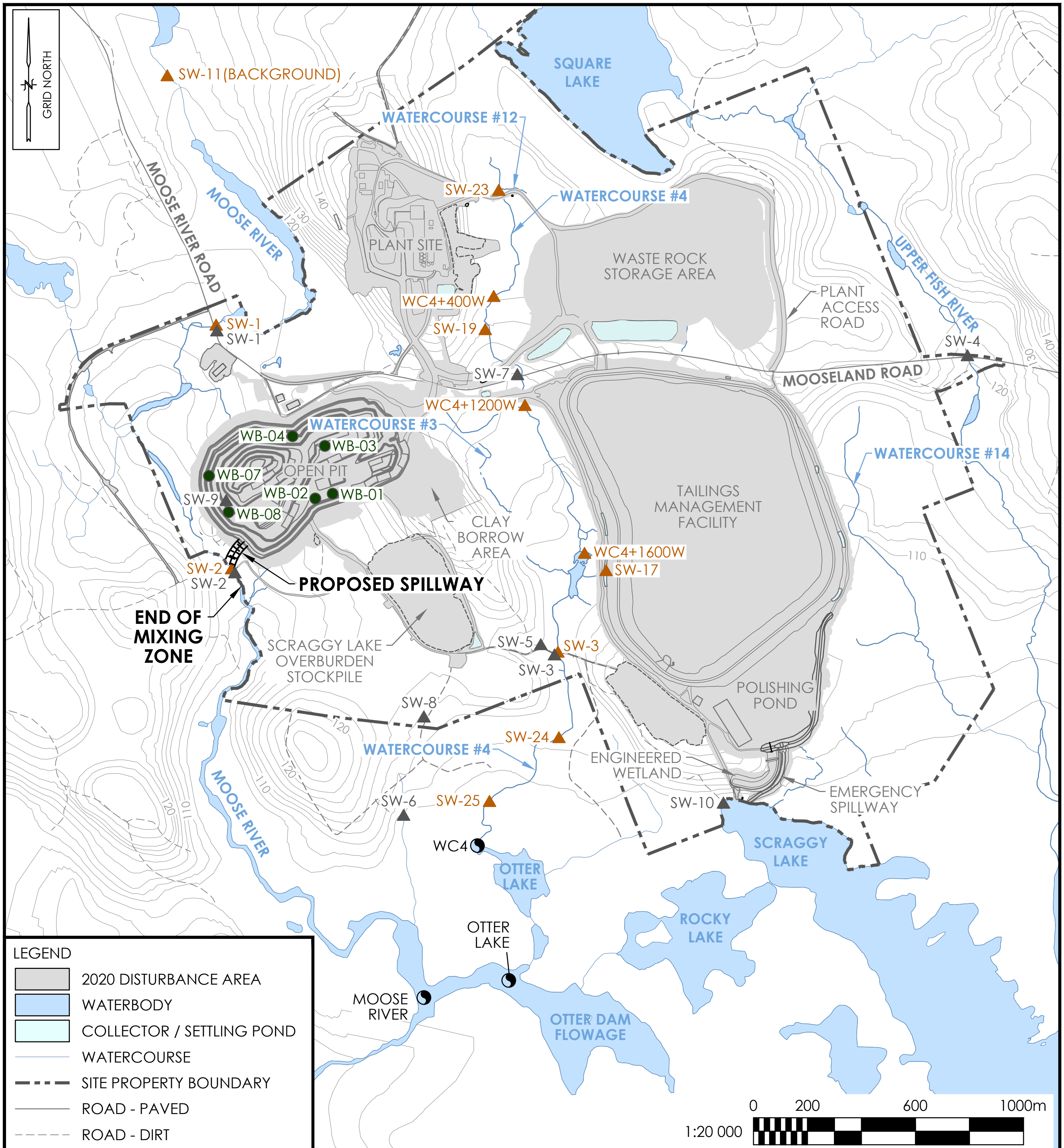


Figure 2.1 Pit Elevation Storage Relationship (Sept. 2022)

Prior to in-pit tailings deposition, seepage mitigation will be conducted ahead of the highest forecasted water and tailings elevation. The concept for the seepage mitigation includes placement of a clay till liner between the tailings and the pit wall. The vertical extent of the clay till layer is from the crest of the pit to the rock bench at approximate elevation 60 m Canadian Geodetic Vertical Datum 2013 (CGVD2013), which is below most of the underground workings. This material results in a reduction in tailings and water storage in the pit.

Tailings will be deposited in the pit as part of the Touquoy expansion Project for approximately two years followed by four years of pit water filling from natural runoff, direct precipitation, and groundwater inflow. This will result in a water cover over the tailings surface. Once water quality in the pit lake meets the MDMER discharge criteria, water surplus from natural inputs (e.g., snowmelt or rainfall events) will be released to Moose River via an engineered spillway. However, it is predicted that the pit will fill to its spillway discharge elevation before pit water cover quality recovers to MDMER discharge limit criteria. During the period before pit water quality recovers to MDMER limits, a treatment system will be installed to treat excess pit water prior to discharge

Figure 2.2 presents the study area including the Open Pit, surface water monitoring station SW-11, SW-1, and SW-2, and the proposed spillway to convey overflow from the pit to Moose River. The engineered spillway will be 110 m long with an invert elevation of 108.0 metres (m) at the Open Pit and elevation of 107.5 m at the outlet to Moose River at the bank. The channel will have an approximate slope of 0.45% (Figure 2.2). Figure 2.3 presents the catchment areas of the surface water monitoring locations.



REFERENCE

1. PROVINCIAL BASE DATA REPRODUCED AND DISTRIBUTED WITH THE PERMISSION OF SERVICE NOVA SCOTIA & MUNICIPAL RELATIONS (SNSMR, 2006) AS PER THE TERMS OF USE OUTLINED IN THE UNRESTRICTED DATA USE LICENSE AGREEMENT FOR GEOGRAPHIC DATA.
2. SITE DATA PROVIDED BY ATLANTIC MINING NS INC. AND McCALLUM ENVIRONMENTAL.

THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO AN ATLANTIC GOLD CORPORATION MEMO AND MUST NOT BE USED FOR OTHER PURPOSES.

SITE PLAN

ASSIMILIATIVE CAPACITY STUDY
TOUQUOY GOLD PROJECT
HALIFAX COUNTY, NOVA SCOTIA

Client: ATLANTIC MINING NS INC.

Job No.:	121619250
Scale:	1 : 20,000
Date:	2022 10 28
Dwn. By:	JL
App'd By:	RJ
Fig. No.:	2.2

Stantec

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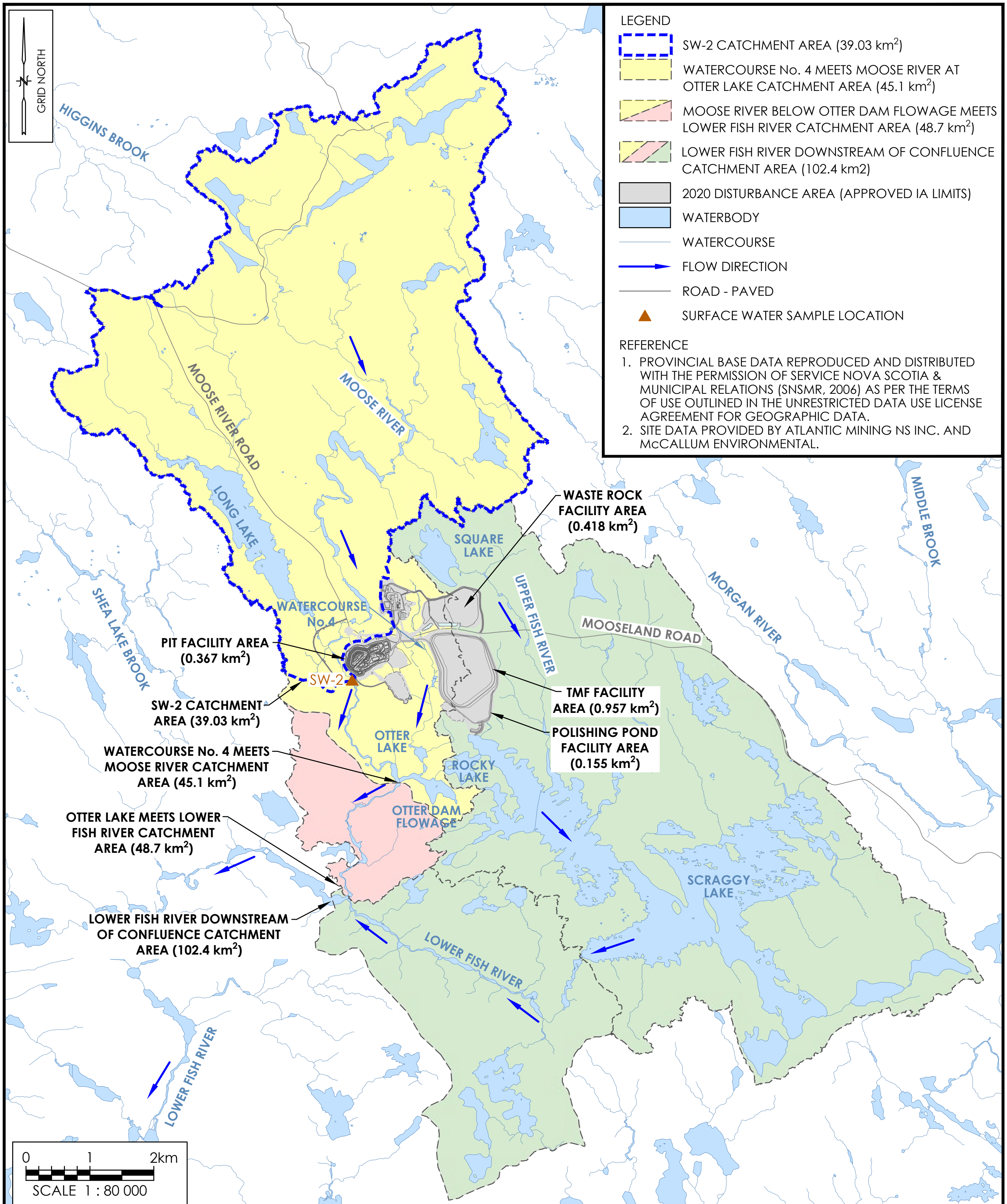

THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO AN ATLANTIC GOLD CORPORATION MEMO AND MUST NOT BE USED FOR OTHER PURPOSES.

CATCHMENT AREAS

ASSIMILIATIVE CAPACITY STUDY
TOUQUOY GOLD PROJECT
HALIFAX COUNTY, NOVA SCOTIA

Client:	ATLANTIC MINING NS INC.
Job No.:	121619250
Scale:	1 : 80,000
Date:	2022 10 20
Dwn. By:	JL
App'd By:	RJ
Fig. No.:	2.3

Stantec

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Baseline surface water quality at Moose River is represented by the background/upstream station SW-11 (2016-2017), in addition to historical water quality monitoring in 2004-2007 stations SW-1, and SW-2. The assessment of baseline water quality conditions is described in more detail in Appendix B. The appendix Table B.1 presents the modified baseline mean and 75th percentile water quality concentrations for the Moose River along with IA receiving water quality compliance criteria. Baseline concentrations of Aluminum, Arsenic, Iron, Lead and Nitrate parameters are elevated with respect to IA receiving water quality compliance criteria with other parameters ranging below IA receiving water quality compliance limits. No baseline parameters exceed MDMER Schedule 4 Table 2 effluent limits, and no parameters were below detection limits. The 75th percentile concentration is a statistic representing poorer than mean water quality and will be used in the Moose River Assimilative Capacity Study to represent receiving water baseline quality. In keeping with IA requirements however, the 95th percentile baseline water quality was also calculated and presented. Baseline surface water quality is summarized in Appendix B.

3.0 REGULATORY FRAMEWORK

The Touquoy Gold Project is subject to provincial and federal water quality guidelines. Provincially, the mine is currently subject to Approval No. 2012-084244-14 (the IA) issued under the Nova Scotia *Environment Act, S.N.S. 1994-95, c.1 s.1 on April 7, 2022*. Federally, effluent discharge from the mine is regulated by the *Metal and Diamond Mining Effluent Regulations* (MDMER).

As the proposed Project uses federal *Fisheries Act* promulgated and authorized effluent limits, effluent will not be acutely toxic. The Industrial Approval receiving water criteria define the downstream edge of the mixing zone and thus the parameter needing the largest mixing zone defines the maximum mixing zone extent. The Project has demonstrated previously via effluent modeling in the Moose River receiver that IA criteria will be met within 100 m downstream of the point of discharge into Moose River. The proposed MDMER effluent criteria protect fish and fish habitat by:

- reducing risk to aquatic communities (DFO 2017),
- being based on modern and recent environmental effects monitoring,
- not being acutely toxic
- not bio accumulative
- not being persistent
- requiring routine whole effluent acute toxicity testing,
- maintaining a mixing zone that is as small as reasonably practical
- not overlapping with upstream or downstream mixing zones and
- if receiving water criteria defining the downstream mixing zone extent are exceeded at MDMER effluent discharge limits, then the discharge limit will be reduced to meet this downstream receiving water criteria.

Under MDMER, the maximum authorized monthly mean concentrations for effluent water quality for existing mines effective June 1, 2021 are presented in Table 3.1, and are based on those presented in Schedule 4 - Table 2 of the MDMER regulations. Wastewater treatment will be required for parameters that are predicted to exceed the MDMER limits in the effluent.

Table 3.1 MDMER Monthly Limits for Existing Mine Effluent after June 1, 2021

Parameter	MDMER Schedule 4, Table 2,
Arsenic	0.3 mg/L
Copper	0.3 mg/L
Cyanide	0.5 mg/L
Lead	0.1 mg/L
Nickel	0.5 mg/L
Zinc	0.5 mg/L
Suspended Solids	15.0 mg/L
Radium 226	0.37 Bq/L
Un-ionized ammonia (as N)	0.5 mg/L

Note: The concentrations for metals and cyanide are total values.

The current Industrial Approval (IA) (2012-084244-14) provides specific criteria for the evaluation of water quality at surface water monitoring stations and groundwater wells in Appendix K of the IA. The criteria provided in Appendix K of the IA are used as provincial criteria in this report. The guidelines are based on the more stringent values from the CCME freshwater aquatic life guidelines, Nova Scotia Environmental Quality Guidelines, and the government of British Columbia ambient water quality guidelines for sulphate. These guidelines are provided in Table A.1 of the appendix.

The Canadian Council Ministers of the Environment (CCME) framework for assessing assimilative capacity of a receiver (CCME 2003) was used in this study. The CCME (2003) guidance document was specifically recommended by NSECC to provide the approach and framework for the Touquoy pit discharge assimilative capacity assessment. The key steps outlined in the CCME guidance are as follows:

1. Identifying physical/chemical and/or biological parameters of potential concern (PoPC) for the proposed discharge. Parameters of potential concern are defined as those predicted to exceed effluent limits in the Open Pit overflow effluent.
2. Establishing appropriate (i.e., freshwater) ambient Water Quality Compliance Criteria (WQCC) for receiving waters. The WQCC for this study were based on the Nova Scotia Environment and Climate Change (NSECC) criteria provided in Table 6 of Appendix K of the Industrial Approval for the site (Approval 2012-084244-14), which are largely derived from the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 2021). This criterion is provided in Table 3.2.
3. If the background concentration of a POPC in the receiving environment is higher than the WQCC on which the discharge limit is established, the discharge limit should not be more stringent than the natural background concentration.
4. Determining the areal extent of the initial mixing zone (IMZ) in the area of the outfall in the receiving water. CCME (2003) defines the mixing zone as, “an area contiguous with a point source (effluent) where the effluent mixes with ambient water and where concentrations of some substances may not comply with water quality guidelines or objectives”.

5. Developing use-protection-based effluent discharge limits at the end-of-pipe which will meet ambient WQCC at the edge of the mixing zone (through modelling and other methods).

As per Chapter 6 of CCME (2003) the conditions within a mixing zone should not result in the bioaccumulation of chemicals (e.g., metals) to levels that are harmful or toxic. Consideration of mixing zone selection is summarized in Appendix A.

The distance from the effluent discharge location to the boundary of the mixing zone in the ultimate receiver should be limited to 100 m as per guidance from NSECC (Environment Canada 2006).

Table 3.2 Industrial Approval Water Quality Compliance Criteria

Parameter	Units	Industrial Approval 14 Water Quality Compliance Criteria (2021-2022)
Chloride (Cl-)	mg/ L	120
Fluoride (F-)	mg/ L	0.12
Nitrate (as N)	mg/ L	13
Nitrite (N)	mg/ L	0.06
Unionized Ammonia (as N)	mg/ L	0.019
Dissolved Sulphate[3]	mg/L	Refer to conditions 7.d.vii-7.d.vii, 128-429 dependent on hardness
Total Suspended Solids (TSS)	mg/ L	Refer to Condition 15.d), dependent on flow conditions, 5 (short term) or 25 (btw. 24 hrs -30d) above background <25, 25 above background btw. 25-250, 10% above background > 250
Total Aluminum (Al)	µg/ L	5(if pH is < 6.5); 100 (if pH is ≥6.5)
Total Antimony (Sb)	µg/ L	20
Total Arsenic (As)	µg/ L	5
Total Barium (Ba)	µg/ L	1000
Total Beryllium (Be)	µg/ L	5.3
Total Boron (B)	µg/ L	1200
Total Cadmium (Cd)	µg/ L	0.04 (if Hardness is < 17 mg/L); $10^{\{0.83(\log[\text{hardness}]) - 2.46\}}$(if Hardness is ≥17 mg/ L to ≤280 mg/ L); 0.37 (if Hardness is >280 mg/L)
Chromium (Cr Total)	µg/ L	-
Chromium (CRVI)	µg/ L	1
Total Cobalt (Co)	µg/ L	10
Total Copper (Cu)	µg/ L	2 (if Hardness is <82 mg/ L); 0.2 * $e^{\{0.854\ 5[\ln(\text{hardness})]-1.465\}}$(if Hardness is ≥82 mg/ L to ≤180 mg/ L); 4 (if Hardness is >180 mg/ L)
Total Cyanide (Cn Free)	µg/ L	5
Total Iron (Fe)	µg/ L	300

Table 3.2 Industrial Approval Water Quality Compliance Criteria

Parameter	Units	Industrial Approval 14 Water Quality Compliance Criteria (2021-2022)
Total Lead (Pb)	µg/ L	1 (if Hardness is ≤60 mg/ L); $e^{\{1.273[\ln(hardness)]-4.705\}}$(if Hardness is >60 mg/ L to ≤180mg/ L); 7 (if Hardness is >180 mg/ L)
Total Manganese (Mn)	µg/ L	820
Total Mercury (Hg)	µg/ L	0.026
Total Molybdenum (Mo)	µg/ L	73
Total Nickel (Ni)	µg/ L	25 (if Hardness is ≤60 mg/ L); $e^{\{0.76[\ln(hardness)]+1.06\}}$ (if Hardness is >60 mg/ L to ≤180 mg/ L); 150 (if Hardness is >180 mg/ L)
Total Selenium (Se)	µg/ L	1
Total Silver (Ag)	µg/ L	0.25
Total Strontium (Sr)	µg/ L	21,000
Total Sulphate	mg/L	128 (hardness is < 30 mg/L), 218 (hardness 31-75 mg/L), 309 (hardness of 76-180 mg/L), 429 (hardness of > 181 mg/L)
Total Thallium (Tl)	µg/ L	0.8
Total Uranium (U)	µg/ L	15
Total Vanadium (V)	µg/ L	6
Total Zinc (Zn)	µg/ L	$\exp^{(0.947[\ln(hardness\ mg\cdot L-1)]-0.815[pH]+0.398[\ln(DOC mg\cdot L-1)]+4.625)}$ (if Hardness is 23.4 to 399 mg/ L, pH is 6.5 to 8.13 & DOC is 0.3 to 22.9 mg/ L
Benzene	mg/ L	2.1
Toluene	mg/ L	0.77
Ethylbenzene	mg/ L	0.32
Total Xylenes	mg/ L	0.33
Modified TPH-Gasoline	mg/ L	1.5
Modified TPH- Fuel Oil	mg/ L	0.1
Modified TPH- Lube Oil	mg/ L	0.1

4.0 RECEIVING WATER HYDROLOGY

The Open Pit effluent will reach Moose River in close proximity to SW-2. The upstream Moose River catchment area at SW-2 is 39.03 square kilometres (km^2) and at SW-11 is 25.80 km^2. No long-term hydrometric stations exist on Moose River around the Touquoy Mine Site.

4.1 REGIONAL REGRESSION ANALYSIS METHODOLOGY

In the absence of long-term local hydrologic records, regional relationships were developed using selected Water Survey of Canada (WSC) stations to transpose flow data to the Touquoy Mine Site. The WSC stations were selected based on criteria including catchment area, station location, and period of record. Transpositional scaling assumes homogeneity (due to their proximity and similar climate and land use conditions) between the selected regional WSC stations.

The regional regression method is limited to gauged stations in areas of hydrologic homogeneity where, as described in 1.3, a) the landscape is subject to similar climate, and physiographic conditions. There are limited gauging station datasets available in Nova Scotia near the site that meet the primary selection criteria (e.g., catchment area, distance to Touquoy Mine Site). The WSC stations selected for the regional hydrology assessment are summarized in Table 4.1.

Table 4.1 WSC Regional Hydrology Stations

Station ID	Station Name	Drainage Area (km^2)	Years of Record	Record Period	Site Proximity (km)	Climate Normal Prec. (mm)
01DH003	Fraser Brook Near Archibald	10.1	26	1965-1990	45	1357.6
01EJ004	Little Sackville River at Middle Sackville	13.1	39	1980-2018	65	1513.2
01EE005	Moose Pit Brook at Tupper Lake	17.7	39	1981-2019	192	1455.0
01EH006	Canaan River at Outlet of Connaught Lake	65.4	11	1986-1996	107	1359.1
01DP004	Middle River of Pictou at Rocklin	92.2	54	1965-2018	58	1232.2
01DG003	Beaverbank River Near Kinsac	96.9	98	1921-2018	60	1396.2
01FA001	River Inhabitants at Glenora	193	55	1965-2019	150	1440.5
01ED013	Shelburne River at Pollard's Falls Bridge	268	21	1999-2019	202	1486.2
01EO003	East River St. Mary's at Newtown	282	15	1965-1979	75	1315.1
01EK001	Musquodoboit River at Crawford Falls	650	82	1915-1996	27	1396.2

Validation for the regional hydrology dataset for the range of uses applied was conducted by confirming the hydrologic homogeneity of the group. A station would not be eliminated because it failed a single test but would be eliminated if it failed multiple tests demonstrating more heterogeneity than homogeneity. The results of hydrologic factors and tests that were assessed to confirm hydrologic homogeneity, include:

- Climate – The climate normal annual precipitation for Halifax Stanfield Airport of 1396.2 mm is used to characterize the Touquoy site. Assessment of longer-term climate stations proximal to the gauging stations indicate that the climate normal annual precipitations range from 1232.2 to 1513.2 mm and thus within -15% to +8% of the climate normal annual precipitation at site.
- Soils – Nova Scotia soils mapping for the areas at each regional gauging station are characterized by dry, moist, and fresh medium to coarse textured soils which would be characterized as Hydrologic Soil Group B and C.
- Vegetation – The watersheds reporting to the regional gauging stations are rural in nature with forest cover in the range of 72 – 95% based on Nova Scotia Forest mapping. Forest cover in the regional hydrology dataset area is characterized by a mixture of coniferous and mixed wood forests, with lesser amounts of deciduous forests.
- Site Proximity – Site proximity ranges from 27 km to 202 km. Site proximity is analogous to correlation with regional climate and physiography.
- Years of Record – Years of record ranged from 11 to 98 years. Generally, a station will only be included if it has at least 10 years of data.
- Period of Record- Period of record ranges from currently monitored to ending in 1979. Generally, a goal is to use regional stations whose period of record is within one climate normal period (i.e. 30 years). As such, 01DH003 is at the temporal boundary and 01EO003 is a decade older than the boundary.
- Regulation – None of the stations are on regulated systems
- Watershed <10x – A general principle in regional regression is to keep the areal proration to no more than one order of magnitude between the watershed area of the gauged site and that of the target site. Station 01EK001 is beyond 10x the size of the largest site watershed but was retained because it is the closest station to site and has a long period of record.
- Mean Annual Flow (MAF) – The MAF regression equation demonstrated high statistical significance with a coefficient of determination of R^2 = 0.9956.
- Mean Monthly Flow (MMF) – Similarly to MAF, the individual monthly regression equations also demonstrated high statistical significance with R^2 ranging from 0.9753 to 0.9965.
- Unit Flow – Unit flows are presented in Figure 4.1 below and range from 23.69 – 37.23 L/s/km^2 with 01EJ004 and 01EK001 presenting outside the linear trend of increasing hydraulic efficiency with increasing drainage area.
- Flow Duration Curve (FDC)- The FDCs for the regional dataset are presented below in Figure 4.2. All station FDCs follow a similar shape pattern with little FDC cross-over indicative of FDC variance.

- Index Flood Flow - In the flood indexing approach, the 95th confidence interval has been used to assess the homogeneity of the regional dataset using the Mean Annual Flood (recurrence interval of 2.33 years) as the Index Flood, the 10-year flood, and their ratios. The Index Flood test results are presented in Figure 4.3. The two stations (01DG003 and 01ED013) with the lowest homogeneity of flood flow relative to the regional dataset are shown in red on the figure. Station 01ED013 plots near the 95th percentile threshold of the Gumbel Distribution test; however, 01DG003 (Beaverbank near Kinsac) plots well outside the 95th confidence interval for the Gumbel Distribution test.

In general, despite some variance among stations with respect to period of record, larger watershed area, unit flows, and index flooding, the regional hydrologic dataset of the ten stations presented in Table 4.1 and used in the regional regression demonstrates more hydrologic homogeneity than heterogeneity and thus are considered acceptable for inclusion in the regional hydrology dataset grouping.

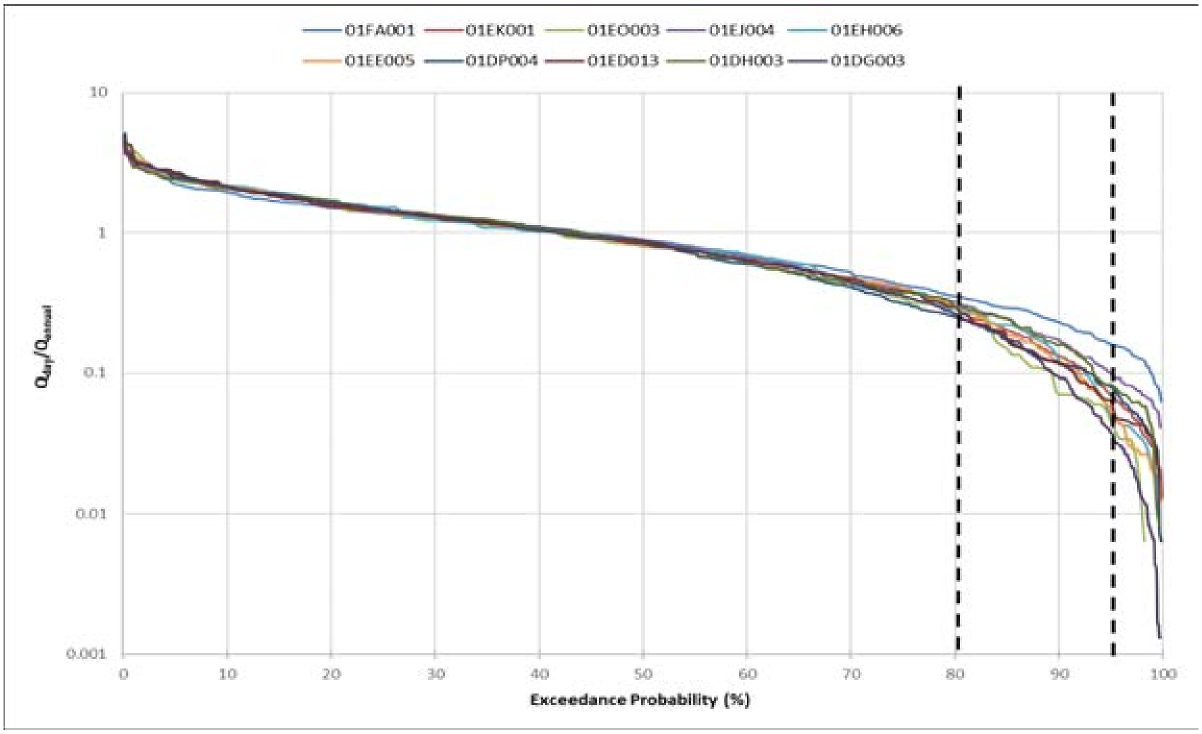

Figure 4.1 Mean Annual Unit Flows for Regional Dataset

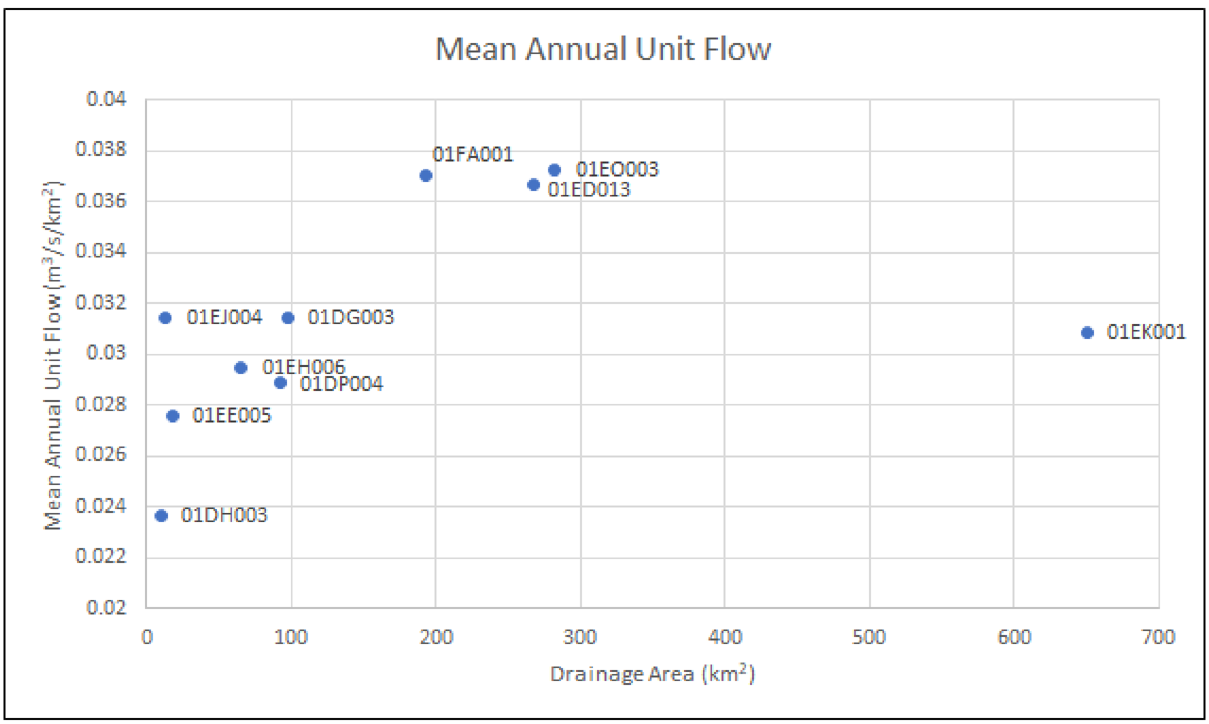

Figure 4.2 Regional Dataset Flow Duration Curves

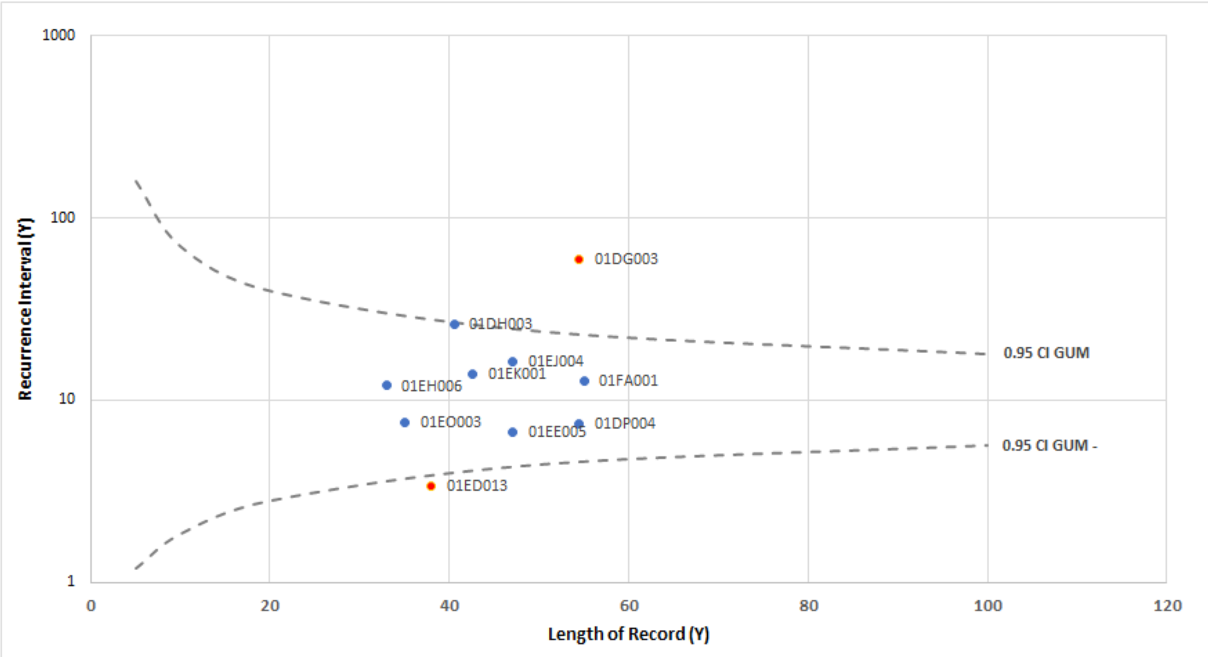

Figure 4.3 Index Flood Test

4.2 RESULTS OF THE REGIONAL REGRESSION ANALYSIS

Average monthly flows for Moose River at SW-2 (drainage area of 39.03 km^2) were derived using the regional relationships for low flow months. A regression relationship was also derived for the 25% MAF, the environmental flow metric that is outlined in the Department of Fisheries and Oceans Canada (DFO 2012). This low flow statistic results in a lower environmental flow than the June Q60 that is used in the DFO Guidelines for the design of fish passage for culverts in Nova Scotia (2015). The MAF is 1.16 m^3/s or 1,160 L^3/s and 25% is 0.29 m^3/s or 290 L/s.

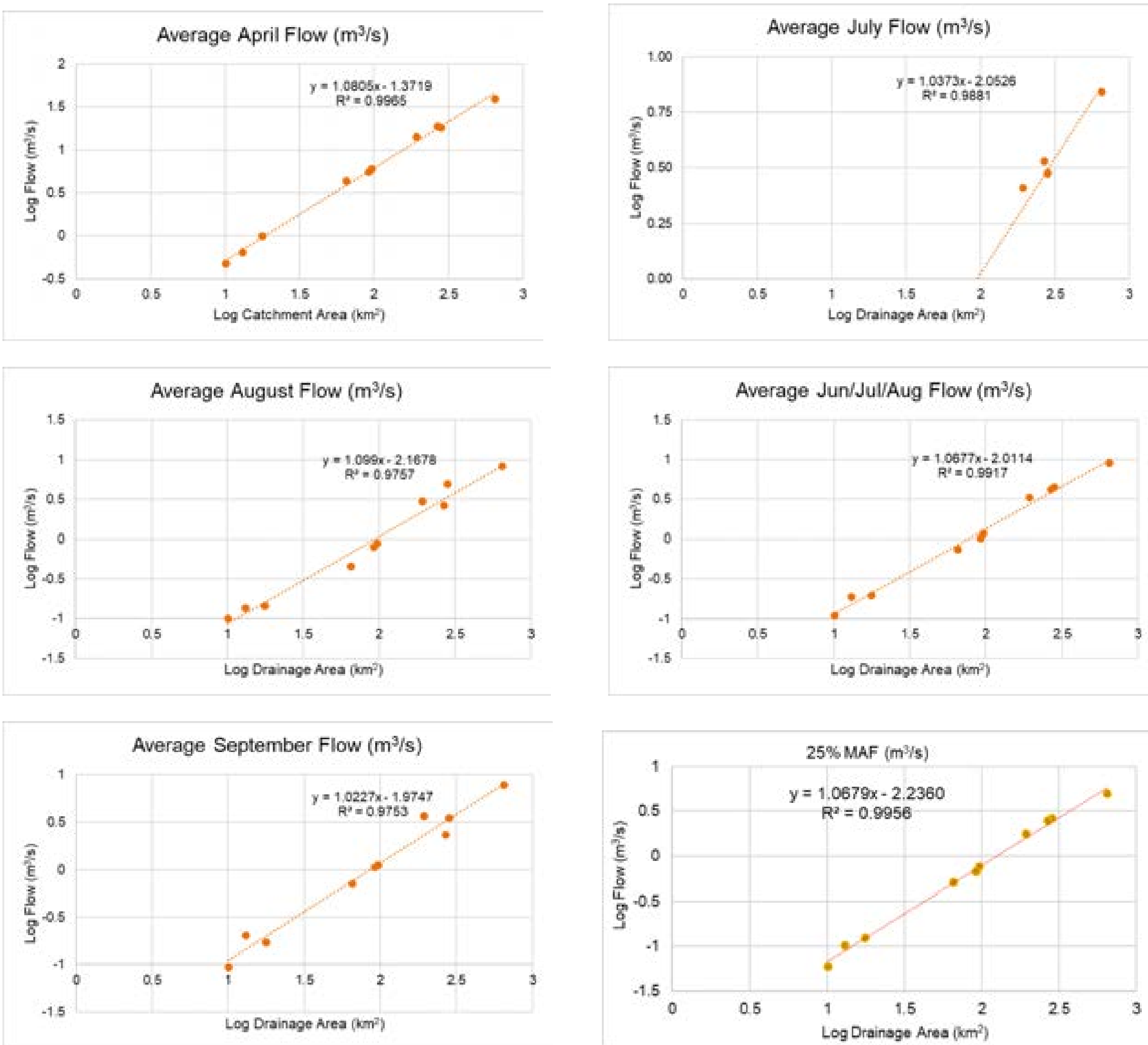

Figure 4.4 Regional Regression Analysis

5.0 EFFLUENT WATER QUANTITY AND QUALITY

An environmental water balance was used to predict the Open Pit effluent overflow to Moose River at mine closure (Stantec 2021b). Figure 5.15 shows the average predicted monthly Open Pit overflow under climate normal conditions. As shown in the figure, average monthly effluent flow will vary seasonally from 3.6 litres per second (L/s) in July to 48.3 L/s in April. The average monthly effluent flow rate to Moose River will be 16.9 L/s.

The Open Pit seepage rate to the river was simulated using a groundwater flow model (Stantec 2022). Average daily baseflow to Moose River was estimated at 7.5 L/s.

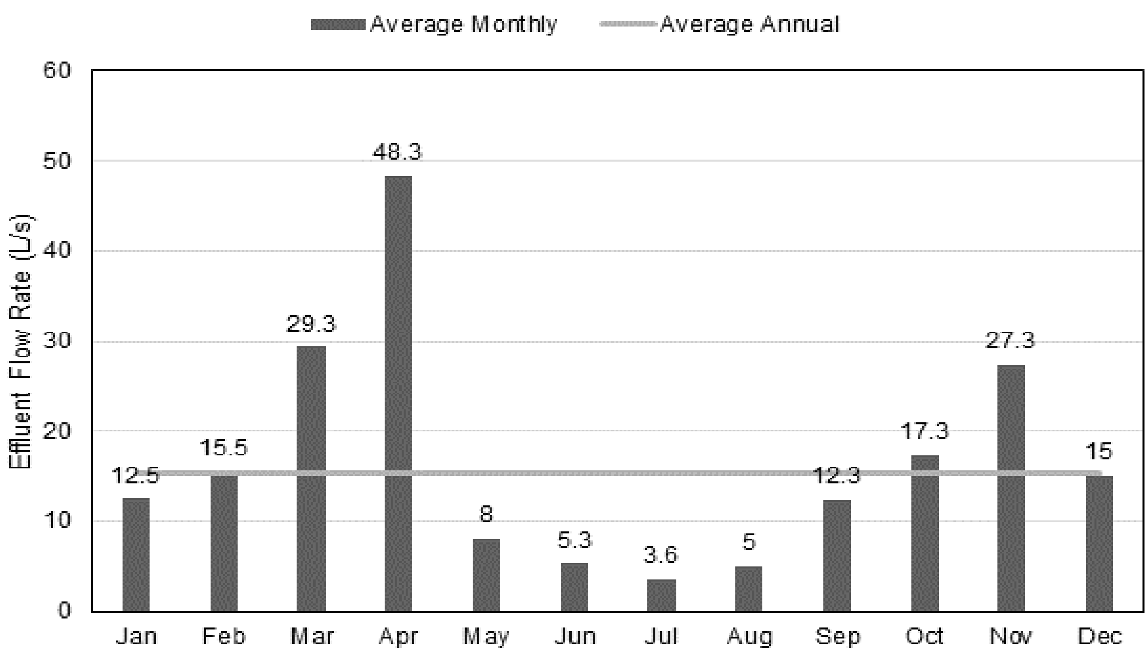

Figure 5.1 Monthly Effluent Flow Rates

Effluent water quality was predicted using the water quality and quantity model and groundwater flow model (Stantec 2022a and Stantec 2022b). Water quality modelling considered the pore water quality in the tailings and the groundwater inflow quality in the pit floor and walls, dilution from surface runoff, direct precipitation, and process water surplus, and the geochemistry of the individual water quality parameters. The water quality model assumed complete mixing of the pit lake which would result in the discharge of water over the spillway once the pit lake reaches the spillway elevation. As the pit discharges from the surface, a stratified system would result in tailings water at the bottom of the pit and clean water discharge at the surface; thus, improving discharge quality. However, the variation of water density due to water chemistry or temperature is not considered significant enough to resist turnover of the pit lake; especially if additional tailings was deposited into the pit until full.

Two in-pit tailings deposition scenarios were modelled, which include:

Base Case:

- The effluent water quality predictions only consider the Touquoy Pit Expansion water and tailings deposition. This is consistent with the EARD previous version of the assimilative capacity model.
- Based on the water quality modelling that was presented in the integrated water and tailings management plan attached to the EARD (2021), the annual mean water quality concentration of the Pit Lake was calculated in the base case at year 6 when it is predicted that the base case pit will fill and excess water discharge will be required.
- This includes deposition of the tailings from the Touquoy expanded ore processing. However, as the up to 2.5 Million cubic meters of waste rock exists in the Touquoy pit the base case was updated to account for this loss in pit storage. This would result in a conservatively higher water quality predictions in effluent discharge than no waste rock in the pit due to the shortened period of sedimentation and natural degradation that occurs overtime.

Worst Case (Continued Operations):

- The base case predictions were revised to consider continued tailings deposition from other deposits, such as Beaver Dam or FMS, until the pit is full (i.e., tailings surface reaches an elevation of 106.0 m CGVD 2013). For example, the Touquoy expansion tailings deposited in the pit in addition to tailings deposited from proposed project.
- In the continued operations case, the pit water level will reach the excess overflow level in 4 years.
- The worst-case in pit deposition also accounts for the up to 2.5 Million cubic meters of waste rock that is stored in the pit. This worst-case model scenario was run in anticipation of regulatory questions of proposed in-pit tailings deposition in the Touquoy pit from other projects. Again, this would result in a conservatively higher water quality predictions in effluent discharge than no waste rock in the pit due to the shortened period of sedimentation and natural degradation that occurs overtime.

The predicted concentration once fully mixed will be calculated for the worst-case water quality concentration for each parameter. Table 5.1 presents a list of predictions of the average and maximum concentrations in the effluent over the 51 years of simulation for metal parameters and nitrogen species for both in-pit deposition scenarios. Concentrations of aluminum, arsenic, cobalt, copper, WAD cyanide, and nitrite in the effluent water quality have exceedance of the WQCC. In addition, the effluent concentrations of arsenic and ammonia are predicted to slightly exceed the 2021 MDMER discharge limit, therefore, arsenic and ammonia treatment will be required prior to release of the effluent to environment.

Total cyanide and weak acid-dissociable (WAD) cyanide concentrations in the effluent are below the MDMER discharge limit for cyanide (i.e., 0.5 milligrams per litre (mg/L) for total cyanide). There are no WQCC guidelines for these forms of cyanide. Further discussion about cyanide is presented in Section 9.0.

Predicted maximum concentration of arsenic in the effluent (without treatment) over the 51 years of simulation is 3.97 mg/L. The MDMER limit is 0.3 mg/L, therefore, arsenic will require treatment prior to discharge. The regulatory effluent limit of 0.3 mg/L was assumed in modeling of the mixing zone.

Table 5.1 Predicted Effluent Water Quality Parameters and Limits

Water Quality Parameter	Base Case In-Pit Deposition Discharge (Touquoy Expansion Project only)		Worst-Case In-Pit Deposition Discharge (Continued Tailings Deposition)		MDMER Maximum Monthly Discharge Limit mg/L	IA Water Quality Compliance Criteria mg/L
	Average Monthly Concentration mg/L	Maximum Concentration mg/L	Average Monthly Concentration mg/L	Maximum Concentration mg/L		
Dissolved Aluminum	**0.015**	**0.033**	**0.022**	**0.135**	**-**	0.005 (pH < 6.5)
Total Arsenic	**0.178**	**0.616**	**0.179**	**3.97**	**0.3**	0.005
Total Calcium	24.5	49.4	33.1	190	-	-
Total Cadmium	0.0000085	0.000008	0.000008	0.000032	-	0.00004 (Hardness < 17 mg/L)
Total Cobalt	0.009	**0.046**	**0.0101**	**0.30**	**-**	0.010
Total Chromium	0.00015	0.00031	0.000207	0.00116	-	-
Total Copper	**0.005**	**0.026**	**0.005**	**0.03**	0.3	0.002 (Hardness < 17 mg/L)
Total Iron	0.012	0.029	0.015	0.077	-	0.3
Total Lead	0.00008	0.00020	0.00012	0.00089	0.1	0.001 (Hardness < 60 mg/L)
Total Mercury	0.000012	0.000016	0.000018	0.000019	-	0.000026
Total Magnesium	3.244	4.89	4.45	10.7	-	-
Total Manganese	0.062	0.102	0.085	0.334	-	0.82
Total Molybdenum	0.003	0.007	0.004	0.032	-	0.073
Total Nickel	0.006	0.013	0.008	0.054	0.5	0.025 (Hardness is < 60 mg/L)
Total Tin	0.001	0.003	0.0015	0.0147	-	-
Total Selenium	0.00020	0.00056	0.00026	0.00283	-	0.001
Total Silver	0.00001	0.00003	0.00002	0.00010	-	0.0001
Dissolved Sulphate	69.0	**166**	80.7	**871**	-	128 (hardness is < 30 mg/L)
Total Thallium	0.00001	0.00003	0.000018	**0.00011**	-	0.0008

Table 5.1 Predicted Effluent Water Quality Parameters and Limits

Water Quality Parameter	Base Case In-Pit Deposition Discharge (Touquoy Expansion Project only)		Worst-Case In-Pit Deposition Discharge (Continued Tailings Deposition)		MDMER Maximum Monthly Discharge Limit mg/L	IA Water Quality Compliance Criteria mg/L
	Average Monthly Concentration mg/L	**Maximum Concentration mg/L**	**Average Monthly Concentration mg/L**	**Maximum Concentration mg/L**		
Total Uranium	0.0028	0.0032	0.0043	0.0058	-	0.015
Total Zinc	0.0009	0.0019	0.0012	0.0084	0.5	$e^{\{0.947(\ln[hardness])-0.815(pH)+0.398(\ln[DOC]+1.625\}}$
WAD Cyanide	**0.016**	**0.087**	**0.072**	**0.0575**	-	0.005 (Free Form Cyanide)
Total Cyanide	0.048	0.249	0.050	1.64	0.5	-
Nitrate (as N)	1.36	3.98	0.747	1.97	-	13
Nitrite (as N)	**0.144**	**0.693**	**0.119**	**1.14**	**-**	0.06
Ammonia (as N)	0.070	0.721	0.447	33.2	**-**	-
Unionized Ammonia (as N)	0.0002	**0.0059**	0.0003 at 10°C (0.0001 at 0.1°C, 0.0009 at 26°c)	0.02 at 10°c (0.009at 0.07°c, 0.0207 at 26°c)	0.5	0.019

Note: Bold values indicate exceedance of water quality compliance criteria, empty field indicates no water quality value.
[1] pH< 6.5 and hardness < 17 mg/L, baseline water quality data at SW-2
[2] Free form of cyanide
[3] Unionized ammonia estimated using various seasonal water summer temperature and average pH observed at SW-11 of 6.0

6.0 GROUNDWATER SEEPAGE FROM TOUQUOY PIT TO MOOSE RIVER

Groundwater seepage from the Open Pit discharging directly to Moose River was predicted using a groundwater model (Stantec 2022). The disposal of tailings in the open pit has the potential to degrade the water quality in the open pit. This water can then migrate from the open pit through groundwater and degrade the water quality in the receiving environments. Therefore, the transport of dissolved constituents from the Touquoy pit to potential downgradient receptors was simulated by use of a groundwater flow and solute transport model.

The solute transport model incorporated the changes in hydraulic conductivity and material characterization from the updated flow model. The updated transport model uses the same source boundary cells and concentrations as the original EARD model. Solute transport was simulated for a period of 500 years considering the porosity of overburden units, weathered and component bedrock units, underground workings and tailings. The simulation considers the transport of a conservative solute from the water in the open pit with a constant source concentration of 1 mg/L through the groundwater to the receiving environment over time. These relative concentrations can be multiplied by the source term concentrations for the various parameters of concern provided by Lorax (2018 and 2022) for the original EARD model to estimate the mass loading to, and average concentration in, Moose River over time. Predicted mass loading and concentrations at Moose River using the updated model are lower than those predicted using the original EARD model due to the lower competent bedrock hydraulic conductivity determined from 2021 field investigations and incorporated into the updated groundwater model.

The average annual baseflow to Moose River along the entire boundary of the Open pit is estimated at 7.0 L/s, based on climate average annual conditions and 1.75 L/S based on 25% MAF low flow condition. However, as calculated in the latest hydrogeology model only a fraction of this baseflow of 2E-05 L/s is considered seepage from the pit to Moose River. During low flow conditions baseflow flow and the corresponding seepage flow would be further reduced, however this was not accounted for in this assimilative capacity study. Adsorption and chemical reactions were not evaluated in the groundwater model; therefore, the groundwater quality predictions are considered conservative. The source term concentration of tailings porewater (Lorax 2018 & 2022) represents the seepage quality from the pit lake during closure in the solute transport model.

Table 6.1 presents a list of average water quality concentrations in the groundwater seepage based on the water quality source terms predicted for the tailings. As shown on **Table 7.1**, no parameters in the seepage are predicted to exceed the MDMER or WQCC. Both the average concentration in seepage and the predicted mass loading is below the detection limit for all parameters. Further details on predicted water quality of seepage from the Touquoy Pit is provided in Appendix C.

Table 6.1 Predicted Water Quality of Seepage from Touquoy Pit

Water Quality Parameter	Source Term Concentration (µg/L)	Predicted Additional Concentration to Baseline in Seepage to Moose River (µg/L)	Average Baseline Concentration Near Pit (Monitoring Well OPM1-B) (µg/L)
Dissolved Aluminum	46.9	< 5	14.58
Dissolved Arsenic	3070	<2	***3633.33***
Dissolved Calcium	86.9	<100	39083.33
Dissolved Cadmium	0.02	<0.1	0.005
Dissolved Cobalt	26.2	<0.4	0.5
Dissolved Chromium	0.2	<1	0.2
Dissolved Copper	9.37	<0.5	1
Dissolved Iron	32.6	<50	***719.17***
Dissolved l Lead	0.0248	<0.5	0.38
Dissolved Mercury	0.005	<0.013	NA
Dissolved Magnesium	14800	<4000	4850
Manganese	370	<100	***1035***
Dissolved Molybdenum	60.3	<202	NA
Dissolved Nickel	6.85	<2	1
Dissolved Tin	6.04	<2	NA
Dissolved Selenium	0.193	<0.5	0.5
Dissolved Silver	0.01	<0.1	0.05
Dissolved Sulphate	897000	<2	11846.15
Dissolved Thallium	0.0154	<0.1	NA
Dissolved Uranium	2.03	<0.1	0.21
Dissolved Zinc	9.6	<5	NA
WAD Cyanide	5.0	<3	NA
Total Cyanide	2.03	<5	NA
Nitrate (as N)	9.6	<50	NA
Nitrite (as N)	5.0	<10	NA
Dissolved Ammonia (as N)	87.0	<50	NA

* Free form of cyanide, ** Stantec 2022

7.0 ASSIMILATION RATIOS

Assimilation or dilution ratio analysis was conducted to find the worst-case month for dilution and mixing, i.e., the month with the lowest assimilative capacity. The Open Pit effluent post-mine closure will be driven by the same metrological factors (precipitation, evaporation, snowmelt) as the whole Moose River catchment. A very low flow in the river will correspond to a very low effluent flow from the Open Pit. The same relationship will exist with high flows. The low flow condition of 25% MAF will not likely result in effluent flow as the pit lake will not crest the spillway. However, in an attempt to run the worst-case water quality condition, the effluent flow during the lowest receiver flow condition in August was prorated to 25% MAF to estimate an effluent flow of 3.8 L/s during this low flow condition.

Table 7.1 presents the dilution ratios of the effluent with the receiver water assuming full mixing. The dilution ratios were calculated as a ratio of flow in the receiver to the effluent flow for the same month. A ratio between the catchment area of Moose River at SW-2 (39.03 km^2) and catchment area of the Open Pit (0.41 km^2) is 95 to 1. The minimum dilution ratio of 38 is observed in September. Groundwater seepage was conservatively excluded from dilution calculations as its water quality is predicted to be similar to background concentrations in Moose River.

Table 7.1 Dilution Ratio in the Receiver at Full Mixing Under Worst Case

Month	Receiver Flow (L/s)	Effluent Flow (L/s) *	Seepage (L/s)	Dilution Ratio of Effluent to Receiver Flow
June/July/August	487	4.6	2.0E-5	107
July	396	3.6	2.0E-5	111
August	381	5.0	2.0E-5	77
April	2,226	48.3	2.0E-5	47
September	450	12.3	2.0E-5	38
25% MAF	290	3.8	2.0E-5	77

Note: *The effluent flow was predicted to be higher in August than July, in contrast to the receiver flow due to the assumption of higher evaporative losses occurring in the month of July.

8.0 MIXING ZONE STUDY

The approach to modelling the areal extent of the initial mixing zone involved the application of an effluent plume model. The Cornell Mixing Zone Expert System (CORMIX), version 12.0 (Doneker and Jirka 2017) was used in this study. CORMIX is a software system for the analysis, prediction, and design of aqueous toxic or conventional pollutant discharges into diverse water bodies. The major emphasis is on the geometry and dilution characteristics of the initial mixing zone, but the system also predicts the behaviour of the discharge plume at larger distances. The basic CORMIX methodology relies on the assumption of steady ambient conditions. Background information regarding the physical characteristics of the receiving waters was used as input to the model, which is provided below.

8.1 CORMIX MODEL INPUTS

The required model inputs for the ambient conditions include flows, water density, wind, and depth of water in Moose River. Ambient flow affects the near-field transport and shape of the resulting plume from the effluent. Boundary ambient conditions are defined by average river depth at the outfall and in the mixing zone. Model inputs are summarized below:

- The average flow in Moose River in September is 450 L/s and the climate normal effluent flow 12.3 L/s in September.
- The Moose River channel geometry at the outfall was estimated based on river bathymetry data measured at SW-2 as part of the on-going hydrometric monitoring program for Touquoy operation. Channel width with active flow at the discharge point is 8 m. The average water depth used in the model is 1.5 m for high water conditions.
- The horizontal angle (sigma) of spillway channel to the bank was assumed 45˚ based on proposed spillway design. The spillway was assumed to have a trapezoidal shape with a bottom width of 3 m and side slopes of 2:1. Longitudinal slope of the spillway is 0.45%.
- Both the effluent and receiver were assumed to have the same temperature of 10°C and same density of 1,000.5 kg/m^3. Additional CORMIX runs for a winter temperature of 1°C and a summer high temperature of 26°C was completed to understand the effect of the seasonal temperature variation on the dilution ratios and extent of the mixing zone.
- The Manning's roughness coefficient used in the model, which represents the roughness or friction applied to the flow by the channel and based on the bottom substrate, was assumed to be 0.035 for low flow conditions and 0.04 for high flow conditions.
- Winds in CORMIX can affect the circulation, mixing, and plume movement in the river channel. The mean wind speed of 4.2 m/s from at the Halifax Stanfield International Airport was used in the model.

8.2 ASSUMPTIONS

The following assumptions of the modelling investigation were made in the assimilative capacity study:

- Steady ambient and effluent conditions were assumed in CORMIX
- Outfall configuration (spillway size and slope) was based on available preliminary design
- CORMIX parameters were derived based on available field data and literature
- Bathymetry information in the mixing zone was based on cross-section information at SW-2
- Modelling was conservatively focused on dilution and mixing ratios and decay and bioaccumulation were not simulated.

9.0 RESULTS AND DILUTION RATIOS

The distance from the effluent discharge location to the boundary of the mixing zone applied in this study is limited to 100 m as per guidance from NSECC (Environment Canada 2006).

The CORMIX model showed that a full-mixing dilution ratio of 38 is achieved within 92 m from the outfall.

Concentrations of the parameters of potential concern at the end of the mixing zone were calculated conservatively. The maximum Open Pit concentrations were used to define the effluent and the 75th percentile was used to define the receiving water ambient water quality conditions. The 75th percentile is commonly used to represent the background water quality to establish receiving water based effluent requirements for point source discharges to surface waterbodies (OMNR 2021).

Treatment of arsenic to the regulatory limit of 0.3 mg/L will be required. The seepage load (concentration times seepage rate) is very low as groundwater is of similar or better quality than background water quality in Moose River (Table 7.1). The site-specific limit of 42 ug/L for arsenic was defined by Intrinsik (2022) and provided to NSECC for review and approval.

The focus of assessment was on seven parameters of potential concern with concentrations in the effluent predicted to exceed the WQCC presented by NSECC: aluminum, arsenic, cobalt, copper, nitrite, and cyanide. Mercury, which is a potentially persistent, bioaccumulative and inherently toxic (PBiT) substance above WQCC, in not a PoPC from seepage to WC4.

At the end of the mixing zone four out of six parameters (cyanide, cobalt, copper, and nitrate) are below the WQCC. Aluminum and arsenic are above the WQCC at the end of the mixing zone due to the elevated natural background concentrations.

Concentrations of the parameters of potential concern at the end of the mixing zone for the worst-case conditions observed in September are presented in Table 9.1 (Base case predictions) and Table 9.2 (Worse case predictions). The receiver water temperature and temperature of the effluent are driven by the same climate conditions. Seasonal temperature variation from 1° C to 26 ° C did not result in a significant change in water density in a freshwater environment, and as a result in changes in extent of the mixing zone. Therefore, the dilution rations and extent of mixing zone do not change from the normal condition of 10°C.

Table 9.1 Base Case Water Quality Modelling Results for September Flow Conditions, mg/L

WQ Parameter	Base Case Effluent Max, mg/L	Moose River Modified Baseline Receiver, 75th Percentile[3]	Moose River Modified Baseline Receiver, 95th Percentile[3]	Water Quality Compliance Criteria	MDMER	75th Baseline, Concentration at 92 m. Fully Mixed
Aluminum	**0.033**	0.204	0.286	0.005[1]	-	0.199
Total Arsenic	**0.3**	0.019	0.031	0.005	0.3	0.0265
WAD Cyanide	**0.087**	<0.003	<0.003	0.005[2]	-	0.0038
Total Cyanide	0.249	0.0015	0.0017	-	0.5	0.0081
Total Cobalt	**0.046**	0.0005	0.0006	0.010	-	0.0017
Total Copper	**0.026**	<0.002	0.0023	0.002[1]	0.3	0.0017
Nitrite (as N)	**0.693**	<0.01	<0.01	0.06	-	0.0233

[1] pH< 6.5 and hardness < 17 mg/L, baseline water quality data at SW-2, [2] Free form of cyanide, [3] – Criteria is dissolved aluminum the analysis was for Total Aluminum measured at SW-2 and SW-11

Table 9.2 Worse Case Water Quality Modelling Results for September Flow Conditions, mg/L

WQ Parameter	Worst Case Effluent Max, mg/L	Moose River Modified Baseline Receiver, 75th Percentile[3]	Moose River Modified Baseline Receiver, 95th Percentile[3]	Water Quality Compliance Criteria	MDMER	75th Baseline, Concentration at 92 m. Fully Mixed
Aluminum	**0.135**	0.204	0.286	0.005[1]	-	0.2022
Total Arsenic[3]	**0.3**	0.019	0.031	0.005	0.3	0.0265
WAD Cyanide	**0.057**	<0.003	<0.003	0.005[2]	-	0.0030
Total Cyanide	0.5	0.0015	0.0017	-	0.5	0.0148
Total Cobalt	**0.3**	0.0005	0.0006	0.010	-	0.0085
Total Copper	**0.03**	<0.002	0.0023	0.002[1]	0.3	0.0018
Nitrite (as N)	**1.14**	<0.01	<0.01	0.06	-	0.0352

[1] pH< 6.5 and hardness < 17 mg/L, baseline water quality data at SW-2, [2] Free form of cyanide, [3] Criteria is dissolved aluminum the analysis was for Total Aluminum measured at SW-2 and SW-11

Aluminum is predicted to have lower concentration in the effluent in comparison with the ambient background. Therefore, the predicted aluminum concentration at the end of the mixing zone will be slightly lower than background, but still above the WQCC (when ambient pH above 6.5), resulting in a slight improvement in ambient aluminum concentrations.

Predicted maximum concentration of arsenic in the effluent is 0.616 mg/L. The MDMER limit is 0.3 mg/L, therefore, arsenic will require treatment prior to discharge. After arsenic treatment to the MDMER limit of 0.3 mg/L, its concentration at the end of the mixing zone is predicted at 0.0265 mg/L. Elevated arsenic baseline concentration limit mixing potential of this parameter. The arsenic concentration at the 92 m mixing zone boundary is above the WQCC. A site-specific water quality criteria of 0.042 mg/L was developed for the Touquoy Mine Site (Intrinsik 2022) based on the CCME guideline (2001). The predicted arsenic concentrations are below the reported lowest toxic levels for fish, algae and aquatic plants.

Concentrations of the parameters of potential concern at the end of the mixing zone for the 25% MAF flow are presented in Table 9.3 (Base case predictions) and Table 9.4 (Worse case predictions). Aluminum is predicted to have lower concentration in the effluent in comparison with the ambient background. Therefore, the predicted aluminum concentration at the end of the mixing zone will be slightly lower than background, but still above the WQCC. The arsenic concentration at the 66 m mixing zone boundary is above the WQCC but below the site-specific water quality criteria of 0.042 mg/L. Other parameters meet the WQCC at the end of the mixing zone.

Using the 95th percentile baseline concentration did not change the extent of the mixing zone from the 75th percentile baseline concentration in Moose River. Full mixing occurs at the same distance from the outfall for each baseline condition. Using the 95th percentile baseline concentrations in Moose River increases the predicted concentrations of each parameter at the end of the mixing zone because of the higher reference point. However, water quality at the end of the mixing zone still meets WQCC, baseline or Site-specific water quality criteria for Arsenic. When the baseline concentration is at or near a water quality compliance criteria, returning to baseline conditions through dilution of point source concentrations within the identified mixing zone is unattainable. Site specific water quality criteria are derived to protect important aquatic life based on the assessment of toxicity data and the application of a species sensitivity distribution type assessment approach.

Table 9.3 Base Case Water Quality Modelling Results for 25% MAF Flow Conditions, mg/L

WQ Parameter	Base Case Effluent Max, mg/L	Moose River Modified Baseline Receiver, 75th Percentile[3]	Moose River Modified Baseline Receiver, 95th Percentile	Water Quality Compliance Criteria	MDMER	75th Baseline, Concentration at 66 m. Fully Mixed	95th Baseline, Concentration at 66 m. Fully Mixed
Aluminum	**0.033**	0.204	0.286	0.005[1]	-	0.2018	0.2827
Total Arsenic	**0.3**	0.019	0.031	0.005	0.3	0.0226	0.0345
WAD Cyanide	**0.087**	<0.003	<0.003	0.005[2]	-	0.0026	0.0026
Total Cyanide	0.249	0.0015	0.0017	-	0.5	0.0047	0.0049
Total Cobalt	**0.046**	0.0005	0.0006	0.010	-	0.0011	0.0012
Total Copper	**0.026**	<0.002	0.0023	0.002[1]	0.3	0.0013	0.0026
Nitrite (as N)	**0.693**	<0.01	<0.01	0.06	-	0.0139	0.0139

[1] pH< 6.5 and hardness < 17 mg/L, baseline water quality data at SW-2, [2] Free form of cyanide, [3] -Criteria is dissolved aluminum the analysis was for Total Aluminum measured at SW-2 and SW-11

Table 9.4 Worst Case Water Quality Modelling Results for 25% MAF Flow Conditions, mg/L

WQ Parameter	Worst Case Effluent Max, mg/L	Moose River Modified Baseline Receiver, 75th Percentile[3]	Moose River Modified Baseline Receiver, 95th Percentile	Water Quality Compliance Criteria	MDMER	75th Baseline, Concentration at 66 m. Fully Mixed	95th Baseline, Concentration at 66 m. Fully Mixed
Aluminum	**0.135**	0.204	0.286	0.005[1]	-	0.2031	0.2841
Total Arsenic	**0.3**	0.019	0.031	0.005	0.3	0.0226	0.0345
WAD Cyanide	**0.057**	<0.003	<0.003	0.005[2]	-	0.0022	0.0022
Total Cyanide	0.5	0.0015	0.0017	-	0.5	0.0079	0.0081
Total Cobalt	**0.3**	0.0005	0.0006	0.010	-	0.0044	0.0045
Total Copper	**0.03**	<0.002	0.0023	0.002[1]	0.3	0.0014	0.0026
Nitrite (as N)	**1.14**	<0.01	<0.01	0.06	-	0.0197	0.0197

[1] pH< 6.5 and hardness < 17 mg/L, baseline water quality data at SW-2, [2] Free form of cyanide, [3] -Criteria is dissolved aluminum the analysis was for Total Aluminum measured at SW-2 and SW-11

10.0 CONCLUSIONS

It was determined that a 100-m mixing zone would be appropriate for the Touquoy pit effluent on the basis of requirements of the IA-14 issued by NSECC.

Ambient water quality was characterized using the 2016 and 2017 water quality data at SW-11. Background water quality in Moose River at SW-11 has four parameters which exceed the WQCC specified in the existing Industrial Approval: total aluminum, arsenic, and iron.

The concentrations of total aluminum, arsenic, cobalt, copper, and nitrite were identified to potentially exceed the WQCC in the Open Pit effluent. Arsenic concentrations in the effluent exceed the MDMER limits. Therefore, arsenic treatment will be required prior to release of the effluent to environment.

The CORMIX (version 12.0) three-dimensional model was used to derive the effluent criteria for the Touquoy pit effluent discharge to Moose River. The outfall configuration, bathymetry and flows were modeled conservatively based on available information. The extent of the downstream mixing zone is 92 m.

Concentrations of the parameters of potential concern at the end of the mixing zone for the worst-case September conditions are presented in Table 9.1 and Table 9.2. As the pit lake behaves like a large sedimentation pond during pit filling some metals concentrations from the pit lake will be improved to the background water quality in Moose River. The predicted aluminum concentration at the end of the mixing zone will be slightly lower than background., but above the WQCC. The predicted arsenic concentration is above the WQCC but below the site-specific water quality criteria (Intrinsik 2022) and proximal to baseline conditions. As noted previously, baseline arsenic water quality in the Moose River is approximately 4x worse that the IA arsenic WQCC and thus achieving the WQCC for arsenic is not reasonable. As such a site-specific arsenic criteria developed by (Intrinsik 2022) based on the CCME guideline (2001) has been proposed at 0.042 mg/L. The proposed site-specific arsenic criteria was submitted to NSECC in September 2022 (Intrinsik 2022).

Concentrations of the parameters of potential concern at the end of the mixing zone for the 25% MAF flow are presented in Table 9.3 and Table 9.4. The predicted concentrations are either below the WQCC (cyanide, cobalt, copper, and nitrite), meet the background conditions (aluminum) or below the site-specific water quality criteria (arsenic).

11.0 CLOSURE

This report has been prepared for the sole benefit of the Atlantic Mining NS Inc. (AMNS). This report may not be used by any other person or entity without the express written consent of Stantec Consulting Ltd. and AMNS.

Any use that a third party makes of this report, or any reliance on decisions made based on it, are the responsibility of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made, or actions taken, based on this report.

The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Conclusions and recommendations presented in this report should not be construed as legal advice.

The conclusions presented in this report represent the best technical judgment of Stantec Consulting Ltd. based on the data obtained from the work. If any conditions become apparent that differ from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

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APPENDIX A

Mixing Zone Selection

The mixing zone was established to follow the 14 guiding principles (CCME 2003b), which include:

No.	Guiding Principal	Justification
1	The dimensions of the Initial Dilution Zone (IDZ) should be restricted to avoid adverse effects on the designated uses of the receiving water system (i.e., the IDZ should be as small as possible);	The extent of the mixing zone is small (i.e., less than 100m). The IDZ does not cause an adverse effect on the designated uses of the River.
2	The IDZ should not impinge on critical fish or wildlife habitats (e.g., spawning or rearing areas for fish; overwintering habitats for migratory waterfowl);	The IDZ of the watercourse does not impinge on critical fish or wildlife habitats. Fish and fish habitat surveys completed on the river did not identify any critical fish or wildlife habitats in the IDZ. Atlantic Salmon in Moose River aren't listed on Schedule 1 of SARA, so critical habitat has not been differentiated.
3	Conditions outside the IDZ should be sufficient to support all of the designated uses of the receiving water system;	The mixing zone is contained within the IDZ and does not effect conditions outside the IDZ, therefore river reaches outside the IDZ are able to support designated uses of the river.
4	Wastewaters that are discharged to the receiving water system must not be acutely toxic to aquatic organisms;	Effluent discharge to Moose River meets MDMER limits and is not considered acutely toxic to aquatic organisms.
5	Conditions within the IDZ should not cause acute or short-term chronic toxicity to aquatic organisms;	Effluent discharge to Moose River will not cause acute or short-term chronic toxicity to aquatic organisms. Based on the CCME factsheets for Arsenic and the BC ambient water quality guidelines for Sulphate, concentrations of these parameters in the IDZ are below the acute or short-term chronic toxicity to aquatic organisms. There are no acute or short-term chronic toxicity fact sheets available for Aluminium, Cobalt, Copper, Cyanide.
6	Conditions within an IDZ should not result in bioconcentration of COPCs to levels that are harmful to the organism, aquatic-dependent wildlife or human health;	None of the PoPC are at a level in the IDZ that may cause bioconcentration of COPCs to levels that are harmful to the organism, aquatic-dependant wildlife or human health.
7	A zone of passage for migrating aquatic organisms must be maintained;	The discharge infrastructure does not cause a physical barrier to the migration of aquatic organisms. Predicted effluent discharge concentrations do not propose a chemical barrier.
8	Placement of mixing zones must not block migration into tributaries;	There is no tributaries within the mixing zone.
9	Mixing zones for adjacent wastewater discharges should not overlap with each other;	There is no overlap in mixing zone with other wastewater discharge(s).
10	Mixing zones should not unduly attract aquatic life or wildlife, thereby causing increased exposure to COPCs;	Physical and chemical characteristics of the effluent do not attract aquatic life or wildlife in the IDZ. The pit lake will be subject to the same natural thermal variability than the rest of the watercourse.

No.	Guiding Principal	Justification
11	Mixing zones should not be used as an alternative to reasonable and practical pollution prevention, including wastewater treatment (pollution prevention principle);	Effluent discharge of the pit lake is proposed to be treated. The mixing zone in this case, is not used as an alternative to that treatment. Detailed design in underway. Additional mitigation measures may be considered and implemented to improve effluent water quality from the pit lake.
12	Mixing zones must not be established such that drinking water intakes are contained therein;	There are no drinking water intakes in the IDZ.
13	Accumulation of toxic substances in water or sediment to toxic levels should not occur in the mixing zone; and	Proposed effluent discharge is not toxic, persistent, or bioaccumulative. Substances in water or sediment to toxic levels will not accumulate.
14	Adverse effects on the aesthetic qualities of the receiving water system (e.g., odour, colour, scum, oil, floating debris,) should be avoided.	Adverse effects of the aesthetic qualities to the receiver are not expected.

APPENDIX B
Review of Baseline Surface Water Quality

B.1. REVIEW OF SURFACE WATER QUALITY MONITORING

This appendix summarizes the review of historical surface water quality monitoring conducted in Moose River. As further described below, the historical surface water quality monitoring includes baseline monitoring conducted between 2004-2007 (CRA 2007) and 2016-2017 (Stantec 2017 2018). As mentioned in information requirements for the 2021 Touquoy Expansion EARD (Stantec 2021), NSE questioned if the 2016-2017 baseline monitoring period was affected by construction due to the uncertainties of the pre-construction period or activities that occurred during that time. As the pit facility construction commenced on June 1, 2016, the available 2016 pre-construction baseline period is very short, with only up to 4 to 5 monitoring events. Therefore, baseline monitoring results in Moose River from 2016-2017 have been excluded at downstream stations of the pit. This baseline period was modified to include only the 2004-2007 data in Moose River and the 2016-2017 (up to the end of September 2017, prior to processing of ore beginning in October 2017) upstream/background station SW-11 to avoid potential effects from construction of the mine to Moose River water quality.

This review identified that the modified baseline surface water quality of Moose River is very similar to what was previously established, such as the water quality have common parameter exceedances, average 2016-2017 baseline water quality at SW-11 is within the minimum and maximum ranges of historical. However, to further build confidence in the Assimilative Capacity Study of Moose River and address NSE's concerns, the modified baseline water quality dataset was carried forward in the Assimilative Capacity study of Moose River. This resulted in negligible changes in the extent of the pit discharge mixing zone or water quality predictions at the point of discharge.

Baseline Surface Water Quality – 2004-2007

Surface water was monitored in watercourses and waterbodies in proximity to the Touquoy Mine Site to document baseline surface water conditions. Monitoring during the initial environmental assessment was conducted between September 2004 and February 2007. Surface water quality was collected at seven sampling locations throughout the Project and surrounding areas monthly since September 2004. An eighth station was added in July 2006. Surface water quality station SW-1 is located upstream of the Touquoy pit and SW-2 located downstream of the Touquoy pit on Moose River. Historical surface water quality monitoring locations are presented in the body of the report Figure 2.1.

Water quality samples were submitted to a laboratory for analysis. Historical surface water quality data from 1988 for Moose River was also available. The surface water quality results were published in the Environmental Assessment Registration Document (EARD) for the Touquoy Gold Project, Moose River Gold Mines, Nova Scotia in March 2007 (Conestoga-Rovers & Associates) and provided in this appendix.

As documented in the EARD (CRA 2007), the water quality in Moose River was characterized as relatively pristine, with very little influence from past mining activities, road salting or from the local residential activity. Nutrients in the river were below or slightly above non-detectable concentrations. Three inorganic nutrients were measured: ammonia, nitrite, nitrate and phosphate (EARD 2007).

Conductivity, total dissolved solids, anion and cation concentrations were reported in the EARD as low. Dissolved ions are derived from the weathering of rocks and from precipitation. The site is far enough removed from the Atlantic Ocean, such that sea spray is not an influence. The watersheds were not heavily urbanized; thus the influences of road salt, lime and fertilizers were not evident. The watersheds have been logged extensively, yet turbidity and total suspended solids are low indicating a lack silt in the soils and or little erosion from logging practices. The water was noted in the 2007 EARD to be very soft in Moose River, indicating little mineral content. The colour was noted in the EARD as relatively low and fluctuates with some tea-stained contributions from wetlands during heavy precipitation events.

The EARD noted low alkalinity in Moose River, the surficial geology being resistant to weathering and containing little carbonate. The pH in Moose River measures ranged from pH 6 to 8. Sulphate is not correlated to the fluctuations at any of the sampling locations. The EARD stated that a potential source will be investigated further which was later conducted in the phased environmental assessment (AMNS 2017) that delineated and remediated historical tailings piles between the existing pit and Moose River.

The EARD (2007) reported that most metal levels at the surface water monitoring stations were below detectable levels. Aluminum, iron and manganese were reported to exceed the Canadian Council of the Ministries of Environment (CCME) guidelines for freshwater aquatic life (FAL) at all stations, a feature of Nova Scotia surface waters. Arsenic concentrations were found to fluctuate in the sampling stations, in Moose River where in the summer (lower water flow) this metal was elevated above the CCME guidelines for freshwater aquatic life. The EARD (2007) noted that arsenopyrite is common in the geology of the area. Lead, cadmium and copper were found to fluctuate throughout the year at most stations and sometimes slightly exceeding the CCME FAL guideline.

Mercury was only detected at SW station 8 (0.02 mg/L) in a tributary to watercourse #4 at near detection limits (0.01 mg/L).

Baseline Surface Water Quality – 2016-2017

Surface water quality monitoring resumed in 2016 to capture a broader surface water network during pre-construction activities. The *Annual Surface Water and Groundwater Baseline Monitoring* reports by Stantec for years 2016 through to 2021 presents monthly and quarterly monitoring results for pre-construction baseline and operations water quality and quantity. Baseline conditions have been established for background (i.e., upstream) and downstream surface water monitoring locations. As per the Industrial Approval 14 (IA), SW-11 is the designated background station in Moose River. The baseline period with respect to projectivities upgradient of Moose River was considered to the end of September 2017, as ore processing commenced in October 2017.

Existing surface water quality monitoring is conducted at 18 locations in and around the Touquoy site are presented in Figure A.1. The historical surface water stations from 2004 at SW-1 and SW-2 in Moose River have been maintained and are still part of the existing surface water quality monitoring network.

Exceedances outlined in the annual reports for both the 2016 and 2017 data set (i.e up to the end of September 2017) are consistent with historical results presented in the 2007 EARD and therefore exceedances are of background conditions and range seasonally. Elevated ammonia, arsenic, mercury, aluminum, iron, nickel, cadmium, copper, lead, zinc, and manganese concentrations are therefore considered in the annual reports to be naturally occurring, or the result of historical anthropogenic (i.e., non-Project related) activities.

Exceedances especially for aluminum, arsenic, and iron are noted in the 2016 and 2017 annual reports at SW-11. These exceedances are considered to be naturally occurring or a result of historical anthropogenic (i.e., non-Project related) activities. Metal exceedances seem to increase during periods of low flow.

Modified Baseline Water Quality

Water quality results are summarized in Table A.1 for the 2004-2007 dataset at SW1 and SW2 and the 2016-2017 dataset (up to the end of September 2017) at SW11 average and 75th percentile water quality metrics. The 75th percentile is commonly used to represent the background water quality to establish receiving water based effluent requirements for point source discharges to surface waterbodies (OMNR 2021). The 95th percentile is also presented, however, due to the natural variability of the data, extreme events, and the potential outliers or laboratory or sampling errors it may not be a good representative of baseline water quality.

The 2004-2007 surface water quality of Moose River is very similar to the 2016-2017 surface water quality at the same locations. The surface water quality has common elevated concentrations of parameters such as arsenic, calcium, cadmium, iron, lead, and nitrate.

With the limited data set available at SW-11 in 2016-2017, a modified baseline water quality dataset was derived from the (2016-2017) SW-11 and (2004-2007) SW-1 and SW-2 data sets, as summarized in Table A.1. Including this additional three years of data provides a more robust baseline data set to represent the natural variation of surface water quality in Moose River. The minimum, maximum, mean, and 75th percentile were calculated on the combined data set. When the result is below the laboratory detection limit, half the detection limit was used to calculate the statistics. This baseline was carried forward in the Assimilative Capacity study of Moose River.

Table B.1 Modified Baseline Water Quality in Moose River

Water Quality Parameter	IA Water Quality Compliance Criteria mg/L	Concentration (mg/L)										
		SW-1 (2004-2007)		SW-2 (2004-2007)		SW-11 (2016-2017)		Modified Baseline				
		Mean	**75th %**	**Mean**	**75th %**	**Mean**	**75th %**	**Min**	**Mean**	**Max**	**75th %**	**95th %**
Total Aluminum	0.005 (pH < 6.5) [0.005 (if pH is < 6.5); 0.10 (if pH is ≥6.5)]	**0.183**	**0.208**	**0.175**	**0.204**	**0.159**	**0.180**	**0.072**	**0.180**	**0.36**	**0.204**	**0.286**
Total Arsenic	0.005	**0.014**	**0.017**	**0.017**	**0.025**	**0.011**	**0.016**	**0.004**	**0.014**	**0.054**	**0.019**	**0.031**
Total Calcium	-	1.3	1.5	1.4	1.5	1.0	1.2	0.73	1.2	2.4	1.5	1.8
Total Cadmium	0.00004 (Hardness < 17 mg/L) [0.04 (if Hardness is < 17 mg/L); 10{0.83(log[hardness]) – 2.46} (if Hardness is ≥17 mg/L to ≤280 mg/L)]	0.00003	0.00003	0.00003	0.00003	0.00001	0.00002	<0.00001	0.00003	0.08	0.00003	0.05
Total Cobalt	0.010	0.0005	0.0005	0.0005	0.0005	<0.0004	<0.0004	0.00040	0.00047	0.00068	0.00050	0.00060
Total Chromium	-	<0.002	<0.002	0.0084	0.0096	<0.001	<0.001	<0.002	0.006	0.011	0.008	0.010
Total Copper	0.002 (Hardness < 17 mg/L) [2 (if Hardness is <82 mg/L); 0.2 * e{0.8545[ln(hardness)]-1.465} (if Hardness is ≥82 mg/L to ≤180 mg/L), 4 (if Hardness is >180 mg/L)]	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002
Total Iron	0.3	**0.57**	**0.77**	**0.48**	**0.59**	**0.48**	**0.81**	**0.17**	**0.54**	**1.20**	**0.73**	**1.10**
Total Lead	0.001 (Hardness < 60 mg/L) [1 (if Hardness is ≤60 mg/L); e{1.273[ln(hardness)]- 4.705} (if Hardness is >60 mg/L to ≤180 mg/L)]	**0.0007**	**0.0008**	**0.0009**	**0.0007**	**<0.0005**	**0.0005**	0.0005	**0.0007**	0.0034	**0.0008**	**0.0010**
Total Mercury	0.000026	<0.00001	<0.00001	<0.00001	<0.00001	<0.000013	<0.000013	<0.000010	0.000011	0.000013	0.000013	0.000013
Total Magnesium	-	0.0005	0.0006	0.0005	0.0006	0.46	0.55	0.34	0.52	0.72	0.60	0.70
Total Manganese	0.82	0.06	0.09	0.07	0.08	0.05	0.06	0.01	0.06	0.17	0.08	0.10
Total Molybdenum	0.073	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.001	<0.002	1.00
Total Nickel	0.025 (Hardness is < 60 mg/L) [25 (if Hardness is ≤60 mg/L); e{0.76[ln(hardness)]+1.06} (if Hardness is >60 mg/L to ≤180 mg/L); 150 (if Hardness is >180 mg/L)]	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.001	<0.002	1.00
Total Tin	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.001	<0.002	1.00
Total Selenium	0.001	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	1	<0.001	1	<0.001	1
Total Silver	0.0001	< 0.0005	< 0.0005	< 0.0005	< 0.0005	<0.0001	<0.0001	0.25	<0.0001	0.25	<0.0001	0.25
Dissolved Sulphate**	128 (hardness is < 30 mg/L) [128 mg/L for Hardness 0-30 mg/L, 218 mg/L for 31-75 mg/L, 309 for 76-180 mg/L, 429 mg/L for > 181 mg/L]	4.0	4.0	2.8	3.8	<2	<2	2.0	2.7	4.0	4.0	4.0
Total Thallium	0.0008	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.05	<0.0001	0.05
Total Uranium	0.015	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.05	<0.0001	0.05
Total Zinc	$e^{\{0.947(\ln[hardness])-0.815(pH)+0.398(\ln[DOC]+1.625\}}$ (if Hardness is 23.4 to 399 mg/L, pH is 6.5 to 8.13, and DOC is 0.3 to 22.9 mg/L)	0.01	0.01	0.01	0.01	<0.005	<0.005	<0.005	0.01	0.052	0.01	0.018
WAD Cyanide	0.005 (Free Form Cyanide)	NA	NA	NA	NA	<0.003	<0.003	<0.0030	<0.003	0.0040	<0.003	0.0040
Total Cyanide*	-	NA	NA	NA	NA	<0.001	0.0013	0.0012	<0.001	0.0018	0.0015	0.0017
Nitrate (as N)	13	0.08	0.08	**0.14**	0.09	<0.05	0.06	0.03	0.05	1.10	0.03	0.09
Nitrite (as N)	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (as N)	-	0.08	0.08	0.07	0.07	<0.05	<0.05	<0.05	<0.05	0.08	0.03	0.06

Notes: Bold values indicate exceedance of water quality compliance criteria; empty field indicates no water quality value. * The Total Cyanide guideline was compared to Strong Acid Dissociable Cyanide, as Total Cyanide was not an analyzed parameter in 2016/2017.
** notes total concentrations.

B.2. WATER QUALITY RESULTS

Table 1. Results of Laboratory Analyses for Surface Water Samples Collected From Sampling Location SW1 from September 2004 to February 2007

	Units	RDL	FWAL 2006	1-Sep-04	15-Oct-04	8-Nov-04	6-Dec-04	11-Jan-05	17-Feb-05	20-Apr-05	13-May-05	13-Jun-05	12-Jul-05	4-Aug-05	4-Aug-05 Duplicate	8-Sep-05	8-Sep-05 Duplicate	7-Oct-05	23-Nov-05	20-Jan-06	20-Jan-06 Duplicate	24-Feb-06	23-Mar-06
INORGANICS																							
Total Alkalinity (Total as $CaCO_3$)	mg/L	5	-	<10	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	NA	<5	NA	<5	<5	<5	NA	<5	<5
Color	TCU	5	-	110	49	57	540	42	49	31	45	53	54	48	NA	29	NA	31	50	39	NA	31	30
Dissolved Hardness ($CaCO_3$)	mg/L	1	-	5.7	5.8	6	4.80	5.60	4.5	3.80	3.8	4.6	5.7	4.9	NA	4.7	NA	6.7	6	5	NA	6	4
Nitrate + Nitrite (as N)	mg/L	0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	NA	<0.05	NA	<0.05	<0.05	0.06	NA	0.06	<0.05
Nitrate (as N)	mg/L	0.05	2.9	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	NA	<0.05	<0.05	<0.05	<0.05	0.06	NA	0.06	<0.05
Nitrite (N)	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	<0.01	<0.01	<0.01	NA	<0.01	<0.01
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	x	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NA	<0.05	NA	<0.05	<0.05	<0.05	NA	<0.05	<0.05
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1	-	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NA	NS	NS
Total Nitrogen	mg/L		-	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NA	NS	NS
Total Org. Carbon (by UV)	mg/L	0.5	-	10.1	8.5	11.2	8.4	6.8	7.2	4.1	6.5	8.1	7.5	6.4	NA	4.7	NA	6.4	12	6.2	NA	6.3	3.8
Ortho Phosphate (as P)	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	<0.01	<0.01	<0.01	NA	<0.01	<0.01
Phosphorus	mg/L	0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1	<0.1
pH	units	0.1	>6.5;<9.0	5.4	5.8	5.9	5.6	6.8	5.25	5.8	6.27	6.5	7.41	7.19	NA	5.98	NA	6.31	6.13	5.15	5.11	7.65	5.47
Reactive Silica (as SiO_2)	mg/L	0.5	-	0.9	0.9	2.1	1.9	2.4	2.2	0.6	0.8	<0.5	<0.5	<0.5	NA	<0.5	NA	0.9	1.9	1.8	NA	1.8	1.5
Dissolved Chloride (Cl)	mg/L	1	-	4	4	4	4	5	4.8	4	3.5	3.5	3.7	3.7	NA	4.3	NA	4	5	5	NA	6	4
Calcium	mg/L	0.1	-	1.3	1.5	1.4	1.1	1.4	1	0.9	0.9	1.1	1.5	1.1	1.1	1.1	1.1	1.6	1.5	1.2	NA	1.5	1
Magnesium	mg/L	0.1	-	0.6	0.5	0.6	0.5	0.5	0.5	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.7	0.5	NA	0.6	0.5
Potassium	mg/L	0.1	-	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.2	0.3	0.3	0.2	0.2	0.2	0.3	0.3	0.3	NA	0.3	0.3
Sodium	mg/L	0.1	-	2.7	3.9	3.2	2.5	3.2	2.8	2.2	2.1	2.5	2.7	2.7	2.7	2.8	2.8	3.2	3.2	2.8	NA	3.4	2.5
Dissolved Sulphate (SO_4)	mg/L	2	-	<2	<2	2	2	4	<2	<2	<5	<2	<2	<2	NA	<5	NA	4	<2	<2	NA	<2	<2
Conductivity	uS/cm	1	-	26	26	31	31	30	29	22	23	23	24	24	NA	26	NA	30	36	29	29	32	27
Turbidity	NTU	0.1	-	1.0	0.6	1.1	1.0	0.6	0.5	0.7	1	0.6	0.8	1.2	NA	1	NA	0.5	2.6	1.7	NA	9.1	0.7
Total Suspended Solids	mg/L	2	-	3.6	1.8	<2	<2	<2	<2	<2	<2	2.5	2.4	<2	NA	3.1	NA	<2	4	<2	NA	50	11
RCAP CALCULATIONS																							
Anion Sum	meq/L	-	-	0.36	0.26	0.26	0.26	0.33	0.141	0.11	0.0983	0.0995	0.105	0.105	NA	0.122	NA	0.208	0.155	0.145	NA	0.164	0.115
Bicarb. Alkalinity (calc. as $CaCO_3$)	mg/L	1	-	<5	<5	<5	<5	<5	<1	<1	<1	<1	<1	<1	NA	<1	NA	<1	<1	<1	NA	<1	<1
Calculated TDS	mg/L	0.1	-	18	16	17	16	20	12.4	9	9	9	10	10	NA	10	NA	16	14	12	NA	14	10
Carb. Alkalinity (calc. as $CaCO_3$)	mg/L	1	-	<5	<5	<5	<5	<5	<1	<1	<1	<1	<1	<1	NA	<1	NA	<1	<1	<1	NA	<1	<1
Cation Sum	meq/L	0.10	-	0.24	0.3	0.27	0.22	0.26	0.238	0.191	0.195	0.232	0.282	0.262	NA	0.243	NA	0.295	0.292	0.248	NA	0.289	0.212
Elements (ICP-MS)																							
Total Aluminum (Al)	µg/L	10	5-100	250	200	230	180	160	150	109	150	180	160	120	130	99	100	100	284	200	NA	219	151
Total Antimony (Sb)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	<2	<2
Total Arsenic (As)	µg/L	2	5	17	8	9	8	7	4.8	7	7.4	16	26	27	26	14	15	10	7.9	5.1	NA	39.9	4.4
Total Barium (Ba)	µg/L	5	-	<5	<5	5	5	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	6.9	5.5	NA	6.1	<5
Total Beryllium (Be)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	<2	<2
Total Bismuth (Bi)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	2.2	<2	<2	<2	<2	<2	<2	<2	ND	<2	NA	<2	<2
Total Boron (B)	µg/L	5	-	5	<5	<5	<5	<5	<5	<5	<5	<5	5	<5	<5	9	9.7	7	5.7	<5	NA	<5	<5
Total Cadmium (Cd)	µg/L	0.3	0.017	<0.3	<0.3	<0.3	0.030	0.020	<0.3	0.031	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.024	0.02	NA	0.027	0.049
Total Chromium (Cr)	µg/L	2	y	<2	<2	<2	<2	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	<2	<2
Total Cobalt (Co)	µg/L	0.4	-	<0.4	<0.4	<0.4	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<1	<1	<0.4	0.51	<0.4	NA	<0.4	<0.4
Total Copper (Cu)	µg/L	2	2-4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	<2	<2
Total Iron (Fe)	µg/L	50	300	1200	660	640	360	330	320	186	250	570	1100	1100	1100	680	700	380	446	300	NA	443	217
Total Lead (Pb)	µg/L	0.5	1-7	0.5	<0.5	0.5	<0.5	0.5	<0.5	<0.5	<0.5	0.5	0.8	0.8	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	NA	0.95	<0.5
Total Manganese (Mn)	µg/L	2	-	65	34	64	80	69	88	66.9	68	100	53	30	32	31	31	33	106	87.4	NA	82.1	90.7
Total Mercury (Hg)	µg/L	0.01	z	NS	NS	NS	NS	<0.01	NS	NS	<0.01	NS	<0.01	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Molybdenum (Mo)	µg/L	2	73	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	<2	<2
Total Nickel (Ni)	µg/L	2	25-150	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	<2	<2
Total Selenium (Se)	µg/L	2	1	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	<1.0	<2	<2	<2	NA	<2	<2
Total Silver (Ag)	µg/L	0.5	0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5	<0.5
Total Strontium (Sr)	µg/L	5	-	8	8	10	8	9	6.5	5.5	5	5.9	6.7	6.8	6.9	7.2	7.4	10	9.3	8.3	NA	8.1	6.7
Total Thallium (Tl)	µg/L	0.1	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1	<.1
Total Tin (Sn)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	<2	<2
Total Titanium (Ti)	µg/L	2	-	3	2	2	2	<2	<2	<2	<2	<2	2.4	2.7	2.9	<2	<2	<2	2.3	<2	NA	<2	<2
Total Uranium (U)	µg/L	0.1	-	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1	<0.1
Total Vanadium (V)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2	<2	<2	NA	<2	<2
Total Zinc (Zn)	µg/L	5	30	8	8	6	9	52	6.3	<5	5.4	<5	11	6.5	6.6	<5	<5	9	8.6	12.1	NA	11	<2
Strong Acid Dissoc. Cyanide (CN)	mg/L	0.002		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
E. Coli (Colilert)	MPN/100ml			NS	12	NS	0	NS	NS	ND	NS	NS	3.1	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Coliform (Colilert)	MPN/100ml			NS	>2420	NS	>200	NS	NS	>200	NS	NS	>200	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

FWAL 2006 = Canadian Environmental Quality Guidelines - Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006)

NS = Not sampled

NA= Not analyzed

RDL = Reportable Detection Limit

x = Ammonia Guideline is based on pH and Temperature

y = Chromium Guideline is based on speciation (Cr III = 8.9 ug/L, CR VI = 1ug/L)

z = Mercury Guideline is based on speciation (Inorganic Hg = 0.026ug/L, Methyl Hg= 0.004ug/L

Table 1. Results of Laboratory Analyses for Surface Water Samples Collected From Sampling Location SW1 from September 2004 to February 2007

	Units	RDL	FWAL 2006	28-Apr-06	25-May-06	28-Jun-06	26-Jul-06	26-Jul-06 Lab-Dup	28-Aug-06	28-Sep-06	28-Sep-06 Lab-Dup	27-Oct-06	27-Nov-06	27-Nov-06	14-Dec-06	18-Jan-07	7-Feb-07	MIN	MAX
INORGANICS																			
Total Alkalinity (Total as $CaCO_3$)	mg/L	5	-	<5	<5	<5	<5	NA	<5	<5	NA	<5	<5	<5	<5	<5	<5	<5	<10
Color	TCU	5	-	36	54	90	110	NA	67	49	NA	52	45	43	43	43	36	29	540
Dissolved Hardness ($CaCO_3$)	mg/L	1	-	4	4	4	5	NA	6	6	NA	7	6	6	6	6	7	3.8	7
Nitrate + Nitrite (as N)	mg/L	0.05	-	0.05	<0.05	<0.05	<0.05	NA	0.07	<0.05	NA	<0.05	<0.05	<0.05	<0.05	0.14	0.08	<0.05	0.14
Nitrate (as N)	mg/L	0.05	2.9	0.05	<0.05	<0.05	<0.05	NA	0.07	<0.05	NA	<0.05	<0.05	<0.05	<0.05	0.14	0.08	<0.05	0.14
Nitrite (N)	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01	NA	<0.01	<0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	x	<0.05	<0.05	<0.05	<0.05	NA	0.08	<0.05	NA	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.08
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1	-	NS	NS	NS	0.4	NA	0.5	0.3	NA	0.4	0.5	0.5	0.4	0.5	0.5	0.3	0.5
Total Nitrogen	mg/L		-	NS	NS	NS	0.31	NA	0.41	0.28	NA	0.26	0.2	0.21	0.22	0.27	NA	0.2	0.41
Total Org. Carbon (by UV)	mg/L	0.5	-	6.2	8.8	14	15	NA	11	7.3	NA	10	8	8.1	7.7	6.6	6.2	3.8	15
Ortho Phosphate (as P)	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01	NA	<0.01	<0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	mg/L	0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
pH	units	0.1	>6.5;<9.0	5.92	5.39	4.96	5.35	NA	5.93	7.33	NA	5.33	5	5.67	5.51	5.52	5.52	4.96	7.65
Reactive Silica (as SiO_2)	mg/L	0.5	-	0.5	<0.5	1.3	1.7	NA	<0.5	<0.5	NA	1.6	1.7	1.6	1.7	2	1.8	<0.5	2.4
Dissolved Chloride (Cl)	mg/L	1	-	3	3	3	3	NA	3	4	NA	4	4	5	5	6	5	3	6
Calcium	mg/L	0.1	-	1	1	1	1.3	1.3	1.5	1.4	1.3	1.8	1.3	1.5	1.3	1.5	1.7	0.9	1.8
Magnesium	mg/L	0.1	-	0.5	0.4	0.4	0.5	0.5	0.5	0.6	0.5	0.6	0.6	0.6	0.5	0.6	0.7	0.4	0.7
Potassium	mg/L	0.1	-	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.2	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.4
Sodium	mg/L	0.1	-	2.5	2.4	2.2	2.4	2.5	3.3	2.2	2.1	2.7	2.6	2.9	2.6	3.3	3.7	2.1	3.9
Dissolved Sulphate (SO_4)	mg/L	2	-	<2	<2	<2	<2	NA	<2	<2	NA	<2	<2	<2	<2	<2	<2	<2	4
Conductivity	uS/cm	1	-	26	25	23	24	NA	22	23	NA	29	29	31	29	36	34	22	36
Turbidity	NTU	0.1	-	2.6	0.9	0.7	1.1	NA	0.8	0.5	NA	0.9	0.5	0.8	0.8	1.1	1	0.5	9.1
Total Suspended Solids	mg/L	2	-	2	2		<2	NA	1	1	NA	<2	<2	6	8	<1	<1	<1	50
RCAP CALCULATIONS																			
Anion Sum	meq/L	-	-	0.0971	0.0959	0.0722	0.0816	NA	0.0972	0.108	NA	0.125	0.12	0.138	0.131	0.168	0.16	0.0722	0.36
Bicarb. Alkalinity (calc. as $CaCO_3$)	mg/L	1	-	<1	<1	<1	<1	NA	<1	<1	NA	<1	<1	<1	<1	<1	<1	<1	<1
Calculated TDS	mg/L	0.1	-	9	8	8	10	NA	10	9	NA	12	11	12	11	14	14	8	20
Carb. Alkalinity (calc. as $CaCO_3$)	mg/L	1	-	<1	<1	<1	<1	NA	<1	<1	NA	<1	<1	<1	<1	<1	<1	<1	<1
Cation Sum	meq/L	0.10	-	0.217	0.212	0.217	0.265	NA	0.313	0.246	NA	0.292	0.256	0.272	0.245	0.287	0.32	0.191	0.32
Elements (ICP-MS)																			
Total Aluminum (Al)	µg/L	10	5-100	167	208	277	308	325	221	154	156	236	184	191	193	192	185	99	325
Total Antimony (Sb)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Arsenic (As)	µg/L	2	5	6.7	8.8	12.1	26.5	28.1	20.9	16.6	16.6	8.5	10.2	9.4	6.6	7.2	8.1	4.4	39.9
Total Barium (Ba)	µg/L	5	-	<5	<5	5.6	5.5	5.7	<5	<5	<5	5.6	<5.0	5.5	5.6	5.9	6.2	<5	6.9
Total Beryllium (Be)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Bismuth (Bi)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.2	2.2
Total Boron (B)	µg/L	5	-	<5	<5	5	5.7	5.2	13.6	8.2	7.1	5.3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	13.6
Total Cadmium (Cd)	µg/L	0.3	0.017	<0.3	<0.3	0.02	<0.3	0.024	0.031	0.031	0.018	0.025	0.027	0.042	0.049	0.03	0.025	0.018	0.049
Total Chromium (Cr)	µg/L	2	y	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	>2.0	<2.0	>2.0	>2.0
Total Cobalt (Co)	µg/L	0.4	-	<0.4	<0.4	0.43	0.44	0.47	<0.4	<0.4	<0.4	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.51
Total Copper (Cu)	µg/L	2	2-4	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0
Total Iron (Fe)	µg/L	50	300	240	427	587	1140	1200	907	767	767	550	375	387	353	332	344	186	1200
Total Lead (Pb)	µg/L	0.5	1-7	<0.5	<0.5	0.61	0.75	0.77	0.78	0.59	0.58	<0.50	<0.50	<0.50	<0.50	<0.50	0.54	0.5	0.95
Total Manganese (Mn)	µg/L	2	-	56.5	85.5	101	98.8	104	33	18.4	18.8	67.9	64.5	62.1	61.5	61.4	69.5	18.4	106
Total Mercury (Hg)	µg/L	0.01	z	NS	NS	NS	<0.01	NS	<0.01	<0.01	NS	<0.01	NS	<0.01	0.01	NS	<0.01	<0.01	0.01
Total Molybdenum (Mo)	µg/L	2	73	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	µg/L	2	25-150	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Selenium (Se)	µg/L	2	1	<2	<2	<1.0	<2	<2	<2	<2	<2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	µg/L	0.5	0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Strontium (Sr)	µg/L	5	-	6.5	6.4	6.6	8.2	8.7	7.8	7	6.9	8	8.6	9.9	7.2	10	8.2	5	10
Total Thallium (Tl)	µg/L	0.1	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<0.10	<2.0	<0.10	<0.10
Total Titanium (Ti)	µg/L	2	-	<2	2.3	<2	2.2	2.8	2.1	2.1	2.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3
Total Uranium (U)	µg/L	0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10	0.1
Total Vanadium (V)	µg/L	2	-	<2	<2	<2.0	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	µg/L	5	30	5.5	<2	13.3	7.6	7.7	11.1	<5	5.4	6.9	5.9	9.2	8.8	9.6	8.5	<5	52
Strong Acid Dissoc. Cyanide (CN)	mg/L	0.002		NS	NS	NS	NS	NS	NS	NS	NS	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
E. Coli (Colilert)	MPN/100ml			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0	12
Total Coliform (Colilert)	MPN/100ml			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	>200	>2420

FWAL 2006 = Canadian Environmental Quality Guidelines - Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006)

NS = Not sampled

NA= Not analyzed

RDL = Reportable Detection Limit

x = Ammonia Guideline is based on pH and Temperature

y = Chromium Guideline is based on speciation (Cr III = 8.9 ug/L, CR VI = 1ug/L)

z = Mercury Guideline is based on speciation (Inorganic Hg = 0.026ug/L, Methyl Hg= 0.004ug/L

Table 2. Results of Laboratory Analyses for Surface Water Samples Collected From Sampling Location SW2 from September 2004 to February 2007

	Units	RDL	FWAL 2006	1-Sep-04	15-Oct-04	8-Nov-04	6-Dec-04	11-Jan-04	17-Feb-05	20-Apr-05	13-May-05	13-Jun-05	12-Jul-05	4-Aug-05	8-Sep-05	8-Sep-05 Duplicate	7-Oct-05	23-Nov-05	20-Jan-06	24-Feb-06	23-Mar-06	28-Apr-06	25-May-06
INORGANICS																							
Total Alkalinity (Total as $CaCO_3$)	mg/L	5	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	NA	<5	<5	<5	<5	<5	<5	<5
Color	TCU	5	-	53	40	50	8	37	46	27	39	43	35	32	19	NA	22	50	42	30	30	31	46
Dissolved Hardness ($CaCO_3$)	mg/L	1	-	6.5	8.5	6	5.1	6.5	5.5	5	4.3	5.2	5.9	5.8	5.6	NA	7.1	6	6	6	5	5	5
Nitrate + Nitrite (as N)	mg/L	0.05	-	<0.05	<0.05	<0.05	0.42	<0.05	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05
Nitrate (as N)	mg/L	0.05	2.9	<0.05	<0.05	<0.05	0.41	<0.05	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NA	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05
Nitrite (N)	mg/L	0.01	0.06	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	x	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Nitrogen	mg/L			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Org. Carbon (by UV)	mg/L	0.5	-	8.3	7.5	10.6	8.4	7.1	6.3	4.4	6	6.9	5.5	5.1	3.2	NA	5.5	10	6.1	6.2	4.7	4.8	7.8
Ortho Phosphate (as P)	mg/L	0.01	-	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	mg/L	0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
pH	units	0.1	>6.5;<9.0	5.8	6	5.4	5.1	6	7.37	5.64	7.45	6.24	6.5	6.8	6.24	NA	6.06	4.97	5.1	6.83	5.41	5.65	7.31
Reactive Silica (as SiO_2)	mg/L	0.5	-	1	0.9	1.7	1.6	2.3	2	0.8	0.8	<0.5	<0.5	<0.5	ND	NA	0.8	1.9	2.2	1.7	1.6	0.8	0.5
Dissolved Chloride (Cl)	mg/L	1	-	6	6	4	5	5	5.8	5.3	4.3	4.4	5.1	5.1	5.6	NA	5	6	8	4	5	4	4
Calcium	mg/L	0.1	-	1.6	2.4	1.4	1.2	1.6	1.4	1.3	1.1	1.3	1.5	1.5	1.4	NA	1.8	1.5	1.4	1.4	1.3	1.2	1.2
Magnesium	mg/L	0.1	-	0.6	0.6	0.6	0.5	0.6	0.5	0.4	0.4	0.5	0.5	0.5	0.5	NA	0.7	0.6	0.5	0.5	0.5	0.5	0.5
Potassium	mg/L	0.1	-	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.2	0.3	NA	0.3	0.4	0.2	0.3	0.2	0.3	0.3
Sodium	mg/L	0.1	-	3.7	6.1	3.5	3	3.4	3.1	3.1	2.7	3.1	3.5	3.7	3.6	NA	3.8	3.4	4.1	2.6	3.2	3.1	3.1
Dissolved Sulphate (SO_4)	mg/L	2	-	3	2	2	2	4	<2	<2	<5	<5	<5	<5	<2	NA	4	<5	<2	<2	<2	<2	<2
Conductivity	uS/cm	1	-	35	36	32	33	33	32	27	25	26	29	31	32	NA	33	36	37	27	32	29	27
Turbidity	NTU	0.1	-	0.9	0.8	1.2	1.4	0.9	0.8	0.7	1	0.9	0.8	0.6	1.3	NA	0.7	2.4	1.7	0.7	3.7	1.4	1.1
Total Suspended Solids	mg/L	2	-	2.1	<2	<2	<2	<2	<2	<2	<2	<2	11	<2	<2	NA	3	5	<2	<2	9	2	2
RCAP CALCULATIONS																							
Anion Sum	meq/L	-	-	0.34	0.31	0.26	0.31	0.33	0.169	0.15	0.123	0.125	0.144	0.144	0.157	NA	0.23	0.164	0.215	0.125	0.145	0.125	0.123
Bicarb. Alkalinity (calc. as $CaCO_3$)	mg/L	1	-	<5	<5	<5	<5	<5	<1	<1	<1	<1	<1	<1	<1	NA	<1	<1	<1	<1	<1	<1	<1
Calculated TDS	mg/L	0.1	-	19	22	17	19	20	13.9	11.6	10	10.2	11.8	11.9	11.9	NA	17	14	16	11	12	11	10
Carb. Alkalinity (calc. as $CaCO_3$)	mg/L	1	-	<5	<5	<5	<5	<5	<1	<1	<1	<1	<1	<1	<1	NA	<1	<1	<1	<1	<1	<1	<1
Cation Sum	meq/L	0.1	-	0.3	0.45	0.29	0.25	0.29	0.265	0.253	0.223	0.265	0.305	0.312	0.294	NA	0.329	0.31	0.309	0.244	0.272	0.249	0.257
Elements (ICP-MS)																							
Total Aluminum (Al)	µg/L	10	5-100	190	170	220	190	160	150	121	160	160	120	100	72	NA	80	254	190	162	219	156	192
Total Antimony (Sb)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	<2	<2	<2	<2	<2	<2	<2
Total Arsenic (As)	µg/L	2	5	21	23	8	7	6	5.1	14.7	7	17	31	35	26	NA	18	9.1	<2	6.9	28.4	5.2	12.4
Total Barium (Ba)	µg/L	5	-	5	<5	6	6	6	5.1	<5	<5	<5	<5	<5	<5	NA	<5	6.6	<5	<5	6.1	5.1	5.5
Total Beryllium (Be)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	<2	<2	<2	<2	<2	<2	<2
Total Bismuth (Bi)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Boron (B)	µg/L	5	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	5.2	NA	6	6	<5	<5	<5	5.5	<5
Total Cadmium (Cd)	µg/L	0.3	0.017	<0.3	<0.3	<0.3	0.02	0.02	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	NA	<0.3	0.031	<0.3	0.023	0.033	<0.3	0.03
Total Chromium (Cr)	µg/L	2	y	<2	<2	<2	<2	6	<2	<2	<2	<2	<2	<2	<2	NA	<2	<2	<2	<2	<2	<2	<2
Total Cobalt (Co)	µg/L	1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.4	NA	<1	0.5	<1	<1	0.44	<1	<1
Total Copper (Cu)	µg/L	2	2-4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	<2	<2	<2	<2	<2	<2	<2
Total Iron (Fe)	µg/L	50	300	780	620	550	320	340	330	216	350	470	670	760	490	NA	320	413	170	220	419	212	389
Total Lead (Pb)	µg/L	0.5	1-7	0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3.4	0.5	<0.5	NA	<0.5	<0.5	<0.5	<0.5	0.62	<0.5	0.51
Total Manganese (Mn)	µg/L	2	-	56	53	62	88	73	82	65.9	65	81	53	40	40	NA	38	102	50.3	65	105	53.4	87.8
Total Mercury (Hg)	µg/L	0.01	z	NS	NS	NS	NS	<0.01	NS	NS	0.01	NS	<0.01	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Molybdenum (Mo)	µg/L	2	73	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	<2	<2	<2	<2	<2	<2	<2
Total Nickel (Ni)	µg/L	2	25-150	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	<2	<2	<2	<2	<2	<2	<2
Total Selenium (Se)	µg/L	2	1	<2	<2	<2	<2	<2	<2	<2	<2	<2	<1.0	<1.0	<2	NA	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	µg/L	0.5	0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Strontium (Sr)	µg/L	5	-	8	9	8	8	8	7.1	6.3	5.4	6.4	7.5	6.7	7	NA	9	8.8	7.5	9	7	6.7	7.6
Total Thallium (Tl)	µg/L	0.1	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Tin (Sn)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	NA	<2	<2	<2	<2	<2	<2	<2
Total Titanium (Ti)	µg/L	2	-	3	2	2	<2	<2	<2	<2	3.8	<2	<2	<2	<2	NA	<2	2.2	<2	<2	<2	<2	<2
Total Uranium (U)	µg/L	0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Vanadium (V)	µg/L	2	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2	NA	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	µg/L	5	30	8	8	ND	5	36	11	6.4	5.7	18	5.7	5.8	<5	NA	6	10.2	17.4	5.7	<5	<5	9.8
Strong Acid Dissoc. Cyanide (CN)	mg/L	0.002		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

FWAL 2006 = Canadian Environmental Quality Guidelines - Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006)

NS = Not sampled

NA= Not analyzed

RDL = Reportable Detection Limit

x = Ammonia Guideline is based on pH and Temperature

y = Chromium Guideline is based on speciation (Cr III = 8.9 ug/L, CR VI = 1ug/L)

z = Mercury Guideline is based on speciation (Inorganic Hg = 0.026ug/L, Methyl Hg= 0.004ug/L

Table 2. Results of Laboratory Analyses for Surface Water Samples Collected From Sampling Location SW2 from September 2004 to February 2007

	Units	RDL	FWAL 2006	28-Jun-06	26-Jul-06	28-Aug-06	28-Sep-06	28-Sep-06 Lab-Dup	27-Oct-06	27-Nov-06 Lab-Dup	14-Dec-06	18-Jan-07	7-Feb-07	MIN	MAX
INORGANICS															
Total Alkalinity (Total as $CaCO_3$)	mg/L	5	-	<5	<5	<5	<5	NA	<5	NA	<5	<5	<5	<5	<5
Color	TCU	5	-	80	84	48	37	NA	62	NA	44	40	34	8	84
Dissolved Hardness ($CaCO_3$)	mg/L	1	-	4	5	7	7	NA	6	NA	5	5	5	4	8.5
Nitrate + Nitrite (as N)	mg/L	0.05	-	<0.05	<0.05	<0.05	<0.05	NA	<0.05	NA	<0.05	0.08	0.07	<0.05	0.42
Nitrate (as N)	mg/L	0.05	2.9	<0.05	<0.05	<0.05	<0.05	NA	<0.05	NA	<0.05	0.08	0.07	<0.05	0.41
Nitrite (N)	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	x	<0.05	<0.05	0.07	<0.05	<0.05	<0.05	NA	0.06	<0.05	<0.05	<0.05	0.07
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1		NS	2	0.5	0.3	NA	0.3	NA	0.3	NA	0.5	0.3	2
Total Nitrogen	mg/L			NS	0.28	0.23	0.28	NA	0.31	NA	0.22	0.2	NA	0.2	0.31
Total Org. Carbon (by UV)	mg/L	0.5	-	11	14	8.5	6.4	NA	11	NA	8	6.4	6.6	3.2	14
Ortho Phosphate (as P)	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01	NA	<0.01	NA	<0.01	<0.01	<0.01	<0.01	0.02
Phosphorus	mg/L	0.1	-	<0.1	<0.1	<0.1	<0.1	NA	<0.1	NA	<0.1	<0.1	<0.1	<0.1	<0.1
pH	units	0.1	>6.5;<9.0	5.26	5.21	6.2	6.62	NA	5.14	NA	4.88	5.11	5.23	4.88	7.45
Reactive Silica (as SiO_2)	mg/L	0.5	-	1	1.4	<0.5	<0.5	NA	1.8	NA	1.8	1.7	1.6	<0.5	2.3
Dissolved Chloride (Cl)	mg/L	1	-	3	3	5	5	NA	4	NA	4	3	4	3	8
Calcium	mg/L	0.1	-	1	1.3	1.9	1.9	NA	1.3	NA	1.2	1.1	1.1	1	2.4
Magnesium	mg/L	0.1	-	0.4	0.5	0.6	0.6	NA	0.6	NA	0.5	0.5	0.6	0.4	0.7
Potassium	mg/L	0.1	-	0.3	0.2	0.2	0.4	NA	0.4	NA	0.3	0.2	0.2	0.2	0.4
Sodium	mg/L	0.1	-	2.5	2.6	4	3.4	NA	2.2	NA	2.2	2.3	2.5	2.2	6.1
Dissolved Sulphate (SO_4)	mg/L	2	-	<2	<2	<2	<2	NA	<2	NA	<2	<2	<2	2	4
Conductivity	uS/cm	1	-	25	25	30	32	NA	29	NA	28	27	29	25	37
Turbidity	NTU	0.1	-	1.1	1.2	1.2	0.7	0.7	0.8	0.5	0.5	0.6	0.6	0.5	3.7
Total Suspended Solids	mg/L	2	-	<2	3	<2	1	NA	<1	NA	1	NA	<1	<1	11
RCAP CALCULATIONS															
Anion Sum	meq/L	-	-	0.0986	0.086	0.134	0.131	NA	0.109	NA	0.115	0.101	0.12	0.086	0.34
Bicarb. Alkalinity (calc. as $CaCO_3$)	mg/L	1	-	<1	<1	<1	<1	NA	<1	NA	<1	<1	<1	NA	NA
Calculated TDS	mg/L	0.1	-	9	10	13	12	NA	11	NA	10	10	11	9	22
Carb. Alkalinity (calc. as $CaCO_3$)	mg/L	1	-	<1	<1	<1	<1	NA	<1	NA	<1	<1	<1	<1	<1
Cation Sum	meq/L	0.1	-	0.23	0.267	0.366	0.336	NA	0.244	NA	0.233	0.216	0.23	0.216	0.45
Elements (ICP-MS)															
Total Aluminum (Al)	µg/L	10	5-100	264	284	216	156	NA	221	NA	179	192	159	72	284
Total Antimony (Sb)	µg/L	2	-	<2	<2	<2	<2	NA	<2.0	NA	<2.0	<2.0	<2.0	<2.0	<2.0
Total Arsenic (As)	µg/L	2	5	10.5	25.3	54.2	31.5	NA	9.8	NA	7.6	7.2	8.5	5.1	54.2
Total Barium (Ba)	µg/L	5	-	6.2	5.5	<5	<5	NA	5	NA	<5.0	5.9	<5.0	<5.0	6.6
Total Beryllium (Be)	µg/L	2	-	<2	<2	<2	<2	NA	<2.0	NA	<2.0	<2.0	<2.0	<2.0	<2.0
Total Bismuth (Bi)	µg/L	2	-	<2	<2	<2	<2	NA	<2.0	NA	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	µg/L	5	-	5.1	<5	5.8	5.6	NA	<5.0	NA	<5.0	<5.0	<5.0	<5.0	6
Total Cadmium (Cd)	µg/L	0.3	0.017	0.04	0.022	0.035	<0.3	NA	0.019	NA	0.023	0.03	0.021	0.019	0.04
Total Chromium (Cr)	µg/L	2	y	<2	<2	<2	<2	NA	<2.0	NA	<2.0	<2.0	10.8	<2.0	6
Total Cobalt (Co)	µg/L	1	-	0.42	0.43	0.5	<1	NA	<0.40	NA	<0.40	<0.40	<0.40	<0.40	0.5
Total Copper (Cu)	µg/L	2	2-4	<2	<2	<2	<2	NA	2.3	NA	<2.0	<2.0	<2.0	<2.0	<2.0
Total Iron (Fe)	µg/L	50	300	544	988	1080	806	NA	513	NA	321	332	297	170	1080
Total Lead (Pb)	µg/L	0.5	1-7	0.56	0.76	1.04	0.63	NA	0.54	NA	<0.50	<0.50	<0.50	<0.50	3.4
Total Manganese (Mn)	µg/L	2	-	112	102	96.3	67.7	NA	76.6	NA	60.9	61.4	65.7	38	112
Total Mercury (Hg)	µg/L	0.01	z	NS	<0.01	<0.01	<0.01	NA	<0.01	NA	0.01	NS	<0.01	<0.01	0.01
Total Molybdenum (Mo)	µg/L	2	73	<2	<2	<2	<2	NA	<2.0	NA	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	µg/L	2	25-150	<2	<2	<2	<2	NA	<2.0	NA	<2.0	<2.0	<2.0	<2.0	<2.0
Total Selenium (Se)	µg/L	2	1	<2	<1.0	<1.0	<1.0	NA	<1.0	NA	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	µg/L	0.5	0.1	<0.5	<0.5	<0.5	<0.5	NA	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10
Total Strontium (Sr)	µg/L	5	-	6.4	7.4	8.1	7.3	NA	8.3	NA	7.1	7	8	5.4	9
Total Thallium (Tl)	µg/L	0.1	0.8	<0.1	<0.1	<0.1	<0.1	NA	<0.10	NA	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	µg/L	2	-	<2	<2	<2	<2	NA	<2.0	NA	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	µg/L	2	-	<2	2.3	2.7	<2	NA	<2.0	NA	<2.0	<2.0	<2.0	<2.0	3.8
Total Uranium (U)	µg/L	0.1	-	<0.1	<0.1	<0.1	<0.1	NA	<0.10	NA	<0.1	<0.1	<0.10	<0.10	<0.10
Total Vanadium (V)	µg/L	2	-	<2	<2.0	<2.0	<2.0	NA	<2.0	NA	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	µg/L	5	30	10.4	<5	9.1	6.3	NA	6.9	NA	8	5.2	8.4	<5	36
Strong Acid Dissoc. Cyanide (CN)	mg/L	0.002		NS	NS	NS	NS	NS	<0.002	NS	<0.002	NS	<0.002	<0.002	<0.002

FWAL 2006 = Canadian Environmental Quality Guidelines - Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006)

NS = Not sampled

NA= Not analyzed

RDL = Reportable Detection Limit

x = Ammonia Guideline is based on pH and Temperature

y = Chromium Guideline is based on speciation (Cr III = 8.9 ug/L, CR VI = 1ug/L)

z = Mercury Guideline is based on speciation (Inorganic Hg = 0.026ug/L, Methyl Hg= 0.004ug/L

Table 3. SW-11 Water Quality

Parameter	Units	Stats: from 01/Jan/21 to 31/Dec/21				IA Appendix K, Table 6, Column C	Mann Kendall Trend Analysis	Sample Date - 2016										Sample Date - 2017							
		Minimum	Mean	Maximum	Exceeding Guideline 1			17-Mar-16	19-Apr-16	26-May-16	27-Jun-16	28-Jul-16	12-Aug-16	15-Sep-16	14-Oct-16	10-Nov-16	20-Dec-16	11-Jan-17	8-Feb-17	4-Apr-17	28-Apr-17	30-May-17	28-Jun-17	26-Jul-17	24-Aug-17
Field Parameters																									
Conductivity (Field)	µS/cm	11.8	17.7	24.7	-	-	Significant Decreasing																		22
Dissolved Oxygen	mg/L	7.29	16.3	73.7	-	-	No trend																		
Oxidation Reduction Potential	mV	76.2	166	371	-	-	Significant Decreasing																		
pH (Field)	pH	4.23	5.06	6.53	-	-	No trend																		5.97
Temperature	°C	0.1	9.68	21.6	-	-	No trend																		20.7
Major Anions		-	-	-																					
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	<1	<1	<1	-	-	No trend	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1	<1	<1	-	-	No trend	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Chloride (Cl)	mg/L	1.9	3.48	5.6	0	120	Significant Decreasing	4.6	3.4	4	3.7	3.5	3.5	3.4	4.6	4	3.3	3.9	3.2	2.9	2.9	3	2.6	2.7	3
Dissolved Sulphate (SO4)	mg/L	<2	<2	2.1	0	Equation	No trend	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.3	<2.0	2.1	<2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Fluoride (F-)	mg/L	<0.1	<0.1	<0.1	0	0.12	No trend	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nutrients		-	-	-																					
Orthophosphate (P)	mg/L	<0.01	0.012	0.084	-	-	No trend	<0.010	<0.010	<0.010	<0.010	0.01	0.013	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010
Nitrate + Nitrite (N)	mg/L	<0.05	<0.05	0.067	-	-	No trend	<0.050	<0.050	1.1	<0.050	0.06	0.053	<0.050	<0.050	<0.050	0.076	0.062	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.086
Nitrate (N)	mg/L	<0.05	<0.05	0.067	0	13	No trend	<0.050	<0.050	1.1	<0.050	0.06	0.053	<0.050	<0.050	<0.050	0.076	0.062	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.086
Nitrite (N)	mg/L	<0.01	<0.01	0.017	0	0.06	No trend	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	<0.05	<0.05	<0.05	-	-	No trend	<0.050	<0.050	<0.050	<0.050	0.066	<0.050	<0.050	<0.050	<0.050	<0.050	0.081	<0.050	<0.050	-	0.051	<0.050	<0.050	<0.050
Unionized Ammonia (as N)	*mg/L*	*4.53E-08*	*0.00000135*	*0.00000918*	0	*0.019*	*No trend*	*0.00000328*	*0.00000143*	*0.00000377*	*0.0000101*	*0.00000973*	*0.00000904*	*0.00000735*	*0.000000286*	*0.000000752*	*0.00000137*	*0.00000807*	*0.00000453*	*0.00000584*	-	*0.0000172*	*0.00000584*	*0.00000558*	*0.00000971*
Physical																									
Total Alkalinity (Total as CaCO3)	mg/L	<5	<5	<5	-	-	No trend	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hardness (CaCO3)	mg/L	3.3	4.63	6	-	-	No trend	3.9	3.2	4.2	4.5	5.3	5.3	4.9	6.8	5.7	5.1	4.1	4.2	3.8	3.9	4	4	4.3	4
Reactive Silica (SiO2)	mg/L	0.76	2.01	7	-	-	Significant Increasing	0.99	0.72	<0.50	<0.50	<0.50	<0.50	<0.50	2.2	2.1	2.4	1.9	1.7	1.2	0.66	0.6	<0.50	<0.50	<0.50
Colour	TCU	69	123	200	-	-	Significant Increasing	45	56	66	110	85	82	47	160	86	71	65	62	43	83	96	110	110	65
Conductivity	µS/cm	18	22.5	27	-	-	Significant Decreasing	19	19	36	20	20	21	22	35	26	26	22	22	19	21	19	19	19	18
pH	pH	5.08	5.48	5.97	-	-	Significant Decreasing	5.85	5.49	5.91	6.34	5.9	6.29	6.2	4.79	5.21	5.47	5.73	5.99	6.1	5.99	6.26	6.1	6.08	6.47
Turbidity	NTU	1	1.43	2.2	-	-	Significant Increasing	0.85	1.1	1.4	1.1	0.8	0.78	0.54	2.6	0.62	1.1	0.62	0.86	0.84	1.2	1.8	1.2	0.91	0.82
Total Organic Carbon (C)	mg/L	7.3	11.8	19	-	-	Significant Increasing	4.7	5.1	5.5	7.4	11	8.7	6.8	20	11	11	6.5	5.7	4.3	6.2	7.6	9.9	10	8
Total Chemical Oxygen Demand	mg/L	<20	33.9	54	-	-	Significant Increasing	16	17	20	27	38	36	24	71	43	22	29	23	21	26	25	33	27	26
Calculated TDS	mg/L	6	10.4	17	-	-	No trend	-	-	-	-	-	-	-	-	-	-	10	8	10	7	7	7	7	7
Total Dissolved Solids	mg/L	-	-	-	-	-	Significant Increasing	9	7	13	8	9	9	10	13	13	11	-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	<1	1.41	2	-	-	No trend	<1.0	<1.0	2.2	<1.0	<1.0	<1.0	1.2	1.2	<1.0	1	<1.0	<1.0	<1.0	2.6	2.4	2	1.6	<2.0
Calculated																									
Anion Sum	me/L	0.05	0.103	0.16	-	-	Significant Decreasing	0.13	0.1	0.19	0.1	0.1	0.1	0.14	0.13	0.16	0.1	0.12	0.09	0.13	0.08	0.09	0.07	0.08	0.09
Cation Sum	me/L	0.16	0.223	0.28	-	-	No trend	0.18	0.15	0.21	0.2	0.24	0.24	0.21	0.3	0.24	0.22	0.18	0.17	0.16	0.18	0.18	0.2	0.2	0.17
Ion Balance (% Difference)	%	20	37.5	61.3	-	-	Significant Increasing	16.1	20	5	33.3	41.2	41.2	20	39.5	20	37.5	20	30.8	10.3	38.5	33.3	48.2	42.9	30.8
Langelier Index (@ 20C)	N/A	-	-	-	-	-	#VALUE!	-	-	-	-	-	-	-	-	-	-	NC	NC	NC	NC	NC	NC	NC	NC
Langelier Index (@ 4C)	N/A	-	-	-	-	-	#VALUE!	-	-	-	-	-	-	-	-	-	-	NC	NC	NC	NC	NC	NC	NC	NC
Saturation pH (@ 20C)	N/A	-	-	-	-	-	#VALUE!	-	-	-	-	-	-	-	-	-	-	NC	NC	NC	NC	NC	NC	NC	NC
Saturation pH (@ 4C)	N/A	-	-	-	-	-	#VALUE!	-	-	-	-	-	-	-	-	-	-	NC	NC	NC	NC	NC	NC	NC	NC
Dissolved Metals																									
Dissolved Aluminum (Al)	µg/L	130	199	310	12	Equation	Significant Increasing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**79**
Dissolved Antimony (Sb)	µg/L	<1	<1	<1	0	20	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1.0
Dissolved Arsenic (As)	µg/L	3.5	12.5	31	10	5	Significant Increasing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**12**
Dissolved Barium (Ba)	µg/L	2.1	3.54	4.6	0	2000	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.1
Dissolved Beryllium (Be)	µg/L	<0.1	0.387	<1	0	5.3	Significant Decreasing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1.0
Dissolved Bismuth (Bi)	µg/L	<2	<2	<2	-	-	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<2.0
Dissolved Boron (B)	µg/L	<50	<50	<50	0	1200	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<50
Dissolved Cadmium (Cd)	µg/L	<0.01	0.012	0.024	0	Equation	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.010
Dissolved Calcium (Ca)	µg/L	740	1060	1400	-	-	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	930
Dissolved Chromium (Cr)	µg/L	<1	<1	<1	-	-	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1.0
Dissolved Cobalt (Co)	µg/L	<0.4	<0.4	<0.4	0	10	Significant Decreasing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.40
Dissolved Copper (Cu)	µg/L	<0.5	<0.5	0.59	0	Equation	Significant Decreasing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<2.0
Dissolved Iron (Fe)	µg/L	160	594	1200	7	300	Significant Increasing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**390**
Dissolved Lead (Pb)	µg/L	<0.5	<0.5	0.53	0	Equation	Significant Increasing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.50
Dissolved Magnesium (Mg)	µg/L	330	482	650	-	-	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	420
Dissolved Manganese (Mn)	µg/L	28	50.9	82	0	820	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
Dissolved Molybdenum (Mo)	µg/L	<2	<2	<2	0	73	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<2.0
Dissolved Nickel (Ni)	µg/L	<2	<2	<2	0	Equation	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<2.0
Dissolved Phosphorus (P)	µg/L	<100	<100	<100	-	-	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100
Dissolved Potassium (K)	µg/L	<100	149	230	-	-	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100
Dissolved Selenium (Se)	µg/L	<0.5	<0.5	<0.5	0	1	Significant Decreasing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1.0
Dissolved Silver (Ag)	µg/L	<0.1	<0.1	<0.1	0	0.25	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10
Dissolved Sodium (Na)	µg/L	1900	2320	2800	-	-	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1800
Dissolved Strontium (Sr)	µg/L	5	6.72	8.4	0	21000	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.3
Dissolved Thallium (Tl)	µg/L	<0.1	<0.1	<0.1	0	0.8	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10
Dissolved Tin (Sn)	µg/L	<2	<2	<2	-	-	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<2.0

Table 3. SW-11 Water Quality

Parameter	Units	Stats: from 01/Jan/21 to 31/Dec/21				IA Appendix K, Table 6, Column C	Mann Kendall Trend Analysis	Sample Date - 2016										Sample Date - 2017							
		Minimum	Mean	Maximum	Exceeding Guideline 1			17-Mar-16	19-Apr-16	26-May-16	27-Jun-16	28-Jul-16	12-Aug-16	15-Sep-16	14-Oct-16	10-Nov-16	20-Dec-16	11-Jan-17	8-Feb-17	4-Apr-17	28-Apr-17	30-May-17	28-Jun-17	26-Jul-17	24-Aug-17
Dissolved Titanium (Ti)	µg/L	<2	<2	3.2	-	-	Significant Increasing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<2.0
Dissolved Uranium (U)	µg/L	<0.1	<0.1	<0.1	0	15	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.10
Dissolved Vanadium (V)	µg/L	<2	<2	<2	0	6	No trend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<2.0
Dissolved Zinc (Zn)	µg/L	<5	<5	<5	0	Equation	Significant Decreasing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5.0
Total Metals																									
Total Aluminum (Al)	µg/L	160	218	330	12	Equation	Significant Increasing	**130**	**130**	**140**	**170**	**180**	**140**	**78**	**360**	**200**	**220**	**160**	**140**	**110**	**150**	**180**	**180**	**150**	**99**
Total Antimony (Sb)	µg/L	<1	<1	<1	0	20	No trend	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	µg/L	4.2	14.9	34	11	5	Significant Increasing	6.8	5.6	11	15	26	27	12	6.8	6.7	5.7	5.4	6.5	5.6	7.9	10	19	26	16
Total Barium (Ba)	µg/L	2.2	3.5	4.6	0	2000	No trend	3.1	3.5	3.6	2.8	2.8	2.5	2.1	8.3	4.9	4.7	3.3	3.1	2.7	3	3.1	3.1	3.1	2.4
Total Beryllium (Be)	µg/L	<0.1	0.387	<1	0	5.3	Significant Decreasing	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth (Bi)	µg/L	<2	<2	<2	-	-	No trend	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	µg/L	<50	<50	<50	0	1200	No trend	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	µg/L	<0.01	0.0123	0.023	0	Equation	No trend	<0.010	0.015	0.018	0.013	<0.010	0.01	<0.010	**0.08**	0.02	0.018	0.018	<0.010	0.011	0.014	0.018	0.011	<0.010	<0.010
Total Calcium (Ca)	µg/L	720	1050	1500	-	-	No trend	910	730	1000	1000	1200	1200	1100	1500	1300	1100	910	950	890	930	910	950	1000	900
Total Chromium (Cr)	µg/L	<1	<1	1.6	-	-	No trend	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cobalt (Co)	µg/L	<0.4	<0.4	0.41	0	10	No trend	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.68	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Total Copper (Cu)	µg/L	<0.5	<0.5	0.95	0	Equation	Significant Decreasing	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**2.2**	<2.0	<2.0	<2.0	<2.0
Total Iron (Fe)	µg/L	240	735	1600	9	300	Significant Increasing	260	190	**410**	**630**	**980**	**1000**	**520**	**760**	**430**	**380**	290	240	240	250	**440**	**850**	**1100**	**690**
Total Lead (Pb)	µg/L	<0.5	<0.5	0.66	0	Equation	Significant Increasing	<0.50	<0.50	<0.50	<0.50	<0.50	0.53	<0.50	0.63	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Magnesium (Mg)	µg/L	340	472	630	-	-	No trend	400	340	390	460	540	550	510	720	590	560	450	440	390	390	410	410	430	410
Total Manganese (Mn)	µg/L	33	53.1	89	0	820	No trend	40	35	56	46	52	56	19	170	70	67	52	38	33	31	58	57	32	13
Total Mercury (Hg)	µg/L	<0.013	<0.013	<0.013	0	0.026	No trend	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	0.013	<0.013	<0.013
Total Molybdenum (Mo)	µg/L	<2	<2	3.1	0	73	No trend	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	µg/L	<2	<2	2.2	0	Equation	No trend	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus (P)	µg/L	<100	<100	<100	-	-	No trend	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Total Potassium (K)	µg/L	<100	139	230	-	-	No trend	210	190	540	130	<100	140	150	530	260	230	110	140	150	370	170	140	<100	<100
Total Selenium (Se)	µg/L	<0.5	<0.5	<0.5	0	1	Significant Decreasing	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	µg/L	<0.1	<0.1	<0.1	0	0.25	No trend	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	µg/L	1800	2240	2700	-	-	No trend	1900	1700	2200	2000	2100	2200	2100	2500	2200	2100	1800	1800	1600	1900	1800	1900	1700	1800
Total Strontium (Sr)	µg/L	4.9	6.65	8.5	0	21000	No trend	5.2	4.4	5.6	6.3	7.5	7.4	6.6	9.9	8.1	7.4	5.6	5.8	5.6	5.4	5.7	5.8	6.3	5.3
Total Thallium (Tl)	µg/L	<0.1	<0.1	<0.1	0	0.8	No trend	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	µg/L	<2	<2	<2	-	-	No trend	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	µg/L	<2	2.71	3.7	-	-	Significant Increasing	<2.0	2	3	2.4	2.7	3.3	<2.0	4.1	<2.0	2.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.5
Total Uranium (U)	µg/L	<0.1	<0.1	<0.1	0	15	No trend	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	µg/L	<2	<2	<2	0	6	No trend	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	µg/L	<5	<5	17	0	Equation	No trend	<5.0	<5.0	6	<5.0	6.3	<5.0	<5.0	7.5	<5.0	<5.0	<5.0	<5.0	<5.0	10	<5.0	<5.0	<5.0	<5.0
Specialty																									
Radium-226	Bq/L	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanate	mg/L	<0.05	<0.05	<0.05	-	-	No trend	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050
Strong Acid Dissoc. Cyanide (CN)	mg/L	-	-	-	-	-	Significant Increasing	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0014	0.0014	0.0018	<0.0010	0.0014
Thiocyanate	mg/L	<0.17	<0.17	<0.17	-	-	No trend	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.003	<0.003	<0.003	0	0.005	No trend	<0.003	<0.003	<0.003	<0.003	0.004	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.0030	<0.0030
Total Cyanide (CN)	mg/L	<0.005	<0.005	<0.005	-	-	Significant Increasing	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0014	0.0014	0.0018	<0.0010	0.0014
Organics																									
Benzene	mg/L	<0.001	<0.001	<0.001	0	2.1	No trend	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Toluene	mg/L	<0.001	<0.001	<0.001	0	0.77	No trend	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ethylbenzene	mg/L	<0.001	<0.001	<0.001	0	0.32	No trend	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Xylenes	mg/L	<0.002	<0.002	<0.002	0	0.33	No trend	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
C6 - C10 (less BTEX)	mg/L	<0.09	<0.09	<0.09	-	-	Significant Increasing	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
>C10-C16 Hydrocarbons	mg/L	<0.05	<0.05	<0.05	-	-	No trend	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
>C16-C21 Hydrocarbons	mg/L	<0.05	<0.05	<0.05	-	-	No trend	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
>C21-<C32 Hydrocarbons	mg/L	<0.09	<0.09	<0.09	-	-	Significant Decreasing	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Modified TPH (Tier1)	mg/L	<0.09	<0.09	<0.09	0	0.1	Significant Decreasing	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Hydrocarbon Resemblance	mg/L					-		-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA
Reached Baseline at C32	mg/L					-		-	-	-	-	-	-	-	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Guidelines																									
Aluminum	µg/L							5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Cadmium	µg/L							0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Copper	µg/L							2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Lead	µg/L							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Nickel	µg/L							25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Dissolved Zinc	µg/L							18.71	19.33	19.92	22.41	26.25	23.91	21.67	33.3	26.25	26.25	21.29	20.2	18.06	20.89	22.65	25.17	25.27	23.12
Sulphate	mg/L							128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128
TSS	mg/L							---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Table 3. SW-11 Water Quality

Parameter	Units	Sample Date - 2018																Sample Date - 2019							
		21-Sep-17	23-Oct-17	20-Nov-17	18-Dec-17	16-Jan-18	13-Feb-18	13-Mar-18	16-Apr-18	15-May-18	14-Jun-18	16-Jul-18	13-Aug-18	2-Oct-18	25-Oct-18	27-Nov-18	18-Dec-18	15-Jan-19	11-Feb-19	6-Mar-19	9-Apr-19	7-May-19	7-Jun-19	10-Jul-19	14-Aug-19
Field Parameters																									
Conductivity (Field)	µS/cm	27	29	36	0	51.3	0	14.4	17.1	34.7	40.3	59.4	46	45.9	48.6	32.2	31.2	15.4	20.9	21.1	35.2	40.3	40.3	44.1	19.1
Dissolved Oxygen	mg/L																								
Oxidation Reduction Potential	mV																								
pH (Field)	pH	5.29	6.83	4.79	4.79	4.84	4.85	5.21	4.86	5.34	5.69	6.08	5.98	5.64	4.54	4.7	5.13	4.73	4.38	5.84	5.35	7.14	7.14	6.04	6.35
Temperature	°C	19.2	10.9	6	0.5	0.6	0.1	1.9	3.7	16.1	15	24	25.7	14.1	7.9	1.1	0.5	0	0.6	0.3	13.3	13.7	13.7	23.2	19.6
Major Anions																									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Chloride (Cl)	mg/L	3.9	4.1	5.2	4.5	13	4.7	5.4	4.8	3.8	3.9	3.8	3.9	4.8	5.2	4.3	4.7	4.1	3.5	4.1	3.5	2.9	2.7	3.3	2.9
Dissolved Sulphate (SO4)	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.2	<2.0	<2.0	<2.0	<2.0	2.6	<2.0
Dissolved Fluoride (F-)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nutrients																									
Orthophosphate (P)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrate + Nitrite (N)	mg/L	<0.050	<0.050	0.058	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.066	<0.050	<0.050
Nitrate (N)	mg/L	<0.050	<0.050	0.058	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.066	<0.050	<0.050
Nitrite (N)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.20	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Unionized Ammonia (as N)	*mg/L*	*0.00000182*	*0.0000336*	*0.000000208*	*0.000000132*	*0.00000015*	*0.000000147*	*0.000000391*	*0.000000203*	*0.00000162*	*0.00000334*	*0.0000159*	*0.0000142*	*0.0000111*	*0.000000136*	*0.000000113*	*0.00000029*	*0.000000111*	*5.19E-08*	*0.00000146*	*0.00000134*	*0.000085*	*0.000085*	*0.0000137*	*0.0000215*
Physical																									
Total Alkalinity (Total as CaCO3)	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hardness (CaCO3)	mg/L	6.3	5.2	5.4	4.6	9.4	4.1	4.7	3.9	4.3	3.9	4.2	5	5.4	5.5	4.7	4.9	3.9	4.2	4.8	3.2	3.3	3.3	3.8	4.1
Reactive Silica (SiO2)	mg/L	1.9	1.8	2.5	2	1.9	1.4	1.5	1	<0.5	<0.5	<0.5	0.53	1.1	2.2	2.1	2	2.3	1.6	1.2	0.85	<0.50	0.52	1.6	0.66
Colour	TCU	170	110	130	79	34	46	39	53	64	100	110	86	64	110	95	71	88	52	47	45	59	93	98	67
Conductivity	µS/cm	24	23	32	26	58	27	27	25	23	21	25	25	28	33	27	27	24	22	24	20	19	19	18	20
pH	pH	5.96	6.02	5.68	5.93	5.45	5.93	6.19	5.99	6.11	6.08	6.95	6.41	5.96	5.36	5.98	6.14	5.55	5.74	5.95	6.74	6.13	5.61	5.98	6.23
Turbidity	NTU	1	1.1	1.3	1.1	1.3	1.2	0.71	0.74	0.88	1.3	2.1	1.2	0.75	2.4	0.49	0.54	0.62	0.64	0.52	1.1	1.3	1	2.2	0.62
Total Organic Carbon (C)	mg/L	18	12	18	8.8	6.7	6.6	5.4	6.6	7.6	9.2	10	9.6	8.9	16	9.6	8	8.6	5.8	5.1	5.5	6.7	9.5	9.1	7.6
Total Chemical Oxygen Demand	mg/L	57	35	50	28	22	21	22	21	22	30	23	26	30	42	22	28	23	<20	<20	<20	33	23	30	22
Calculated TDS	mg/L	11	11	13	11	23	10	12	10	8	8	8	10	11	13	11	11	10	11	10	8	6	7	12	8
Total Dissolved Solids	mg/L	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	3.2	<1.0	<1.0	<1.0	<1.0	5	1	<1.0	1	2.4	3.8	1.6	1	<2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1	1.6	1.2	<2.0
Calculated																									
Anion Sum	me/L	0.11	0.11	0.15	0.13	0.36	0.13	0.15	0.14	0.11	0.11	0.11	0.11	0.13	0.15	0.12	0.13	0.12	0.14	0.12	0.1	0.08	0.08	0.15	0.08
Cation Sum	me/L	0.26	0.23	0.25	0.2	0.41	0.2	0.23	0.2	0.21	0.19	0.2	0.25	0.25	0.27	0.22	0.22	0.19	0.19	0.22	0.16	0.16	0.17	0.19	0.2
Ion Balance (% Difference)	%	40.5	35.3	25	21.2	6.49	21.2	21.1	17.7	31.3	26.7	29	38.9	31.6	28.6	29.4	25.7	22.6	15.2	29.4	23.1	33.3	36	11.8	42.9
Langelier Index (@ 20C)	N/A	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Langelier Index (@ 4C)	N/A	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Saturation pH (@ 20C)	N/A	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Saturation pH (@ 4C)	N/A	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Dissolved Metals																									
Dissolved Aluminum (Al)	µg/L	**290**	**180**	**250**	**160**	**130**	**100**	**120**	**130**	**150**	**170**	**150**	**110**	**110**	**250**	**170**	**140**	**150**	**110**	**100**	**95**	**110**	**160**	**140**	**95**
Dissolved Antimony (Sb)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Arsenic (As)	µg/L	**13**	**8.4**	**6.4**	**7.7**	3.2	3.6	3.5	4	**8**	**8**	**21**	**27**	**8.5**	**6.5**	**7.2**	**7.6**	4.7	**5.2**	**5.4**	**5.1**	**7.4**	**7.1**	**18**	**22**
Dissolved Barium (Ba)	µg/L	5.9	3.5	5.6	3.8	8.9	3.9	4.1	3.6	2.9	2.3	2.8	2.8	3.7	5.4	3.8	3.7	3.5	3.3	3.6	2.8	3	2.9	2.2	2.4
Dissolved Beryllium (Be)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Bismuth (Bi)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Boron (B)	µg/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Dissolved Cadmium (Cd)	µg/L	0.028	<0.010	0.026	0.015	**0.05**	0.021	0.013	0.015	0.014	<0.010	<0.010	<0.010	<0.010	0.018	0.014	0.013	0.017	0.017	0.02	0.014	0.011	<0.010	<0.010	<0.010
Dissolved Calcium (Ca)	µg/L	1500	1300	1200	1100	1900	860	1000	840	990	910	950	1100	1200	1200	1100	1100	900	970	1000	670	740	750	870	900
Dissolved Chromium (Cr)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Cobalt (Co)	µg/L	<0.40	<0.40	<0.40	<0.40	0.68	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.41	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Dissolved Copper (Cu)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved Iron (Fe)	µg/L	**870**	**560**	**530**	290	170	160	160	170	250	300	**670**	**910**	**370**	**470**	**330**	280	250	190	190	130	130	**330**	**580**	**730**
Dissolved Lead (Pb)	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved Magnesium (Mg)	µg/L	620	500	590	490	1100	470	530	450	450	400	430	530	590	590	500	510	410	430	520	360	350	350	390	440
Dissolved Manganese (Mn)	µg/L	84	31	89	55	210	90	62	48	62	51	45	17	26	86	53	46	55	48	41	66	42	50	34	15
Dissolved Molybdenum (Mo)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Nickel (Ni)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Phosphorus (P)	µg/L	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Dissolved Potassium (K)	µg/L	160	140	340	180	290	160	190	220	210	110	<100	<100	140	160	130	160	120	150	240	240	250	170	110	140
Dissolved Selenium (Se)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.50	<0.50
Dissolved Silver (Ag)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Sodium (Na)	µg/L	2200	2200	2500	2100	4800	2600	2900	2500	2400	2100	2200	2600	2800	3000	2500	2500	2300	2100	2600	2100	1900	1900	2100	2100
Dissolved Strontium (Sr)	µg/L	10	7.3	7.7	5.9	13	5.7	6.7	5.6	6.2	5.9	6.2	7.2	7.5	8.3	6.5	7.4	5.8	5.7	6.3	4.2	4.7	4.9	5.1	5.9
Dissolved Thallium (Tl)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Tin (Sn)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Table 3. SW-11 Water Quality

Parameter	Units					Sample Date - 2018												Sample Date - 2019							
		21-Sep-17	23-Oct-17	20-Nov-17	18-Dec-17	16-Jan-18	13-Feb-18	13-Mar-18	16-Apr-18	15-May-18	14-Jun-18	16-Jul-18	13-Aug-18	2-Oct-18	25-Oct-18	27-Nov-18	18-Dec-18	15-Jan-19	11-Feb-19	6-Mar-19	9-Apr-19	7-May-19	7-Jun-19	10-Jul-19	14-Aug-19
Dissolved Titanium (Ti)	µg/L	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Uranium (U)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Vanadium (V)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Zinc (Zn)	µg/L	<5.0	<5.0	<5.0	<5.0	7.6	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Metals																									
Total Aluminum (Al)	µg/L	**310**	**200**	**290**	**180**	**160**	**170**	**130**	**140**	**160**	**180**	**210**	**120**	**120**	**270**	**200**	**150**	**160**	**130**	**110**	**120**	**130**	**190**	**160**	**110**
Total Antimony (Sb)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	µg/L	16	9.6	7.9	8.8	3.9	4.8	4.1	4.5	9	9.4	33	34	10	7.6	8.5	8.6	5.6	6.1	6.5	5.6	9	9.3	22	26
Total Barium (Ba)	µg/L	5.9	3.4	5.7	4	8.7	4	4	3.9	2.8	2.5	3.3	2.6	3.6	5.6	3.8	3.7	3.5	3.2	3.4	2.8	3.1	3.2	2.4	2.3
Total Beryllium (Be)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth (Bi)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	µg/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	µg/L	0.021	0.011	0.025	0.019	**0.046**	0.02	0.021	0.015	<0.010	<0.010	<0.010	<0.010	0.011	0.024	<0.010	0.011	0.015	0.013	0.016	0.014	0.014	0.014	<0.010	<0.010
Total Calcium (Ca)	µg/L	1500	1200	1200	1000	1800	830	900	820	890	910	1000	1100	1200	1200	1000	1100	860	930	1000	670	730	750	840	850
Total Chromium (Cr)	µg/L	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	1.1	<1.0	1.1	<1.0
Total Cobalt (Co)	µg/L	<0.40	<0.40	0.42	<0.40	0.66	<0.40	<0.40	<0.40	<0.40	<0.40	0.49	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Total Copper (Cu)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	<0.50	<0.50	<0.50	0.52	<0.50	<0.50
Total Iron (Fe)	µg/L	**1100**	**670**	**650**	**330**	210	260	210	210	**330**	**460**	**1400**	**1200**	**480**	**530**	**380**	**330**	**320**	240	230	170	210	**450**	**800**	**1000**
Total Lead (Pb)	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.75	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.52
Total Magnesium (Mg)	µg/L	580	520	630	460	1100	470	480	420	400	410	450	500	580	590	510	500	390	430	480	310	360	380	410	430
Total Manganese (Mn)	µg/L	88	33	95	57	200	94	56	47	57	56	100	22	29	85	54	46	57	48	40	59	42	55	41	20
Total Mercury (Hg)	µg/L	0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.0020	<0.013
Total Molybdenum (Mo)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus (P)	µg/L	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Total Potassium (K)	µg/L	160	110	330	190	290	170	160	220	230	120	<100	<100	130	140	130	150	110	140	180	240	240	160	120	130
Total Selenium (Se)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.50	<0.50	<0.50
Total Silver (Ag)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	µg/L	2100	2200	2500	2000	4700	2500	2400	2400	2200	2300	2300	2400	2800	3000	2600	2400	2100	2100	2300	1700	1900	2000	2100	2100
Total Strontium (Sr)	µg/L	9.7	7.7	8.2	6.2	12	5.4	6.4	5.1	5.8	5.3	7.1	6.9	7.4	8	7	7.6	6.2	5.8	5.9	4	4.6	5.1	5.4	5.8
Total Thallium (Tl)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	µg/L	2.1	<2.0	3.3	2.2	<2.0	<2.0	<2.0	<2.0	<2.0	2.1	2.7	2.6	<2.0	2.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.4	3.1	3	2.7
Total Uranium (U)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	µg/L	<5.0	<5.0	<5.0	<5.0	5.7	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Specialty																									
Radium-226	Bq/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanate	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Strong Acid Dissoc. Cyanide (CN)	mg/L	0.0015	0.0011	<0.0010	<0.0010	0.001	<0.0010	0.0011	<0.0010	<0.0010	0.0013	0.0013	<0.005	0.001	0.0016	<0.0020	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Thiocyanate	mg/L	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Total Cyanide (CN)	mg/L	0.0015	0.0011	<0.0010	<0.0010	0.001	<0.0010	0.0011	<0.0010	<0.0010	0.0013	0.0013	<0.005	0.001	0.0016	<0.0020	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Organics																									
Benzene	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Toluene	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ethylbenzene	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Xylenes	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
C6 - C10 (less BTEX)	mg/L	<0.050	<0.050	<0.050	<0.050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.050	<0.10	<0.10	<0.10
>C10-C16 Hydrocarbons	mg/L	<0.010	<0.010	<0.010	<0.010	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.010	<0.050	<0.050	<0.050
>C16-C21 Hydrocarbons	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
>C21-<C32 Hydrocarbons	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Modified TPH (Tier1)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Hydrocarbon Resemblance	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Reached Baseline at C32	mg/L	NA	NA	NA	NA									NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Guidelines																									
Aluminum	µg/L	5	100	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	100	100	5	5
Cadmium	µg/L	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Copper	µg/L	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Lead	µg/L	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Nickel	µg/L	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Dissolved Zinc	µg/L	31.93	20.76	31.93	24.02	21.55	21.42	19.77	21.42	22.65	24.44	25.27	24.86	24.12	30.47	24.86	23.12	23.8	20.34	19.33	19.92	12.79	14.7	24.34	22.65
Sulphate	mg/L	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128
TSS	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Table 3. SW-11 Water Quality

Parameter	Units	Sample Date - 2020																						
								C063555	C088067	C0A9079	C0D5291	C0G5256	C0H4686	C0J9598	C0M7320	C0Q8176	C0T1983	C0W0330	C103561	C137357	C155916	C1A2398	C1B8924	C1F0549	C1J6639
		4-Sep-19	3-Oct-19	13-Nov-19	2-Dec-19	22-Jan-20	10-Feb-20	9-Mar-20	6-Apr-20	4-May-20	1-Jun-20	29-Jun-20	13-Jul-20	4-Aug-20	1-Sep-20	13-Oct-20	3-Nov-20	1-Dec-20	5-Jan-21	9-Feb-21	1-Mar-21	14-Apr-21	3-May-21	2-Jun-21	14-Jul-21
Field Parameters																								
Conductivity (Field)	µS/cm	19.6	20.5	20.2	14.9	13.3	13.5	12.9	10.5	13.7	19.4	-	20.4	34.9	19.4	19.3	19.6	18.9	24.7	11.9	11.8	13.4	14.2	16.5	19.5
Dissolved Oxygen	mg/L					14.04	13.81	13.89	12.69	10.75	9.24	-	7.65	6.63	8.94	10.29	11.45	12.33	14.17	13.1	13.26	11.93	11.18	9.78	73.7
Oxidation Reduction Potential	mV					219.4	212.4	251.1	271.9	251.4	160.8	-	200.4	79.5	163.4	224.9	221.7	186.1	85.7	254.9	170.5	166.8	202.5	121.3	371
pH (Field)	pH	6.84	5.32	4.77	4.61	6.01	5.21	5.19	4.83	4.81	6.6	-	5.03	6.07	6.6	4.54	4.55	5.13	6.53	4.64	6.04	5.14	4.77	5.22	4.62
Temperature	°C	20.8	11.8	5.9	-0.1	-0.5	-0.4	-0.1	3.5	8.7	17.4	-	20.6	22.2	17.4	8.6	5.9	5.4	3.3	0.1	0.4	7.6	8.5	12.9	21.6
Major Anions												-												
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Chloride (Cl)	mg/L	2.4	4	5.3	3.7	3.9	4.6	2.5	2	2.5	2.6	-	4	3.7	3	4.8	4.6	3.8	5.6	3.6	3.8	1.9	3	2.8	1.9
Dissolved Sulphate (SO4)	mg/L	2.7	2.7	<2.0	<2.0	<2.0	2.6	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Fluoride (F-)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nutrients												-												
Orthophosphate (P)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.084	0.01
Nitrate + Nitrite (N)	mg/L	<0.060	<0.050	<0.050	<0.050	0.054	0.074	0.068	<0.050	0.054	<0.050	-	<0.050	<0.050	<0.050	0.091	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrate (N)	mg/L	<0.060	<0.050	<0.050	<0.050	0.054	0.074	0.068	<0.050	0.054	<0.050	-	<0.050	<0.050	<0.050	0.091	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrite (N)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Unionized Ammonia (as N)	*mg/L*	*0.0000724*	*0.00000112*	*0.000000197*	*8.32E-08*	*0.00000202*	*0.000000323*	*0.000000316*	*0.000000186*	*0.00000027*	*0.0000325*	-	0.00000111	0.0000136	*0.0000325*	*0.000000144*	*0.000000119*	*0.000000434*	0.00000918	9.06E-08	0.00000233	0.00000053	0.000000243	0.000000964	0.000000463
Physical																								
Total Alkalinity (Total as CaCO3)	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Hardness (CaCO3)	mg/L	3.9	5.8	4.5	3.4	4.1	4.3	3.8	2.3	2.7	3.6	-	4.1	5.1	4.4	5.6	5.2	4.9	5.1	3.5	3.4	3.3	3.4	4.2	5.1
Reactive Silica (SiO2)	mg/L	0.82	1.1	2	1.7	2.4	2.3	2.3	1.3	0.98	<0.50	-	1.2	1	0.72	1.5	2.1	2.1	2.4	1.7	2.2	0.76	0.81	0.92	1
Colour	TCU	56	95	80	84	80	59	70	74	84	76	-	110	120	63	130	130	110	73	74	74	69	110	120	120
Conductivity	µS/cm	22	27	25	23	23	24	22	17	18	20	-	21	22	21	26	28	26	27	21	21	19	18	20	22
pH	pH	6.54	5.97	5.36	5.47	5.92	5.6	5.4	6.01	5.54	5.78	-	5.89	5.92	6.17	5.63	5.19	5.29	5.12	5.19	5.31	5.81	5.61	5.67	5.97
Turbidity	NTU	0.6	2.4	1.5	1.3	0.71	0.71	1.2	0.98	1.4	0.99	-	1.1	0.88	1	1.1	1.6	1.5	1.1	1.3	2.2	1.2	1.5	1.3	1.8
Total Organic Carbon (C)	mg/L	6.8	12	13	10	7.5	6.8	7.4	6.9	8.2	7.3	-	10	12	9.2	13	15	13	8.4	8.5	7.7	7.3	10	11	12
Total Chemical Oxygen Demand	mg/L	<20	29	26	33	29	20	26	<20	23	<20	-	28	33	28	39	44	32	28	27	26	<20	27	33	41
Calculated TDS	mg/L	10	13	12	9	11	14	9	6	7	6	-	9	10	8	14	12	11	13	9	10	6	7	8	8
Total Dissolved Solids	mg/L	-	-	-	-	-	-	-	-	-	25	-	-	-	-	-	-	-	-	-	-	-	-		
Total Suspended Solids	mg/L	2.8	1.4	2	1.4	<1.0	<1.0	<1.0	<1.0	1.4	1.8	-	<2.5	1.6	1.6	2	2.2	<1.0	1.2	<2.0	1.2	2	2	2	1.6
Calculated																								
Anion Sum	me/L	0.13	0.17	0.15	0.1	0.11	0.19	0.07	0.06	0.07	0.07	-	0.11	0.11	0.09	0.19	0.13	0.11	0.16	0.1	0.11	0.05	0.09	0.08	0.06
Cation Sum	me/L	0.19	0.25	0.22	0.18	0.19	0.2	0.19	0.12	0.14	0.18	-	0.2	0.24	0.21	0.25	0.25	0.24	0.24	0.18	0.18	0.16	0.17	0.21	0.25
Ion Balance (% Difference)	%	18.8	19.1	18.9	28.6	26.7	2.56	46.2	33.3	33.3	44	-	29	37.1	40	13.6	31.6	37.1	20	28.6	24.1	52.4	30.8	44.8	61.3
Langelier Index (@ 20C)	N/A	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	-	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Langelier Index (@ 4C)	N/A	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	-	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Saturation pH (@ 20C)	N/A	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	-	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Saturation pH (@ 4C)	N/A	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	-	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Dissolved Metals																								
Dissolved Aluminum (Al)	µg/L	76	**160**	**210**	**170**	**160**	**140**	**140**	**110**	**140**	**130**	-	**150**	**170**	**110**	**210**	**230**	**220**	**160**	**140**	**160**	**130**	**170**	**200**	**200**
Dissolved Antimony (Sb)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Arsenic (As)	µg/L	**15**	**9.1**	**5.9**	**5.6**	5	4.9	3.7	3.9	4.4	**12**	-	**26**	**28**	**23**	**11**	**8.6**	**7.3**	**6.4**	4.7	3.5	**6.4**	**6**	**11**	**31**
Dissolved Barium (Ba)	µg/L	2.1	4.1	4.4	3.3	4.1	3.7	3.7	2.5	3.3	4.2	-	2.5	2.3	2.7	4.2	4.4	4.7	4.1	3.3	3.4	2.9	3	3	2.1
Dissolved Beryllium (Be)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Bismuth (Bi)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Boron (B)	µg/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Dissolved Cadmium (Cd)	µg/L	<0.010	<0.010	0.015	0.014	0.016	0.019	0.019	0.012	0.013	0.019	-	<0.010	0.011	<0.010	0.012	0.014	0.017	0.012	0.016	0.016	<0.010	0.011	<0.010	<0.010
Dissolved Calcium (Ca)	µg/L	820	1300	960	720	910	980	880	480	600	800	-	900	1200	970	1300	1200	1100	1100	750	740	770	780	1000	1200
Dissolved Chromium (Cr)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Cobalt (Co)	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	-	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Dissolved Copper (Cu)	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved Iron (Fe)	µg/L	**560**	**370**	**330**	250	250	210	220	150	190	**320**	-	**730**	**970**	**830**	**560**	**550**	**400**	280	220	240	160	270	**520**	**1100**
Dissolved Lead (Pb)	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50	<0.50	<0.50	0.66	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.52
Dissolved Magnesium (Mg)	µg/L	450	600	520	390	450	460	400	260	290	380	-	450	500	480	590	570	540	570	390	390	330	340	410	530
Dissolved Manganese (Mn)	µg/L	13	34	67	55	54	51	70	48	43	67	-	50	61	14	42	51	60	46	60	51	34	45	63	28
Dissolved Molybdenum (Mo)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Nickel (Ni)	µg/L	<2.0	<2.0	3.9	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Phosphorus (P)	µg/L	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Dissolved Potassium (K)	µg/L	120	130	170	130	120	150	130	160	150	160	-	200	100	<100	180	210	170	140	140	150	160	130	180	<100
Dissolved Selenium (Se)	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved Silver (Ag)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Sodium (Na)	µg/L	2200	2600	2600	2100	2200	2300	2300	1500	1700	2000	-	2000	2200	2200	2600	2600	2600	2700	2000	2200	1900	2000	2300	2400
Dissolved Strontium (Sr)	µg/L	5.1	8.9	7	4.6	6	6	5.5	3.3	4.2	5.3	-	5.9	7.8	6.5	7.9	7.6	7.5	7.5	5	5	5	5	5.8	7.8
Dissolved Thallium (Tl)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Tin (Sn)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Table 3. SW-11 Water Quality

Parameter	Units	Sample Date - 2020																							
								C063555	C088067	C0A9079	C0D5291	C0G5256	C0H4686	C0J9598	C0M7320	C0Q8176	C0T1983	C0W0330	C103561	C137357	C155916	C1A2398	C1B8924	C1F0549	C1J6639
		4-Sep-19	3-Oct-19	13-Nov-19	2-Dec-19	22-Jan-20	10-Feb-20	9-Mar-20	6-Apr-20	4-May-20	1-Jun-20	29-Jun-20	13-Jul-20	4-Aug-20	1-Sep-20	13-Oct-20	3-Nov-20	1-Dec-20	5-Jan-21	9-Feb-21	1-Mar-21	14-Apr-21	3-May-21	2-Jun-21	14-Jul-21
Dissolved Titanium (Ti)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	2.1	2.4	<2.0	<2.0	<2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	2	3
Dissolved Uranium (U)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Vanadium (V)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Zinc (Zn)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Metals																									
Total Aluminum (Al)	µg/L	**110**	**160**	**230**	**190**	**170**	**140**	**160**	**120**	**160**	**150**	-	**170**	**190**	**130**	**220**	**250**	**250**	**190**	**160**	**170**	**180**	**200**	**210**	**220**
Total Antimony (Sb)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	µg/L	21	9.8	7	6	5.9	5.6	4	4.2	5.4	14	-	33	34	26	12	10	8	7.5	5.5	4.2	7.8	6.9	13	34
Total Barium (Ba)	µg/L	2.8	3.9	4.8	3.6	4	3.3	3.5	2.6	3.2	2.5	-	2.7	4.5	2.7	4.4	4.2	4.4	3.9	3.2	3.2	3	3.1	3	2.2
Total Beryllium (Be)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth (Bi)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	µg/L	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	µg/L	<0.010	0.011	0.019	0.011	0.015	0.013	0.017	0.011	0.022	0.015	-	<0.010	<0.010	<0.010	0.013	0.016	0.011	0.012	0.013	0.016	<0.010	0.01	0.013	<0.010
Total Calcium (Ca)	µg/L	860	1200	1000	710	830	930	840	470	580	750	-	950	1200	1000	1200	1200	1000	1100	720	730	790	760	920	1200
Total Chromium (Cr)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cobalt (Co)	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	-	<0.40	0.42	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Total Copper (Cu)	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.66	-	0.54	1.3	<0.50	<0.50	<0.50	<0.50	<0.50	0.54	<0.50	<0.50	<0.50	0.52	<0.50
Total Iron (Fe)	µg/L	**890**	**460**	**410**	280	290	260	250	190	230	**390**	-	**1100**	**1400**	**1100**	**720**	**650**	**440**	**330**	250	270	240	**380**	**640**	**1300**
Total Lead (Pb)	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.5	<0.50	0.65	-	0.96	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.53	0.58
Total Magnesium (Mg)	µg/L	460	560	530	390	450	440	400	240	290	340	-	480	510	510	580	540	500	550	380	370	360	340	380	510
Total Manganese (Mn)	µg/L	27	34	68	53	56	51	70	48	43	66	-	57	90	19	44	53	56	47	61	50	36	48	62	33
Total Mercury (Hg)	µg/L	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	0.013	<0.013	<0.013	-	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013		<0.013
Total Molybdenum (Mo)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.1	<2.0
Total Nickel (Ni)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus (P)	µg/L	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Total Potassium (K)	µg/L	140	110	210	<100	150	140	120	150	140	160	-	150	110	<100	190	180	150	150	140	110	150	130	160	<100
Total Selenium (Se)	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Silver (Ag)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	µg/L	2200	2500	2600	2000	2300	2200	2300	1400	1600	1800	-	2100	2200	2300	2600	2400	2300	2600	1900	2100	2000	1800	2100	2300
Total Strontium (Sr)	µg/L	5.4	8.1	7.1	4.8	6.5	6	5.5	3.6	3.9	4.9	-	6.3	8	6.6	8.3	7.1	6.9	7.2	5.1	5	4.9	5.1	5.1	7.8
Total Thallium (Tl)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	µg/L	2.2	<2.0	3.3	2.4	2.6	<2.0	<2.0	<2.0	2.7	2.2	-	3.2	2.9	2.5	2.2	2.9	4	<2.0	<2.0	2.4	2.3	2.3	3.2	3.3
Total Uranium (U)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Specialty																									
Radium-226	Bq/L	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-		
Cyanate	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Strong Acid Dissoc. Cyanide (CN)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	-	-	-	-	-	-	-	-	-	-	-	-		
Thiocyanate	mg/L	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	-	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Total Cyanide (CN)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Organics																									
Benzene	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Toluene	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ethylbenzene	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Xylenes	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	-	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
C6 - C10 (less BTEX)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.090	<0.090	<0.090	<0.090	<0.090	-	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
>C10-C16 Hydrocarbons	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
>C16-C21 Hydrocarbons	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
>C21-<C32 Hydrocarbons	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.090	<0.090	<0.090	<0.090	<0.090	-	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
Modified TPH (Tier1)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.090	<0.090	<0.090	<0.090	<0.090	-	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090
Hydrocarbon Resemblance	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Reached Baseline at C32	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calculated Guidelines																									
Aluminum	µg/L	100	5	5	5	5	5	5	5	5	100	-	5	5	100	5	5	5	100	5	5	5	5	5	5
Cadmium	µg/L	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Copper	µg/L	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Lead	µg/L	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Nickel	µg/L	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Dissolved Zinc	µg/L	16.43	27.17	28.05	25.27	22.54	21.67	22.41	21.8	23.35	20.55	-	25.27	27.17	22.53	28.05	29.69	28.05	23.01	23.69	22.77	22.29	25.27	26.25	27.17
Sulphate	mg/L	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128
TSS	mg/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Table 3. SW-11 Water Quality

Parameter	Units	C1L7946	C1P4375	C1U1946	C1W9009	C1AC984
		3-Aug-21	1-Sep-21	13-Oct-21	3-Nov-21	7-Dec-21
Field Parameters						
Conductivity (Field)	µS/cm	22.7	22.3	20.5	19.5	15.9
Dissolved Oxygen	mg/L	7.68	7.29	9.66	10.65	13.32
Oxidation Reduction Potential	mV	158.5	76.2	102	108.1	170.5
pH (Field)	pH	4.84	5.02	4.94	4.75	4.23
Temperature	°C	18.8	19.2	12.2	8.4	3.1
Major Anions						
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Chloride (Cl)	mg/L	2.8	3.2	4	4.4	4.8
Dissolved Sulphate (SO4)	mg/L	<2.0	2.1	<2.0	<2.0	<2.0
Dissolved Fluoride (F-)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10
Nutrients						
Orthophosphate (P)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrate + Nitrite (N)	mg/L	<0.050	<0.050	<0.050	0.067	<0.050
Nitrate (N)	mg/L	<0.050	<0.050	<0.050	0.067	<0.050
Nitrite (N)	mg/L	<0.010	<0.010	0.017	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Unionized Ammonia (as N)	*mg/L*	0.000000627	0.000000977	0.00000048	*0.00000023*	*4.53E-08*
Physical						
Total Alkalinity (Total as CaCO3)	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Hardness (CaCO3)	mg/L	5.3	5.8	5.7	6	4.7
Reactive Silica (SiO2)	mg/L	1.6	1.6	1.4	2.7	7
Colour	TCU	200	180	150	180	130
Conductivity	µS/cm	23	23	24	25	27
pH	pH	5.23	5.7	5.57	5.5	5.08
Turbidity	NTU	1.4	1.1	1	1.6	1.6
Total Organic Carbon (C)	mg/L	19	16	15	16	11
Total Chemical Oxygen Demand	mg/L	54	43	42	44	32
Calculated TDS	mg/L	10	13	11	13	17
Total Dissolved Solids	mg/L					
Total Suspended Solids	mg/L	<2.0	1.6	1	1.8	<1.0
Calculated						
Anion Sum	me/L	0.08	0.14	0.11	0.13	0.13
Cation Sum	me/L	0.26	0.27	0.25	0.28	0.23
Ion Balance (% Difference)	%	52.9	31.7	38.9	36.6	27.8
Langelier Index (@ 20C)	N/A	NC	NC	NC	NC	NC
Langelier Index (@ 4C)	N/A	NC	NC	NC	NC	NC
Saturation pH (@ 20C)	N/A	NC	NC	NC	NC	NC
Saturation pH (@ 4C)	N/A	NC	NC	NC	NC	NC
Dissolved Metals						
Dissolved Aluminum (Al)	µg/L	**310**	**220**	**230**	**280**	**190**
Dissolved Antimony (Sb)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Arsenic (As)	µg/L	**19**	**27**	**14**	**14**	**6.9**
Dissolved Barium (Ba)	µg/L	4.6	3.7	4.4	4	4
Dissolved Beryllium (Be)	µg/L	<1.0	<1.0	<0.10	<0.10	<0.10
Dissolved Bismuth (Bi)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Boron (B)	µg/L	<50	<50	<50	<50	<50
Dissolved Cadmium (Cd)	µg/L	0.024	0.011	0.01	0.012	0.017
Dissolved Calcium (Ca)	µg/L	1200	1400	1400	1300	1100
Dissolved Chromium (Cr)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Cobalt (Co)	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Dissolved Copper (Cu)	µg/L	0.59	<0.50	<0.50	<0.50	<0.50
Dissolved Iron (Fe)	µg/L	**1100**	**1200**	**690**	**940**	**410**
Dissolved Lead (Pb)	µg/L	0.53	<0.50	<0.50	0.52	<0.50
Dissolved Magnesium (Mg)	µg/L	550	590	520	650	510
Dissolved Manganese (Mn)	µg/L	82	46	41	48	67
Dissolved Molybdenum (Mo)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Nickel (Ni)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Phosphorus (P)	µg/L	<100	<100	<100	<100	<100
Dissolved Potassium (K)	µg/L	120	130	180	230	180
Dissolved Selenium (Se)	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved Silver (Ag)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Sodium (Na)	µg/L	2400	2300	2300	2800	2500
Dissolved Strontium (Sr)	µg/L	8	8.2	8.4	8.3	6.6
Dissolved Thallium (Tl)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Tin (Sn)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0

Table 3. SW-11 Water Quality

Parameter	Units	C1L7946	C1P4375	C1U1946	C1W9009	C1AC984
		3-Aug-21	1-Sep-21	13-Oct-21	3-Nov-21	7-Dec-21
Dissolved Titanium (Ti)	µg/L	3.2	3.2	2	3.1	<2.0
Dissolved Uranium (U)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Vanadium (V)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Zinc (Zn)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Total Metals						
Total Aluminum (Al)	µg/L	**330**	**250**	**240**	**270**	**200**
Total Antimony (Sb)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	µg/L	24	34	16	17	8.3
Total Barium (Ba)	µg/L	4.6	3.8	4	4.2	3.8
Total Beryllium (Be)	µg/L	<1.0	<1.0	<0.10	<0.10	<0.10
Total Bismuth (Bi)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	µg/L	<50	<50	<50	<50	<50
Total Cadmium (Cd)	µg/L	0.023	0.011	0.012	0.013	0.015
Total Calcium (Ca)	µg/L	1200	1500	1300	1400	990
Total Chromium (Cr)	µg/L	<1.0	<1.0	<1.0	1.6	<1.0
Total Cobalt (Co)	µg/L	0.41	<0.40	<0.40	<0.40	<0.40
Total Copper (Cu)	µg/L	0.76	<0.50	<0.50	0.95	<0.50
Total Iron (Fe)	µg/L	**1400**	**1600**	**840**	**1100**	**470**
Total Lead (Pb)	µg/L	0.61	0.6	<0.50	0.66	<0.50
Total Magnesium (Mg)	µg/L	520	610	530	630	480
Total Manganese (Mn)	µg/L	89	53	44	50	64
Total Mercury (Hg)	µg/L	<0.013	<0.013	<0.013	<0.013	<0.013
Total Molybdenum (Mo)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	µg/L	<2.0	<2.0	<2.0	2.2	<2.0
Total Phosphorus (P)	µg/L	<100	<100	<100	<100	<100
Total Potassium (K)	µg/L	110	130	150	230	160
Total Selenium (Se)	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
Total Silver (Ag)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	µg/L	2200	2400	2400	2700	2400
Total Strontium (Sr)	µg/L	8.1	8.3	8.5	8.2	6.5
Total Thallium (Tl)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	µg/L	3.7	3.7	2.4	3.6	3.6
Total Uranium (U)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	µg/L	<5.0	<5.0	<5.0	17	<5.0
Specialty						
Radium-226	Bq/L					
Cyanate	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Strong Acid Dissoc. Cyanide (CN)	mg/L					
Thiocyanate	mg/L	<0.17	<0.17	<0.17	<0.17	<0.17
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Total Cyanide (CN)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Organics						
Benzene	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Toluene	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ethylbenzene	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Xylenes	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
C6 - C10 (less BTEX)	mg/L	<0.090	<0.090	<0.090	<0.090	<0.090
>C10-C16 Hydrocarbons	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
>C16-C21 Hydrocarbons	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
>C21-<C32 Hydrocarbons	mg/L	<0.090	<0.090	<0.090	<0.090	<0.090
Modified TPH (Tier1)	mg/L	<0.090	<0.090	<0.090	<0.090	<0.090
Hydrocarbon Resemblance	mg/L	NA	NA	NA	NA	NA
Reached Baseline at C32	mg/L	NA	NA	NA	NA	NA
Calculated Guidelines						
Aluminum	µg/L	5	5	5	5	5
Cadmium	µg/L	0.04	0.04	0.04	0.04	0.04
Copper	µg/L	2	2	2	2	2
Lead	µg/L	1	1	1	1	1
Nickel	µg/L	25	25	25	25	25
Dissolved Zinc	µg/L	32.62	30.47	29.69	30.47	26.25
Sulphate	mg/L	128	128	128	128	128
TSS	mg/L	---	---	---	---	---

APPENDIX C

Groundwater Quality Predictions

Stantec

Memo

To:	Sara Wallace/Christian Deveau	From:	Walter Weinig, PG, PMP, QP Mark Flinn, P.Eng., MBA
	Atlantic Mining Nova Scotia Inc.		Stantec Consulting Ltd.
File:	121619250	Date:	October 28, 2022

Reference: Environmental Assessment Responses – Question 3 Groundwater Predictions Compared to Industrial Approval Requirements, Touquoy Gold Project Site Modifications Addendum

In response to the letter from Nova Scotia Environment and Climate Change (NSECC) dated May 12, 2022, and pertaining to the Touquoy Gold Project Site Modifications Addendum, Stantec is pleased to provide the following information to address question 3 related to groundwater predictions and subsequent comparisons to of these predictions to groundwater criteria as laid out in the Industrial Approval (2012-084244-12).

Methods

The groundwater predictions were developed based on the March 2022 (Stantec, 2022) updated groundwater model, using a scaled-concentration method and assuming conservative transport. In this method, a constant source concentration of 1 milligram per cubic metre (mg/m^3) was applied to the model cells that represent tailings contained in the Touquoy pit. The solute transport model was run for a period of 500 years. Scaled concentrations at the location of interest were extracted from the transport model results. These scaled concentrations were then multiplied by the estimated in-pit source concentration for each dissolved constituent to calculate the predicted increase in concentration for that constituent over baseline conditions. Predicted concentrations can only be generated for those parameters with source terms. Source terms have not been developed for antimony, phosphorous, potassium and strong cyanide. As a result, predictions for these parameters could not be generated.

The data used to establish baseline concentrations were derived from historical analytical results from monitoring well location OPM-1B. This location was selected because it represents the closest downgradient monitoring point to the Touquoy pit. Analytical results from the period between March 2016 and September 2017, representing 12 monitoring events were reviewed. The baseline period for groundwater wells is defined as the period prior to operation of the various project facilities. Groundwater data collected prior to October 2017 are considered within the baseline period as outlined in an e-mail from NSECC (Christine Hynes) dated May 10, 2019. Using the baseline data from OPM-1B an average baseline concentration was developed for each parameter. Where select parameters were not detected above the laboratory detection limits a value of half the detection limit was used to develop the baseline concentration.

In previous discussions with NSECC it has been identified that surface water monitoring and associated data are available between 2004-2007 (CRA 2007). Included in this data set is groundwater information. There are a series of monitoring wells (WB series) installed and sampled in 2006. However, analytical results from these monitoring wells were only presented for one groundwater monitoring event in November 2006. The monitoring wells were also sampled for total metals as compared to the industry standard dissolved metals (for which groundwater guidelines have been derived). As there has been much discussion about baseline data for this site, Stantec acknowledges the availability of this data; however, based on the reasons outlined above, they were not considered in the assessment of baseline concentrations for OPM-1B for the purposes of this memo.

Reference: Environmental Assessment Responses – Question 3 Groundwater Predictions Compared to Industrial Approval Requirements, Touquoy Gold Project Site Modifications Addendum

Prediction Results

Groundwater predictions were generated for location OPM-1B for two time periods; 5 years and 500 years from the time tailings are placed in the Touquoy pit. The results are presented in Table 1, attached, and are compared to the criteria specified by Condition 8 of the IA.

In general, the calculated Baseline results indicated that:

- arsenic and manganese exceeded criteria listed in Appendix K, columns A, B and C; and,
- iron exceeded criteria in Appendix K, columns A and C

The order of magnitude predicted additional concentrations above baseline concentrations ranged from 0.00834 ug/L (dissolved sulphate in the 500-year scenario) to 0.00000000000000043 ug/L (dissolved silver in the 5-year scenario). That is to say that the predicated incremental concentration increase resulting from the placement and storage of tailings in the Touqouy pit is extremely small and therefore minimally increases parameter concentrations from baseline. In many cases these increases are too low to be distinguishable from baseline by current laboratory detection methods.

The baseline concentration, plus the predicted incremental concentration increase resulting from the placement and storage of tailings in the pit, are not materially increased from the average groundwater baseline concentrations.

References:

Conestoga Rovers & Associates (CRA). 2007. Environmental Assessment Registration Document (EARD) for the Touquoy Gold Project, Moose River Gold Mines, Nova Scotia in March 2007.

Stantec, 2022. Report Update: Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Tailings in Touquoy Open Pit. Prepared for Atlantic Mining NS Inc, March.

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TABLE 1 **Groundwater Predictions**
Atlantic Mining NS Inc.
Touquoy Gold Project
Stantec Consulting Ltd. Project No. 121619250.2000

Parameter	**Appendix K Column A (ug/L)**	**Appendix K Column B (ug/L)**	**Appendix K Column C (ug/L)**	**Average Baseline Concentration NearPit, Monitoring Well OPM1-B (2016-2017)**	**Predicted Additional Concentration (ug/L)**		**Predicted GW Concentrations - Downgradient of Pit, MW OPM-1B (ug/L)**	
Elapsed Time (years)					**5**	**500**	**5**	**500**
Dissolved Aluminum (Al)	5 (if pH <6.5); 100 (if pH>6.5)	-	5 (if pH <6.5); 100 (if pH>6.5)	14.58	2.02E-12	4.36E-07	14.58	14.58
Dissolved Antimony (Sb)	6	6	20	0.5	No Source Term	No Source Term	-	-
Dissolved Arsenic (As)	5	10	5	***3633.33***	1.32E-10	2.86E-05	***3633.33***	***3633.33***
Dissolved Cadmium (Cd)	0.04-0.37[1] (hardness dep)	7	0.04-0.37[1] (hardness dep)	0.005	8.61E-16	1.86E-10	0.0050	0.0050
Dissolved Calcium (Ca)	-	-	-	39083.33	3.74E-09	8.08E-04	39083.33	39083.33
Dissolved Chloride (Cl)	120,000	250,000	120,000	11,276.92	No Source Term	No Source Term	-	-
Dissolved Chromium (Cr)	-	50	-	0.5	8.61E-15	1.86E-09	0.50	0.50
Dissolved Cobalt (Co)	10	10	10	0.2	1.13E-12	2.44E-07	0.20	0.20
Dissolved Copper (Cu)	2-4[2] (hardness dep)	2,000	2-4[2] (hardness dep)	1	4.03E-13	8.72E-08	1.00	1.00
Dissolved Iron (Fe)	300	-	300	***719.17***	1.40E-12	3.03E-07	***719.17***	***719.17***
Dissolved Lead (Pb)	1-7[3] (hardness dep)	5	1-7[3] (hardness dep)	0.38	1.07E-15	2.31E-10	0.38	0.38
Dissolved Magnesium (Mg)	-	-	-	4850	6.37E-10	1.38E-04	4850.00	4850.00
Dissolved Manganese (Mn)	120	120	820	***1035***	1.59E-11	3.44E-06	***1035.00***	***1035.00***
Dissolved Nickel (Ni)	25-150[4] (hardness dep)	-	25-150[4] (hardness dep)	1	2.60E-12	5.61E-07	1.00	1.00
Dissolved Phosphorus (P)	-	-	-	50	No Source Term	No Source Term	-	-
Dissolved Potassium (K)	-	-	-	1106.67	No Source Term	No Source Term	-	-
Dissolved Selenium (Se)	1	50	1	0.5	8.31E-15	1.80E-09	0.50	0.50
Dissolved Silver (Ag)	0.25	-	0.25	0.05	4.30E-16	9.30E-11	0.05	0.05
Dissolved Sodium (Na)	200,000	200,000	-		No Source Term	No Source Term	-	-
Dissolved Uranium (U)	15	20	15	0.21	8.74E-14	1.89E-08	0.21	0.21
Dissolved Zinc (Zn)	equation[5] (hardness,pH,DOC)	5,000	equation[5] (hardness,pH,DOC)	2.5	4.13E-13	8.93E-08	2.50	2.50
Dissolved Sulphate (SO4)		500,000		11846.15	3.86E-08	8.34E-03	11846.15	11846.16
Ammonia Nitrogen (NH3-N)	-	-	-	98.33	1.46E-09	3.16E-04	98.33	98.33
Total (Strong Acid Dissociable) Cyanide (SAD CN)	-	-	-	85	No Source Term	No Source Term	-	-
Weak Acid Dissociable Cyanide (WAD CN)	5[6]	200[6]	5[6]	1.5	2.15E-13	4.65E-08	1.50	1.50

NOTES:

1. Cadmium criteria equation: 0.04 (if hardness is <17 mg/L); $10^{(0.83[\log[hardness]]-2.46)}$ (if hardness is >17mg/L to <280 mg/L; 0.37 (if Hardness is >280 mg/L)
2. Copper criteria equation: 2 (if Hardness is <82 mg/L); $0.2*e^{(0.8549[\ln(hardness)]-1.465)}$ (if hardness is >82 mg/Lto <180mg/L); 4 (if hardness is >180 mg/L)
3. Lead criteria equation: 1 (if hardness is <60 mg/L); $e^{(1.273[\ln(hardness)]-4.705)}$ (if hardness is >60 mg/L to <180 mg/L); 7 (if hardness is >180 mg/L)
4. Nickel criteria equation: 25 (if hardness is <60 mg/L); $e^{(0.76[\ln(hardness)]+1.08)}$ (if hardness is >60 mg/L to <180 mg/L); 150 (if Hardness is >180 mg/L)
5. Zinc criteria equation: $\exp^{(0.947[\ln(hardness\ mg/L)]-0.815(pH)) + 0.398[\ln(DOC\ mg/L)] + 4.625)}$ (if hardness is 23.4 to 399 mg/L, pH is 6.5 to 8.13 & DOC is 0.3 to 22.9 mg/L)
In the absence of hardness, pH, DOC the CCME fact sheet for dissolved Zinc was consulted (2018).
Based on conservative assumptions the guideline for the protection of Freshwater Aquatic Life for short term zinc exposure is 37 ug/L.
The guidance for longer term exposure of Freshwater Aquatic life is 7.0 ug/L
6. Criteria is specifically for free cyanide.
7. **Bold:** Exceeds Appendix K Column A
8. highlight: Exceeds Appendix K Column B
9. *italics*: Exceeds Appendix K Column C

Addendum # 1 - Touquoy Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge Revision 2

Stantec

Memo

To:	Sara Wallace - AMNS	From:	Rachel Jones, P.Eng. Mark Flinn, P.Eng., MBA
File:	121619250	Date:	December 20, 2022

Reference: Addendum # 1 - Touquoy Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge Revision 2

This addendum is to the Touquoy Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge Revision 2, by Stantec dated November 18, 2022. This addendum was written in response to DFO and the NS Minister of Environment and Climate Change comments, advice and questions pertaining to the Assimilative Capacity of Moose River.

Stantec response to DFO's Comments and advice (blue) on the NS Minister of Environment and Climate Changes Question:

No.	Summary of Stantec Response to Questions
1	On August 16, 2021, DFO provided the following comments on the EA Registration Document related to the use of average flows to assess ecological flow requirements and effects to fish and fish habitat.
	DFO Comment: Use of average flows to assess ecological flow requirements is not appropriate because it does not adequately capture actual flow conditions in a watercourse such as the extreme low periods in the summer when even the natural flow regime of a watercourse could potentially inhibit fish from carrying out life processes. As per DFO's framework, flow alterations should be assessed using actual (instantaneous) flow. Having daily flow data would allow an assessment of the potential effects of the project during actual flow conditions. **Stantec Response:** The DFO framework for assessing the ecological flow requirements to support fisheries in Canada (2013) was developed for "water extraction and flow alteration that can impact physical attributes of rivers and cause ecological changes which can impact Canadian fisheries resources". The framework was to act as guidance on scientific based tools for assessing impacts of flow alteration on fisheries to aid their understanding of the various methodologies, and to inform decision makers and Canadians in their understanding of potential trade-offs of various management scenarios. This framework was not developed for the application of assimilative capacity studies but has been adapted to an assimilative capacity application. In response to the Minister's questions (May 2022) on our March Additional Information Addendum to the Environmental Assessment Registration Document for Touquoy Mine Project Modifications, it was recommended by DFO to "*Complete the assimilative capacity study of Moose River to be compliant with the Industrial Approval which uses SW-11 as the background station for quality and propose discharge criteria that will be protective of fish and fish habitat, in all areas of the Moose River. Incorporate Fisheries and Oceans Canada recommendations to determine summer flow conditions.*" Station 11 was used as the background station for water quality in this revision. The proposed discharge criteria a protective of fish and fish habitat as detailed in the revision. Regarding DFO summer flow conditions, the 25% MAF threshold was applied in the assimilative capacity study. This was based on the review and approaches of ecological flows (Linsari et. al 2013) stated that "the variations of the original Tennant thresholds are also used in other jurisdictions, e.g., 25% MAF is regularly used as the minimum flow level required to maintain aquatic life across the Atlantic provinces of Canada (Cassie and El-Jabi 1995)". As per DFO's request, an assessment of daily flow has been conducted, this is described in subsequent sections.

2	On April 22, 2022, DFO provided the following comments related to the Assimilative Capacity Study (Appendix D) included in the EARD Addendum.
	DFO Comment: The 2008 Focus Report for the original project EA provided an alternatives analysis regarding potential discharge locations for mining effluent from the TMF. Discharging effluent into Moose River was one of the alternatives considered in Section 2.11.7 of the Report. The following excerpt from page 31 of the Focus Report should be considered in the context of the proposed plan for in-pit tailings disposal and connection of the pit lake to Moose River via a spillway: *“Effluent could be piped to Moose River for discharge from Site (1). The average flow in Moose River is significant, 6000 M m3/yr. Moose River may host a small salmon population. Some years, however, Moose River dries up into a series of pools. Sufficient dilution could not be guaranteed in this event, possibly resulting in impact.”* This conclusion from the 2008 Focus Report highlights the importance of considering the concentration of deleterious substances during years when actual flows in Moose River fall below the monthly average. Section 8.0 of the assimilative capacity study in Appendix D of the Addendum uses estimates of the average monthly flow in Moose River at SW-2 to estimate assimilation ratios. However, the average monthly flows measured by AMNS at SW-2 in August 2017, August and September 2018, July through September 2019, and July and August 2020 were well below the average monthly flows used in the study to estimate the assimilation ratio. For example, the study used an estimated average flow of 381 L/s at SW-2 for the month of August, whereas the average flow measured at SW-2 in August 2019 and August 2020 was only 98.1 L/s and 117.2 L/s, respectively. Therefore, the assimilative study does not appear to consider assimilation ratios during years when flows are below average, which monitoring data suggests is likely to occur regularly during the post-mine closure period, and the predictions may not represent the likely worst-case scenario. **Stantec Response**: The intent of assigning a receiving water low flow threshold is not to seek the lowest flow on record and apply it. The inherent conservatism in assimilative capacity studies comes from the combined collection of poor conditions such as a reasonable and ecologically significant low flow such as the 25% MAF threshold. The same reasonability is applied to receiving water quality where the 75^{th} percentile concentration was applied instead of the maximum parameter concentration. Using the lowest flow on record and maximum receiving water quality to define the effluent receiving water conditions would not result in a reasonable condition and would extend the level of conservatism applied to the realm of the unrealistic.
3	**DFO Comment**: Section 8.0 of the assimilative capacity study states: “The Open Pit effluent post-mine closure will be driven by the same metrological factors (precipitation, evaporation, snowmelt) as the whole Moose River catchment. A very low flow in the river will correspond to a very low effluent flow from the Open Pit. The same relationship will exist with high flows.”. Based on this relationship, it is not clear why the average effluent flow presented in the study for the period June-August is substantially less than it is for September (4.6 L/s vs. 12.3 L/s, respectively) when the estimated average flows in Moose River presented for the same time periods are similar (487 L/s vs. 450 L/s, respectively). **Stantec Response:** The correlation between the Moose River and effluent response is not reflecting metrological conditions, as would be expected. There are inherent limitations to representing site hydrologic condition from regional hydrometric or nearby climate data. These limitations are explained further below.

Reference: Addendum # 1 - Touquoy Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge Revision 2

The regional regression relationships derived for the months of September compared to June/July/August have different slopes and pivot points of the log regression line that was fitted to the data set. These regional regression relationships are presented on Figure 1, extracted from Figure 4 of the assimilative capacity study relationships. For example, as shown in Figure 1, at a very low catchment area (e.g. 1km^2) September flow is higher than June/July/August. However, for a higher catchment area (e.g. 100 km^2) the June/July/August flow is slightly higher. This is a function of the variation in hydrologic response to a precipitation event of the regional watersheds included in the regression relationships. T

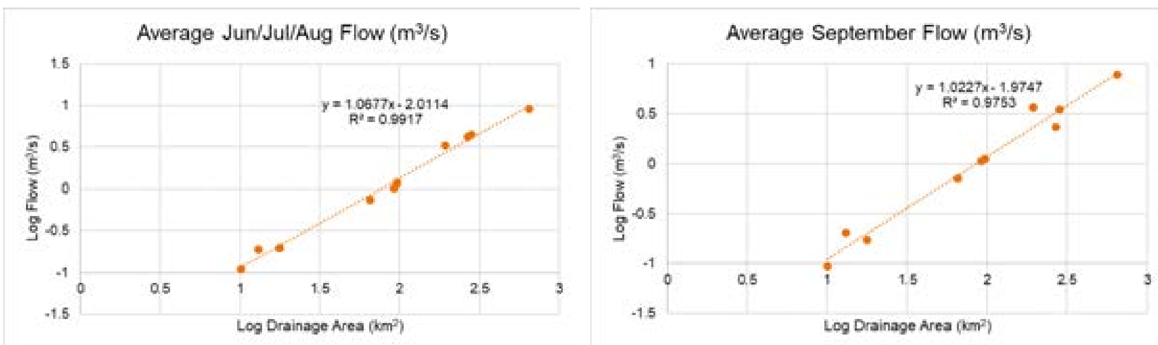

Figure1 Regional Regression Relationships Extracted from the Assimilative Capacity Study (Figure 4)

Limitations of applying two data sets to represent the site. The average effluent flow from the Touquoy pit is based on the climate normal precipitation from the Halifax climate station. The estimate of average flows in Moose River are based on the regional regression analysis of the ECCC hydrometric station flow record for each month. The variation in climate conditions over the regional watersheds is different from the Halifax climate. In addition, the available period of record for the regional assessment is also different from the most recent available climate normal of 1981-2010. Thus, the response to these meteorological factors does not always correlate month to month, as shown in Table 7.1 of the Moose River assimilative capacity study (Stantec 2022).

Table.1 Dilution Ratio in the Receiver at Full Mixing Under Worst Case (Table 7.1 Assimilative Capacity Study)

Month	Receiver Flow (L/s)	Effluent Flow (L/s) *	Seepage (L/s)	Dilution Ratio of Effluent to Receiver Flow
June/July/August	487	4.6	2.0E-5	107
July	396	3.6	2.0E-5	111
August	381	5.0	2.0E-5	77
April	2,226	48.3	2.0E-5	47
September	450	12.3	2.0E-5	38
25% MAF	290	3.8	2.0E-5	77

Note: *The effluent flow was predicted to be higher in August than July, in contrast to the receiver flow due to the assumption of higher evaporative losses occurring in the month of July.

To better correlate monthly Moose River flows to effluent flows, the average monthly observed flows in Moose River are used to estimate a dilution factor. Table 7.1 from the assimilative capacity study was revised to consider the available observed flows from 2017 to present at Moose River. Monthly averages of observed flows were calculated from the six years of observed data. The lowest dilution ratio of effluent to receiver flow is 41 (Table 2) compared to a dilution ratio of 38 (Table 1) that was calculated based on the regional dataset. This higher dilution ratio of effluent to receiver flow would result in improved water quality concentrations at the end of the mixing zone than what was presented in the assimilative capacity study.

Table.2 Revised Table 7.1 considering Observed Receiver Flow

Month	Receiver Flow (Observed Flow) (L/s)	Effluent Flow (L/s) *	Seepage (L/s)	Observed Dilution Ratio of Effluent to Receiver Flow
June/July/August	452	4.6	2.00E-05	98
July	311	3.6	2.00E-05	86
August	234	5	2.00E-05	47
April	3,514	48.3	2.00E-05	73
September	504	12.3	2.00E-05	41
25% MAF	350.8	3.8	2.00E-05	92

4 **DFO Comment:** As explained in previous comments, assessments of effects to fish and fish habitat should not rely exclusively on average annual or monthly flows. Daily flows are highly variable so average flows are often not representative of the actual real-world fish habitat conditions at any given time.

Since long-term, site-specific flow data is not available for Moose River, it is helpful to use long-term datasets from nearby gauged rivers to understand the natural flow regime of Moose River at SW-2. However, AMNS has been monitoring daily flows at SW-2 since 2017, so the estimated flows should also be compared to the actual measured flows. As per DFO's comments above, the actual flows measured at SW-2 in Moose River during summer are often much lower than those estimated in Appendix D on both a daily and monthly basis. Therefore, the estimated average flows used in Appendix D do not represent a conservative low flow scenario.

Stantec Response:

A review of the observed low flows in Moose River was conducted at hydrometric monitoring station SW-2, which is located downstream of the Touquoy pit. As required under the industrial approval, flow monitoring of Moose River commenced in July of 2017 to monitor flow during the open water period between June 1 and September 30. Figure 1 presents the observed hourly flows for each year at SW-2. Hydrometric station SW-2 was selected for review as this station had the lowest observed flows at Moose River during the dry period than at SW-11, and therefore would result in conservatively lower flow conditions.

The lowest observed flows during the flow monitoring period ranged between 50 L/s and 88 L/s with low flow occurring typically in late July, August or early September. These low flow conditions occur following a period of dry conditions in the watershed. Observed low flows in the summer are below the 25% Mean Annual Flow (MAF) metric of 290 L/s that was presented in the assimilative capacity study.

Reference: Addendum # 1 - Touquoy Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge Revision 2

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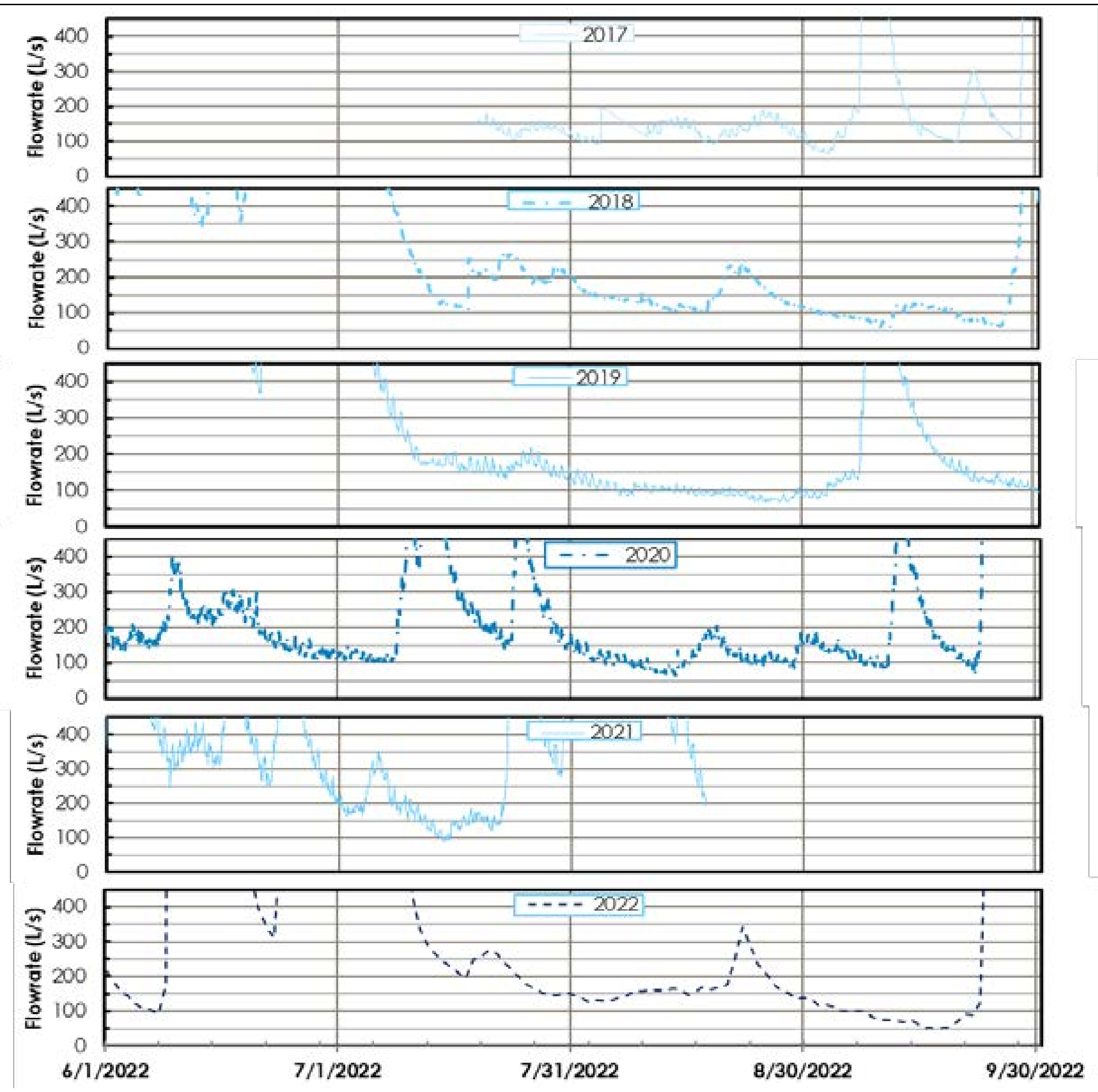
<tr><td></td><td>

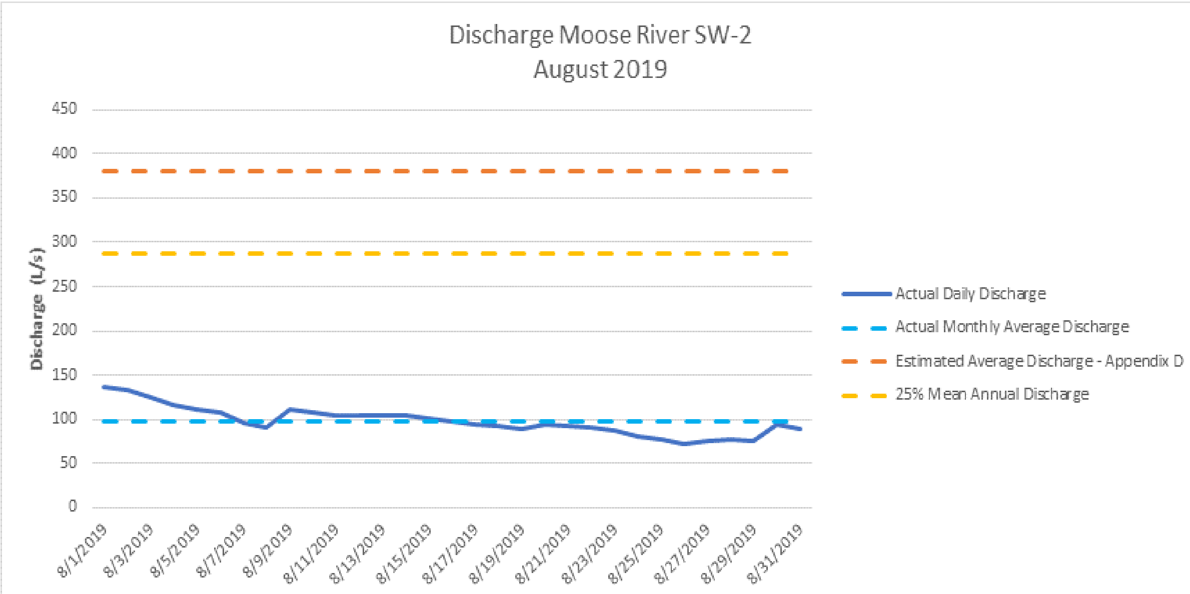
Figure 1 – Observed Flows at SW-2</td></tr>
<tr><td>5</td><td>

DFO Comment: The email below indicates that 25% Mean Annual Flow (MAF) statistic was used in the updated Assimilative Capacity Study. In the EARD Addendum, AMNS estimated the MAF at SW-2 to be 1,150 L/s. Therefore, 25% MAF is equal to 287.5 L/s.

Stantec Response: The EARD assimilative capacity addendum, the MAF was rounded down to 1,150 L/s and the assimilative capacity memo the MAF was rounded up. This inconsistency results in a negligible change in dilution ratio of effluent to receiver flow from 77 to 76. The results of the assimilative capacity study do not change.

</td></tr>
</table>

Reference: Addendum # 1 - Touquoy Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge Revision 2

6	**DFO Comment:** The 25% MAF value is 2-3 times greater than the average flows measured at SW-2 in August 2019 and August 2020. Therefore, 25% MAF does not represent a conservative low flow scenario for Moose River at SW-2. To further illustrate this point, Figure 1 below compares the flows used in the Assimilative Capacity Study (25% MAF, estimated monthly average) to the actual measured flows from the SW-2 monitoring data for August 2019.  **Stantec Response:** As observed flows are lower than the 25% MAF condition, the 7-day low was assessed in this study as described in the next section.
7	**DFO Comment:** DFO recommends using additional flow statistics in the Assimilative Capacity Study to better predict water quality during real-world low flow conditions, including: a. 7-day low flow from the SW-2 hydrometric monitoring data, 2017-present (i.e., the lowest running 7-day average flow at SW-2 for the period). This represents real-world low flow conditions that have been observed in Moose River since the project commenced. b. 7-day, 10-year low flow (7Q10) at SW-2 estimated from long-term datasets from nearby gauged rivers (i.e., the lowest running 7-day average flow predicted at SW-2 with an average recurrence interval of 10 years). This represents a reasonable conservative scenario for low flow conditions. **Stantec Response:** As described in the assimilative capacity study, regional relationships were developed using selected Water Survey of Canada (WSC) stations to transpose flow data to the Touquoy Mine Site in the absence of long-term local hydrologic records. The WSC stations that were selected were assumed homogeneous due to similar climate and physiographic conditions. a) 7-Day Q10 Observed Moose River flows The 7-day moving average was calculated for the available observed (open water) flow between June 1 and September 30 at SW-2. A statistical analysis was run on the 7-day low flow for each year using US Army Corp of Engineers HEC-SSP statistical software package. The six years of data were fit to the log-logistics distribution to calculate the 10-year annual exceedance probability low flow. The 7-day Q10- flow of 61 L/s was calculated, which corresponds to the minimum 7-day average flow with a recurrence period of 10 years.

	The 7-day Q10 low flow condition is primarily driven by base flow into Moose River. Based on a review of climate data at the Halifax station, the net precipitation (i.e. precipitation less evaporative losses in the pit) is zero over the 7-day low flow period. Under these conditions the pit lake would be expected to evaporate at a rate exceeding inflow. Therefore, as effluent discharge from the pit lake is driven by meteorological conditions there is no effluent discharge from the pit expected during this period. In addition, groundwater seepage flows of 2.0E-5 L/s from the open pit have been accounted for but have been estimated to contribute a negligible amount of flow to the Moose River during the 7Q10 period. However, as requested by DFO to provide an assessment of assimilative capacity under observed summer flows and 7Q10 estimated flows of 70 L/s, the discharge from the pit lake was prorated to the area of the Moose River watershed. At SW-2 the Moose River watershed is 39.03 km^2 and the area of the pit lake watershed is 0.513 km^2, resulting is an areal proration of 76:1. The same areal proration was applied to the estimated 7Q10 flow of 61 L/s to estimate pit lake discharge of 0.8 L/s. This 7-Day Q10 ecological flow scenario results in a similar dilution factor as the 25% MAF scenario of 77 presented in the assimilative capacity study. Under the 7-Day Q10 scenario, because of the similar dilution ratio the water quality modelling results also are consistent with the 25% MAF flow conditions. Therefore, water quality at the end of the mixing zone still meets WQCC, baseline or Site-specific water quality criteria for Arsenic. When the baseline concentration is at or near a water quality compliance criterion, returning to baseline conditions through dilution of point source concentrations within the identified mixing zone is unattainable. Site specific water quality criteria are derived to protect important aquatic life based on the assessment of toxicity data and the application of a species sensitivity distribution type assessment approach. b) 7-Day Q10 Regional Regression Relationship The 7-day Q10 ecological flow statistic (Figure 2), for Moose River at SW-2 (drainage area of 39.03 km^2) was derived using the regional relationships for low flow months. This flow metric was recommended by DFO in email correspondence dated December 1, 2022 (see DFO comment No., below). As expected, this ecological flow statistic results in a lower flow than the June Q60 that is used in the DFO Guidelines for the design of fish passage for culverts in Nova Scotia (2015) or the 25% MAF that is outlined in the Department of Fisheries and Oceans Canada (DFO 2012). Applying the regional regression relationship 7-Day Q10 to the watershed area at SW-2 is 12.3 L/s. This flow metric results in a lower flow than any other assessed flow metric and lower than observed flow in Moose River since commencement of hydrometric monitoring in 2017.

Reference: Addendum # 1 - Touquoy Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge Revision 2

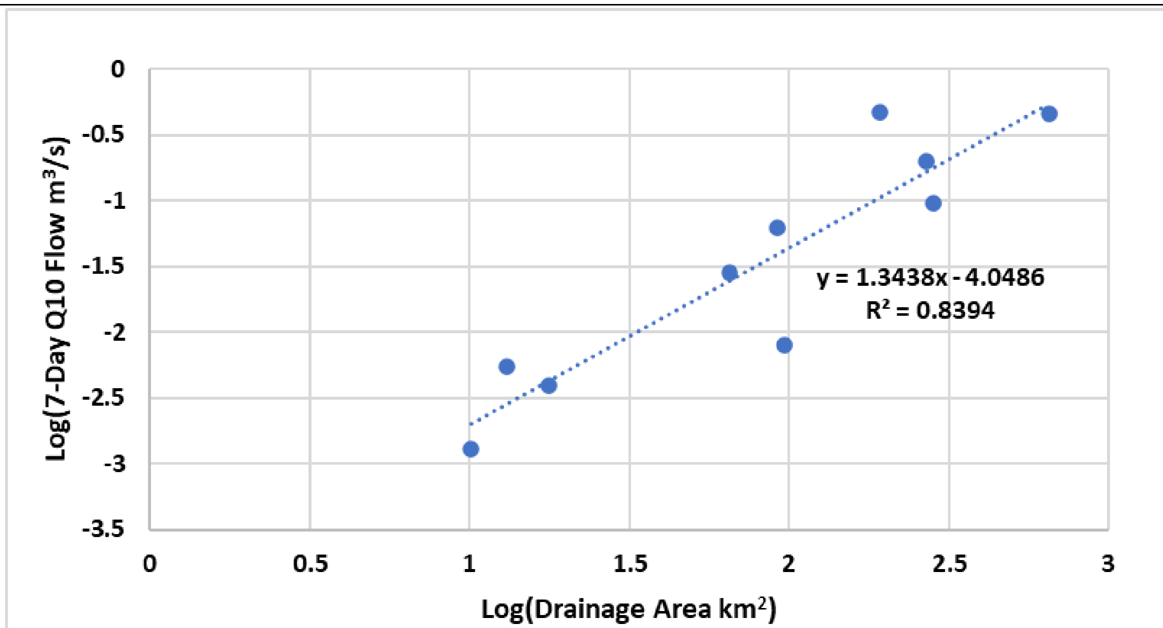


Figure Regional Regression Analysis – 7Q10

The goodness of fit of the of the regional regression relationship of the annual 7-day low flow to drainage area is lower than the mean annual flow statistic. Low flows in the range show more variability as these low flow conditions are more sensitive due to hydraulic controls in the river and groundwater seepage/baseflow augmentation. A large portion of Moose River watersheds is from the Long Lake tributary. This tributary is hydraulicly controlled by a remnant dam/existing beaver dam which provides flow attenuation to the downstream Moose River during low flow conditions.

The regional regression relationship 7-day Q10 low flow statistic is significantly lower than the 7-day Q10 low flow statics based on the six years of observed data. Although the period of record of Moose River flow observations is a fewer than the regional regression analysis method, it is likely to be more representative of the site and Q10 flow conditions. Notwithstanding the above, when the Moose River is flowing at 12.3 L/s, the pit lake would not be discharging, in which case we would revert to a simple areal proration to simulate a pit lake discharge of 76:1 as described above and yielding a dilution factor of 76.

8 The email below incorrectly states that the DFO Ecological Flow Requirements Framework uses 25% MAF. Please refer to the DFO Framework and the Department's August 2021 and March 2022 comments for the correct guidelines and associated advice regarding the interpretation and application of the Framework.

Stantec Response:

Please see excerpt above from the DFO Ecological Flow Requirements Framework reference to use of 25%MAF in Atlantic provinces of Canada.

As described in response no. 1, the 7-day Q10 ecological flow metric was evaluated as part of this addendum. Because assimilative capacity in the river is lowest under those low flow conditions this scenario will produce the most conservative results, although these modelled conditions are not expected to occur, Moose River has sufficient assimilative capacity to meet the WQCC, background concentration or Site-specific water quality criteria at the end of the mixing zone.

REFERENCES

Fisheries and Oceans Canada. 2013. Framework for assessing the ecological flow requirements to support fish in Canada. Published by the Canadian Science Advisory Secretariat. Science advisory report 2013/017 Website: file:///C:/Users/rljones/Pictures/Framework_For_Assessing_Ecological_Flows.pdf

Linnansaari, T., Monk, W.A., Baird, D.J, and Curry, R.A. 2013. Review of approaches and methods to assess Environmental Flows across Canada and Internationally. Prepared for Fisheries and Oceans Canada. 1 Canadian Rivers Institute, University of New Brunswick, Department of Biology, P.O. Box 4400, Fredericton, New Brunswick, E3B 5A3 2 Environment Canada, Canadian Rivers Institute, University of New Brunswick, Department of Biology, P.O. Box 4400, Fredericton, New Brunswick. Published by the Canadian Science Advisory Secretariat. Research Document 2012/039. Website: https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/348885.pdf

Stantec 2022. Touquoy Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge. Final Report, Revision 2.

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Attachment 8

Assimilative Capacity Study of Watercourse No. 4

Touquoy Gold Project Assimilative Capacity Study of Watercourse 4 – TMF and WRSA Seepage

Final Report

December 20, 2022

Prepared for:

Atlantic Mining NS Inc.
409 Billybell Way, Mooseland
Middle Musquodoboit, NS B0X 1N0

Prepared by:

Stantec Consulting Ltd.
300W-675 Cochrane Drive
Markham, ON L3R 0B8

File: 121619250

Revision: 3

TOUQUOY GOLD PROJECT ASSIMILATIVE CAPACITY STUDY OF WATERCOURSE 4 – TMF AND WRSA SEEPAGE

This document entitled Touquoy Gold Project Assimilative Capacity Study of Watercourse 4 – TMF and WRSA Seepage was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of Atlantic Mining NS Inc. (the “Client”) to support the regulatory review process for its Environmental Assessment (the “Application”) for the Touquoy Gold Site Modifications (the “Project”). In connection therewith, this document may be reviewed and used by the Nova Scotia Environment and Climate Change participating in the review process in the normal course of its duties. Except as set forth in the previous sentence, any reliance on this document by any other party or use of it for any other purpose is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The information and conclusions in the document are based on the conditions existing at the time the document was published and does not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by the Client or others, unless expressly stated otherwise in the document. Any use which another party makes of this document is the responsibility and risk of such party. Such party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other party as a result of decisions made or actions taken based on this document.

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Prepared by Rachel Jones
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LIST OF APPENDICES

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Atlantic Mining NS Inc. (AMNS) to conduct an assimilative capacity study of Watercourse 4 (WC4) for runoff from Waste Rock Storage Area (WRSA), seepage from the Tailings Management Facility (TMF) and seepage from WRSA of the Touquoy Gold Project. The Touquoy Gold Mine is located in Halifax County, Nova Scotia, approximately 60 kilometres northeast of Halifax.

The objective of the assimilative capacity study is to define parameters of potential concern (PoPC) for the WRSA and TMF seepage and WRSA runoff, characterize the mixing zone and predict PoPC concentrations in WC4. This assimilative capacity study was conducted in response to an information requirement of the May 12 Minister's Letter on the Touquoy Gold Project Modifications Environmental Assessment Registration Document (NSE 2022). The Minister's letter requested to:

"Complete an assimilative capacity study of Watercourse #4 that will be protective of fish and fish habitat. Incorporate Fisheries and Oceans Canada recommendations to determine summer flow conditions".

2.0 PROJECT DESCRIPTION

The Touquoy Mine Site in Halifax County, Nova Scotia comprises an area approximately 271 hectares (ha). Site areas associated with major project components include the Mill Facility, Open Pit, TMF, WRSA, Clay Borrow Area, and ancillary facilities. The Open Pit is located between Moose River on the west and Watercourse # 4 (WC4) on the east that each flow north to south adjacent to the limits of the Open Pit.

The existing Open Pit is actively dewatered and pumped to the TMF. Water in the TMF is decanted to the effluent treatment plant for treatment. To continue operation of the mill during the permitting phase of the waste rock expansion and the 2.5 m TMF raise, approximately 2.5 million tonnes of waste rock was end dumped in the pit at the lowest pit elevations.

The expansion of the WRSA is expected to increase the area of the existing WRSA by approximately 6.3 ha, affecting existing watershed areas, and associated surface water quantity. Of the 6.3 ha expansion, 1.2 ha is located within the catchment area draining the Fish River headwaters of Square Lake and. 5.1 ha is located within the catchment area of Watercourse #4. Runoff associated with the WRSA is considered to be mine-contact water and has the potential to contain increased TSS, nutrients and possible contaminants of potential concern.

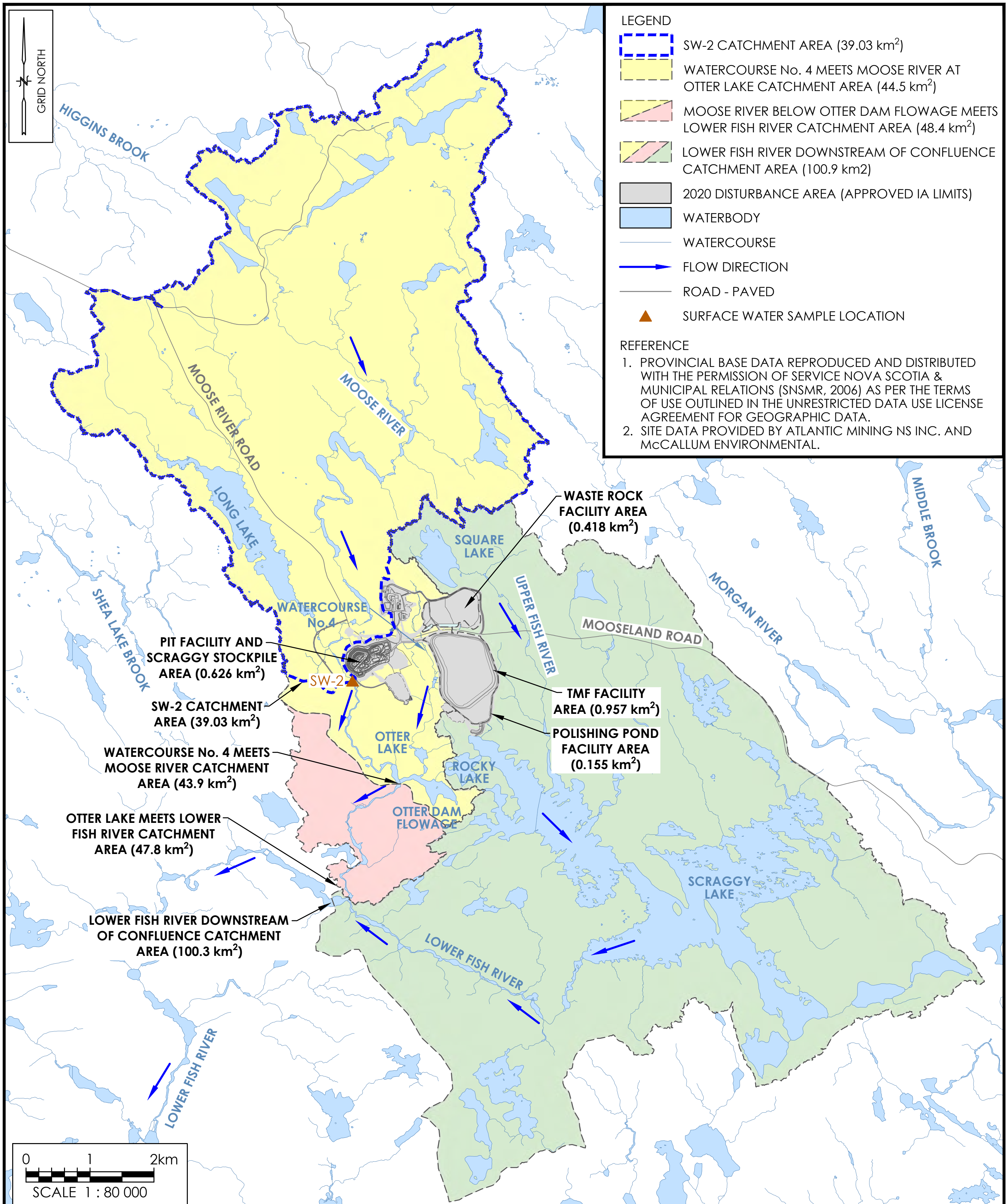
Expansion of the Clay Borrow Area will increase the existing site from approximately 7.6 ha to 13.5 ha and will alter the topography and vegetative cover of the drainage area associated with Watercourse #4, potentially resulting in a reduction of surface water quantity to the watercourse. All the Clay Borrow Area expansion is within the boundaries of Watercourse #4. Runoff generated over the exposed clay has the potential to contain elevated TSS, aluminum and other parameters associated with clay soil and could affect the water quality of Watercourse #4.

A new WRSA sedimentation pond and treatment system is proposed to mitigate both the WRSA expansion (5.1 ha) and the Clay Borrow Area expansion (7.8 ha). The operational goals of the new sedimentation pond for the WRSA would be to collect and treat the runoff. The runoff would then be drained by gravity to a location on Watercourse #4 as upstream of Mooseland Road as possible. The pond would be designed as a wet pond with permanent pool and active flood storage for larger storm and melt events. It is expected that treated effluent from the new sedimentation pond for the WRSA will meet the CCME FAL or criteria presented in Appendix K of the IA No. 2012-084244-15.

Figure 2.1 presents the catchment areas of Moose River, Otter Lake, and Upper Fish River. Figure 2.2 shows the site plant with the TMF, WRSA, WC4, and surface water monitoring stations.

Figure 2.3 presents a conceptual diagram of catchment areas and flow direction in the receivers. The locations where the mixing zone was assessed is also identified on Figure 2.3.

WC4 is a small second order stream that discharges into Moose River within the Lower Fish River watershed. WC4 consists of swift moving sections of water with small boulder and organic substrate along slow moving pond-like sections with organic/fine sediments and aquatic vegetation (Stantec 2021).



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CATCHMENT AREAS

ASSIMILIATIVE CAPACITY STUDY
TOUQUOY GOLD PROJECT
HALIFAX COUNTY, NOVA SCOTIA

Client: ATLANTIC MINING NS INC.

Job No.:	121619250
Scale:	1 : 80,000
Date:	2022 11 15
Dwn. By:	JL
App'd By:	RJ
Fig. No.:	2.1

Stantec

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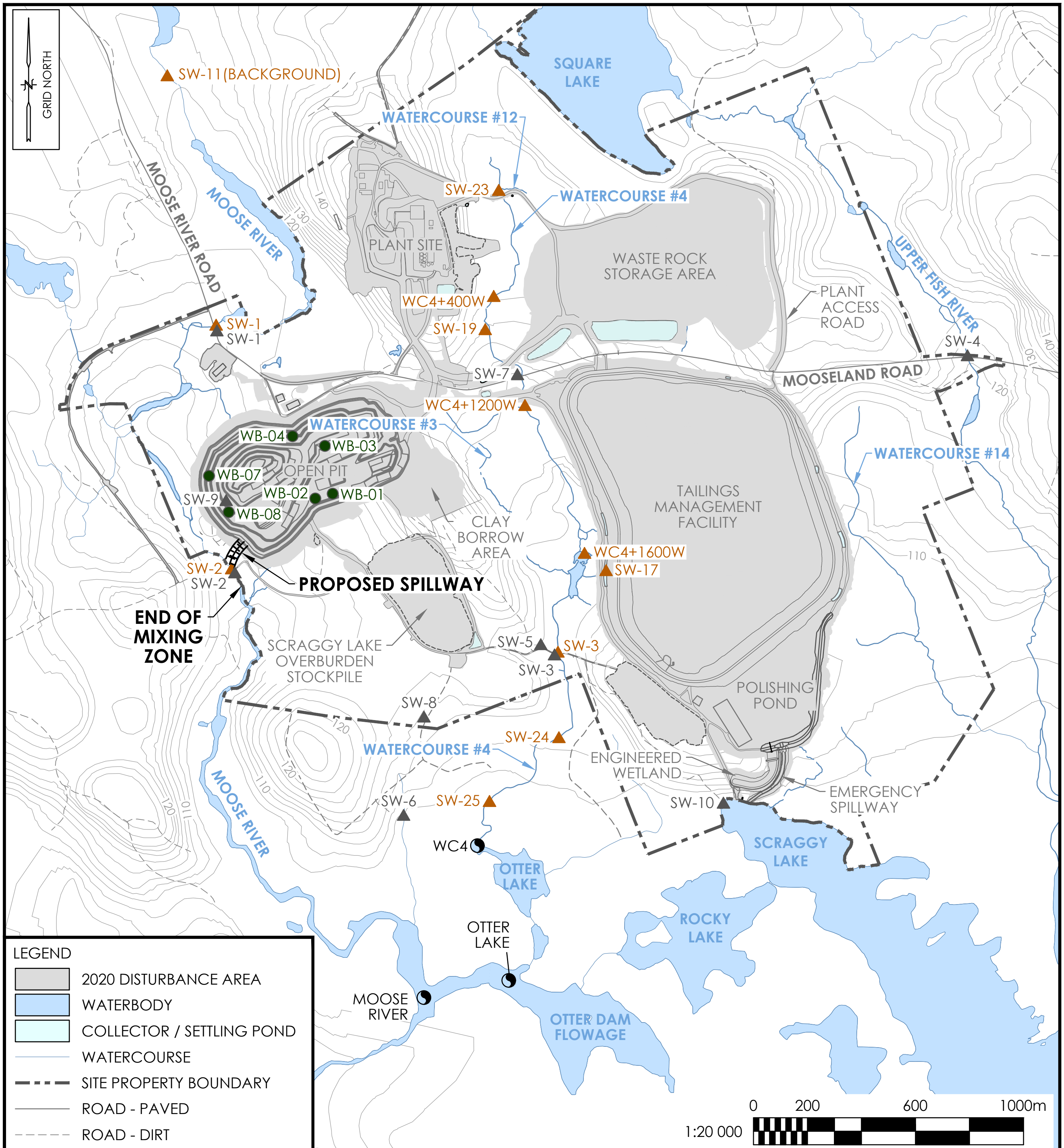

REFERENCE
1. PROVINCIAL BASE DATA REPRODUCED AND DISTRIBUTED WITH THE PERMISSION OF SERVICE NOVA SCOTIA & MUNICIPAL RELATIONS (SNSMR, 2006) AS PER THE TERMS OF USE OUTLINED IN THE UNRESTRICTED DATA USE LICENSE AGREEMENT FOR GEOGRAPHIC DATA.
2. SITE DATA PROVIDED BY ATLANTIC MINING NS INC. AND McCALLUM ENVIRONMENTAL.

THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO AN ATLANTIC GOLD CORPORATION MEMO AND MUST NOT BE USED FOR OTHER PURPOSES.

SITE PLAN
ASSIMILIATIVE CAPACITY STUDY
TOUQUOY GOLD PROJECT
HALIFAX COUNTY, NOVA SCOTIA

Client:	ATLANTIC MINING NS INC.
Job No.:	121619250
Scale:	1 : 20,000
Date:	2022 10 28
Dwn. By:	JL
App'd By:	RJ
Fig. No.:	2.2

Stantec

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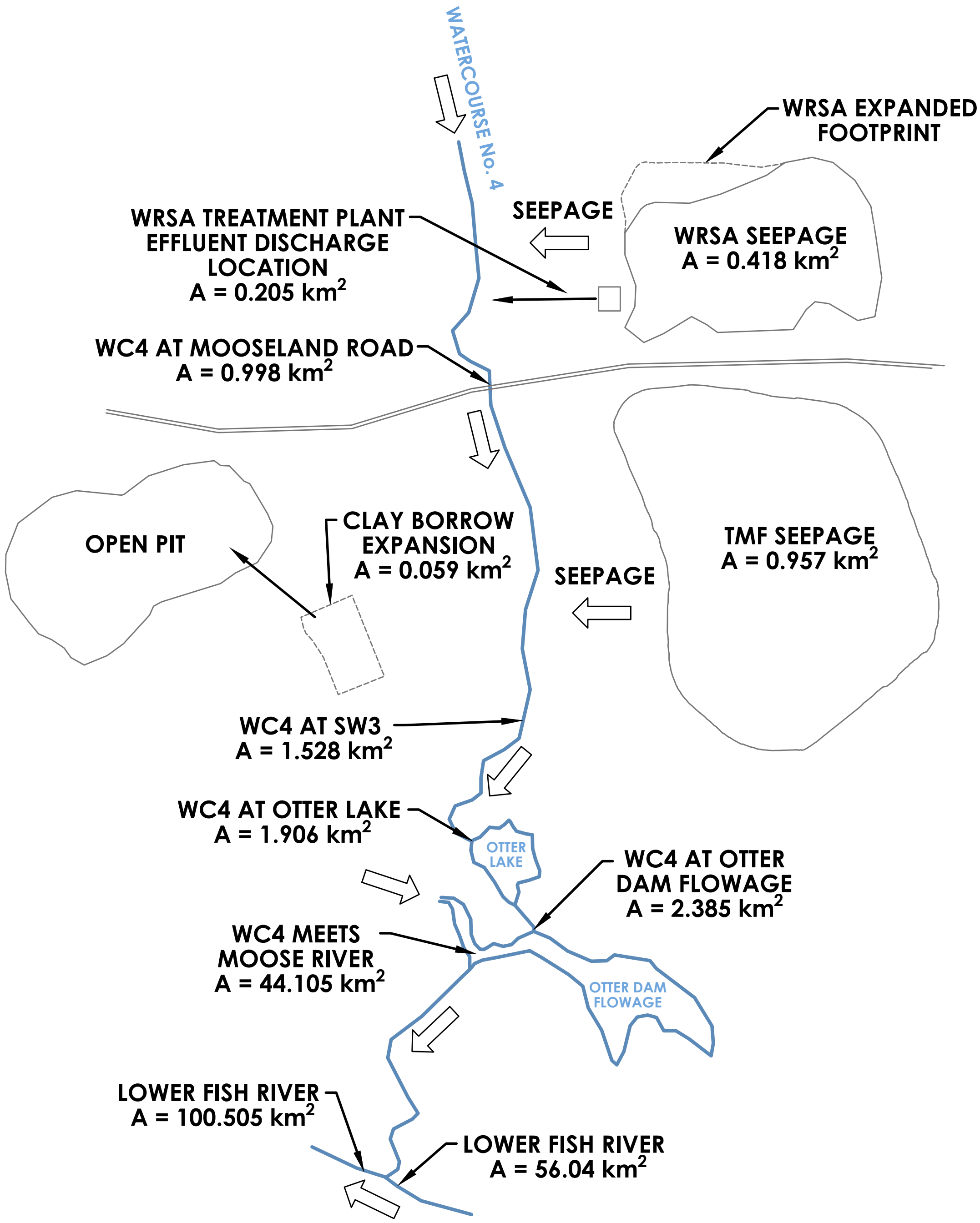

THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO AN ATLANTIC GOLD CORPORATION MEMO AND MUST NOT BE USED FOR OTHER PURPOSES.

SCHEMATIC FLOW DIAGRAM

ASSIMILIATIVE CAPACITY STUDY
TOUQUOY GOLD PROJECT
HALIFAX COUNTY, NOVA SCOTIA

Client: ATLANTIC MINING NS INC.

Job No.:	121619250
Scale:	N.T.S.
Date:	2022 12 16
Dwn. By:	JL
App'd By:	RJ

Fig. No.: 2.3

Stantec

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3.0 REGULATORY FRAMEWORK

The Touquoy Gold Project is subject to provincial and federal water quality guidelines. Provincially, the mine is currently subject to Approval No. 2012-084244-14 (the IA) issued under the Nova Scotia *Environment Act, S.N.S. 1994-95, c.1 s.1 on April 7, 2022*. Federally, effluent discharge from the Open Pit is regulated by the *Metal and Diamond Mining Effluent Regulations* (MDMER).

As the proposed Project uses federal *Fisheries Act* promulgated and authorized effluent limits, seepage from the WRSA and TMF will not be acutely toxic. The proposed MDMER criteria protect fish and fish habitat by:

- reducing risk to aquatic communities (DFO 2017),
- being based on modern and recent environmental effects monitoring,
- not being acutely toxic,
- not bio accumulative or persistent,
- requiring routine whole effluent acute toxicity testing,
- maintaining a mixing zone that is as small as reasonably practical,
- not overlapping with upstream or downstream mixing zones, and
- if receiving water criteria defining the downstream mixing zone extent are exceeded at MDMER effluent discharge limits, then the discharge limit will be reduced to meet this downstream receiving water criteria.

Under MDMER, the maximum authorized monthly mean concentrations for effluent water quality for existing mines effective June 1, 2021 are presented in Table 3.1, and are based on those presented in Schedule 4 - Table 2 of the MDMER regulation. Wastewater treatment will be required for parameters that are predicted to exceed the MDMER limits in the effluent.

Table 3.1 MDMER Limits for Mine Effluent after June 1, 2021

Parameter	MDMER, Table 2, Schedule 4
Arsenic	0.3 mg/L
Copper	0.3 mg/L
Cyanide	0.5 mg/L
Lead	0.1 mg/L
Nickel	0.5 mg/L
Zinc	0.5 mg/L
Suspended Solids	15.0 mg/L
Radium 226	0.37 Bq/L
Un-ionized ammonia (as N)	0.5 mg/L

Note: The concentrations for metals and cyanide are total values.

The current Industrial Approval (IA) (2012-084244-15) provides specific criteria for the evaluation of water quality at surface water monitoring stations and groundwater wells in Appendix K of the IA. The criteria provided in Appendix K of the IA are used as provincial criteria in this report. The criteria are referred to by several terms in the IA including "limits" however, for consistency will be referred to herein as water quality compliance criteria (WQCC). WQCC are based on the more stringent values from the CCME freshwater aquatic life guidelines, Nova Scotia Environmental Quality Guidelines, and the government of British Columbia ambient water quality guidelines for sulphate.

However, in the case of this assimilative capacity assessment for WC4 both, a point and no point source effluent discharge is predicted. The mine source is seepage from the existing WRSA and TMF and runoff from WRSA. MDMER defines effluent as an effluent from a mine facility or component and "any seepage or surface runoff containing any deleterious substance that flows over, through or out of the mine." Thus, as MDMER views mine seepage as a form of "effluent" the same water quality criteria applicable to effluent (i.e., non-persistent, non-bio-accumulative, non-toxic, and not exceeding MDMER limits) was applied to mine component seepage at the point that seepage discharges to the receiving waterbody. Predicted in the groundwater model seepage water quality from the TMF and WRSA was used in the assessment, predicted concentrations are below MDMER (Stantec 2022). Predicted treated effluent from the new sedimentation pond for the WRSA will meet the CCME FAL or criteria presented in Appendix K of the IA No. 2012-084244-15.

The Canadian Council of Ministers of the Environment (CCME) Guidance on the Site-Specific Application of water quality guidelines in Canada: Procedures for deriving numerical water quality objectives (CCME 2003) was used in this study. The key steps outlined in the CCME guidance are as follows:

1. Identifying chemical parameters of potential concern (PoPC) in the TMF and WRSA seepage. Parameters of potential concern are defined as those which exceed the applicable regulatory limits in the WRSA and TMF seepage.
2. Establishing appropriate (i.e., freshwater) ambient WQCC for receiving waters. The WQCC for this study were based on the Nova Scotia Environment and Climate Change (NSECC) criteria provided in Table 6 of Appendix K of the Industrial Approval for the site (Approval 2012-084244-14), which are derived from the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 2021).
3. If the background concentration of a PoPC in the receiving environment is higher than the WQCC on which the discharge criteria is established, the discharge criteria should not be more stringent than the natural background concentration.
4. Determining the areal extent of the initial mixing zone (IMZ) in the area of the outfall in the receiving water. CCME (2003) mixing zones as areas where the effluent mixes with ambient water and where concentrations of some substances may not comply with water quality guidelines or objectives.
5. Developing use-protection-based effluent discharge criteria which will meet ambient concentrations or the WQCC at the edge of the mixing zone (through modelling and other methods).

As per Chapter 6 of CCME (2003a) the conditions within a mixing zone should not result in the bioaccumulation of chemicals (e.g., metals) to levels that are harmful or toxic. Effluents should not contain persistent or toxic constituents. Considerations of the mixing zone selection are summarized in Appendix A.

4.0 RECEIVING WATER HYDROLOGY

The WRSA runoff and WRSA and TMF seepage reach WC4, which outflows to Otter Lake and then reaches Moose River downstream of SW-2 (Figure 2.2). The WC4 catchment area at Otter Lake is 1.9 square kilometres (km^2), Otter Dam Flowage catchment is 2.385 km^2 and Moose River catchment upstream of Otter Lake is 39.4 km^2. No long-term hydrometric stations exist on Moose River around the Touquoy Mine Site.

4.1 REGIONAL REGRESSION ANALYSIS METHODOLOGY

In the absence of long-term local hydrologic records, regional relationships were developed using selected Water Survey of Canada (WSC) stations to transpose flow data to the Touquoy Mine Site. The WSC stations were selected based on criteria including catchment area, station location, and period of record. Transpositional scaling is based on the assumption of homogeneity (due to their proximity and similar climate and land use conditions) between the selected regional WSC stations.

The regional regression method is limited to gauged stations in areas of hydrologic homogeneity where the landscape is subject to similar climate, and physiographic conditions. There are limited gauging station datasets available in Nova Scotia near the site that meet the primary selection criteria (e.g., catchment area, distance to Touquoy Mine Site). The WSC stations selected for the regional hydrology assessment are summarized in Table 4.1.

Table 4.1 WSC Regional Hydrology Stations

Station ID	Station Name	Drainage Area (km^2)	Years of Record	Record Period	Site Proximity (km)	Climate Normal Prec. (mm)
01DH003	Fraser Brook Near Archibald	10.1	26	1965-1990	45	1357.6
01EJ004	Little Sackville River at Middle Sackville	13.1	39	1980-2018	65	1513.2
01EE005	Moose Pit Brook at Tupper Lake	17.7	39	1981-2019	192	1455.0
01EH006	Canaan River at Outlet of Connaught Lake	65.4	11	1986-1996	107	1359.1
01DP004	Middle River of Pictou at Rocklin	92.2	54	1965-2018	58	1232.2

Table 4.1 WSC Regional Hydrology Stations

Station ID	Station Name	Drainage Area (km^2)	Years of Record	Record Period	Site Proximity (km)	Climate Normal Prec. (mm)
01DG003	Beaverbank River Near Kinsac	96.9	98	1921-2018	60	1396.2
01FA001	River Inhabitants at Glenora	193	55	1965-2019	150	1440.5
01ED013	Shelburne River at Pollard's Falls Bridge	268	21	1999-2019	202	1486.2
01EO003	East River St. Mary’s at Newtown	282	15	1965-1979	75	1315.1
01EK001	Musquodoboit River at Crawford Falls	650	82	1915-1996	27	1396.2

Validation of the regional hydrology dataset is presented in Appendix B. It was concluded that, despite some variance among stations the regional hydrologic dataset of the ten stations presented in Table 4.1 used in the regional regression demonstrates more hydrologic homogeneity than heterogeneity and thus is considered acceptable for inclusion in the regional hydrology dataset grouping.

4.2 RESULTS OF THE REGIONAL REGRESSION ANALYSIS

Average monthly flows at various locations of WC4 and Moose River were derived using the regional relationships. A regression relationship was also derived for the 25% MAF, the environmental flow metric that is outlined in the Department of Fisheries and Oceans Canada (Linnansaari et al, 2012). Also, the June Q60 statistics from the DFO Guidelines for the design of fish passage for culverts in Nova Scotia (2015) was used. The 25% MAF low flow statistic results in a lower environmental flow than the June Q60 and thus 25% MAF was the governing low flow statistic applied in this study.

Figure 4.1 presents the regression analysis completed to determine the relationship between catchment areas and average flow in July, August, September, and the 25% MAF and June Q60 for the selected WSC stations. Summer months typically correspond to the lowest flows therefore they were analysed in this study.

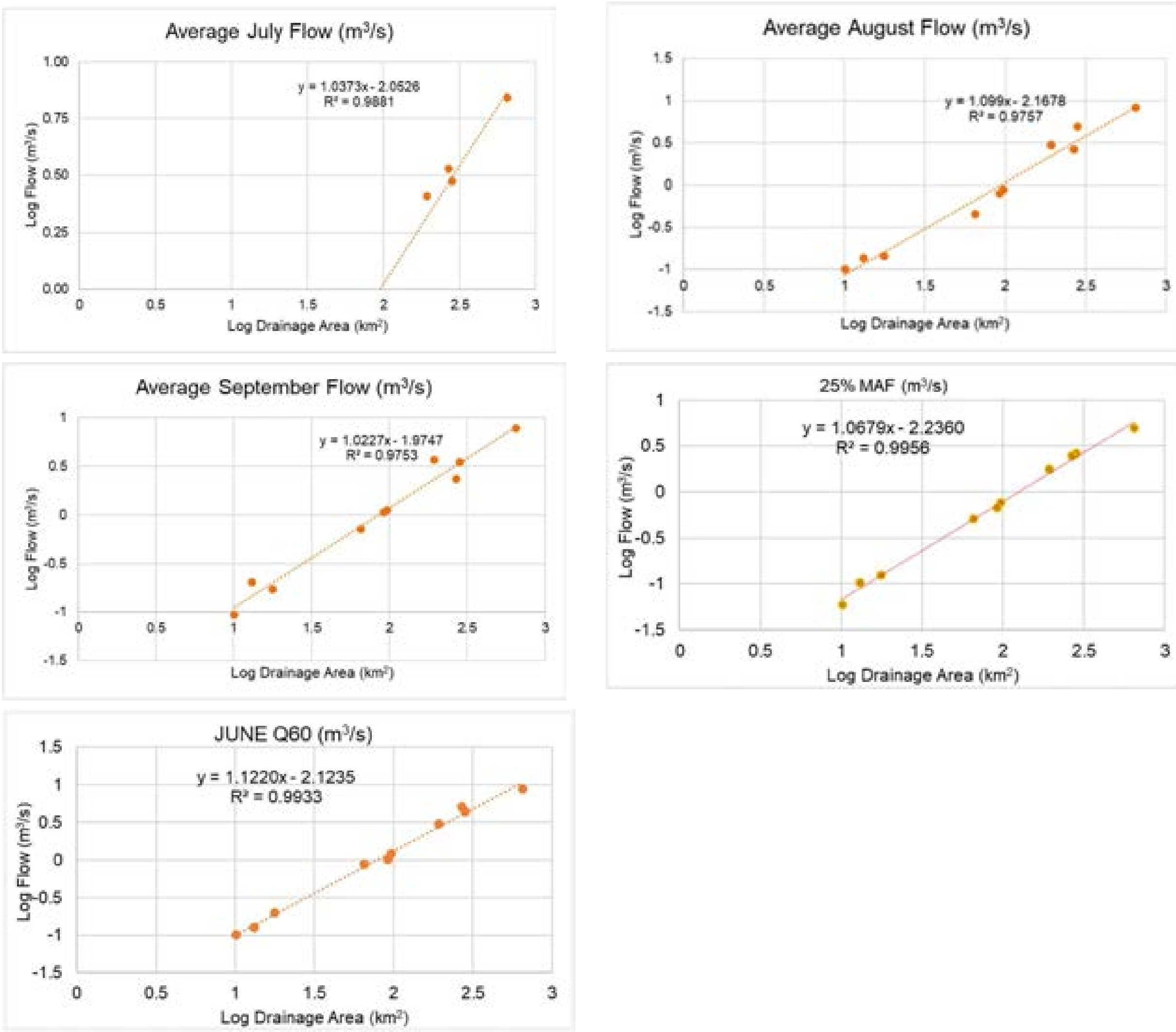

Figure 4.1 Regional Regression Analysis

As presented on Figure 4.1, strong linear trends exist between the average monthly flow rates of the selected monitoring stations and drainage area for July, August, and September with correlation coefficients (R^2) of 0.988, 0.976, and 0.975, respectively. From these regional relationships, the average monthly flows were estimated for WC4 and Moose River. Results of the statistical analysis on the regional flow records indicated that generally the lowest monthly flow events occur in August.

The 25% MAF low flow and June Q60 were plotted against the drainage area for each station to determine a regression relationship between the stations. As shown in Figure 4.1, the *R* squared coefficient of determination is 0.996 and 0.993, respectfully, showing a strong relationship of the MAF and June Q60 and drainage area between stations.

5.0 RECEIVING WATER QUALITY

Surface water has been monitored in watercourses and waterbodies in proximity to the Touquoy Mine Site during the initial environmental assessment conducted between September 2004 and February 2007 to document baseline conditions. Surface water quality monitoring resumed in 2016 to capture a broader surface water network during pre-construction activities. Surface water monitoring locations are presented in Figure 2.2.

For the purpose of this Assimilative Capacity study, water quality data observed in 2004-2007 at station SW-3 was used as baseline conditions for WC4 and Otter Lake. SW-3 is located on WC4 and it represents un-impacted conditions of WC4.

Water quality data from other stations on WC4 were not used their data are limited and not representative of baseline conditions. For example, SW-23 has some limited data for 2017 and SW-19 has limited data for 2016-2017.

Baseline water quality data at SW-3 are summarized in Table 5.1. Baseline concentrations of aluminum and iron are elevated with respect to IA receiving water quality compliance criteria with other parameters ranging below IA receiving water quality compliance criteria. No baseline parameters exceed MDMER Schedule 4 Table 2 effluent limits. The 75th percentile concentration is a statistic representing poorer than mean water quality and will be used in this Assimilative Capacity Study to represent water baseline quality in WC4. The 75th percentile is commonly used to represent the background water quality to establish receiving water based effluent requirements for point source discharges to surface waterbodies (OMNR 2021). The 95th percentile is also presented as per the IA Condition 7.Ah, this statistic is more sensitive to the natural variability of the data, extreme events, and the potential outliers or laboratory/sampling errors. Baseline data is summarized in Appendix C.

Table 5.1 Baseline Water Quality at SW-3

Water Quality Parameter	SW-3 (2004-2007)			IA Water Quality Compliance Criteria mg/L
	Average Con. mg/L	75th Percentile Conc. mg/L	95th Percentile Conc. mg/L	
Total Aluminum	**0.187**	**0.231**	**0.375**	0.005 (pH < 6.5) [0.005 (if pH is < 6.5); 0.10 (if pH is ≥6.5)]
Total Arsenic	0.0027	0.0029	0.0035	0.005
Total Cadmium	0.00002	0.00003	0.00004	0.00004 (Hardness < 17 mg/L) [0.04 (if Hardness is < 17 mg/L); 10{0.83(log[hardness]) – 2.46} (if Hardness is ≥17 mg/L to ≤280 mg/L)]
Total Cobalt	0.00062	0.0007	0.0009	0.010
Total Chromium	<0.002	<0.002	<0.002	-

Table 5.1 Baseline Water Quality at SW-3

Water Quality Parameter	SW-3 (2004-2007)			IA Water Quality Compliance Criteria mg/L
	Average Con. mg/L	75th Percentile Conc. mg/L	95th Percentile Conc. mg/L	
Total Copper	<0.002	<0.002	<0.002	0.002 (Hardness < 17 mg/L) [2 (if Hardness is <82 mg/L); 0.2 * e{0.8545[ln(hardness)]-1.465} (if Hardness is ≥82 mg/L to ≤180 mg/L), 4 (if Hardness is >180 mg/L)]
Total Iron	0.248	0.288	**0.461**	0.3
Total Lead	<0.00067	<0.00076	0.00093	0.001 (Hardness < 60 mg/L) [1 (if Hardness is ≤60 mg/L); e{1.273[ln(hardness)]-4.705} (if Hardness is >60 mg/L to ≤180 mg/L)]
Total Mercury	<0.00001	<0.00001	<0.00001	0.000026
Total Manganese	0.055	0.068	0.114	0.82
Total Molybdenum	<0.002	<0.002	<0.002	0.073
Total Nickel	<0.002	<0.002	<0.002	0.025 (Hardness is < 60 mg/L) [25 (if Hardness is ≤60 mg/L); e{0.76[ln(hardness)]+1.06} (if Hardness is >60 mg/L to ≤180 mg/L); 150 (if Hardness is >180 mg/L)]
Total Tin	<0.002	<0.002	<0.002	-
Total Selenium	<0.001	<0.001	<0.001	0.001
Total Silver	<0.0001	<0.0001	<0.0001	0.0001
Dissolved Sulphate*	<2	<2	<2	128 (hardness is < 30 mg/L) [128 mg/L for Hardness 0-30 mg/L, 218 mg/L for 31-75 mg/L, 309 for 76-180 mg/L, 429 mg/L for > 181 mg/L]
Total Thallium	<0.0001	<0.0001	<0.0001	0.0008
Total Uranium	<0.0001	<0.0001	<0.0001	0.015
Total Zinc	0.012	0.001	0.005	$e^{\{0.947(\ln[hardness])-0.815(pH)+0.398(\ln[DOC]+1.625\}}$ (if Hardness is 23.4 to 399 mg/L, pH is 6.5 to 8.13, and DOC is 0.3 to 22.9 mg/L)
WAD Cyanide*	<0.003	<0.003	<0.003	0.005 (Free Form Cyanide)
Total Cyanide**	<0.001	<0.001	<0.001	-
Nitrate (as N)	0.09	0.09	0.12	13
Nitrite (as N)	<0.01	<0.01	<0.01	0.06
Ammonia (as N)	<0.05	<0.05	<0.05	-

Note: Bold values indicate exceedance of water quality compliance criteria, empty field indicates no water quality value.

* This parameter was not analyzed in baseline data at SW-3. To fill in statistical data gaps water quality results for SW-11 was used for this parameter

** The Total Cyanide guideline was compared to Strong Acid Dissociable Cyanide, as Total Cyanide was not an analyzed parameter in 2016/2017.

6.0 WATERCOURSE 4 INPUTS

Contact water inputs to watercourse 4 includes the proposed effluent discharge from the WRSA treatment plant ad sedimentation pond and basal seepage from the WRSA and TMF. These inputs are described in the following sections.

6.1 WRSA RUNOFF

A new WRSA sediment pond and treatment system designed for nitrate removal will be constructed to provide treatment for the portion of WRSA runoff returned to the watercourse.

The water quantity design goal of the new WRSA sedimentation pond is to replace anticipated flow losses to Watercourse #4 from the WRSA and Clay Borrow Area and to do so through hydrograph matching such that future instantaneous flows are maintained within 10% of existing flows. With the proposed expansion of the WRSA, approximately 21 ha of the western area of the WRSA (16 ha of existing and 5 ha of the expanded WRSA area) will be diverted to a newly constructed treatment system for sediment and nitrate removal before being gravity drained to Watercourse #4 in the headwater area upstream of Mooseland Road.

Effluent from the new WRSA sediment pond and treatment system supplementing flow in Watercourse #4 will meet CCME FAL or criteria presented in Appendix K of the IA No. 2012-084244-15. As guidelines are already achieved in the effluent this treated effluent discharge does not require a mixing zone.

6.2 SEEPAGE WATER QUANTITY AND QUALITY

Runoff from WRSA and shallow groundwater seepage will be captured in perimeter ditches and not predicted to reach WC4. The TMF has sufficient storage capacity to avoid overflow. The only predicted source of contact water reaching WC4 is deeper basal groundwater seepage from the TMF and WRSA.

The TMF and WRSA seepage rate to WC4 was simulated using a groundwater flow model (Stantec 2022). The average daily seepage rate from the TMF is 2.5 L/s and from the WRSA is 5.5 L/s. These seepage rates are representative of the mean annual flow conditions in WC4. Seepage rate from the WRSA accounts for the repair to the WRSA west perimeter ditch that was not constructed as design; a low permeable cut-off was installed to limit seepage to WC4. It is reasonable to expect that during dry conditions the seepage rates will be proportionally lower. Therefore, at the 25% MAF the average daily seepage rate from the TMF will be 0.63 L/s and from the WRSA will be 1.38 L/s.

Seepage water quality was predicted using the groundwater flow model (Stantec 2022). Results of the water quality modelling considered the pore water quality in the tailings, groundwater quality, dilution from surface runoff, direct precipitation, and process water surplus, and the geochemistry of the individual water quality parameters. Adsorption and chemical reactions that serve to attenuate contaminant transport were not evaluated in the groundwater model; therefore, the groundwater quality predictions are considered conservative.

Table 6.1 presents water quality predictions for the TMF and WRSA seepage.

Concentrations of aluminum, arsenic, copper, selenium, sulphate, nitrite, and nitrate are above the WQCC in the WRSA seepage. Concentrations of sulphate and nitrate are elevated above the WQCC in the TMF seepage. No exceedances of the MDMER discharge limits were predicted.

Table 6.1 Predicted Seepage Water Quality Parameters and Limits

Water Quality Parameter	Seepage		MDMER Limit mg/L	IA Water Quality Compliance Criteria mg/L
	WRSA mg/L	TMF mg/L		
Aluminum [1]	**0.0087**	0.0015	-	0.005 (pH < 6.5) [0.005 (if pH is < 6.5); 0.10 (if pH is ≥6.5)]
Total Arsenic	**0.032**	0.00089	0.3	0.005
Total Calcium	357	143	-	-
Total Cadmium	0.000023	0.000008	-	0.00004 (Hardness < 17 mg/L)
Total Cobalt	0.0052	0.0037	-	0.010
Total Chromium	0.0005	0.0001	-	-
Total Copper	**0.0021**	0.0004	0.3	0.002 (Hardness < 17 mg/L)
Total Iron	0.0015	0.001	-	0.3
Total Lead	0.00025	0.00001	0.1	0.001 (Hardness < 60 mg/L)
Total Magnesium	71.5	29.4	-	-
Total Manganese	0.256	0.0063	-	0.82
Total Molybdenum	0.002	0.0026	-	0.073
Total Nickel	0.015	0.0019	0.5	0.025 (Hardness is < 60 mg/L)
Total Tin	0.0022	0.00002	-	-
Total Selenium	**0.0014**	0.00038	-	0.001
Total Silver	0.00005	0.00005	-	0.0001
Dissolved Sulphate	**1,113**	**582**	-	128 (hardness is < 30 mg/L)
Total Thallium	0.000011	0.000005	-	0.0008
Total Uranium	0.011	0.003	-	0.015
Total Zinc	0.0052	0.001	0.5	$e^{\{0.947(\ln[\text{hardness}])-0.815(\text{pH})+0.398(\ln[\text{DOC}]+1.625\}}$
Total Cyanide	n/a	0.005	0.5	-
Nitrate (as N)	**25**	**25**	-	13
Nitrite (as N)	**0.2**	0.005	-	0.06
Ammonia (as N)	0.43	0.164	-	-

Note: Bold values indicate exceedance of water quality compliance criteria, empty field indicates no water quality value.

[1] Total Aluminum. The Criteria are for dissolved Aluminum.

7.0 ASSIMILATION RATIOS

Assimilation or dilution ratio analysis was conducted to find the worst-case month for dilution and mixing, i.e., the month with the lowest assimilative capacity. The worst-case conditions are observed during low flow conditions in WC4. Based on conducted regression analysis the lowest flows are observed in summer (June, July, August, and September). Additionally, the 25% MAF and June Q60 were assessed as described in Section 4.2.

Table 7.1 presents flow in WC4 and seepage rates from the TMF and WRSA. The minimum flow is observed in August, however, the 25% MAF flow has even lower flow. Therefore, the worst-case scenario in terms of flow is the 25% MAF. This flow scenario was used in the assimilative capacity assessment.

Table 7.1 Receiver Flows and Seepage Rates, L/s

	WC4 at Mooseland Rd	WC4 at SW-3	WC4 at Otter Lake	WC4 at Moose River	Moose River at WC4	WRSA Seepage	TMF Seepage	WRSA Runoff
June	9.7	17.2	22.8	30.5	900	2.93	1.37	2.12
July	7.0	11.8	15.4	20.2	461	2.11	0.95	1.71
August	5.3	9.2	12.2	16.2	447	1.60	0.74	1.19
September	8.4	14.1	18.2	23.9	521	2.54	1.13	2.10
June 60%	5.8	10.3	13.7	18.3	540	1.76	0.82	1.27
25% MAF	4.5	7.8	10.2	13.5	339	1.38	0.63	1.07
MAF	18.1	31.3	41.0	54.2	1,357	5.50	2.50	4.28

Table 7.2 presents the dilution ratios of the seepage and WRSA runoff in different receivers moving downstream from WC4 assuming full mixing. The dilution ratios were calculated as a ratio of total flow in the receiver to a sum of seepage and runoff. The WRSA runoff does not account for the operational constraints of the proposed effluent treatment plant or the attenuation of floods in the proposed sedimentation pond, thus providing a conservatively high estimate of the daily WRSA runoff to WC4.

Table 7.2 Dilution Ratio of Seepage and WRSA Runoff to Receiver Flow, times

	WC4 at Mooseland Rd	WC4 at SW-3	WC4 at Otter Lake	WC4 at Moose River	Moose River at WC4
25% MAF	2.9	3.6	4.3	5.4	113

8.0 MIXING ZONE STUDY

Seepage from the TMF and WRSA is a diffuse source which reaches WC4 over the distance of about 2 km. Seepage from the WRSA reaches WC4 along the creek reach ending at Mooseland Rd. WC4 at this reach has a trapezoidal shape with bottom width of about 1 m, approximate bank slopes are 2:1 (H:V) and average water depth is 0.1 m. The channel is rocky and shallow, it consists of rubble (70%), cobble, silt, and gravel.

Seepage from the TMF reaches WC4 along the creek reach ending at SW-3. WC4 at this reach has a trapezoidal shape with bottom width of about 1.5-2 m, steep banks of 1:3 (H:V) and average water depth of 0.15-0.2 m. The channel is rocky and shallow, it consists of rubble (70%), silt (20%), cobble, and gravel.

Modeling shows that WC4 is well mixed, with seepage that potentially reaches the watercourse fully mixing within a very short distance.

Concentrations of the parameters of potential concern at the end of each WC4 reach were calculated conservatively. The 75th percentile was used to define the receiving water quality conditions.

The focus of assessment was on seven PoPC with concentrations in the seepage predicted to exceed the WQCC presented by NSECC: aluminum, arsenic, copper, selenium, nitrate, nitrite, and sulphate. Mercury, which is a potentially persistent, bioaccumulative and inherently toxic (PBiT) substance above WQCC, in not a PoPC from seepage to WC4.

Concentrations of PoPC at various sections of WC4, for the worst-case conditions observed at the 25% MAF are presented in Table 8.1.

Table 8.1 Water Quality Modelling Results, mg/L

WQ Parameter	WRSA Seepage	TMF Seepage	WRSA Runoff	SW-3 Receiver, 75th Percentile	IA WQ Comp-liance Criteria	WC4 at Moose-land Rd	WC4 at SW-3	WC4 at Otter Lake	WC4 at Moose River
Aluminum[1,2]	**0.0087**	0.0015	0.005	**0.231**	0.005	**0.152**	**0.167**	**0.179**	**0.189**
Total Arsenic	**0.032**	0.00089	0.005	0.0029	0.005	**0.009**	**0.007**	**0.006**	0.005
Total Copper	0.0021	0.0004	0.002[1]	<0.002	0.002[1]	0.001	0.001	0.001	0.001
Total Selenium	0.0014	0.00038	0.001	<0.001	0.001	0.0008	0.0007	0.0006	0.0006
Nitrate (as N)	25	25	13	0.09	13	7.0	6.0	4.9	3.9
Nitrite (as N)	0.2	0.005	0.06	<0.01	0.06	0.05	0.04	0.03	0.02
Sulphate	**1,113**	**582**	128	<2	128	**241.48**	**188.2**	**154.3**	123.8

[1] pH< 6.5 and hardness < 17 mg/L, baseline water quality data at SW-3

[2] Criteria is dissolved aluminum the analysis was for Total Aluminum measured at SW-3

Aluminum is predicted to have lower concentrations in the seepage in comparison with the ambient background. Therefore, the predicted aluminum concentration in WC4 is slightly lower than background, but still above the WQCC (when ambient pH below 6.5), resulting in a slight improvement in ambient aluminum concentrations.

Predicted maximum concentration of arsenic in the WRSA seepage is 0.032 mg/L and in the TMF seepage is 0.00089 mg/L. Arsenic concentrations are decreasing along WC4 due to dilution and mixing and reaching the WQCC prior the watercourse outflow to Moose River.

Predicted maximum concentration of sulphate in the WRSA seepage is 1,113 mg/L and in TMF seepage is 582 mg/L. Sulphate concentration is decreasing downstream of WC4 and reaching the WQCC prior the watercourse outflow to Moose River. At the end of the WC4 mixing zone, at the confluence of WC4 with Moose River, six out of seven parameters (arsenic, copper, selenium, nitrate, nitrite, and sulphate) are below the WQCC and inherently are not chronically toxic. Aluminum is above the WQCC due to elevated natural background concentrations. The results of the assimilative capacity study show that water quality in WC4 is protective of fish and fish habitat at the end of the mixing zone. The study was competed using the low flow summer conditions as per recommendations of Fisheries and Oceans Canada.

9.0 MIXING ZONE MODEL VALIDATION

To validate the mixing zone assimilative capacity model for WC4, empirical field monitoring results at SW-19 on WC4 downstream of the WRSA were compared to the model predicted results at Mooseland Road. SW-3 empirical field monitoring results were compared to the model predicted results for the same location at SW-3. For validation consistency the empirical field monitoring data 75th percentile was used to assign baseline water quality for the period extending from 2016 – 2021. In keeping with set up guidance in ECCC (2003), assimilative capacity studies are both intentionally and inherently conservative in their predictions. Study conservatism is derived from the corresponding use of both poor receiver quality (i.e., 75th percentile) and low flow conditions (i.e., 25% MAF) in the receiver. Therefore, the assimilative capacity study assumes that these two worst case events in the effluent occur at the same time. These conservative inputs serve to reduce the available assimilative capacity in the receiver and extend the boundaries of the mixing zone. As such, it would be reasonable to assume that assimilative capacity mixing zone predictions would be more conservative than empirical field observations. However, the comparison is useful to contextualize the assimilative capacity model results.

Seven POPCs were identified in seepage quality from the WRSA and TMF as exceeding WQCC and of these seven POPCs, all exceed from the WRSA while only two, nitrate and sulphate, exceed from the TMF. Similarly, the relative concentrations of POPCs in seepage effluent from the WRSA are higher than those of TMF seepage. The TMF is a mine tailings impoundment with clay till liner with perimeter tailings beaching that further reduces seepage through the dam. Perimeter seepage collection ditches are installed around the TMF to capture shallow seepage that is routinely pumped back to the TMF. Tailings reclaim water is subject to process treatment to reduce cyanide concentrations after gold leaching which has the co-treatment effect of reducing the concentration of several metals in the process water. Seepage quantities from the TMF are lower than seepage quantities from the WRSA. The WRSA does not have a lining system. However, perimeter ditching is in place to capture shallow seepage flows via gravity to downgradient collection ponds which are pumped to the TMF. Unlike the TMF, runoff and seepage from the WRSA undergoes no process treatment at the WRSA. Thus, the WRSA contributes more POPCs, at higher concentration and higher seepage rates than the TMF and thus contributes higher POPC loads to WC4.

Table 9.1 presents the assimilative capacity study results at Mooseland Road and empirical field monitoring concentrations at SW-19 to represent the initial effects of WRSA seepage on WC4. Table 9.1 also presents both model predicted and empirical field concentrations at SW-3 downstream from the TMF. Similar to Table 8.1, both the modelled predictions and empirical field observations for copper, selenium, nitrate, and nitrite were below WQCC at either modelled or monitored station. Only aluminum, arsenic and sulphate had exceedances of WQCC, as discussed below:

- Aluminum had an elevated baseline 75th percentile concentration at SW-3 of 0.231 mg/L considerably above the WQCC. As both WRSA and TMF seepage quality has lower aluminum concentrations than the receiver, the seepage has the effect of improving aluminum concentrations in WC4. Both the model predicted and empirical field observations demonstrate this trend in aluminum in WC4.
- Arsenic concentrations in TMF seepage are lower than the WQCC as presented in Table 9.1. However arsenic concentrations in WRSA seepage are elevated above the WQCC indicating the WRSA as the critical arsenic source. Empirical field observations at SW-19 indicate that arsenic concentrations meet the WCQQ while the modelled results are more conservative. Downstream modelled and empirical field observations match more closely at SW-3, slightly above the WQCC. Table 8.1 predictions of arsenic concentrations downstream at Otter Lake and the end of WC4 where it confluences with Moose River show arsenic quality improvement and achievement of the WQCC of 5 µg/L.
- Finally sulphate seepage concentrations from the TMF are approximately half those of WRSA seepage. The model predicted concentrations of sulphate at Mooseland Road downstream of the WRSA and at SW-3 downstream of the TMF exceed the WQCC. However, the empirical field observations show sulphate as below the WQCC at Mooseland Road and just above the WQCC of 128 mg/L at SW-3 demonstrating the anticipated conservatism in the assimilative capacity model results.

In summary, of the seven POPCs, four: copper, selenium, nitrate, and nitrite, demonstrate meeting or being lower than the WQCC in both modelled and empirical field observations in WC4. Aluminum is considerably elevated in baseline above the WQCC and WRSA and TMF seepage quality is lower than WC4 baseline conditions resulting in aluminum concentration improvement in WC4. However due to the considerably elevated concentration of aluminum in WC4, the WQCC cannot be achieved. Arsenic concentrations at Mooseland Road are lower than predictions and more closely match at SW-3. Arsenic is modelled to be marginally above the WQCC downstream of the TMF and recovers to WQCC at the end of WQCC. Both model predicted and empirical field observations are considerably lower than the site specific arsenic guideline developed by Intrinsik (2022). Sulphate concentrations are predicted to exceed WQCC at Mooseland Road and WC-3, however the empirical field observations show they meet WQCC at Mooseland Road and are just slightly above at WC-3.

Table 9.1 Empirical Field and Model Predicted Surface Water Quality, mg/L

WQ Parameter	IA WQ Compliance Criteria	Predicted WC4 at Mooseland Rd	Empirical field SW-19	Predicted WC4 at SW-3	Empirical field SW-3
Aluminum[1,2]	0.005	**0.152**	**0.197**	**0.167**	**0.250**
Total Arsenic	0.005	**0.009**	**0.005**	**0.007**	**0.008**
Total Copper	0.002[1]	0.001	0.002	0.001	0.001
Total Selenium	0.001	0.0008	<0.001	0.0007	<0.001
Nitrate (as N)	13	7.0	1.1	6.0	0.69
Nitrite (as N)	0.06	0.05	<0.01	0.04	<0.01
Dissolved Sulphate	128	**241.4**	**127.5**	**188.2**	**130**

10.0 CONCLUSIONS

Background water quality in WC4 was characterized using the 2004-2007 water quality data at SW-3. The background water quality for WC4 (location SW-3) has two parameters which exceed the WQCC specified in the existing Industrial Approval: total aluminum and iron.

The potential parameters of concern from predicted seepage inputs to WC4 includes aluminum, arsenic, copper, selenium, nitrate, nitrite, and sulphate from the WRSA and Sulphate and Nitrate from the TMF. All parameter concentrations in the seepage are below the MDMER limits.

Predicted and observed concentrations of the parameters of potential concern along WC4 are presented in Table 8.1 and 9.1.

At the end of the WC4 mixing zone six out of seven parameters (arsenic, copper, selenium, nitrate, nitrite, and sulphate) are below the WQCC. Aluminum is above the WQCC in WC4 due to elevated natural background concentrations.

The results of the assimilative capacity study show that water quality in WC4 is protective of fish and fish habitat at the end of the mixing zone. The study was competed using the low flow summer conditions as per recommendations of Fisheries and Oceans Canada.

11.0 CLOSURE

This report has been prepared for the sole benefit of the Atlantic Mining NS Inc. (AMNS). This report may not be used by any other person or entity without the express written consent of Stantec Consulting Ltd. and AMNS.

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The information and conclusions contained in this report are based upon work undertaken by trained professional and technical staff in accordance with accepted engineering and scientific practices current at the time the work was performed. Conclusions and recommendations presented in this report should not be construed as legal advice.

The conclusions presented in this report represent the best technical judgment of Stantec Consulting Ltd. based on the data obtained from the work. If any conditions become apparent that differ from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

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APPENDIX A

Mixing Zone Selection

The mixing zone was established to follow the 14 guiding principles (CCME 2003b), which include:

No.	Guiding Principal	Justification
1	The dimensions of the Initial Dilution Zone (IDZ) should be restricted to avoid adverse effects on the designated uses of the receiving water system (i.e., the IDZ should be as small as possible);	The extent of the mixing zone is small (i.e., limited to WC4 itself). The IDZ does not cause an adverse effect on the designated uses of the watercourse.
2	The IDZ should not impinge on critical fish or wildlife habitats (e.g., spawning or rearing areas for fish; overwintering habitats for migratory waterfowl);	The IDZ of the watercourse does not impinge on critical fish or wildlife habitats. Fish and fish habitat surveys completed on the watercourse did not identify any critical fish or wildlife habitats in the IDZ.
3	Conditions outside the IDZ should be sufficient to support all the designated uses of the receiving water system;	The mixing zone is contained within the IDZ and does not effect conditions outside the IDZ, therefore river reaches outside the IDZ are able to support designated uses of the river.
4	Wastewaters that are discharged to the receiving water system must not be acutely toxic to aquatic organisms;	Effluent discharge to the watercourse meets MDMER limits and is not considered acutely toxic to aquatic organisms.
5	Conditions within the IDZ should not cause acute or short-term chronic toxicity to aquatic organisms;	Effluent discharge to the watercourse will not cause acute or short-term chronic toxicity to aquatic organisms. Based on the CCME factsheets for Arsenic and Nitrate and the BC ambient water quality guidelines for Sulphate, concentrations of these parameters in the IDZ are below the acute or short-term chronic toxicity to aquatic organisms. There are no acute or short-term chronic toxicity fact sheets available for Aluminium, Copper, Cyanide.
6	Conditions within an IDZ should not result in bioconcentration of COPCs to levels that are harmful to the organism, aquatic-dependent wildlife or human health;	None of the PoPC are at a level in the IDZ that may cause bioconcentration of COPCs to levels that are harmful to the organism, aquatic-dependant wildlife or human health.
7	A zone of passage for migrating aquatic organisms must be maintained;	The discharge infrastructure does not cause a physical barrier to the migration of aquatic organisms. Predicted effluent discharge concentrations do not propose a chemical barrier.
8	Placement of mixing zones must not block migration into tributaries;	There are no tributaries within the mixing zone.
9	Mixing zones for adjacent wastewater discharges should not overlap with each other;	There is no overlap in mixing zone with other wastewater discharge(s).
10	Mixing zones should not unduly attract aquatic life or wildlife, thereby causing increased exposure to COPCs;	Physical and chemical characteristics of the effluent do not attract aquatic life or wildlife in the IDZ. The mixing does not have a point discharge to WC4; only seepage over a diffuse length.
11	Mixing zones should not be used as an alternative to reasonable and practical pollution prevention, including wastewater treatment (pollution prevention principle);	Physical controls to limit seepage to WC4 have been put into place, include repairs to the WRSA seepage collection perimeter ditches, tailings beaching, and seepage control blanket in the TMF. No point source discharge is being considered to WC4.

No.	Guiding Principal	Justification
12	Mixing zones must not be established such that drinking water intakes are contained therein;	There are no drinking water intakes in the IDZ
13	Accumulation of toxic substances in water or sediment to toxic levels should not occur in the mixing zone; and	Substances in water or sediment are not at toxic levels will not accumulate.
14	Adverse effects on the aesthetic qualities of the receiving water system (e.g., odour, colour, scum, oil, floating debris,) should be avoided.	Adverse effects of the aesthetic qualities to the receiver are not expected.

APPENDIX B

Regional Regression Analysis

Regional Regression Analysis

In the absence of long-term local hydrologic records, regional relationships were developed using selected Water Survey of Canada (WSC) stations to transpose flow data to the Touquoy Mine Site. The WSC stations were selected based on criteria including catchment area, station location, and period of record. Transpositional scaling assumes homogeneity (due to their proximity and similar climate and land use conditions) between the selected regional WSC stations.

The regional regression method is limited to gauged stations in areas of hydrologic homogeneity where, as described in 1.3, a) the landscape is subject to similar climate, and physiographic conditions. There are limited gauging station datasets available in Nova Scotia near the site that meet the primary selection criteria (e.g., catchment area, distance to Touquoy Mine Site). The WSC stations selected for the regional hydrology assessment are summarized in Table 1.

Table 1. WSC Regional Hydrology Stations

Station ID	Station Name	Drainage Area (km^2)	Years of Record	Record Period	Site Proximity (km)	Climate Normal Prec. (mm)
01DH003	Fraser Brook Near Archibald	10.1	26	1965-1990	45	1357.6
01EJ004	Little Sackville River at Middle Sackville	13.1	39	1980-2018	65	1513.2
01EE005	Moose Pit Brook at Tupper Lake	17.7	39	1981-2019	192	1455.0
01EH006	Canaan River at Outlet of Connaught Lake	65.4	11	1986-1996	107	1359.1
01DP004	Middle River of Pictou at Rocklin	92.2	54	1965-2018	58	1232.2
01DG003	Beaverbank River Near Kinsac	96.9	98	1921-2018	60	1396.2
01FA001	River Inhabitants at Glenora	193	55	1965-2019	150	1440.5
01ED013	Shelburne River at Pollard's Falls Bridge	268	21	1999-2019	202	1486.2
01EO003	East River St. Mary’s at Newtown	282	15	1965-1979	75	1315.1
01EK001	Musquodoboit River at Crawford Falls	650	82	1915-1996	27	1396.2

Validation for the regional hydrology dataset for the range of uses applied was conducted by confirming the hydrologic homogeneity of the group. A station would not be eliminated because it failed a single test but would be eliminated if it failed multiple tests demonstrating more heterogeneity than homogeneity. The results of hydrologic factors and tests that were assessed to confirm hydrologic homogeneity, include:

- Climate – The climate normal annual precipitation for Halifax Stanfield Airport of 1396.2 mm is used to characterize the Touquoy site. Assessment of longer-term climate stations proximal to the gauging stations indicate that the climate normal annual precipitations range from 1232.2 to 1513.2 mm and thus within -15% to +8% of the climate normal annual precipitation at site.
- Soils – Nova Scotia soils mapping for the areas at each regional gauging station are characterized by dry, moist, and fresh medium to coarse textured soils which would be characterized as Hydrologic Soil Group B and C.
- Vegetation – The watersheds reporting to the regional gauging stations are rural in nature with forest cover in the range of 72 – 95% based on Nova Scotia Forest mapping. Forest cover in the regional hydrology dataset area is characterized by a mixture of coniferous and mixed wood forests, with lesser amounts of deciduous forests.
- Site Proximity – Site proximity ranges from 27 km to 202 km. Site proximity is analogous to correlation with regional climate and physiography.
- Years of Record – Years of record ranged from 11 to 98 years. Generally, a station will only be included if it has at least 10 years of data.
- Period of Record- Period of record ranges from currently monitored to ending in 1979. Generally, a goal is to use regional stations whose period of record is within one climate normal period (i.e. 30 years). As such, 01DH003 is at the temporal boundary and 01EO003 is a decade older than the boundary.
- Regulation – None of the stations are on regulated systems
- Watershed <10x – A general principle in regional regression is to keep the areal proration to no more than one order of magnitude between the watershed area of the gauged site and that of the target site. Station 01EK001 is beyond 10x the size of the largest site watershed but was retained because it is the closest station to site and has a long period of record.
- Mean Annual Flow (MAF) – The MAF regression equation demonstrated high statistical significance with a coefficient of determination of $R^2 = 0.9956$.
- Mean Monthly Flow (MMF) – Similarly to MAF, the individual monthly regression equations also demonstrated high statistical significance with R^2 ranging from 0.9753 to 0.9965.
- Unit Flow – Unit flows are presented in Figure 1 below and range from 23.69 – 37.23 L/s/km^2 with 01EJ004 and 01EK001 presenting outside the linear trend of increasing hydraulic efficiency with increasing drainage area.
- Flow Duration Curve (FDC)- The FDCs for the regional dataset are presented below in Figure 2. All station FDCs follow a similar shape pattern with little FDC cross-over indicative of FDC variance.

- Index Flood Flow - In the flood indexing approach, the 95th confidence interval has been used to assess the homogeneity of the regional dataset using the Mean Annual Flood (recurrence interval of 2.33 years) as the Index Flood, the 10-year flood, and their ratios. The Index Flood test results are presented in Figure 3. The two stations (01DG003 and 01ED013) with the lowest homogeneity of flood flow relative to the regional dataset are shown in red on the figure. Station 01ED013 plots near the 95th percentile threshold of the Gumbel Distribution test; however, 01DG003 (Beaverbank near Kinsac) plots well outside the 95th confidence interval for the Gumbel Distribution test.

In general, despite some variance among stations with respect to period of record, larger watershed area, unit flows, and index flooding, the regional hydrologic dataset of the ten stations presented in Table 1 and used in the regional regression demonstrates more hydrologic homogeneity than heterogeneity and thus are considered acceptable for inclusion in the regional hydrology dataset grouping.

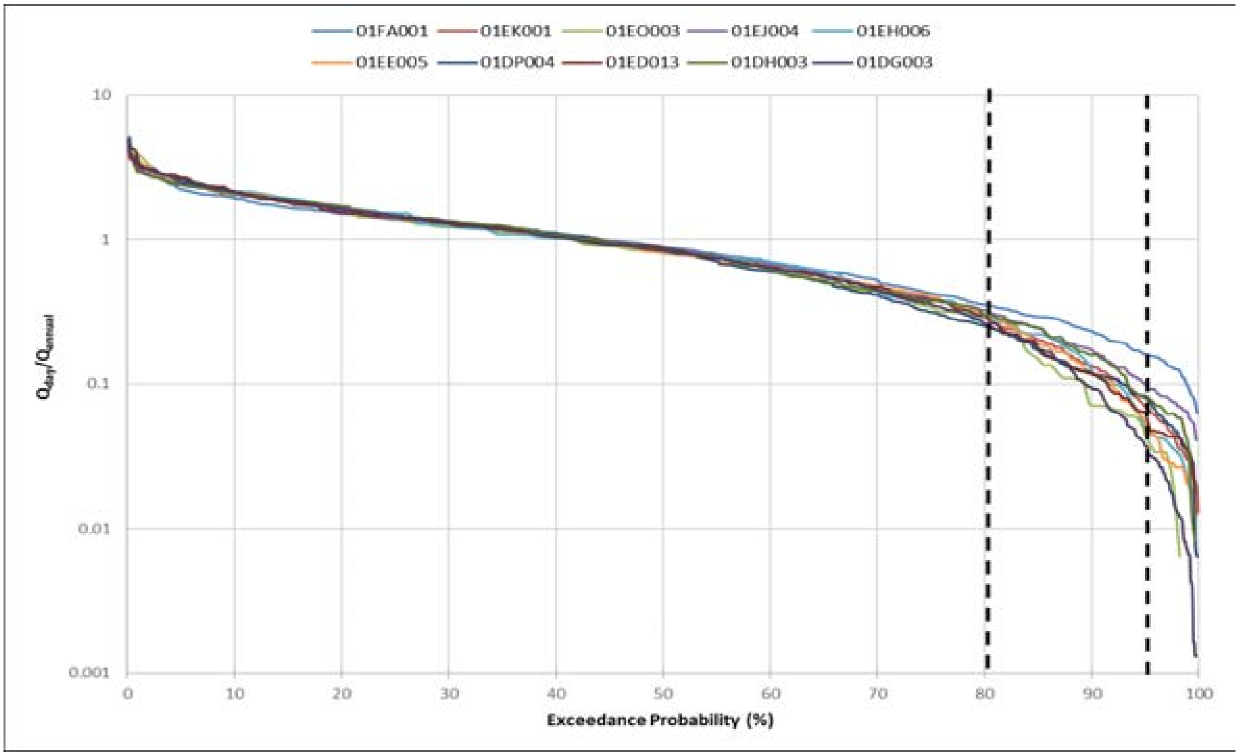


Figure 1 Mean Annual Unit Flows for Regional Dataset

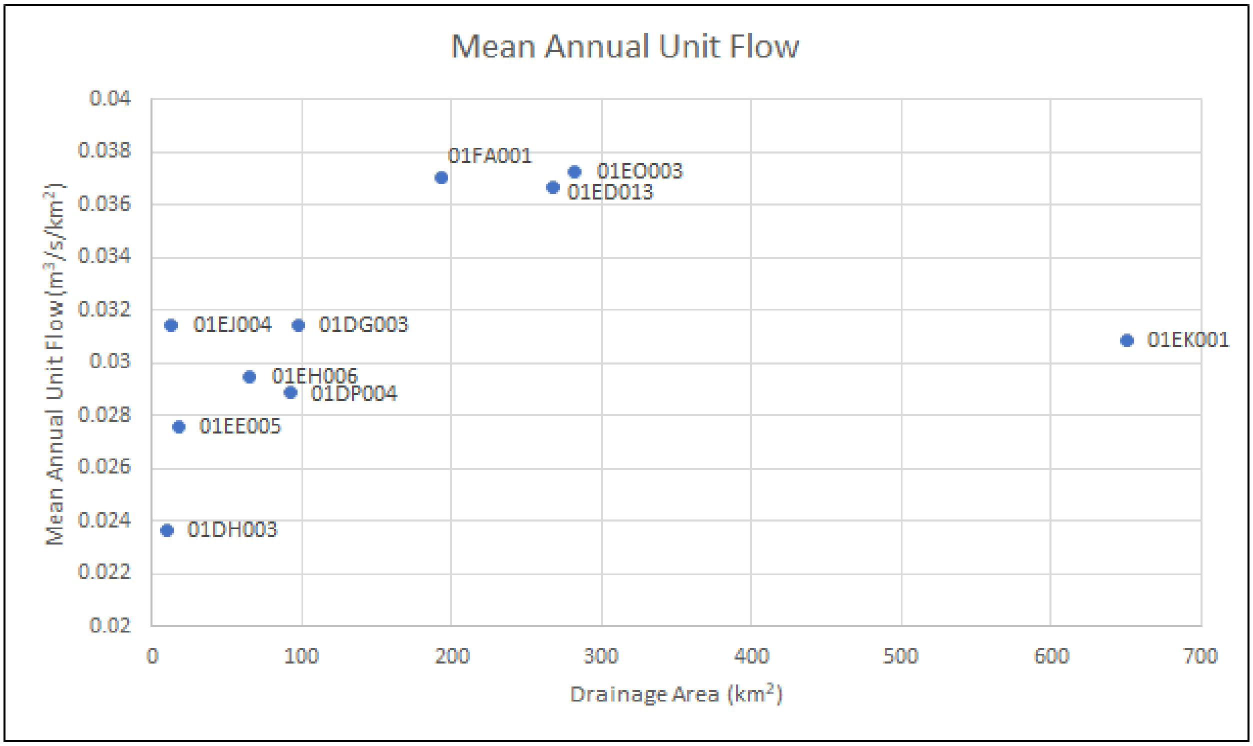


Figure 2 **Regional Dataset Flow Duration Curves**

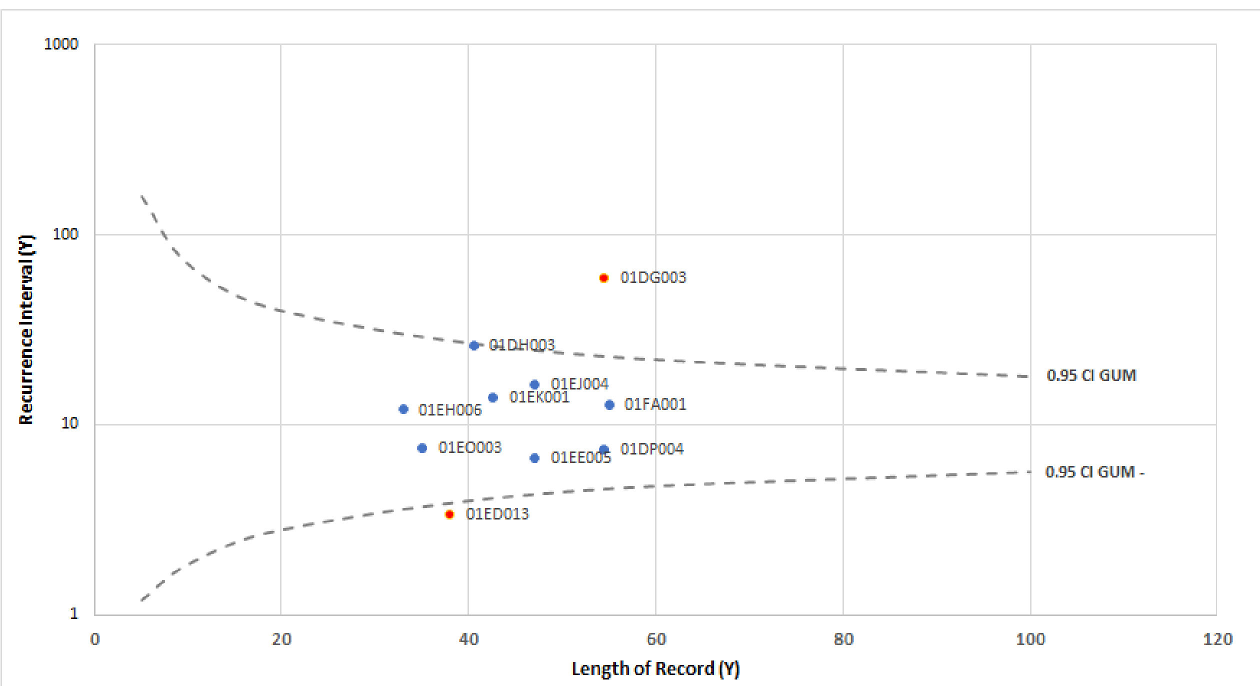


Figure 3 **Index Flood Test**

APPENDIX C

WC4 Baseline Water Quality Data

APPENDIX C

WC4 BASELINE WATER QAULITY

DATA

Table 1. Results of Laboratory Analyses for Surface Water Samples Collected From Sampling Location SW3 from September 2004 to February 2007

	Units	RDL	FWAL 2006	1-Sep-04	15-Oct-04	8-Nov-04	6-Dec-04	11-Jan-05	11-Jan-05 DUP	20-Apr-05	13-May-05	13-Jun-05	12-Jul-05	4-Aug-05	8-Sep-05	7-Oct-05	23-Nov-05	20-Jan-06	24-Feb-06	23-Mar-06	28-Apr-06
INORGANICS																					
Total Alkalinity (Total as $CaCO_3$)	mg/L	5	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	5	<5	<5	<5	<5	<5
Color	TCU	5	-	130	47	77	36	27	26	29	51	65	38	33	30	39	68	42	25	23	45
Dissolved Hardness ($CaCO_3$)	mg/L	1	-	8.4	6	7.1	5.3	3.9	3.9	6.2	4.3	5.7	7.6	8.6	9.4	15	8	6	8	8	6
Nitrate + Nitrite (as N)	mg/L	0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	0.14	0.09	<0.05	<0.05	<0.05	0.09	0.06	<0.05
Nitrate (as N)	mg/L	0.05	2.9	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	0.14	0.09	<0.05	<0.05	<0.05	0.09	0.06	<0.05
Nitrite (N)	mg/L	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	x	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Nitrogen	mg/L			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total Org. Carbon (by UV)	mg/L	0.5	-	15.8	10	17.2	7.7	6.7	6.7	4.1	NS	10	7.3	5.7	6.3	9.7	15	6.1	4	3	7.1
Ortho Phosphate (as P)	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phosphorus	mg/L	0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	5.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
pH	units	0.1	>6.5;<9.0	5.6	5.5	4.9	5.2	5.1	5	5.73	6.28	6.07	6.45	6.19	6.35	6.32	4.65	5.1	6.47	5.69	5.52
Reactive Silica (as SiO_2)	mg/L	0.5	-	3.2	2.7	3.2	3	2.2	2.3	1.8	1.7	<0.5	1.1	0.8	1.5	2.7	2.2	2.2	3.2	2.3	1.6
Dissolved Chloride (Cl)	mg/L	1	-	8	4	6	6	4	4	8.6	5.5	6.4	8.8	9.8	12	8	9	8	9	10	6
Calcium	mg/L	0.1	-	2.2	1.4	1.7	1.3	0.9	0.9	1.6	1.1	1.4	1.9	2.1	2.4	3.7	1.9	1.4	1.9	2	1.4
Magnesium	mg/L	0.1	-	0.7	0.6	0.7	0.5	0.4	0.4	0.5	0.4	0.5	0.7	0.8	0.8	1.3	0.8	0.5	0.7	0.7	0.5
Potassium	mg/L	0.1	-	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.2	0.3	0.3	0.4	0.3	0.5	0.2	0.2	0.2	0.3
Sodium	mg/L	0.1	-	5.6	2.9	4.8	4	2.3	2.3	5.3	3.5	4.6	5.8	6.4	6.8	6.4	4.4	4.1	5.5	6.1	4.5
Dissolved Sulphate (SO_4)	mg/L	2	-	<5.0	<5.0	2	2	2	2	<5	<5	<5	<5	<5	<5	10	<5	<2	<2	<2	<2
Conductivity	us/cm	1	-	42	26	43	39	26	26	40	29	34	45	52	56	59	50	37	45	51	36
Turbidity	NTU	0.1	-	0.7	0.4	0.5	0.2	0.5	0.3	0.2	0.4	0.7	<0.1	0.5	1.3	0.3	3.1	1.7	0.2	0.5	0.7
Total Suspended Solids	mg/L	2	-	1.6	1.8	<2	<2	<2	<2	<2	<2	3	3	2.9	9.5	12	<2	<2	<2	<2	<2
RCAP CALCULATIONS																					
Anion Sum	meq/L	-	-	0.43	0.26	0.1	0.31	0.26	0.26	0.243	0.154	0.181	0.252	0.287	0.341	0.537	0.253	0.215	0.256	0.299	0.18
Bicarb. Alkalinity (calc. as $CaCO_3$)	mg/L	1	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	5	<5	<5	<5	<5	<5
Calculated TDS	mg/L	0.1	-	28	<0.1	22	20	15	15	18.3	12.8	13.6	19.2	21.1	24.4	36	19	16	21	22	15
Carb. Alkalinity (calc. as $CaCO_3$)	mg/L	1	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cation Sum	meq/L	0.1	-	0.42	0.26	0.38	0.3	0.2	0.2	0.368	0.256	0.333	0.421	0.466	0.499	0.587	0.4	0.309	0.399	0.438	0.325
Elements (ICP-MS)																					
Total Aluminum (Al)	ug/L	10	5-100	390	240	310	160	120	120	93.7	150	180	91	65	67	97	305	190	119	129	186
Total Antimony (Sb)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Arsenic (As)	µg/L	2	5	3	<2	<2	<2	<2	<2	<2	<2	2.5	2.7	2.3	<2	<2	<2	<2	<2	<2	<2
Total Barium (Ba)	µg/L	5	-	7	<5	7	<5	<5	<5	<5	<5	<5	<5	<5	<5	6	7.6	<5	<5	<5	<5
Total Beryllium (Be)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Bismuth (Bi)	µg/L	2	-	<2	<2	<2	<2	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Boron (B)	µg/L	5	-	6	<5	<5	<5	5	<5	<5	<5	<5	6	5.5	6.8	9	7.4	<5	<5	<5	5.4
Total Cadmium (Cd)	µg/L	0.3	0.017	<0.3	<0.3	<0.3	0.03	<0.3	0.02	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.03	<0.3	<0.3	0.023	0.018
Total Chromium (Cr)	µg/L	2	y	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Cobalt (Co)	µg/L	1	-	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.49	<0.4	<1	<1	<1
Total Copper (Cu)	µg/L	2	2-4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Iron (Fe)	µg/L	50	300	610	430	460	200	240	260	91	150	300	260	190	130	140	255	170	96	149	142
Total Lead (Pb)	µg/L	0.5	7-Jan	0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Manganese (Mn)	µg/L	2	-	76	66	99	70	61	64	25.8	39	41	23	22	14	16	117	50.3	31	68.9	36.6
Total Mercury (Hg)	µg/L	0.01	z	NS	NS	NS	NS	<0.01	<0.01	NS	0.01	NS	<0.01	NS	NS	NS	NS	NS	NS	NS	NS
Total Molybdenum (Mo)	µg/L	2	73	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Nickel (Ni)	µg/L	2	25-150	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Selenium (Se)	µg/L	2	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Silver (Ag)	µg/L	0.5	0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Strontium (Sr)	µg/L	5	-	10	6	9	7	5	5	6.3	<5	6.2	8	9.8	11	16	9.5	7.5	8.4	8.5	6.1
Total Thallium (Tl)	µg/L	0.1	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Tin (Sn)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Titanium (Ti)	µg/L	2	-	3	2	3	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	4	<2	<2	<2	<2
Total Uranium (U)	µg/L	0.1	-	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Vanadium (V)	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Zinc (Zn)	µg/L	5	30	7	6	6	5	47	48	<5	<5	<5	<5	5.8	<5	7	10	17.4	<5	<5	<5
Strong Acid Dissoc. Cyanide (CN)	mg/L	0.002	-	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

FWAL 2006 = Canadian Environmental Quality Guidelines - Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006)

NS = Not sampled

NA= Not analyzed

RDL = Reportable Detection Limit

x = Ammonia Guideline is based on pH and Temperature

y = Chromium Guideline is based on speciation (Cr III = 8.9 ug/L, CR VI = 1ug/L)

z = Mercury Guideline is based on speciation (Inorganic Hg = 0.026ug/L, Methyl Hg= 0.004ug/L

Table 3. Results of Laboratory Analyses for Surface Water Samples Collected From Sampling Location SW3 from September 2004 to February 2007

	Units	RDL	FWAL 2006	25-May-06	28-Jun-06	26-Jul-06	26-Jul-06	28-Aug-06	28-Sep-06	27-Oct-06	27-Oct-06	27-Nov-06	14-Dec-06	18-Jan-07	7-Feb-07	MIN	MAX
INORGANICS																	
Total Alkalinity (Total as $CaCO_3$)	mg/L	5	-	<5	<5	<5	NA	<5	<5	<5	NA	<5	<5	NA	NS	<5.0	<5
Color	TCU	5	-	59	110	130	NA	46	31	55	NA	46	40	NA	NS	23	130
Dissolved Hardness ($CaCO_3$)	mg/L	1	-	6	5	7	NA	11	8	7	NA	7	6	NA	NS	3.9	15
Nitrate + Nitrite (as N)	mg/L	0.05	-	<0.05	<0.05	0.09	NA	0.08	0.08	<0.05	NA	<0.05	<0.05	NA	NS	<0.05	0.14
Nitrate (as N)	mg/L	0.05	2.9	<0.05	<0.05	0.09	NA	0.08	0.08	<0.05	NA	<0.05	<0.05	NA	NS	<0.05	0.14
Nitrite (N)	mg/L	0.01	0.06	<0.01	<0.01	<0.01	NA	<0.01	<0.01	<0.01	NA	<0.01	<0.01	NA	NS	<0.01	<0.01
Nitrogen (Ammonia Nitrogen)	mg/L	0.05	x	<0.05	<0.05	<0.05	NA	<0.05	<0.05	<0.05	NA	<0.05	<0.05	NA	NS	<0.05	<0.05
Total Kjeldahl Nitrogen (TKN)	mg/L	0.1		NS	NS	1.2	NA	0.5	0.3	0.3	NA	NA	0.3	NA	NS	0.3	1.2
Total Nitrogen	mg/L			NS	NS	0.36	NA	0.37	0.3	0.28	NA	0.21	NA	0.21	NS	0.21	0.37
Total Org. Carbon (by UV)	mg/L	0.5	-	9.7	17	23	NA	8.5	5.3	11	NA	9	6.6	NA	NS	3	23
Ortho Phosphate (as P)	mg/L	0.01	-	<0.01	<0.01	<0.01	NA	<0.01	<0.01	<0.01	NA	<0.01	<0.01	NA	NS	<0.01	<0.01
Phosphorus	mg/L	0.1	-	<0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.1	NA	<0.1	<0.1	NA	NS	<0.1	5.3
pH	units	0.1	>6.5;<9.0	6.04	5.02	4.86	4.74	6.57	6.04	5.22	5.28	5.04	5.33	NA	NS	4.65	6.57
Reactive Silica (as SiO_2)	mg/L	0.5	-	1.4	2.3	2.8	NA	2.6	1.9	3.5	NA	3.4	2.9	NA	NS	0.8	3.5
Dissolved Chloride (Cl)	mg/L	1	-	6	4	4	NA	7	9	6	NA	7	6	NA	NS	4	12
Calcium	mg/L	0.1	-	1.5	1.2	1.7	NA	3.1	2.2	1.7	NA	1.6	1.4	NA	NS	0.9	3.7
Magnesium	mg/L	0.1	-	0.5	0.4	0.6	NA	0.7	0.7	0.6	NA	0.7	0.5	NA	NS	0.4	1.3
Potassium	mg/L	0.1	-	0.2	0.2	0.2	NA	0.2	0.3	0.2	NA	0.2	0.1	NA	NS	0.1	0.5
Sodium	mg/L	0.1	-	4.7	3.3	3.5	NA	5.3	4.3	3.5	NA	3.9	3.2	NA	NS	2.3	6.8
Dissolved Sulphate (SO_4)	mg/L	2	-	<2	<2	<2	NA	<2	<2	<2	NA	<2	<2	NA	NS	<2.0	10
Conductivity	us/cm	1	-	35	28	33	NA	40	42	36	35	37	32	NA	NS	26	59
Turbidity	NTU	0.1	-	0.3	0.3	0.5	NA	1.2	0.3	0.5	NA	0.5	0.3	NA	NS	0.2	3.1
Total Suspended Solids	mg/L	2	-	<2	<2	3	NA	7	2	<1	NA	NA	2	NA	NS	1.6	12
RCAP CALCULATIONS																	
Anion Sum	meq/L	-	-	0.175	0.105	0.123	NA	0.209	0.247	0.176	NA	0.192	0.165	NA	NS	0.1	0.537
Bicarb. Alkalinity (calc. as $CaCO_3$)	mg/L	1	-	<5	<5	<5	NA	<1	<1	<1	NA	<1	<1	NA	NS	<1.0	5
Calculated TDS	mg/L	0.1	-	15	12	14	NA	20	19	16	NA	17	14	NA	NS	12	36
Carb. Alkalinity (calc. as $CaCO_3$)	mg/L	1	-	<5	<5	<5	NA	<1	<1	<1	NA	<1	<1	NA	NS	<1.0	<1
Cation Sum	meq/L	0.1	-	0.338	0.269	0.322	NA	0.465	0.37	0.308	NA	0.327	0.262	NA	NS	0.2	0.587
Elements (ICP-MS)																	
Total Aluminum (Al)	ug/L	10	5-100	216	330	446	NA	171	74.3	235	NA	219	165	NA	NS	65	446
Total Antimony (Sb)	µg/L	2	-	<2	<2	<2	NA	<2	<2	<2	NA	<2	<2	NA	NS	<2.0	<2.0
Total Arsenic (As)	µg/L	2	5	<2	<2	2.1	NA	3.7	<2	<2.0	NA	<2.0	<2	NA	NS	<2.0	3.7
Total Barium (Ba)	µg/L	5	-	<5	5.4	7.1	NA	<5	<5	<5.0	NA	7.1	<5	NA	NS	<5.0	7.6
Total Beryllium (Be)	µg/L	2	-	<2	<2	<2	NA	<2	<2	<2.0	NA	<2.0	<2	NA	NS	<2.0	<2
Total Bismuth (Bi)	µg/L	2	-	<2	<2	<2	NA	<2	<2	<2.1	NA	<2.0	<2.0	NA	NS	<2.0	2
Total Boron (B)	µg/L	5	-	5.3	5.7	<5	NA	7.7	6.5	<5.0	NA	<5.0	<5.0	NA	NS	<5.0	9
Total Cadmium (Cd)	µg/L	0.3	0.017	0.036	0.02	0.036	NA	<0.3	<0.3	0.02	NA	0.018	0.017	NA	NS	<0.017	0.036
Total Chromium (Cr)	µg/L	2	y	<2	<2	<2	NA	<2	<2	<2.0	NA	<2.0	<2.0	NA	NS	<2.0	<2.0
Total Cobalt (Co)	µg/L	1	-	<1	<1	0.47	NA	0.91	<1	<0.40	NA	<0.40	<0.40	NA	NS	<0.40	0.91
Total Copper (Cu)	µg/L	2	2-4	<2	<2	<2	NA	<2	<2	<2.0	NA	<2.0	<2.0	NA	NS	<2.0	<2.0
Total Iron (Fe)	µg/L	50	300	196	298	446	NA	462	129	250	NA	215	170	NA	NS	91	610
Total Lead (Pb)	µg/L	0.5	7-Jan	<0.5	0.62	0.76	NA	0.97	<0.5	<0.50	NA	<0.50	<0.50	NA	NS	<0.50	0.97
Total Manganese (Mn)	µg/L	2	-	39	58.9	108	NA	141	12.9	56.2	NA	52.8	42.4	NA	NS	12.9	141
Total Mercury (Hg)	µg/L	0.01	z	NS	NS	<0.01	NA	<0.01	<0.01	<0.01	NA	<0.01	<0.01	NA	NS	<0.01	<0.01
Total Molybdenum (Mo)	µg/L	2	73	<2	<2	<2	NA	<2	<2	<2.0	NA	<2.0	<2.0	NA	NS	<2.0	<2.0
Total Nickel (Ni)	µg/L	2	25-150	<2	<2	<2	NA	<2	<2	<2.0	NA	<2.0	<2.0	NA	NS	<2.0	<2.0
Total Selenium (Se)	µg/L	2	1	<1	<1	<1	NA	<1	<1	<1.0	NA	<1.0	<1.0	NA	NS	<1.0	<1.0
Total Silver (Ag)	µg/L	0.5	0.1	<0.5	<0.5	<0.5	NA	<0.1	<0.1	<0.10	NA	<0.10	<0.10	NA	NS	<0.10	<0.10
Total Strontium (Sr)	µg/L	5	-	6.8	6.3	8.4	NA	8.7	8.3	7.5	NA	7.9	6.1	NA	NS	<5	16
Total Thallium (Tl)	µg/L	0.1	0.8	<0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.10	NA	<0.10	<0.10	NA	NS	<0.10	<0.10
Total Tin (Sn)	µg/L	2	-	<2	<2	<2	NA	<2	<2	<2.0	NA	<2.0	<2.0	NA	NS	<2.0	<2.0
Total Titanium (Ti)	µg/L	2	-	<2	2.4	3.2	NA	2.5	<2	<2.0	NA	<2.0	<2.0	NA	NS	<2.0	4
Total Uranium (U)	µg/L	0.1	-	<0.1	<0.1	<0.1	NA	<0.1	<0.1	<0.10	NA	<0.10	<0.10	NA	NS	<0.10	0.1
Total Vanadium (V)	µg/L	2	-	<2	<2	<2	NA	<2	<2	<2.0	NA	<2.0	<2.0	NA	NS	<2.0	<2.0
Total Zinc (Zn)	µg/L	5	30	5.9	12.9	9.4	NA	6.9	6	6.1	NS	7.8	6.1	NA	NS	<5.0	48
Strong Acid Dissoc. Cyanide (CN)	mg/L	0.002	-	NS	NS	<0.002	NA	<0.002	<0.002	<0.002	<0.002	NS	<0.002	NA	NS	<0.002	<0.002

FWAL 2006 = Canadian Environmental Quality Guidelines - Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006)

NS = Not sampled

NA= Not analyzed

RDL = Reportable Detection Limit

x = Ammonia Guideline is based on pH and Temperature

y = Chromium Guideline is based on speciation (Cr III = 8.9 ug/L, CR VI = 1ug/L)

z = Mercury Guideline is based on speciation (Inorganic Hg = 0.026ug/L, Methyl Hg= 0.004ug/L

Addendum # 1 - Touquoy Gold Project Assimilative Capacity Study of Watercourse No.4 – Touquoy Pit Discharge Revision 3

Stantec

Memo

To:	Sara Wallace - AMNS	From:	Rachel Jones, P.Eng. Mark Flinn, P.Eng., MBA
File:	121619250	Date:	December 20, 2022

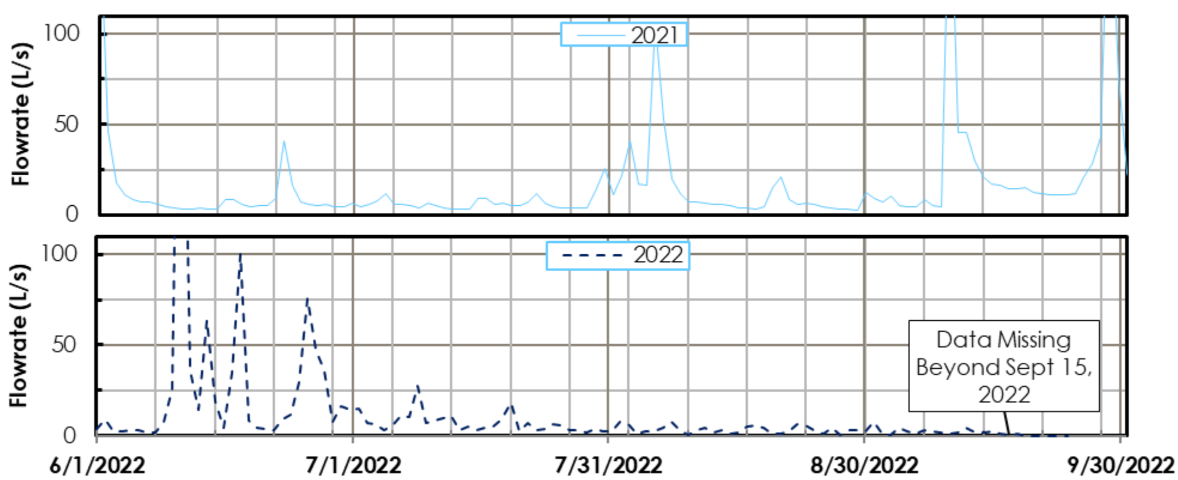
Reference: Addendum # 1 - Touquoy Gold Project Assimilative Capacity Study of Watercourse No.4 – Touquoy Pit Discharge Revision 3

This addendum is to the Touquoy Gold Project Assimilative Capacity Study of Watercourse No. 4 – Touquoy Pit Discharge Revision 3, by Stantec dated December 20, 2022. This addendum was written in response to DFO and the NS Minister of Environment and Climate Change comments, advice and questions pertaining to the Assimilative Capacity of Watercourse No. 4.

Stantec response to DFO's Comments and advice (blue) on the NS Minister of Environment and Climate Changes Question:

No	Summary of Stantec Response to Questions
1	On August 16, 2021, DFO provided the following comments on the EA Registration Document related to the use of average flows to assess ecological flow requirements and effects to fish and fish habitat.
	DFO Comment: Use of average flows to assess ecological flow requirements is not appropriate because it does not adequately capture actual flow conditions in a watercourse such as the extreme low periods in the summer when even the natural flow regime of a watercourse could potentially inhibit fish from carrying out life processes. As per DFO's framework, flow alterations should be assessed using actual (instantaneous) flow. Having daily flow data would allow an assessment of the potential effects of the project during actual flow conditions. **Stantec Response:** The DFO framework for assessing the ecological flow requirements to support fisheries in Canada (2013) was developed for "water extraction and flow alteration that can impact physical attributes of rivers and cause ecological changes which can impact Canadian fisheries resources". The framework was to act as guidance on scientific based tools for assessing impacts of flow alteration on fisheries to aid their understanding of the various methodologies, and to inform decision makers and Canadians in their understanding of potential trade-offs of various management scenarios. This framework was not developed for the application of assimilative capacity studies but has been adapted to an assimilative capacity application. Regarding DFO summer flow conditions, the 25% MAF threshold was applied in the assimilative capacity study. This was based on the review and approaches of ecological flows (Linsari et. al 2013) stated that "the variations of the original Tennant thresholds are also used in other jurisdictions, e.g., 25% MAF is regularly used as the minimum flow level required to maintain aquatic life across the Atlantic provinces of Canada (Cassie and El-Jabi 1995)". As per DFO's request, an assessment of daily flow has been conducted, this is described in subsequent sections.
4	**DFO Comment:** As explained in previous comments, assessments of effects to fish and fish habitat should not rely exclusively on average annual or monthly flows. Daily flows are highly variable so average flows are often not representative of the actual real-world fish habitat conditions at any given time. Since long-term, site-specific flow data is not available for Moose River, it is helpful to use long-term datasets from nearby gauged rivers to understand the natural flow regime of Moose River at SW-2. However, AMNS has been

Reference: Addendum # 1 - Touquoy Gold Project Assimilative Capacity Study of Watercourse No.4 – Touquoy Pit Discharge Revision 3

No	Summary of Stantec Response to Questions
	monitoring daily flows at SW-2 since 2017, so the estimated flows should also be compared to the actual measured flows. As per DFO's comments above, the actual flows measured at SW-2 in Moose River during summer are often much lower than those estimated in Appendix D on both a daily and monthly basis. Therefore, the estimated average flows used in Appendix D do not represent a conservative low flow scenario **Stantec Response:** Hydrometric monitoring of Watercourse No. 4 is conducted to develop a baseline dataset for the Touquoy expansion project. Hydrometric monitoring of Watercourse No. 4 commenced in July of 2017 to present during the open water period between June 1 and September 30. A review of the observed low flows in Watercourse No. 4 was conducted at hydrometric monitoring station SW-3, which is located downstream of the Touquoy TMF. Figure 1 presents the observed flows for each year at SW-3. The observed flows at SW-3 during the period of flow monitoring approaches 0 L/s, intermittently in the dryer months of the year of June, July, and August. Observed low flow in the summer is below the 25% Mean Annual Flow (MAF) metric of 7.8 L/s that was presented in the assimilative capacity study. As expected for a watershed of 1.5 km^2 in area, the 7-day Q10 ecological flow condition is dry (i.e. no flow). These low flow conditions occur following a period of low precipitation at the watershed. Under these conditions the WRSA sedimentation pond would be expected to evaporate at a rate exceeding inflow. Therefore, as effluent discharge from the WRSA sedimentation pond is driven by meteorological conditions there is no effluent discharge from the WRSA expected during this period. In addition, groundwater seepage to the watercourse was assumed to be negligible as seepage would be held in soil storage under these dry, unsaturated soil conditions. Typical of existing conditions any toe seepage collected in the perimeter WRSA collection ditches during a dry period would be lost in the voids of the collection ditches and/or evaporated and would not be of enough volume to result in gravity drainage to the WRSA sediment pond.  **Figure 1 – Observed Flows at SW-3**

Reference: Addendum # 1 - Touquoy Gold Project Assimilative Capacity Study of Watercourse No.4 – Touquoy Pit Discharge Revision 3

No	Summary of Stantec Response to Questions

However, as requested by DFO to provide an assessment of assimilative capacity under observed summer flows, the lowest average daily flow observed at SW-3 of 0.25L/s was used to represent this summer flow condition. The discharge from the proposed WRSA effluent treatment plant was prorated to the area of the watershed downstream. The WC4 watershed area of seepage from WRSA and TMF to WC4 at Moose River is 2.21 km^2 and at Moose River at WC4 is 44.1 km^2. Water quality modelling results are summarized in Table 1 below. Under this low flow scenario, Aluminum, Total Arsenic, Nitrate, Nitrite, and Sulphate would be above IA WQ quality objectives in WC4 at the confluence with Moose River. However, the concentrations would be below background for Aluminum and Total Arsenic.

Water quality meets IA WQ objectives or background just downstream of the confluence with Moose River.

Table 1 Water Quality Modelling Results, mg/L

WQ Parameter	WRSA Seepage	TMF Seepage	WRSA Runoff	SW-3 Receiver, 75th Percentile	IA WQ Compliance Criteria	WC4 at Mooseland Rd	WC4 at SW3	WC4 at Otter Lake	WC4 at MR	MR at WC4
Aluminum[1,2]	0.0087	0.0015	0.005	0.231	0.005	0.020	0.023	0.027	0.033	0.202
Total Arsenic	0.032	0.00089	0.005	0.0029	0.005	0.019	0.015	0.015	0.015	0.019
Total Copper	0.0021	0.0004	0.002[1]	<0.002	0.002[1]	0.002	0.002	0.002	0.002	0.001
Total Selenium	0.0014	0.00038	0.001	<0.001	0.001	0.0012	0.0010	0.0010	0.0010	0.0005
Nitrate (as N)	25	25	13	0.09	13	18.6	19.3	18.9	18.4	0.2
Nitrite (as N)	0.2	0.005	0.06	<0.01	0.06	0.13	0.10	0.10	0.10	0.01
Sulphate	1,113	582	128	<2	128	643.5	612.6	599.7	583.2	10.1

[1] pH< 6.5 and hardness < 17 mg/L, baseline water quality data at SW-3

[2] Criteria is dissolved aluminum the analysis was for Total Aluminum measured at SW-3

3 MR = Moose River

8 The email below incorrectly states that the DFO Ecological Flow Requirements Framework uses 25% MAF. Please refer to the DFO Framework and the Department's August 2021 and March 2022 comments for the correct guidelines and associated advice regarding the interpretation and application of the Framework.

Stantec Response:

As described in response no. 1, please see excerpt above from the DFO Ecological Flow Requirements Framework reference to use of 25% MAF in the Atlantic provinces of Canada.

REFERENCES

Fisheries and Oceans Canada. 2013. Framework for assessing the ecological flow requirements to support fish in Canada. Published by the Canadian Science Advisory Secretariat. Science advisory report 2013/017 Website: file:///C:/Users/rljones/Pictures/Framework_For_Assessing_Ecological_Flows.pdf

Linnansaari, T., Monk, W.A., Baird, D.J, and Curry, R.A. 2013. Review of approaches and methods to assess Environmental Flows across Canada and Internationally. Prepared for Fisheries and Oceans Canada. 1 Canadian Rivers Institute, University of New Brunswick, Department of Biology, P.O. Box 4400, Fredericton, New Brunswick, E3B 5A3 2 Environment Canada, Canadian Rivers Institute, University of New Brunswick, Department of Biology, P.O. Box 4400, Fredericton, New Brunswick. Published by the Canadian Science Advisory Secretariat. Research Document 2012/039. Website: https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/348885.pdf

Stantec 2022. Touquoy Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge. Final Report, Revision 2.

Attachment 9

Touquoy Open Pit Water Treatment - Conceptual Approach

Stantec

Memo

To:	Sara Wallace Middle Musquodoboit, NS	From:	Eric Arseneau Fredericton, NB
Project/File:	121619250	Date:	November 2, 2022

Reference: Touquoy Open Pit Water Treatment - Conceptual Approach

In response to additional information requested as part of the provincial Environmental Assessment Registration Document (EARD), the following memo details the proposed treatment schedule, treatment process as well as the anticipated discharge requirements to protect fish and fish habitat in relation to in-pit deposition of tailings.

Schedule:

In-pit water treatment will start when effluent discharge is predicted to commence, 6 years after tailings/waste rock deposition is initiated and will continue for approximately 24 years.

The detailed plan for how treatment will be implemented consists of the following components:

- Year 0: Initiate water quality and volume monitoring of the Open Pit at start of deposition
- Year 3: Commence the preliminary design of the water treatment system, informed by the water quality and flow data collected to date
- Year 4: Based on the preliminary design, 1 - source and select a design-build vendor; 2 - completion of final design; and 3 - Industrial Approval (IA) amendment submission
- Year 5: Construct and commission water treatment system
- Year 6: Start up the water treatment system
- Year 6 to 30: Operation of the water treatment system

Initial water quality modelling for the Touquoy pit water quality has identified that arsenic and ammonia are parameters of concern and will likely require water treatment prior to discharge to the environment.

Proposed Water Treatment:

Below is a description of the in-pit tailings water treatment concepts for metals, nitrite and cyanide brought forward to regulators as part of the EA process.

Treatment of effluent from the pit will be required to meet *Metal and Diamond Mine Effluent Regulations* (MDMER) limits as well as site specific requirements set under the IA. The pit was modelled to become full in Year 6 and treatment of effluent required until Year 30; the reclamation phase was simulated to occur in Year 6 – 30 after in pit deposition of Touquoy tailings ceases. Water will be continuously treated from the pit from Year 6.

Modelling has shown that the future water quality in the Open Pit would be similar to the tailings management facility (TMF) effluent that is being treated by the Touquoy effluent treatment plant (ETP). Current timelines indicate treatment of open pit surplus water will not be required until Year 6 of in pit tailings deposition; however, AMNS maintains the operational flexibility to treat effluent through the existing ETP to control water levels in the depleted open pit. If effluent treatment is required to manage pit water levels, the water-based discharges will be treated using the existing site infrastructure (ETP, Polishing Pond, Constructed Wetland, Etc.) to meet MDMER authorized limits and IA limits prior to discharge and closure.

Proposed water quality treatment during operation/closure for in-pit surplus water disposal involves the following:

1. Mill cyanide destruction is on-going from the existing operation using the INCO (air/SO_2 in the presence of a soluble copper catalyst at a controlled pH) process.
2. Sedimentation: in-pit deposition facilitates sedimentation of mill tailings suspended solids, and supplemental natural CN degradation of mill tailings solution in the Open Pit, with seasonal discharge to the effluent treatment facility.
3. Metals removal, solids precipitation, and pH adjustment as batch treatment in the pit and/or in the effluent treatment facility. A number of treatment approaches are being considered, the in-situ batch treatment of the Open Pit water and treatment with a dedicated treatment plant, and a combination of the two.
    a. Batch Treatment

As part of the treatment circuit, metals removal, solids precipitation and pH adjustment will be achieved through batch treatment of the pit lake once operation is ceased. Batch treatment will increase the pH to induce precipitation of minerals and remove metals by enhancing natural oxidation. Arsenic co-precipitates with iron when iron is oxidized from the ferrous to ferric iron form. A lime mixing station will be installed near the pit and pit water will be pumped from the pond for mixing. The lime will be applied to the pit as a slurry. Air injection and/or aerators will be installed in the pit for mixing.

    b. Treatment Plant of Surplus Flows

In-situ treatment of surplus water in the pit will be applied once the pit is full, as required, or integrated into the batch treatment circuit while the pit is filling. A packaged treatment plant will be installed adjacent to the pit, or flow will be pumped to the existing Touquoy ETP at a rate of approximately 400 m^3/hr. This treatment will be comparable to the existing plant that provides pH adjustment through liming for metals precipitation, and coagulation/flocculation or filtering to remove sediment. In addition, ammonia treatment may be required. The engineered treatment options for ammonia removal that are considered include:

- Naturally occurring and enhanced biological processes that converts ammonia to nitrate and nitrite (i.e., nitrification)
- Natural volatilization and enhanced volatilization
- Break-point chlorination with post oxidation quenching (to remove chlorine residual).
- Adsorption columns

The treatment options that are being considered for arsenic removal consist of the following:

- Co-precipitation with ferric iron or aluminum (to a lesser degree), which may require pre-oxidation to convert arsenic from the arsenite to arsenate form, followed by liquid-solids separation to return the solids to the pit

- Reverse Osmoses (RO) membrane treatment where the concentrate is either returned to the pit and the permeate discharged, or the concentrate is treated for arsenic and then blended with the permeate for discharge
- Adsorption using engineered adsorbants such as ion exchange resins, zeolite, activated alumina, iron or titanium based sorbents, and granular ferric hydroxide (GFH)

Modelling has shown that the future water quality parameters of concern in the pit water would be similar to the TMF effluent that is being treated by the Touquoy ETP. However, as natural degradation takes place during the 6 years of pit filling, the required treatment will be reduced, and some aspects may no longer be required. The pit filling time provides opportunity to monitor the pit water quality and conduct additional modelling and bench-scale level work.

The details of the treatment plan are undergoing design. The footprint of the water treatment plan will be sited during design.

Closure:

As the pit will be prepared for closure throughout operation (e.g., the banks will be sloped back and stabilized), the project will file for closure status under MDMER once mining activities cease. Closure is subject to MDMER Environmental Effect Monitoring (EEM) monitoring requirements that must occur 3 years post-closure. Concurrently, during this period, site specific provincial requirements will continue to apply and are expected to apply until the mine reaches its reclamation objectives (i.e. physical & chemical stability objectives). In addition, the mine will always be subject to the provisions described in Section 34 of the *Fisheries Act* which deal with fish and fish habitat protection and pollution prevention.

Discharge Requirements:

Water-based discharges are protective of fish and fish habitat under the *Fisheries Act* as they will be managed and treated to meet MDMER authorized limits and site-specific limits prior to discharge and closure. Discharges will be subject to the MDMER discharge limits that came into force in 2021, which are intended "to reduce the risks of the negative effects of mines on fish and fish habitat" (Government of Canada 2017) as well as site specific requirements set under the IA.

Additional steps to determine site specific water quality criteria which will be protective of fish and fish habitat will be initiated during Year 0 where tools (e.g. WHAM F-TOX) will be used to assess impacts of heavy metals on fisheries resources. These tools will be utilized to compare the baseline Moose River, predicted discharge concentrations and actual discharge concentrations to show the level of acute and chronic effects.

Furthermore, other toxicity models dealing with major ions, including sulphate, chloride, and magnesium/calcium toxicity will be utilized to further assess acute and chronic effects. These models should be completed several years prior to initial water treatment design so that the provincial site-specific discharge criteria can be informed and ultimately met.

Regards,

STANTEC CONSULTING LTD.

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Senior Environmental Scientist
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Attachment 10
Pit Slope Seepage Mitigation Technical Specifications and Drawings

Touquoy In-Pit Tailings Deposition: Pit Wall Seepage Mitigation Liner

Design Report

October 20, 2022

Prepared for:

Atlantic Mining NS Inc.

Prepared by:

Stantec Consulting Ltd.
141 Kelsey Drive
St. John's, NL A1B 0L2
Tel: 709-576-1458

File: 121619250

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LIST OF APPENDICES

1.0 INTRODUCTION

At the request of Atlantic Mining NS Inc. (AMNS), Stantec Consulting Ltd. (Stantec) has completed the design for the Pit Wall Seepage Mitigation Liner planned for the In-Pit Tailings Deposition in the Touquoy Mine Open Pit. In support of planning for In-Pit tailings disposal, a memo summarizing the conceptual seepage mitigation measures (*MEM-012-5500-B-11MAR22, Stantec, March 14, 2022*) was submitted. This report provides updated details of the design and includes design drawings and specifications.

This work was completed in general accordance with the geotechnical scope of our proposal PR0-122, dated April 27, 2022.

2.0 BACKGROUND

The Touquoy Mine consists of an Open Pit, Mill Facility, Waste Rock Storge Area (WRSA) and a Tailings Management Facility (TMF) as shown on Drawing No. 1. The tailings from the milling process are currently transported from the mill to the TMF via an HDPE pipeline. The existing TMF is approaching the capacity for tailings storage, with estimated timeline of October 2022 for the TMF to be full.

In-Pit tailings disposal is proposed to meet future tailings storage requirements for additional ore processing from both newly identified resources, as well as anticipated processing of medium to low-grade ore at the site.

To support the proposed tailings deposition within the Open Pit, a detailed field investigation of subsurface conditions in the vicinity of the Pit consisting of borehole drilling including in-situ packer testing and downhole surveys, Ground Penetrating Radar (GPR) and a desktop review of underground workings was completed in the fall and winter of 2021/2022. This information is reported under separate cover (*Factual Data Report - Hydrogeological Site Investigation, Touquoy In-Pit Tailings Disposal, Stantec 2022*). In addition, groundwater modeling was completed for the project to assess the environmental impact from the tailings disposal in the Pit (*Report Update: Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Tailings in Touquoy Open Pit, Stantec 2022*).

Based on the available information and analysis completed, the hydraulic conductivity for the bedrock mass in the pit area does not indicate additional seepage mitigations are required to avoid environmental interactions between the tailings deposited in the Pit and the environment (*Report Update: Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Tailings in Touquoy Open Pit, Stantec 2022*). However, to address any uncertainty related to the presence and interconnectivity of the underground workings, a low permeability liner is proposed on the western side of the Pit. The sections below provide details of the design of the Pit Slope Seepage Mitigation Liner (Liner).

3.0 PIT SLOPE SEEPAGE MITIGATION LINER

In the area of historical underground workings, a low permeability liner is proposed to mitigate potential seepage from the Pit through the underground workings to the environment. The lateral extent of the liner is shown on the attached Drawing. No 5500C-102 and 103.

The design for the liner includes placement of clay till between the tailings and the pit wall. For the purposes of this report, the terms upstream and interior are used to describe towards the middle of the Pit and the terms downstream or exterior are used to describe towards the outside of the Pit or the surrounding environment.

A typical cross section of the liner is shown on Drawing No. 5500C-103 and includes the following components:

- Low Permeability Liner (Clay Till Borrow)
- Upstream Filter Material (Fine Filter)
- Upstream Protection / Stabilization Layer (Rockfill)

The following sections provide additional details of each component.

3.1 COMPONENTS / MATERIALS

3.1.1 Low Permeability Liner (Clay Till Borrow)

A low permeability element will be constructed of locally sourced clay till borrow as per the attached specifications. The vertical extent of the clay layer is from the crest of the pit to the rock bench at approximate elevation 60 m, which is below the historical underground mine workings. The clay till borrow will be placed directly on and adjacent to the pit benches and walls.

Using laboratory testing data from the construction of the Touquoy TMF, the clay till borrow will provide a liner with a hydraulic conductivity less than $1x10^{-8}$ m/s (generally in the order of $2.9x10^{-9}$ m/s), which is similar the lower permeability bedrock in the area of the open pit. The total normal thickness of the liner will be a minimum of 3.5 m wide (horizontally) to allow placement and compaction with conventional construction equipment. Clay till and filters disturbed by hauling shall be removed/repaired and replaced as needed prior to additional fill placement.

3.1.2 Upstream Filter (Fine Filter)

A filter layer will be placed on the interior of the low permeability liner for protection during construction and to prevent the migration of fines into the rockfill layer caused by any groundwater seepage into the Pit, particularly during early stages of pit filling when the exterior water levels are anticipated to be higher than the pit water level. The seepage from the exterior through the liner is predicted to be minimal due the low permeabilities of the bedrock and the liner. The filter layer will consist of a 50-mm minus sand and gravel as per the attached specifications. The filter will be placed between the clay till liner and the rockfill along the entire height of the liner. The filter thickness will be a minimum of 1.0 m horizontal when placed upstream of the low permeability layer and 1.0 m vertical when placed above the low permeability layer.

3.1.3 Upstream Protection / Stabilization Layer (Rockfill)

A rockfill protection/stabilization zone on the interior of the liner and upstream filter layer will provide overall slope stability of the fill zone and erosion protection from surface water and wave runup within the pit. The Rockfill is separated into two types, Type A and Type B, as per the attached specification. Rockfill Type A is specified above the closure water level of the Pit. Rockfill Type B is specified below the closure water level of the Pit. The rockfill will be placed on the upstream side a minimum of 5 m wide and with a maximum upstream slope of 1.5 Horizontal to 1.0 Vertical (1.5H:1V) to maintain adequate stability of the slope. Additional rockfill width was included on the upstream side of the slope to allow for a safety berm and allow construction equipment access and turnaround area.

3.2 CONSTRUCTION METHODOLOGY

3.2.1 Previously Placed Rockfill – Dynamic Compaction

Rockfill has been placed in this area of the pit by the mine fleet to elevation 60.0 m via end dumping without compaction. To densify the existing rockfill, it is recommended that dynamic compaction be completed prior to additional material placement above this elevation. The “zone of interest” of the dynamic compaction is the section of rockfill approximately 10 m below the elevation 60 bench. The dynamic compaction zone is presented on Drawing No. 5500C-102 and 103 (attached).

Dynamic compaction is a process whereby a heavy tamper is repeatedly raised and dropped from a specified height to impact onto the ground surface, thereby transmitting high compaction energy into the soil/aggregate mass. The depth of improvement depends upon the mass of the tamper and the height of the drop. The degree of improvement depends upon the amount of energy applied per unit area and therefore also relies on the spacing of the drop locations.

For the purpose of this scope, of the following recommendations are provided for Dynamic Compaction:

- Ram Mass: 15 tonne
- Drop Height: 18 metres
- Grid Spacing:
  - Initial Grid: 3 m
  - Secondary Grid: In between the Initial Grid
- Number of Drops per location: 8

Following completion of the dynamic compaction, fill placement can proceed as noted below.

3.2.2 Pit Slope Rockfall Hazard Assessment

Prior to work being completed under/adjacent to the pit wall, a rockfall hazard assessment shall be completed along the pit slopes. All slopes shall be scaled to remove loose rock. Scaling will be completed using mechanical equipment to the next bench up prior to completing work below. Following scaling an inspection by a qualified person will be completed to assess if additional rockfall mitigations such as wire mesh or netting is required.

3.2.3 Liner Construction

Material placement and compaction will be completed using construction equipment with enclosed cabs to protect against possible rockfalls. Regular review of the pit walls and benches will be completed during construction to identify any additional mitigations.

The liner, filter and rockfill will all be placed in horizontal lifts as the construction proceeds. The clay till borrow will be placed adjacent to the pit wall and pit bench geometry and the filter will be placed upstream or over the liner. The temporary slopes of the clay and filter will be based on what is constructable in the field with the equipment available. The liner and filter will not be placed more than 1m above the rockfill bench as construction proceeds.

3.3 CONSTRUCTION STAGING

To meet construction schedules and limit the head differential on the liner from the downstream to the upstream, while meeting the tailings depositional requirements, the liner is proposed to be constructed in stages. Preliminary Stages are outlined below and will depend on pit filling and tailings deposition rates:

- Stage 1 – Construction to the Pit Bench at Elevation 80 m
- Stage 2 – Construction to Pit Bench Elevation of 100 m
- Stage 3 – Construction to ultimate stage

Stages will be reviewed based on ongoing water balancing to maintain the clay liner above the pit water/tailings levels. Stages are intended to be completed during non-freezing months of the year and to limit the differential head on the liner. Frost cover should be placed on clay till exposed during the freezing months. Unsuitable clay till shall be removed prior to starting the subsequent stage.

3.4 DRAWINGS AND SPECIFICATIONS

Drawings and specifications for the scope of work have been prepared to further define the work, materials and contractor responsibilities. The following are appended to this report.

- Drawings
  - Drawing No. 5500C-101
  - Drawing No. 5500C-102
  - Drawing No. 5500C-103
- Specifications

- Technical Specifications - Touquoy Mine In-Pit Tailings Deposition – Pit Slope Seepage Mitigation Liner

4.0 CLOSURE

We trust the information provided within this memorandum meets your current requirements. If you have any questions, please contact us at your convenience.

Stantec Consulting Ltd.

Paul Deering P.Eng.
Senior Principal, Geotechnical Engineer
Tel: 709-576-1458
Paul.Deering@stantec.com

5.0 REFERENCES

Stantec 2022. Factual Data Report - Hydrogeological Site Investigation, Touquoy In-Pit Tailings Disposal. March 14, 2022.

Stantec 2022. Report Update: Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Tailings in Touquoy Open Pit. March 2022.

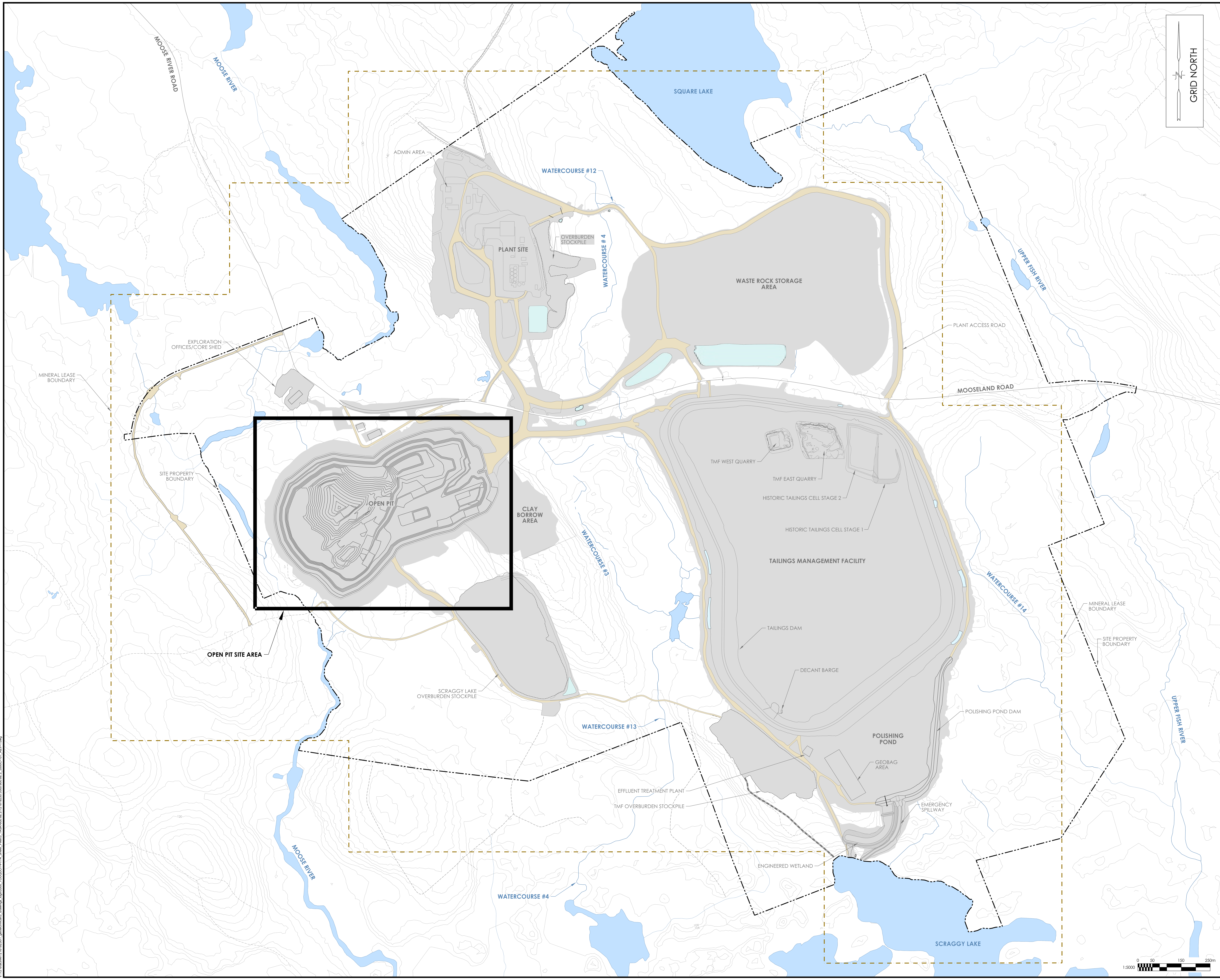
Stantec 2022. Touquoy In-Pit Tailings Deposition – Pit Wall Seepage Mitigation Liner (MEM-012-5500-B-11MAR22). March 14, 2022

Appendix A DRAWINGS 1 TO 3

Drawing No. 5500C-101

Drawing No. 5500C-102

Drawing No. 5500C-103



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Legend

LEGEND

- 2020 DISTURBANCE AREA (APPROVED IA LIMITS)
- WATERBODY
- COLLECTOR / SETTLING POND
- WATERCOURSE
- SITE PROPERTY BOUNDARY
- MINERAL LEASE BOUNDARY
- MINE HAUL/ACCESS ROAD
- ROAD - OTHER (PAVED)
- ROAD - OTHER (DIRT)

Notes

1. EXISTING TOPOGRAPHY SHOWN IS BASED ON LIDAR DATA PROVIDED BY CONESTOGA-ROVERS & ASSOCIATES (2010). CONTOURS HAVE BEEN SMOOTHED USING MUCH3D (2m GRID SPACING). ACTUAL FIELD CONDITIONS MAY VARY.
2. WATERCOURSES BASED ON NOVA SCOTIA PROVINCIAL (SNSMR, 2006) AND McCALLUM ENVIRONMENTAL DATA.

ISSUED FOR CONSTRUCTION

STAMP

REGISTERED PROFESSIONAL ENGINEER P. D. Deering 11621 PROVINCE OF NOVA SCOTIA

STAMP

No.	DETAILS	BY	APPD.	DATE
1	UPDATED PIT DESIGN - ISSUED FOR CONSTRUCTION	JG	PD	2022-10-20
0	ISSUED FOR PERMITTING	JG	PD	2022-05-11

REVISIONS

CLIENT:
ATLANTIC MINING NS INC.

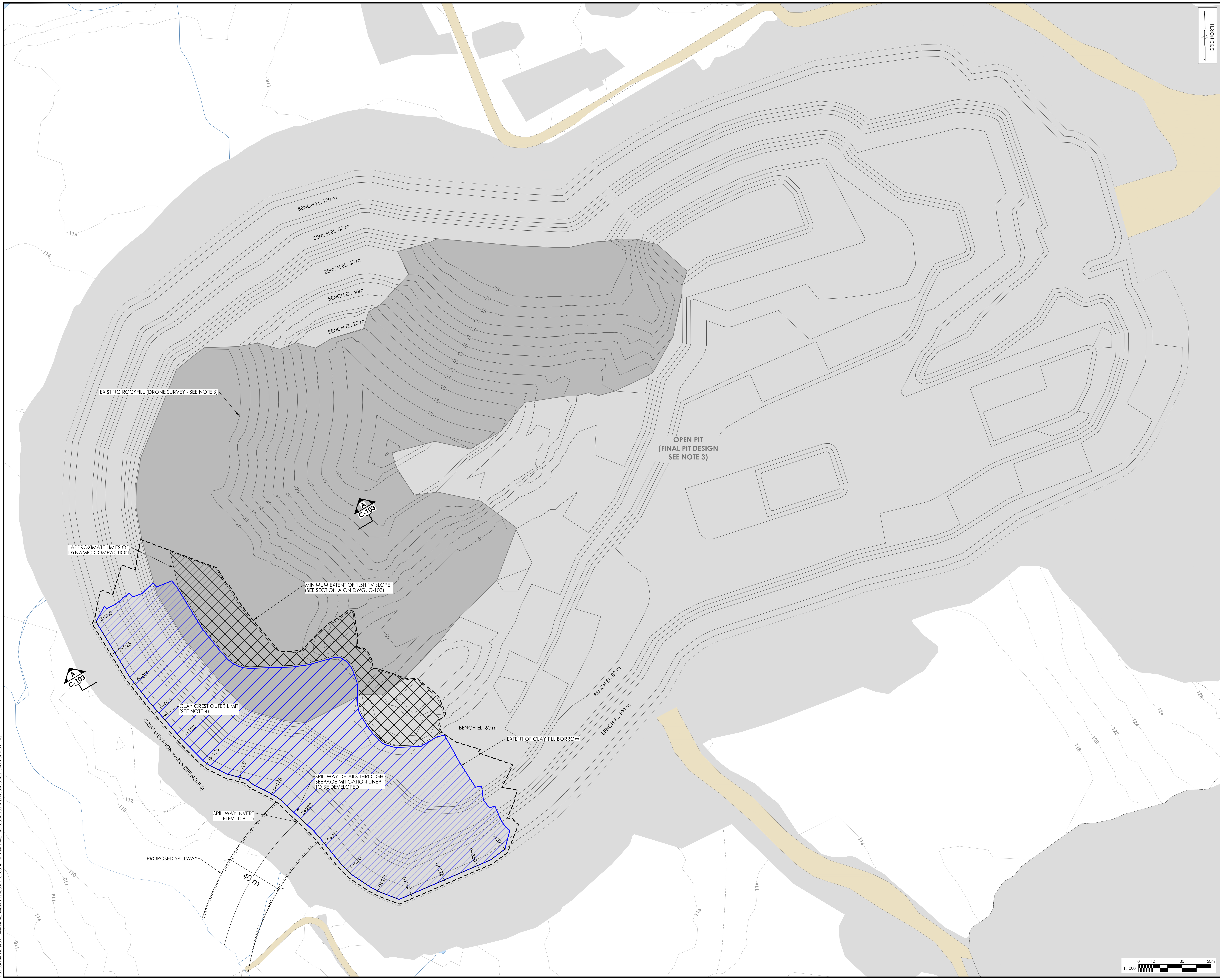
PROJECT:
TOUQUOY GOLD PROJECT

PROJECT LOCATION:
HALIFAX COUNTY, NOVA SCOTIA

JOB No.:	SCALE:	DATE:
121619250	1:5000	2022-10-20
DRAWN BY:	DESIGNED BY:	APPROVED BY:
JDL	JAG	PDD

DRAWING TITLE:
PIT SLOPE SEEPAGE MITIGATION LINER GENERAL SITE PLAN

DRAWING No.:	REVISION No.
5500C-101	1



ISSUED FOR CONSTRUCTION

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Legend

LEGEND

- 2020 DISTURBANCE AREA (APPROVED IA LIMITS)
- EXISTING ROCKFILL
- PIT SLOPE SEEPAGE MITIGATION LINER
- APPROXIMATE LIMITS OF DYNAMIC COMPACTION
- MINIMUM EXTENT OF 1.5H:1V SLOPE
- 124.0 LIDAR CONTOURS
- WATERCOURSE
- MINE HAUL/ACCESS ROAD

Notes

1. LIDAR DATA PROVIDED BY CONESTOGA-ROVERS & ASSOCIATES (2010). CONTOURS HAVE BEEN SMOOTHED USING MUCH3D (2m GRID SPACING). ACTUAL FIELD CONDITIONS MAY VARY.
2. WATERCOURSES BASED ON NOVA SCOTIA PROVINCIAL (SNSMR, 2006) AND McCALLUM ENVIRONMENTAL DATA.
3. FINAL PIT DESIGN (2022-08-31) AND DRONE SURVEY (2022-09-12) PROVIDED BY ATLANTIC MINING NS INC.
4. SEEPAGE MITIGATION LINER CLAY CREST OUTER LIMIT IS BASED ON FINAL PIT DESIGN EL. 110 m CONTOUR (AMNS INC., 2022-08-31). ACTUAL FIELD CONDITIONS MAY VARY.

STAMP

REGISTERED PROFESSIONAL ENGINEER
DATE 05/20/22
P. D. Deering
11621
PROVINCE OF NOVA SCOTIA

STAMP

No.	DETAILS	BY	APPD.	DATE
1	UPDATED PIT DESIGN - ISSUED FOR CONSTRUCTION	JG	PD	2022-10-20
0	ISSUED FOR PERMITTING	JG	PD	2022-05-12

REVISIONS

CLIENT: **ATLANTIC MINING NS INC.**

PROJECT: **TOUQUOY GOLD PROJECT**

PROJECT LOCATION: **HALIFAX COUNTY, NOVA SCOTIA**

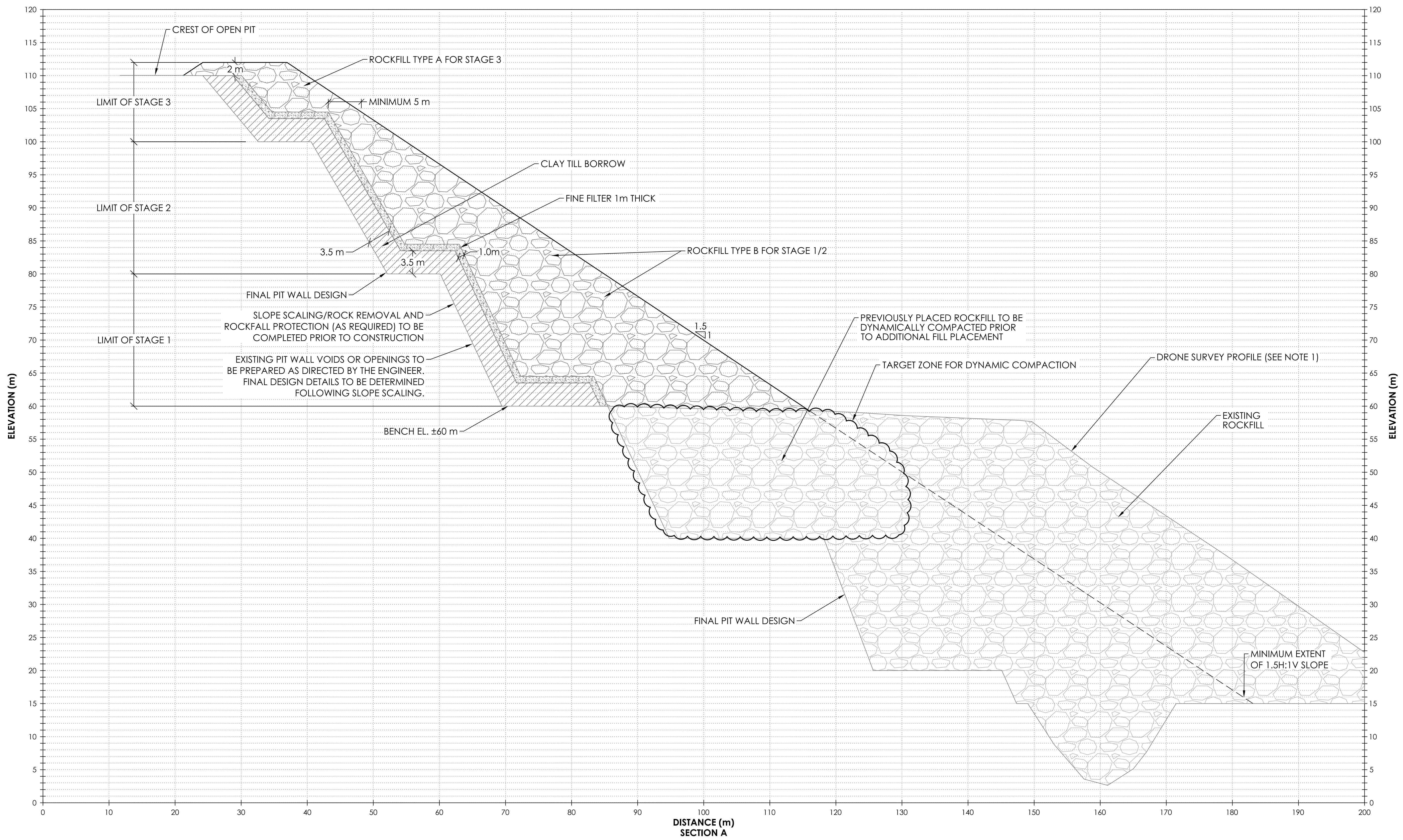
JOB No.:	SCALE:	DATE:
121619250	1 : 1000	2022-10-20
DRAWN BY:	DESIGNED BY:	APPROVED BY:
JDL	JAG	PDD

DRAWING TITLE:

PIT SLOPE SEEPAGE MITIGATION LINER PLAN VIEW

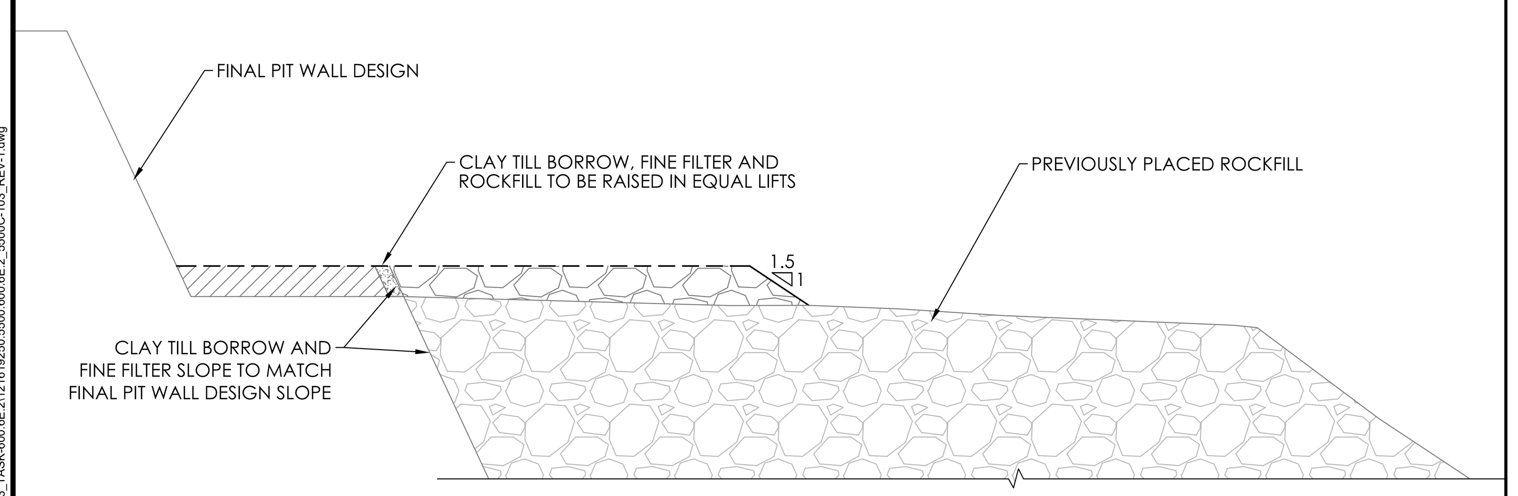
DRAWING No.: **5500C-102**

REVISION No.: **1**



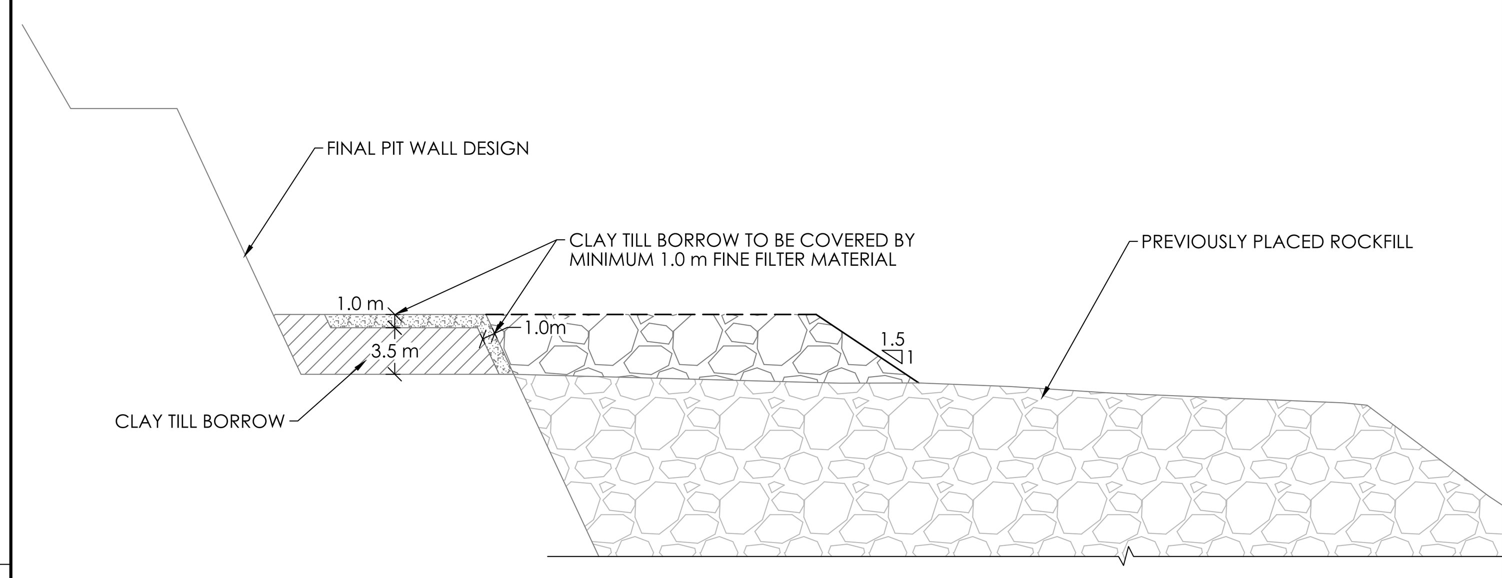
TYPICAL SECTION - SEEPAGE MITIGATION LINER A C-102 C-103

SCALE 1 : 400



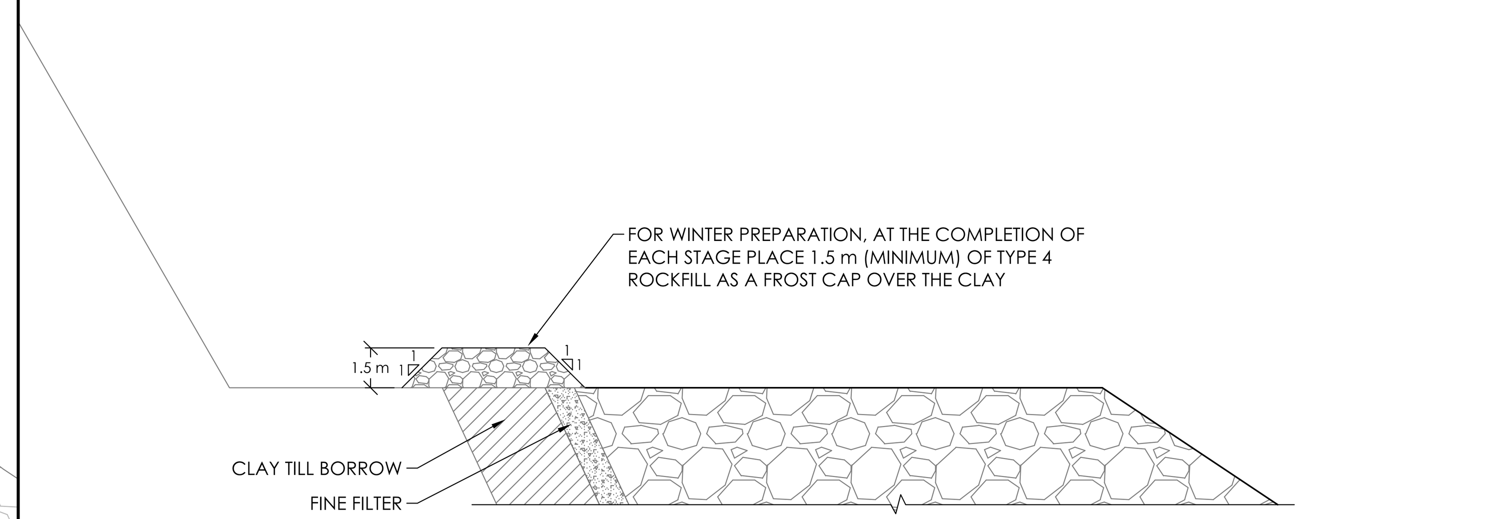
SEEPAGE MITIGATION LINER - CONSTRUCTION TYPICAL SECTION 1 C-103

SCALE 1 : 400



SEEPAGE MITIGATION LINER - FINE FILTER TYPICAL SECTION 2 C-103

SCALE 1 : 400



FROST PROTECTION DETAIL 3 C-103

SCALE 1 : 200

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Legend

Notes

1. FINAL PIT DESIGN AND DRONE SURVEY PROVIDED BY ATLANTIC MINING NS INC.

ISSUED FOR CONSTRUCTION

STAMP

STAMP

No.	DETAILS	BY	APPD.	DATE
1	UPDATED PIT DESIGN - ISSUED FOR CONSTRUCTION	JG	PD	2022-10-20
0	ISSUED FOR PERMITTING	JG	PD	2022-05-12

REVISIONS

CLIENT:
ATLANTIC MINING NS INC.

PROJECT:
TOUQUOY GOLD PROJECT

PROJECT LOCATION:
HALIFAX COUNTY, NOVA SCOTIA

JOB No.:	SCALE:	DATE:
121619250	1: 400	2022-10-20
DRAWN BY:	DESIGNED BY:	APPROVED BY:
JDL	JAG	PDD

DRAWING TITLE:
PIT SLOPE SEEPAGE MITIGATION LINER TYPICAL SECTION

DRAWING No.:	REVISION No.
5500C-103	1

Appendix B SPECIFICATIONS

TECHNICAL SPECIFICATIONS TOUQUOY MINE IN-PIT TAILINGS DEPOSITION – PIT SLOPE SEEPAGE MITIGATION LINER

REVISION: 01

Prepared for:
Atlantic Mining Nova Scotia Inc.

Prepared by:
Stantec Consulting Ltd.

Stantec File No.: 121619250

October 20, 2022

Revision Record	Date	Description
Rev. 00	May 27, 2022	Issued for Review
Rev. 01	October 20, 2022	Issued for Construction

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LIST OF TABLES

1.0 GENERAL

These specifications are for the construction of the Pit Slope Seepage Mitigation Liner as part of the Touquoy Mine In-Pit Tailings Disposal project.

In general, the Work sequence shall be carried out as follows:

1. Establish erosion and sediment control measures.
2. Assess and stabilize pit slopes above work areas.
3. Dynamic compaction of the existing rockfill in the area of the Western Seepage Mitigation as per the project drawings.
4. Placement and compaction of clay till borrow to form the low permeability element.
5. Placement and compaction of filter between the clay till borrow and the rockfill on the pit side.
6. Placement and compaction of rockfill.
7. Placement of fill materials to be completed in the stages outlined on the project drawings or as determined based on project requirements and Engineers approval.
8. Construction and maintenance of access roads during construction.

1.1 Dewatering

1. Dewatering activities shall be executed in compliance with the Erosion and Sediment Control Plan.
2. Foundation must be free of standing water prior to fill placement.
3. Dewatering shall be accomplished by ditching and pumping as needed.
4. Water to be discharged from the construction area as needed to the Open Pit.

1.2 Quality Control/Quality Assurance

1. Contractor Responsibility
    a. The Contractor is responsible to allow the Owner and/or his representative full access to the various construction works so that he or his representative may carry out inspection and testing as outlined below.
    b. The Contractor must correct all Work at his/her expense for which any test result indicates the Work does not conform to the requirements of the Contract.
    c. The Contractor must certify that all materials and equipment used in the Work area are in accordance with the provisions of the Contract.

2. The Engineer or his representative will perform testing on the fill material to assure their compliance with the specifications. The Engineer will conduct field density or unit weight and other tests on the fill, and related laboratory testing to determine the relative degree of compaction and other properties. In addition, concurrent with construction, the Engineer will take samples of the materials from the borrow areas, stockpiles, and placed materials, and test these samples for moisture content and gradation, and carry out any other control or record tests which may be required. The Engineer will perform testing as frequently as it is deemed necessary.
3. Tests by the Engineer or his representative will be performed in accordance with the procedures specified in the following ASTM specifications:
    a. Moisture Content – ASTM D2216
    b. Grain Size Analysis – ASTM D422
    c. In-Place Density of Soil by Nuclear Method – ASTM D2922
    d. Maximum Density and Optimum Moisture Content - Standard Proctor – ASTM D698
    e. Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D5084
4. Testing Frequency shall conform to the following Table 1.1 or as directed by the Engineer:

Table 1.1 Testing Frequency

Material	Particle Size Distribution	Atterberg Limits	Permeability	Proctor Density	Density In-situ
Clay Till Borrow	500 m^3	4,000 m^3	5,000 m^3	5,000 m^3	Each layer, 20 m grid
Fine Filter	200 m^3	N/A	N/A	5,000 m^3	Each Layer
Rockfill Type A and B	25,000 m^3	N/A	N/A	N/A	N/A

1.3 Foundation Preparation: Existing Rockfill Foundation

1. Rockfill has been placed to elevation 60.0 m. Previously placed rockfill will be dynamically compacted in accordance with Section 4 and the project drawings.
2. Once dynamic compaction is complete and the area is leveled off and re-compacted, additional rockfill can be placed.

1.4 Pit Wall Voids or Openings Mitigation

1. If voids or openings are encountered on the pit wall following scaling that will impact the placement of clay till adjacent to the wall, additional measures will be taken to safely and adequately placed and compact clay till against the wall.
2. Details of additional measures will be determined by the Engineer or representative based on site conditions encountered that and could include but not limited to: placement of chain link fencing; geogrids; geotextiles and/ or alternative techniques to ensure the clay layer remain intact and not compromised by the slope feature.

1.5 Placement of Fine Filter

1. Clay Till Borrow shall be placed, compacted and shaped to final grades prior to placement of Fine Filter adjacent or onto the Clay Till Borrow as per the design drawings.

2.0 PIT WALL ROCK SLOPE ROCKFALL HAZARD MITIGATION

1. Prior to initiating any work beneath the pit slopes, an assessment of the rock slopes in relation to rockfall hazards shall be completed and appropriate remedial measures implemented. The assessment must be completed by a professional Engineer with experience in rock slope engineering and design.
2. Based on Stantec's preliminary assessment of the slopes it is anticipated that slopes will need to be scaled to remove any loose and unstable rock fragments. In addition, in select areas following scaling operations, covering the rock slope with wire mesh may be required.

2.1 Scaling

1. Definitions
    a. Scaling / Rock Removal: Consists of the removal of "loose rock" and/or unstable rock fragments, rock pieces, rock blocks, rock masses, soil, and rock layers, by equipment and methods approved by the Engineer from exposed bedrock surfaces.
2. Execution
    a. Scale the rock slope in areas identified by the Engineer either manually with hand tools or by a mechanical device designed to catch onto and pull loose rock from the slope.
    b. The Contractor is to assess the appropriateness of the methods to carry out the scaling and removal operations safely and effectively. Prior to the initiation of the work, the Contractor must advise the Engineer in writing, or as otherwise agreed, of how Contractor intends to complete operations and must obtain the Engineers approval.
    c. All scaling operations must be completed starting from the top and proceeding downwards.
    d. Comply with all safety requirements during the scaling operation.

2.2 Rockfall Protection Netting

1. Description
    a. Rockfall protection netting is typically used in applications where the netting is draped over the face of the slope to provide protection for areas below.
    b. Details regarding the rockfall protection netting will be determined and defined following the site assessment by the rock slope Engineer.

3.0 MATERIALS

1. The locations of the materials are shown on the drawings. The material types are as follows:
    a. Clay Till Borrow;
    b. Fine Filter;
    c. Rockfill – Type A
    d. Rockfill – Type B
2. Materials shall be obtained from specified borrow sources or approved borrow sources. Only suitable material from the specified or approved sources shall be used. Suitability of the materials will be determined by the Engineer using any or all tests described herein.
3. The gradation and distribution of the materials shall be such that the layer does not contain lenses, pockets, streaks, and layers of materials differing substantially in texture or gradation from the surrounding material.
4. If, as determined by the Engineer or his representative, segregation has occurred, the segregated material shall be removed and replaced with suitable material by and at the expense of the Contractor.
5. Materials containing brush, roots, peat, and sod or other organic, perishable, or deleterious matter, snow, ice, or frozen soil shall not be used.
6. If, for any reason, the Contractor places the materials which do not meet the requirements of this specification, all such materials shall be removed and replaced with satisfactory materials by and at the expense of the Contractor.
7. Unless otherwise shown or approved, the fill shall be placed with equipment travelling parallel to the Open Pit wall.
8. The surface of the materials placed shall be sloped or towards the open pit so that water will readily drain off.

3.1 Clay Till Borrow

1. <u>Gradation Limits and Plasticity Requirements</u>
    a. The specified clay till borrow shall be sourced from the drumlins located at the mill site, southeast end of the open pit, southwest end of the TMF or approved alternative borrow source.
    b. Clay Till Borrow shall contain a minimum of 45% percent by weight of silt and clay size particles (the materials passing the 0.075 mm sieve size). The maximum particle size shall

be 100 mm, and such particles shall not constitute more than 20 percent of the Clay Till Borrow. Oversize particles shall be removed.

c. The Clay Till Borrow shall have a Plasticity Index greater than 4, and a placed as per the details provided under "Compaction" below.

2. Placement

a. Type 1 material shall be spread in horizontal layers with a maximum loose lift thickness of 500 mm and each layer shall be compacted to the specified density using a minimum 10 tonne sheep's foot roller.

b. Type 1 materials shall not be placed under water, nor shall any materials be placed until the subgrade is approved by the Engineer.

c. Unless approved by the Engineer, placement of clay borrow shall be suspended when snow is falling or when the ambient temperature is 0 degree C or less.

3. Moisture Content Control

a. The moisture content shall be uniform as practicable throughout any one layer of material and shall be at or not more than two percent above or below the optimum moisture content for the clay borrow material determined by the Engineer or his representative.

4. Compaction

a. The density of the Type 1 in place, shall not be less than 98 percent of the Standard Proctor Maximum Dry Density as determined in accordance with ASTM D698.

b. Compaction shall be carried out in a systematic fashion to ensure that a consistent number of passes are made completely over each lift.

c. The method of placing and compaction of the Type 1 material shall achieve a permeability of 1×10^{-8} m/s or lower to be verified during construction by the Engineer or his representative using laboratory and field testing.

d. Proof roll the top of the clay layer using a sheep's foot roller and remove any soft and/or yielding spots and replaced with dry Type 1 material.

e. Any soft and/or yielding spots identified during the compaction process shall be removed and replaced with dry Type 1 material.

5. Staged Construction
    a. Prior to placing additional clay layers for the next stage of the construction the following shall be completed:
        - If required, remove frost protection material from the top of the previously placed clay surface.
        - Scarify the top of the clay and remove all unsuitable material.

3.2 Fine Filter

1. Gradation Limits and Material Type
    a. Gradation limits for the Fine Filter shall be as follows:

Table 2.1 Fine Filter Gradation Limits

Type 2 – Fine Filter	
Particle Size (mm)	**Percent Passing by Weight**
50 mm	100
19 mm	88 - 100
6.3 mm	60 - 95
4.75 mm	50 - 90
2.36 mm	30 - 77
1.18 mm	20 - 60
0.60 mm	12 - 40
0.15 mm	0 - 15
0.075 mm	0 - 8

    b. Filter material should be produced from a hard durable rock source and be free of deleterious materials such as organic matter, and weak rock.

2. Placement
    a. Filter materials shall be spread in horizontal layers with a maximum loose lift thickness 300 mm.
    b. Each layer shall be compacted to the specified density using a minimum 8 tonne smooth drum vibratory roller. Compaction shall be conducted in a systematic fashion to ensure that a consistent number of passes are made completely over each lift.
    c. No filter materials shall be placed under water, nor shall any materials be placed until the subgrade is approved by the Engineer.

3. Compaction:
   a. 95 percent of the Standard Proctor Maximum Dry Density as determined in accordance with ASTM D698.
   b. A minimum of 2 passes shall be carried out with the specified roller to achieve the desired level of compaction for the project. Actual number of passes should be determined by evaluating a trial section.
4. Moisture Content Control
   a. Moisture content shall be uniform as practicable throughout any one layer of material and shall be at or not more than two percent above or below the optimum moisture content for the filter material as determined by the Engineer or his representative.

3.3 Rockfill Type A

1. Gradation Limits and Material Type
   a. Rockfill Type A shall consist of coarse, non-mineralized, non-acid generating, non-metal leaching waste rock from the open pit mine.
   b. Rockfill Type A should be produced from a hard durable rock source, such as the greywacke and/or the durable argillite and be free of deleterious materials such as organic matter, and weak rock.
   c. Gradation limits for the Type A Rockfill are shown in Table 2.4 below.

Table 2.2 Rockfill Type A Gradation Limits

Rockfill Type A	
Particle Size (mm)	**Percent Passing by Weight**
900 mm	100
150 mm	45 - 100
60 mm	10 - 45
19 mm	0 - 30
1.18 mm	0 - 15
0.075 mm	0 - 5

2. Placement
   a. Rockfill Type A material shall be spread in horizontal layers with a maximum loose lift thickness of 900 mm.

3. Compaction:
    a. A minimum of 4 passes with a minimum 15 tonne smooth steel drum vibratory roller is required to achieve the desired level of compaction within the rockfill. A rolling pattern may be conducted in the field if determined necessary by the Engineer to assess compaction effort. The minimum number of passes will be adjusted in the field if the Engineer deems necessary.
    b. Compaction shall be carried out in a systematic fashion to ensure that a consistent number of passes is made completely over each lift and will be verified by visual methods in the field by the Engineer.

3.4 Rockfill Type B

1. Gradation Limits and Material Type
    a. Rockfill Type B should be produced from blasting of bedrock and be free of deleterious materials such as organic matter.
    b. Maximum particle size shall be limited to 900 mm.
2. Placement
    a. Rockfill Type B material shall be spread in horizontal layers with a maximum loose lift thickness of 900 mm.
3. Compaction:
    a. A minimum of 4 passes with a minimum 15 tonne smooth steel drum vibratory roller is required to achieve the desired level of compaction within the rockfill. A rolling pattern may be conducted in the field if determined necessary by the Engineer to assess compaction effort. The minimum number of passes will be adjusted in the field if the Engineer deems necessary.
    b. Compaction shall be carried out in a systematic fashion to ensure that a consistent number of passes is made completely over each lift and will be verified by visual methods in the field by the Engineer.

4.0 DYNAMIC COMPACTION

4.1 Definitions

1. Dynamic Compaction: A process whereby a heavy tamper is repeatedly raised and dropped from a specified height to impact onto the ground surface, thereby transmitting high compaction energy into the soil mass. The depth of improvement depends upon the mass of the tamper and the height of the drop. The degree of improvement depends upon the amount of energy applied per unit area.
2. Pass: The application of the portion of the planned energy at a single drop point location. If the multiple drops required at a drop point cannot be applied at one time because of deep craters, an additional pass (or passes) will be required after the craters are filled with rock fill.
3. Phase: The pattern in which the energy is applied. For example, every other drop point of the grid pattern could be densified as Phase 1; after completion of Phase 1, intermediate drop points could be densified as Phase 2.
4. Surplus material: excavated material not required for re-use onsite.
5. Subgrade: the surface of mass excavation or fill finished to lines and elevations indicated.

4.2 Inspection and Monitoring

1. The dynamic compaction operation will be monitored by the Engineer or site representative. This, however, shall not relieve the Contractor of the responsibility to keep adequate records of the operation.
2. The monitoring will include, but not be limited to, observations of crater depths, determining if heave is occurring adjacent to certain craters, deciding on the need for additional tamping at select locations or the need for importation of rock fill, monitoring of ground vibrations adjacent to existing buildings, structures and services, and the observation of roller compaction.
3. The Contractor shall notify the Engineer at least 24 hours before any specific activity so that the required inspection and monitoring can be carried out.

4.3 Protection of Persons and Properties

1. In addition to the general safety program which is in place for the overall Touquoy Mine Project, a safety program specific to the dynamic compaction operation shall be prepared by the Contractor and submitted for review by the Engineer prior to commencement of the work.

2. The dynamic compaction safety program shall address required setback distances from the drop point to protect personnel from flying particles that may occur from impact of the tamper on the ground, the manner by which the cable is attached to the tamper, the nature and frequency of safety checks on the cable and associated equipment to prevent failure during the work, and any other aspects of the dynamic compaction operation which could affect job-site personnel, off-site personnel, and adjacent properties.
3. Ground vibrations from dynamic compaction operations shall not exceed 50 mm per second on the ground surface adjacent to buildings near the site. If ground vibrations approach this limit, halt work, and develop, with Engineer, modifications to procedures and site conditions to reduce vibrations.

4.4 Equipment

1. The contractor shall provide all cranes, tampers, and associated equipment required for the performance of the dynamic compaction operation. The contractor shall also provide the equipment necessary for excavating as required and for leveling the ground surface between passes.
2. Tamper: The tamper be designed by the Contractor to resist the high impact stresses to which it will be subjected. The tamper shall have a minimum mass of 15 tonnes, and a flat base of circular or octagonal shape. The contact pressure (weight of tamper divided by the base area) shall be in the range of 70 to 75 kPa.
3. Crane: The crane shall have a rated capacity of 90 to 110 tonnes. A single cable with a free spool hoisting drum shall be used to lift and drop the tamper under “free” fall conditions.

4.5 Grid and Elevation Surveys

1. Drawing 5500C-102 and 103 shows the limits of the dynamic compaction operation.
2. The Contractor shall mark all the grid points in the field by stakes or wire markers. The tamper shall be dropped within 0.3 m of the grid point location. Following ground leveling after each pass, the stakes or wire markers shall be replaced for the next pass.
3. The Contractor shall obtain ground surface elevations on a 6-m grid immediately prior to dynamic compaction and following ground leveling after each pass of the dynamic compaction. The elevations shall be obtained at the same locations to determine the settlement induced by the dynamic compaction.

4.6 Energy Application

1. The compaction shall be applied in two phases which are designated as the Primary (first phase) and Secondary (second phase) Locations. The primary locations shall be completed with a grid spacing of 3 m. The secondary locations shall be completed at the same grid spacing but at locations intermediate to the primary locations.

2. Compaction shall be carried out at each location using a 15-tonne tamper, minimum of 8 drops and a drop height of 18 m.
3. The Contractor and the Engineers representative shall coordinate the control of drop heights and the counting of the number of drops at each grid point to ensure that the proper energy is applied. Additional drops shall be carried out at specific locations if requested by the Engineer/Engineers representative.
4. Multiple passes may be required to deliver the full energy. One pass will be comprised of either of the following:
    a. The application of all the specified drops at a grid point location; or
    b. When the crater depth reaches 1.5 m
5. After each pass, rock fill shall be placed in the craters to raise the grade to the prevailing level. If work is carried out under cold-weather conditions, remove any frozen soil before filling; rock fill temperature shall be at or above 2 degrees C during placement and compaction.
6. Energy application at secondary locations shall be carried out no sooner than 1 day after energy application at the immediately adjacent primary locations.
7. After the last pass has been completed, the ground surface shall be leveled, and a low-level energy ironing pass shall be applied. The ironing pass shall consist of 2 drops of the 15-tonne tamper from heights of 4 m at a grid point spacing of 2 m center to center or less.

4.7 Records

1. The Contractor shall keep accurate records of the dynamic compaction operation including locations where drops have been made, the number of drops per location, depths of craters, pass number, ground surface elevations before and after each pass, and if rock fill is placed at the site for crater filling or other purposes, the quantity and locations of fill placed for crater filling or other purposes.
2. All recorded information shall be available onsite for review by the AMNS or the Engineer. Records shall be submitted to the AMNS and the Engineer upon completion of the work.
3. Any circumstances affecting the work because of the dynamic compaction operation should be brought to the attention of the Engineer.

5.0 WINTER CONSTRUCTION

1. The placement of engineered fill during cold weather conditions requires additional care and effort. Special procedures and precautions must be exercised to minimize the risk of future problems.
2. A site meeting shall be held at project start-up to discuss the schedule of fill placement for the liner construction and to determine if fill placement will occur during the winter months.
3. Fill placement during the winter months shall adhere to the following recommendations:
    a. The rootmat/topsoil layer and any overlying snow will reduce the frost penetration. Conduct only the excavation work required for each day of work to minimize freezing of the underlying soil. This applies for fill areas and the borrow source.
    b. Excavated material to be used as fill should not be stockpiled but should be placed and compacted immediately after excavation.
    c. Placement of frost susceptible fill materials (i.e., Type 1, 2) shall not be carried out at temperatures below 0°C. During strong wind conditions, this allowable temperature should be increased to suit the site-specific conditions. Placement of rockfill materials (Type 4 and 12) may be placed below -5°C under the direction of the Engineer.
    d. Fill materials should be compacted to the specified dry density before the temperature of the fill drops below 2°C. To maintain imported fill above 2°C, it may be necessary to haul the fill in dump trucks having heated boxes with insulated tarpaulins over the box. Regular checks of the soil temperature should be made at the pit, in the trucks at the site prior to dumping, and frequently during compaction.
    e. The moisture content of fill materials should be approximately 2% below optimum. Fill materials with moisture contents above the optimum value should not be used.
    f. Fill placement shall be conducted in small areas. This may allow for continuous placement of fill lifts during the workday without the requirement for excavation/scraping of frozen material prior to placement of the next lift.
    g. For intermediate fill lifts, frost protection (e.g., straw, insulated tarp, etc.) shall be provided at the end of the workday or fill that freezes overnight shall be scraped off and disposed of prior to placing subsequent lifts of fill in the morning. Any snow or ice shall also be removed. Fill surfaces shall be sloped to prevent ponding of water during milder weather.
    h. Edges of fill lifts should be tapered and compacted.
    i. Frozen material from the borrow pit shall be removed from the face of the excavated area and disposed of.

j. Material containing snow or ice shall not be incorporated in the work. During snow events, fill placement should be stopped. When the earthworks restart, all snow and ice should be removed from the fill surface prior to subsequent fill placement. To remove all snow and/or ice after a snow event, some of the underlying fill may have to be removed and wasted.

Attachment 11
Underground Workings and Fault Grouting

Stantec

Memo

To:	Sara Wallace	From:	Paul Deering, P.Eng.
Cc	Mark Flinn, P.Eng. Jeff Gilchrist, P.Eng.		
File:	121619250.5500	Date:	October 21, 2022
Doc No.	**MEM-018-5500-A-21OCT22**	Revision:	A

Reference: In-Pit Tailings Deposition – NSECC IR #9 – Underground Workings and Fault Grouting

In response to a letter received from Nova Scotia Environment and Climate Change dated May 12, 2022, we provide the following request:

> *Provide information on the need and potential methodologies for grouting underground mine workings and fracture zones between the open pit and the Moose River.*

Several documents have been provided regarding mitigation measures recommended to deal with concerns related to the underground mine workings, and the technical basis that there are no requirements for grouting fracture zones between the open pit and the Moose River.

Stantec's Design Report entitled *"Touquoy In-Pit Tailings Deposition: Pit Wall Seepage Mitigation Liner"* dated October 20, 2022, provide details on the recommended project measures. A copy of this report is provided under separate cover in response to other requests from NSECC. In Section 2.0, Background, of this report we provide the following commentary:

> *Based on the available information and analysis completed, the hydraulic conductivity for the bedrock mass in the pit area does not indicate additional seepage mitigations are required to avoid environmental interactions between the tailings deposited in the Pit and the environment (Report Update: Groundwater Flow and Solute Transport Modelling to Evaluate Disposal of Tailings in Touquoy Open Pit, Stantec 2022). However, to address any uncertainty related to the presence and interconnectivity of the underground workings, a low permeability liner is proposed on the western side of the Pit.*

In addition, Stantec's technical memorandum "*Reference: AMNS EA IR Request 1.b: Hydraulic Connectivity Testing Considering"* dated October 20, 2022, provides a holistic review and interpretation of the available hydrogeology data surrounding the open pit mine. The information and analyses provided in this memo and supporting reports show that sufficient hydrogeological characterization has been completed to understand the hydraulic conductivity and connectivity surrounding the open pit mine at Touquoy. This memorandum supports the recommendation of using a low permeability liner to mitigate uncertainty around the underground workings. In addition, this memorandum concludes the hydraulic testing indicated that faults in the area do not indicate increased water flow and therefore grouting of faults will not be a requirement.

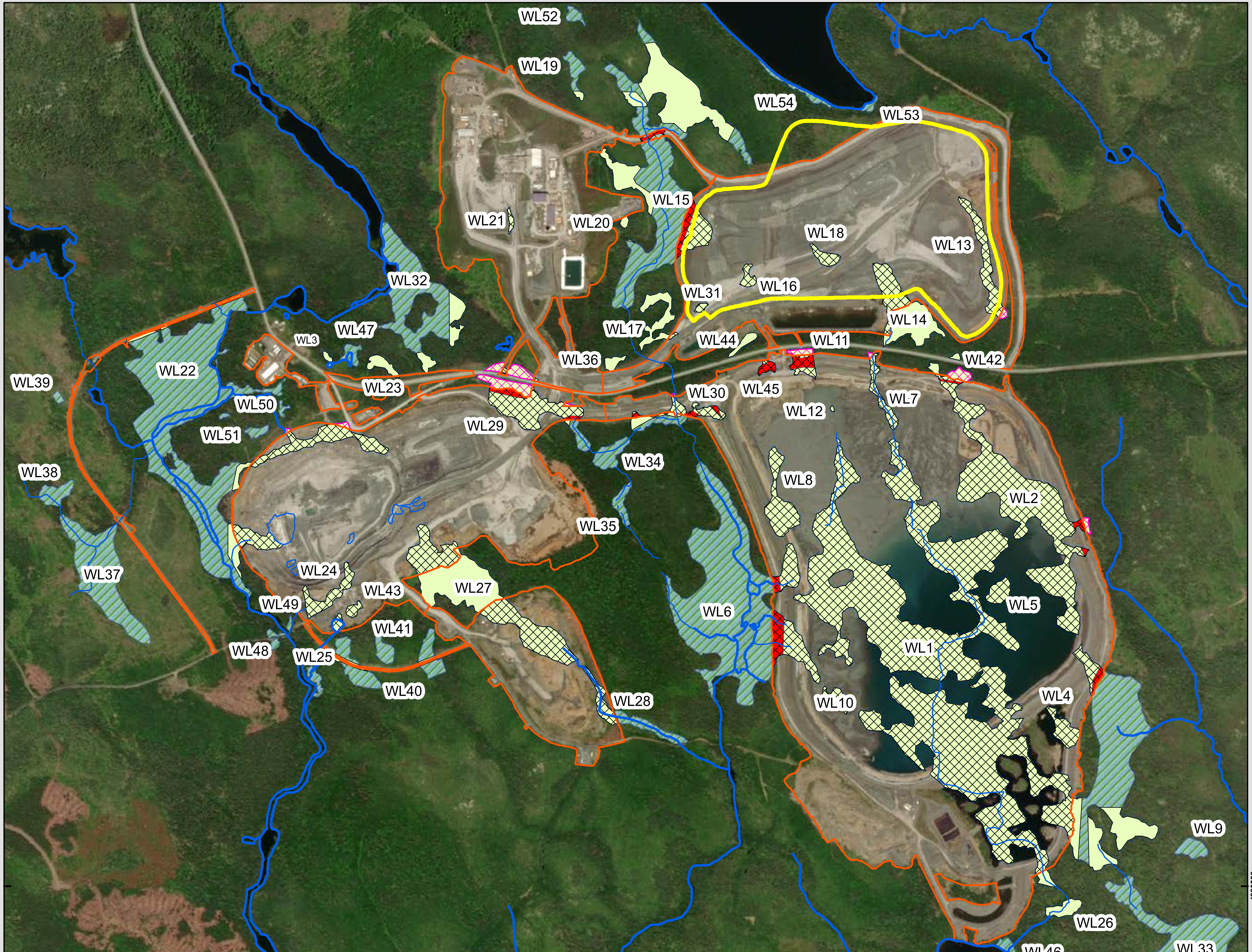
Reference: In-Pit Tailings Deposition – NSECC IR #9 – Underground Workings and Fault Grouting

We trust the information provided within this memorandum meets your current requirements. If you have any questions, please contact us at your convenience.

Stantec Consulting Ltd.

Paul Deering P.Eng.
Senior Principal

Attachment 12
Alternative Waste Rock Storage Area Design



Prepared For:

St Barbara

FIGURE 1

Touquoy Gold Mine

WRD Extension with

2021 Wetland Impacts

- WRD Northern Extension
- NSTDB Mapped Watercourse
- Field Delineated Watercourse
- 2021 Disturbance Area
- Direct Impact Area (as of Dec 31, 2021)
- Indirect Impact Area
- Non-permitted Alteration
- Approved Alteration
- Field Delineated Wetlands

Coordinate System: NAD 1983 CSRS UTM Zone 20N
Projection: Transverse Mercator
Datum: North American 1983 CSRS
Units: Meter

0 125 250 500 m

1:10,000 Scale when printed @ 11" x 17"

Drawn By: LP

Date: 9/26/2022

McCallum Environmental Ltd.

Document Name: 220926_WRD Expansion

Attachment 13
Historic Tailings

AECOM Imagine it. Delivered.

AECOM Canada Ltd.
1701 Hollis Street
SH400 (PO Box 576 CRO)
Halifax, NS B3J 3M8
Canada

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Melissa Nicholson
Manager Environment
St Barbara Atlantic Operations
Atlantic Mining NS Inc.
6749 Moose River Rd.
Middle Musquodoboit, NS B0N 1X0

October 4, 2022

Project #
60664547

Dear Ms. Nicholson,

Subject: Response to Environmental Assessment – Atlantic Mining NS Incorporated Touquoy Gold Project Site Modifications – Historic Tailings

As part of the letter issued to Atlantic Mining NS Incorporated (AMNS) on September 8, 2021 regarding the Environmental Assessment – Atlantic Mining NS Incorporated Touquoy Gold Project Site Modifications, additional information was requested by the Minister of Environment and Climate Change in Consultation with Nova Scotia Environment and Climate Change (NSECC). One item from the request requiring additional information is:

"*Historic Tailings: Provide a description and map of historic mine tailings within or near the proposed project footprint. Provide a plan to manage the historic tailings."*

In response to this request, please find attached to this memo, **Figure 1 – Historic Tailings Locations (Attachment 1).** All historic tailings within or near the proposed project footprint (labelled as Proposed EA Project Footprint on **Figure 1**) that are disturbed as part of the site modifications will be managed in accordance with the Nova Scotia Environment Contaminated Site Regulations (CSR) along with the previously NSECC approved Historic Tailings Management Plan (HTMP) (Stantec, 2019) (**Attachment 2)** with some updates to accommodate current site conditions and changes since the original HTMP was developed in July 2018. The associated descriptions and updates are further discussed below in this memo.

Historic Tailings Management Plan – 2022 Updates

Given the project site changes since the HTMP was approved, AECOM Canada Ltd. (AECOM) was retained by Atlantic Mining NS (AMNS) to review and suggest modifications to the HTMP to be reflective of current site conditions. The major updates to the HTMP are as follows:

1. The remaining areas of historic tailings has decreased due to remediation that occurred during pit development in 2018 and 2019. Further historic tailing management may be required in limited areas near the above noted proposed project footprint, (specifically the proposed open pit spill way area, which is intended to be constructed as part of site closure activities).
2. The disposal location for historic tailings will be switched to a different location, as the clay cells built within the tailings management facility (TMF), are now at capacity and capped.

Remaining Areas of Historic Tailings

The proposed open pit spill way (approximate location) intersects with historic tailings from the G&K Stamp Mill Area as shown on **Figure 1.** Based on preliminary conceptual design information for the spillway, the area of intersection between the spillway and historic tailings is estimated to be 640 square meters. From initial assessment of the spill way area, the approximate tailings thickness ranges from 0 to 1 m below ground surface. It is anticipated there is approximately 640 m^3 of historic tailings which may require management under the HTMP, unless the proposed spillway location is adjusted. Analytical concentrations of arsenic within the historic tailings for this management area reportedly range from 1900 mg/kg to 9400 mg/kg while analytical mercury concentrations range from non-detect to 0.9 mg/kg. All historic tailings will be managed in accordance with the Historic Tailings Management Plan, apart from the updated disposal location.

AMNS is considering moving the location of the proposed open pit spill way to an area outside of the identified historic tailings area to limit potential environmental impacts associated with remediating the historic tailings. Should the encountering historic tailings be unavoidable or discovered in unanticipated areas, AMNS will follow the general steps as outlined in **Figure 2 – Attachment 1** in addition to complying with the Nova Scotia Environment Contaminated Sites Regulations (NSE CSR). Should historic tailings require management, AMNS will complete the following:

1. Review and implement the HTMP.
2. Retain a Site professional to determine if notification of contamination is required under NSE CSR Protocol 100.
3. Delineate and assess the tailings following NSE CSR Protocol 200 and/or Protocol 400.
4. Submit a Phase II ESA report to NSE in accordance with NSE CSR Protocol 200 and/or Protocol 400.
5. Develop a Remedial Action Plan in accordance with NSE CSR Protocol 600 and submit to NSE for review.
6. Implement the Remedial Action Plan and HTMP to remediate the historic tailings.
7. Complete confirmation of remediation sampling as required by the NSE CSR.
8. Submit a Record of Site Condition form (Form 700) in accordance with NSE CSR Protocol 700.

Disposal Options Update

As part of the HTMP, several remedial options for the historic tailings were reviewed. In 2019, the HTMP selected Cell Encapsulation within the Tailings Management Facility as the chosen remedial option. To date, all historic tailings managed under the HTMP have been encapsulated within the existing TMF. However, this remedial option is no longer the best option for future disposal of historic tailings (if required), as the TMF is near capacity. Therefore, all remedial options will be re-evaluated using the criteria outline in the HTMP and the flow chart provided in the HTMP which is attached (**Figure 2 – Attachment 1)**) to this memo for reference.

Relocation or adjustment of the spillway location is an option being evaluated by AMNS. It is AECOM's understanding that a detailed design of the spillway has not yet been completed as the project is still in the preliminary conceptual design phase. Therefore, the final location of the spillway could potentially be adjusted to avoid the disturbance of historic tailings. This option could limit potential environmental impacts associated with remediating the historic tailings. This option should be further considered as part of continued site reclamation planning

As mentioned above, the TMF is reaching capacity is no longer the preferred historic tailings disposal option. If historic tailings remediation is a requirement, Cell Encapsulation of the historic tailings within the current pit limits is being considered as a potential remedial option. Further geochemical investigation would be required to confirm it this is an acceptable remedial option. AMNS would seek input and approval from NSECC if this option is to be considered.

Based on the criteria as outlined in the HTMP, one possible remedial option would be off-site disposal.

"Off-site disposal is an option for tailings material for which no other suitable remedial measure could be found, which could be the case for high levels of mercury if found in historic tailings". (HTMP, 2018).

Off-site disposal facility options for arsenic contaminated Historic Tailings include the following facilities which are approved and equipped to remediate arsenic contaminated materials:

1. Northex Environnement inc, 699, Montee de la Pomme de Or", Contrecoeur,Quebec, J0L 1C0, 450-587-8877
2. Atlas Environmental Treatment and Services Inc, 510, chemin Jolicoeur-et-Ste Croix",Malartic,Quebec, J0Y 1Z0,1 866 757-3353

Additionally, AMNS will continue to evaluate remedial options for the historic tailings. Should other viable options be considered suitable, AMNS would present the alternative remedial options to NSECC for review.

The management of any historic tailings is planned to be completed in accordance with the existing HTMP and the current NSE CSR framework with the appropriate NSE protocols, forms, and reports will be issued to NSECC as required within this provincial framework.

Sincerely,

AECOM Canada Ltd.

Rory McNeil, P.Eng.
Environmental Engineer/Site Professional
rory.mcneil@aecom.com

Rob McCullough, BES., CET., CESA., EP.
Senior Technical Lead
Rob.mccullough@aecom.com

Attachments:

Attachment 1: **Figure 1 – Historic Tailings Locations**
Figure 2 – Flow Chart

Attachment 2: **Historic Tailings Management Plan**

References: **Stantec, 2018. Historic Tailings Management Plan, Dated July 26, 2018**

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("AECOM") for the benefit of the Client ("Client") in accordance with the agreement between AECOM and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represents AECOM's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to AECOM which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

AECOM shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. AECOM accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

AECOM agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but AECOM makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

Without in any way limiting the generality of the foregoing, any estimates or opinions regarding probable construction costs or construction schedule provided by AECOM represent AECOM's professional judgement in light of its experience and the knowledge and information available to it at the time of preparation. Since AECOM has no control over market or economic conditions, prices for construction labour, equipment or materials or bidding procedures, AECOM, its directors, officers and employees are not able to, nor do they, make any representations, warranties or guarantees whatsoever, whether express or implied, with respect to such estimates or opinions, or their variance from actual construction costs or schedules, and accept no responsibility for any loss or damage arising therefrom or in any way related thereto. Persons relying on such estimates or opinions do so at their own risk.

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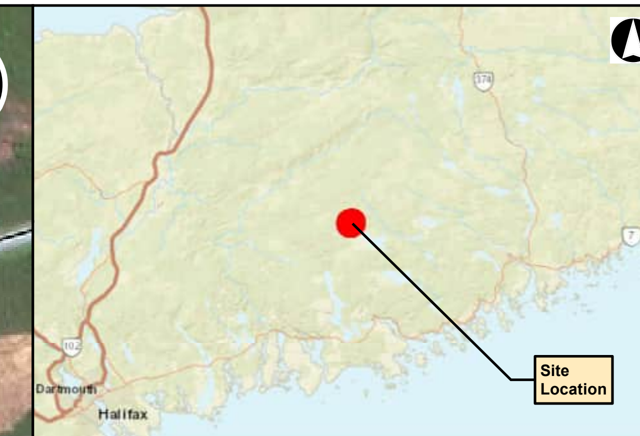
This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

AECOM: 2015-04-13

Attachment 1

Figure 1 – Historic Tailings Locations
Figure 2 – Flow Chart



Legend

- Approximate Extent of Historical Tailings Remediated in 2018 and 2019
- Approximate Extent of Historical Tailings Remaining Within IA Limit
- Approximate Extent of Tailings Areas Outside of Proposed IA Limits
- IA limits – Outside Berm
- Proposed Open Pit Spillway, Final Location to be Confirmed Upon Detailed Design
- Proposed EA Project Footprint (Clay Borrow Expansion)
- Roads

Note:
Drone image - January 3, 2020

0 30 60 120 180 240
Metres

TOUQUOY GOLD PROJECT

Historic Tailings Locations

Oct 22, 2021	1:3,750 * when printed 11"x17"	Datum: NAD 1983 CSRS UTM Zone 20N Source: Image: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong),
P# 60664547		

AECOM

Figure 1

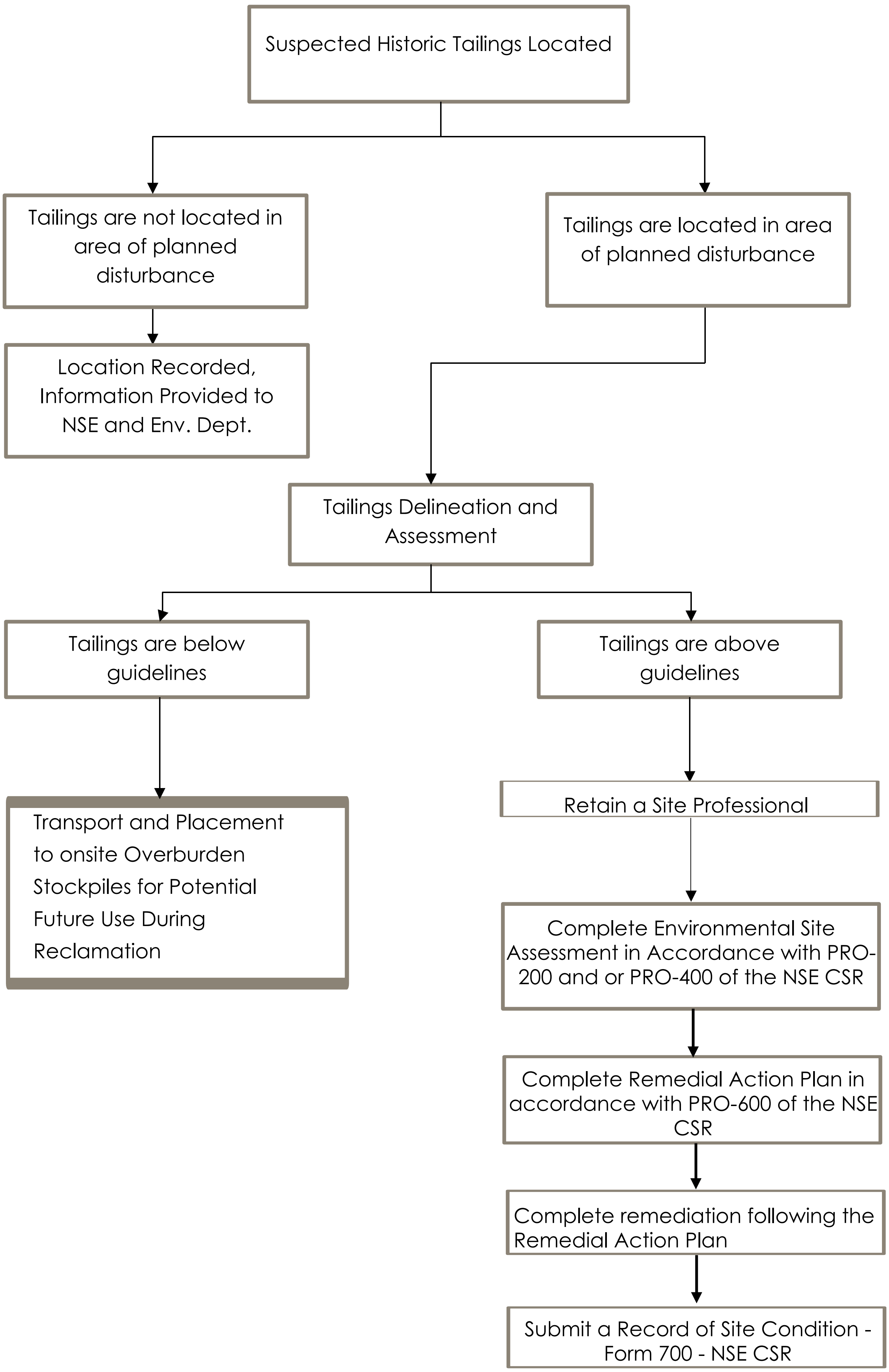


Figure 2 – Historic Tailings Remedial Flow Chart

Attachment 2

Historic Tailings Management Plan (Stantec 2018). Provided under separate cover as Appendix H to the March Additional Information Addendum

Attachment 14
Moose River Fish Surveys

Touquoy Gold Modifications: 2022 Moose River Fish Surveys

Final Report

November 1, 2022

Prepared for:

Atlantic Mining NS Inc.
409 Billybell Way
Mooseland
Middle Musquodoboit, Nova Scotia
B0N 1X0

Prepared by:

Stantec Consulting Ltd.
102-40 Highfield Park Drive
Dartmouth, NS B3A 0A3

File: 121619250

Table of Contents

1.0 INTRODUCTION

Atlantic Mining NS Inc. (AMNS) currently operates the Touquoy Gold Mine, located in Moose River Gold Mines, approximately 100 km northeast of Halifax, Nova Scotia (NS), in a historical gold mining district.

AMNS is proposing modifications to the Approved Project to support the ongoing operation. These modifications include: use of the exhausted Open Pit for tailings disposal once the existing approved Tailings Management Facility (TMF) reaches ultimate capacity; expansion of the Waste Rock Storage Area (WRSA); expansion of the Clay Borrow Area; and realignment of the Plant Access Road used to access the Plant Site. These proposed modifications will increase the current approved development area, or, in the case of the in-pit tailings disposal, present a new activity not previously assessed in the original Environmental Assessment (EA) process for the Touquoy Gold Project conducted in 2007 (CRA 2007a,b).

The modifications to the Approved Project are currently undergoing a provincial environmental assessment under the *Environment Act*. This report has been prepared in response to recommendations from Fisheries and Oceans Canada (DFO) to AMNS on October 14, 2021, and in response to an information request included in the Minister of Nova Scotia Environment and Climate Change's (NSECC) Decision regarding the environmental assessment on May 12, 2022:

"*Conduct additional fish sampling in Moose River. Survey methods and level of effort are to be designed in consultation with Fisheries and Oceans Canada (DFO).*"

A study design was submitted to DFO (Stantec 2022a; September 1, 2022) documenting the proposed survey methods and level of effort for the fish surveys conducted in Moose River in September of 2022 at the Touquoy Mine on behalf of AMNS. DFO provided feedback on the study design on September 9, 2022, and email responses and a memo from AMNS were submitted back to DFO on September 12, 2022 (Stantec 2022b).

This report summarizes fish work conducted in Moose River in June and September of 2022 for the Touquoy Mine on behalf of AMNS and in accordance with the Study Design and correspondence with DFO.

2.0 OBJECTIVES

The objectives of the Moose River fish community assessment were to document diversity and abundance of the existing fish community, including the potential presence and abundance of species at risk (SAR) and species of conservation concern (SOCC).

3.0 METHODS

Qualitative backpack electrofishing was conducted at six locations on Moose River using a backpack electrofisher in the June and September of 2022 (Figure 3.1). Minnow traps were also set at two locations in September (MR-02 and MR-04) to further inform the fish community in deeper water habitats. Table 3.1 lists the sampling locations selected and the rationale for selection based on their proximity to the open pit and proposed final discharge point (FDP) to Moose River associated with the in pit tailings disposal.

Table 3.1 Moose River Fish Sampling Locations and Sampling Design

Sampling Location	Coordinates (Decimal Degrees)*	Location Relative to Open Pit	Location Relative to Proposed Final Discharge Point (FDP) to Moose River
MR-02	44.987459, -62.946504	660 m upstream of pit (reference). Upstream of confluence with outlet of Long Lake.	975 m upstream of FDP (reference). Upstream of confluence with outlet of Long Lake.
MR-03	44.983627, -62.948257	75 m upstream of pit (reference). Downstream of confluence with outlet of Long Lake.	500 m upstream of FDP (reference). Downstream of confluence with outlet of Long Lake.
MR-04	44.980289, -62.945377	Adjacent to pit (exposure)	100 m upstream of FDP (reference)
MR-05	44.97782, -62.943796	350 m downstream of pit (exposure)	175 m downstream of FDP (nearfield exposure)
MR-06	44.973118, -62.945841	920 m downstream of pit (exposure)	720 m downstream of FDP (midfield exposure)
MR-07	44.969017, -62.941508	1500 m downstream of pit (exposure)	1300 m downstream of FDP (farfield exposure)
Note: * Field confirmed coordinates			

Sampling took place in early summer (June 28 and 30, 2022), and in the fall (September 12 to 16, 2022). The sampling locations were selected to represent a variety of representative habitats found in Moose River (i.e., riffles, runs, and pools).

In June, sampling was conducted with an experienced two-person crew using a Smith Root backpack electrofisher (LR-24). One person operated the backpack electrofisher and the other person collected fish with a dip net. In September, following feedback from DFO, sampling was conducted with a three-person crew. One person operated the backpack electrofisher, one person collected fish with a dip net and one person collected fish with a single person seine downstream. A minimum of 750 seconds of shocking time were applied at each sampling location in both June and September.

The fish communities in deeper water runs/pools at MR-02 and MR-04 were also assessed using three minnow traps baited with small quantities of cat food. Fishing was completed under a Section 52 Fishery (General) Regulations licence from the Maritimes Region.

Fish were anesthetized with clove oil, identified to species, counted, measured, weighed and released. On September 12th, the balance broke in the field and weights were not able to be collected. Catch per unit effort (CPUE) was determined for each sampling location for all species captured.

The in-situ water quality parameters measured included: water temperature, dissolved oxygen, conductivity (all measured using a YSI2030 meter), and pH (measured using a Hanna Model #98127 pH pen). These parameters were collected to confirm that water temperatures were suitable for electrofishing and to inform electrofisher settings.

The six sites (MR-02 to MR-07) were also sampled for environmental DNA (eDNA) of Atlantic salmon to assess the presence of eDNA from this species in this reach of Moose River as evidence to support their presence or absence. The results of these analyses will be provided in an addendum at a later date.

Photos of each site and representative photos of each fish species collected are provided in Appendix A. Raw data with effort, biological information and in situ water quality are provided in Appendix B. Fish habitat information was not collected as it was documented previously under separate cover (Stantec 2020a,b).

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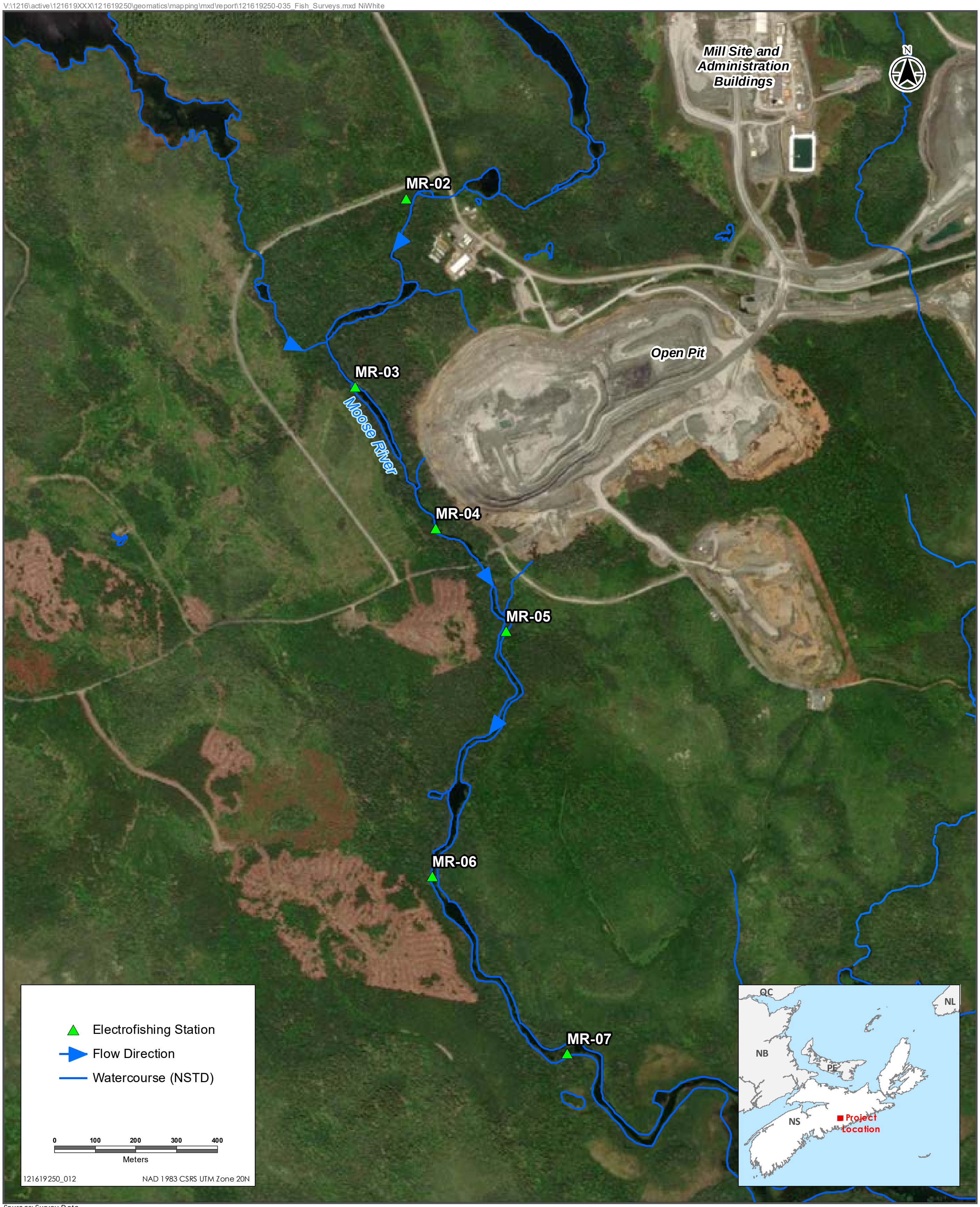

Sources: Survey Data

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Location of Fish Surveys in Moose River at the Touquoy Mine, NS, 2022

Stantec

Figure 3.1

4.0 RESULTS

The fish sampling locations in Moose River were limited to wadable areas within riffles and run habitats as a result of safety concerns surrounding deep water depths and swift velocities. A total of ten fish species were confirmed to be present in Moose River during sampling in 2022.

In June 2022, a total of 25 fish consisting of four different species were collected from Moose River (Table 4.1). At the time of the June survey water levels were low. The dominant species by relative abundance was American eel (*Anguilla rostrata*; 72%). No Atlantic salmon (*Salmo salar*) were captured or observed.

In September 2022, a total of 112 fish consisting of ten species were collected from Moose River (Table 4.1). Water levels at the time of the September survey were low. The catch was dominated by American eel (44%), followed by creek chub (*Semotilus atromaculatus*; 13%) and white sucker (*Catostomus commersonii*; 12%). A total of six Atlantic salmon parr were captured from across MR-02, MR-05 and MR-06. Both landlocked and sea-run Atlantic salmon have the potential to be present in Moose River as both occur within the watershed (CRA 2007a; DFO 2013). Raw data are provided in Appendix B.

Table 4.1 Total Number of Fish Captured in Moose River, NS for Electrofishing Surveys in June and September 2022

Sites	MR-02		MR-03		MR-04		MR-05		MR-06		MR-07	
Month	**June**	**Sept**	**June**	**Sept**	**June**	**Sept**	**June**	**Sept**	**June**	**Sept**	**June**	**Sept**
American eel (*Anguilla rostrata*)	3	9	5	11	4	8	1	4	4	11	1	6
Atlantic salmon (*Salmo salar*)	-	1	-	-	-	-	-	4	-	1	-	-
Banded killifish (*Fundulus diaphanus*)	-	2	-	3	-	-	-	-	-	-	2	1
Brook trout (*Salvelinus fontinalis*)	-	1	-	-	-	-	-	-	-	1	-	-
Brown bullhead (*Ameiurus nebulosus*)	-	1	-	-	-	-	-	-	-	1	-	-
Creek chub (*Semotilus atromaculatus*)	-	4	-	5	-	1	-	2	-	3	-	-
Lake chub (*Couesius plumbeus*)	-	5	-	2	-	1	-	-	-	-	-	1
Northern redbelly dace (*Chrosomus eos*)	-	3	1	1	-	2	-	-	-	-	-	2
White sucker (*Catostomus commersoni*)	-	10	-	-	-	1	-	-	-	2	-	-
Yellow perch (*Perca flavescens*)	-	-	1	1	-	-	3	1	-	-	-	-
Grand Total	3	36	7	23	4	13	4	11	4	19	3	10

In June, relative abundance (CPUE) ranged from 4 to 9 fish per 1000 seconds (Table 4.2) of electrofishing and was considered low at all locations. In September, relative abundance ranged from 3 to 47 fish per 1000 seconds and varied by sampling location.

Table 4.2 Relative Abundance (Catch Per Unit Effort) for Electrofishing Surveys in Moose River, June and September 2022

Survey Timing	Area	Number of fish caught	Effort (seconds)	CPUE (#fish/1000 seconds)
June	MR-02	3	758	4
	MR-03	7	756	9
	MR-04	4	769	5
	MR-05	4	754	5
	MR-06	4	750	5
	MR-07	3	750	4
September	MR-02	36	753	47
	MR-03	23	762	3
	MR-04	13	763	17
	MR-05	11	761	15
	MR-06	19	756	25
	MR-07	10	759	13

Using minnow traps in September of 2022, a total of 23 fish across eight different species were collected from Moose Rive (Table 4.3). The catch was dominated by Northern redbelly dace (57%), followed by yellow perch (13%) and brown bullhead (13%). Relative abundance (CPUE) was similar between sampling locations MR-02 and MR-04 (Table 4.4). Raw data are provided in Appendix B.

Table 4.3 Number of Fish Captured in Moose River, NS for Minnow Trap Surveys in September 2022

Species	**MR-02**	**MR-04**
American eel (*Anguilla rostrata*)	1	0
Banded killifish (*Fundulus diaphanus*)	0	1
Brown bullhead (*Ameiurus nebulosus*)	3	0
Lake chub (*Couesius plumbeus*)	1	0
Northern redbelly dace (*Chrosomus eos*)	9	4
White sucker (*Catostomus commersoni*)	1	0
Yellow perch (*Perca flavescens*)	3	0
Grand Total	**18**	**5**

Table 4.4 Summary of Relative Abundance (Catch Per Unit Effort) for Minnow Trap Surveys in Moose River, September 2022

Waterbody Name	Minnow Traps		
	Total Effort (Trap hours)	Total Catch	CPUE (fish / trap / day)
MR-02	16.75	18	8.6
MR-04	5.5	5	7.3

Water temperature at the time of the June survey ranged between 13.2°C and 22.0°C. Conductivity ranged between 23.6 µS/cm and 1010 µS/cm (Appendix B, Table B.2). Dissolved oxygen concentrations were 8.10 to 8.70 mg/L (89-95%) and above the CWQG PAL recommended maximum value of 6.5 for all life stages of fish, but below the 9.5 mg/L for early life stages (CCME 1999). The pH range was 5.20 to 5.83 and was below the CWQG PAL recommended range (6.5 – 9.0).

During the September survey, water temperature ranged from 18.7°C to 20.7°C. Conductivity ranged between 32.4 µS/cm and 40.5 µS/cm. Dissolved oxygen concentrations were 7.4 mg/L to 8.6 mg/L (84-95%) and were above the CWQG PAL recommended maximum value of 6.5 for all life stages of fish, but below the 9.5 mg/L for early life stages (CCME 1999). The pH ranged from 6.15- 6.67 and was generally within the CWQG PAL recommended range (6.5 – 9.0).

5.0 SUMMARY

Electrofishing was conducted at six sites in Moose River in June and September of 2022. In Moose River the types of fish habitat sampled by electrofisher were limited to wadable reaches during low flow conditions. In September, minnow traps were used to sample deeper water runs that were not able to be safely electrofished.

During the 2022 electrofishing and minnow trap surveys, ten species of fish were confirmed to be present in Moose River. Similar species were captured in the June and September, as were those caught by electrofishing and using minnow traps. The CPUE was lower in the June indicating that the September is the best time to conduct a long-term sampling program as it will result in the highest abundance and number of species of fish being captured.

Two SAR/SOCC were captured: American eel and Atlantic salmon. American eel is a species at risk which is listed as threatened under COSEWIC. Sea-run Atlantic salmon are part of the Nova Scotia Southern Upland population. It is currently listed as Endangered under COSEWIC. Both American eel and Atlantic salmon currently have no prohibitions under the *Species at Risk Act*.

Water temperatures during the surveys were 22˚C or below as specified by the licence. Dissolved oxygen concentrations ranged between 7.40 to 8.70 mg/L, which are above the recommended minimum value for all life stages of fish, but below the recommended minimum for early life stages. The pH in Moose River during the surveys were considered generally low (range 5.20 to 6.67).

6.0 CLOSURE

This document titled Touquoy Gold Modifications: 2022 Moose River Fish Surveys was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Atlantic Mining NS Inc. (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

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APPENDIX A

Photos

Moose River Spring Fish Survey: June 28-30, 2022

Photo 1 **Representative Habitat In Moose River (MR-02) Facing Upstream (June Survey)**

Photo 2 **Representative Habitat In Moose River (MR-02) Facing Downstream (June Survey)**

Photo 3 **Representative Habitat In Moose River (MR-03) Facing Upstream (June Survey)**

Photo 4 **Representative Habitat In Moose River (MR-03) Facing Downstream (June Survey)**

Moose River Spring Fish Survey: June 28-30, 2022			
			
Photo 5	**Representative Habitat In Moose River (MR-04) Facing Upstream (June Survey)**	**Photo 6**	**Representative Habitat In Moose River (MR-04) Facing Downstream (June Survey)**
			
Photo 7	**Representative Habitat In Moose River (MR-05) Facing Upstream (June Survey)**	**Photo 8**	**Representative Habitat In Moose River (MR-05) Facing Downstream (June Survey)**

Moose River Spring Fish Survey: June 28-30, 2022

Photo 9 **Representative Habitat In Moose River (MR-06) Facing Upstream (June Survey)**

Photo 10 **Representative Habitat In Moose River (MR-06) Facing Downstream (June Survey)**

Photo 11 **Representative Habitat In Moose River (MR-07) Facing Upstream (June Survey)**

Photo 12 **Representative Habitat In Moose River (MR-07) Facing Downstream (June Survey)**

Moose River Fall Fish Survey: September 12 to 14, 2022	
	
Photo 13 Representative Habitat In Moose River (MR-02) Facing Upstream (September Survey)	Photo 14 Representative Habitat In Moose River during Fall (MR-04) Facing Upstream (September Survey)
	
Photo 15 Representative Habitat In Moose River (MR-04) Facing Downstream (September Survey)	Photo 16 Representative Habitat In Moose River (MR-05) Downstream (September Survey)

Representative Fish Species Captured in Moose River (Spring and Fall 2022)	
	
Photo 17 **Representative Creek Chub (*Semotilus atromaculatus*)**	**Photo 18** **Representative Banded Killifish (*Fundulus diaphanus*)**
	
Photo 19 **Representative Northern Redbelly Dace (*Chrosomus eos*)**	**Photo 20** **Representative American Eel (*Anguilla rostrata*)**

Representative Fish Species Captured in Moose River (Spring and Fall 2022)	
	
Photo 21 **Representative Yellow Perch (*Perca flavescens*)**	**Photo 22** **Representative Lake Chub (*Couesius plumbeus*)**
	
Photo 23 **Representative Brown Bullhead (*Ameiurus nebulosus*)**	**Photo 24** **Representative White Sucker (*Catostomus commersonii*)**

Representative Fish Species Captured in Moose River (Spring and Fall 2022)

Photo 25 **Representative Atlantic Salmon (*Salmo salar*)**

Photo 26 **Representative Brook Trout (*Salvelinus fontinalis*)**

APPENDIX B

Fish Data

Table B.1 - Raw Fishing Effort Data for Electrofishing Surveys in Moose River, NS, 2022
Touquoy Gold Modifications: 2022 Aquatic Survey
File: 121619250

Survey Timing	Location	Site ID	Latitude	Longitude	Fishing Method	Survey Date	Pass/Sweep	Voltage (V)	Duty Cycle (%)	Frequency (Hz)	Pulse Width (ms)	Electrofishing Time (s)	Comment
June	Moose River	MR-02	44.987796	-62.946666	Backpack Electrofisher	2022-06-30	1	700	15	35	3.4	758	Riffle/run slow moving side channel
	Moose River	MR-03	44.983625	-62.948319	Backpack Electrofisher	2022-06-29	1	650	15	35	3.4	756	2 missed eels
	Moose River	MR-04	44.980487	-62.945827	Backpack Electrofisher	2022-06-30	1	650	15	35	3.4	769	-
	Moose River	MR-05	44.978219	-62.9436	Backpack Electrofisher	2022-06-29	1	750	15	35	3.4	754	1 eel missed, jumped out of bucket
	Moose River	MR-06	44.972799	-62.945907	Backpack Electrofisher	2022-06-28	1	675	15	35	3.4	750	4 missed eels
	Moose River	MR-07	44.968869	-62.941713	Backpack Electrofisher	2022-06-28	1	725	15	35	3.4	750	5 missed eels
September	Moose River	MR-02	44.97782	-62.943796	Backpack Electrofisher	2022-09-12	1	900	20	50	4	753	-
	Moose River	MR-03	44.969017	-62.941508	Backpack Electrofisher	2022-09-12	1	550	20	60	4.2	762	-
	Moose River	MR-04	44.973118	-62.945841	Backpack Electrofisher	2022-09-13	1	640	12	60	4.2	763	-
	Moose River	MR-05	44.980289	-62.945377	Backpack Electrofisher	2022-09-14	1	590	25	60	4.2	761	2 missed eels
	Moose River	MR-06	44.987459	-62.946504	Backpack Electrofisher	2022-09-13	1	510	25	60	4.2	756	-
	Moose River	MR-07	44.983627	-62.948257	Backpack Electrofisher	2022-09-14	1	800	25	60	4.2	759	2 missed fish

Table B.2 - Raw Fishing Data for Minnow Trap Surveys in Moose River, NS, 2022
Touquoy Gold Modifications: 2022 Aquatic Survey
File: 121619250

Station ID	Latitude	Longitude	Fishing Method	Survey Start Date	Survey Start Time (UTC)	Survey End Date	Survey End Time (UTC)	Number of Traps	Effort Per Trap (hours)	Fish	CPUE (fish per trap day day)	Comments
MR-02	44.987894	-62.945869	Minnow Trap	2022-09-13	19:15:52	2022-09-14	12:02:50	3	16.75	18	8.6	
MR-04	44.979923	-62.94461	Minnow Trap	2022-09-13	13:18:43	2022-09-13	18:50:12	3	5.5	5	7.3	

Table B.3 Morphometric Fish Data for Fish Surveys in Moose River, NS, 2022
Touquoy Gold Modifications: 2022 Aquatic Survey
File: 121619250

Survey Timing	Location	StationID	Latitude	Longitude	Date	Fishing Method	Common Name	Fork Length(mm)	Weight (g)	Comments
June	Moose River	MR-02	44.987796	-62.946666	2022-06-30	Backpack Electrofisher	American eel (*Anguilla rostrata*)	167	6.0	
June	Moose River	MR-02	44.987796	-62.946666	2022-06-30	Backpack Electrofisher	American eel (*Anguilla rostrata*)	178	8.1	
June	Moose River	MR-02	44.987796	-62.946666	2022-06-30	Backpack Electrofisher	American eel (*Anguilla rostrata*)	198	12.7	
June	Moose River	MR-03	44.983625	-62.948319	2022-06-29	Backpack Electrofisher	American eel (*Anguilla rostrata*)	201	13.9	
June	Moose River	MR-03	44.983625	-62.948319	2022-06-29	Backpack Electrofisher	American eel (*Anguilla rostrata*)	212	18.0	
June	Moose River	MR-03	44.983625	-62.948319	2022-06-29	Backpack Electrofisher	American eel (*Anguilla rostrata*)	240	23.4	
June	Moose River	MR-03	44.983625	-62.948319	2022-06-29	Backpack Electrofisher	American eel (*Anguilla rostrata*)	279	33.4	
June	Moose River	MR-03	44.983625	-62.948319	2022-06-29	Backpack Electrofisher	American eel (*Anguilla rostrata*)	300	48.8	
June	Moose River	MR-03	44.983625	-62.948319	2022-06-29	Backpack Electrofisher	Northern Redbelly Dace (*Chrosomus eos*)	47	1.3	
June	Moose River	MR-03	44.983625	-62.948319	2022-06-29	Backpack Electrofisher	Yellow Perch (*Perca flavescens*)	95	9.7	
June	Moose River	MR-04	44.980487	-62.945827	2022-06-30	Backpack Electrofisher	American eel (*Anguilla rostrata*)	108	1.4	
June	Moose River	MR-04	44.980487	-62.945827	2022-06-30	Backpack Electrofisher	American eel (*Anguilla rostrata*)	183	8.7	
June	Moose River	MR-04	44.980487	-62.945827	2022-06-30	Backpack Electrofisher	American eel (*Anguilla rostrata*)	195	12.4	
June	Moose River	MR-04	44.980487	-62.945827	2022-06-30	Backpack Electrofisher	American eel (*Anguilla rostrata*)	233	21.1	
June	Moose River	MR-05	44.978219	-62.943600	2022-06-29	Backpack Electrofisher	American eel (*Anguilla rostrata*)	195	11.9	
June	Moose River	MR-05	44.978219	-62.943600	2022-06-29	Backpack Electrofisher	Yellow Perch (*Perca flavescens*)	75	4.8	
June	Moose River	MR-05	44.978219	-62.943600	2022-06-29	Backpack Electrofisher	Yellow Perch (*Perca flavescens*)	80	5.4	
June	Moose River	MR-05	44.978219	-62.943600	2022-06-29	Backpack Electrofisher	Yellow Perch (*Perca flavescens*)	107	14.0	
June	Moose River	MR-06	44.972799	-62.945907	2022-06-28	Backpack Electrofisher	American eel (*Anguilla rostrata*)	206	14.2	
June	Moose River	MR-06	44.972799	-62.945907	2022-06-28	Backpack Electrofisher	American eel (*Anguilla rostrata*)	210	14.4	
June	Moose River	MR-06	44.972799	-62.945907	2022-06-28	Backpack Electrofisher	American eel (*Anguilla rostrata*)	272	36.9	
June	Moose River	MR-06	44.972799	-62.945907	2022-06-28	Backpack Electrofisher	American eel (*Anguilla rostrata*)	320	67.0	
June	Moose River	MR-07	44.968869	-62.941713	2022-06-28	Backpack Electrofisher	American eel (*Anguilla rostrata*)	180	nd	
June	Moose River	MR-07	44.968869	-62.941713	2022-06-28	Backpack Electrofisher	Banded Killifish (*Fundulus diaphanus*)	51	2.9	
June	Moose River	MR-07	44.968869	-62.941713	2022-06-28	Backpack Electrofisher	Banded Killifish (*Fundulus diaphanus*)	59	3.7	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	150	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	214	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	278	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	300	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	300	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	305	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	335	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	465	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	480	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Banded Killifish (*Fundulus diaphanus*)	30	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Banded Killifish (*Fundulus diaphanus*)	37	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	47	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	47	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	48	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Northern Redbelly Dace (*Chrosomus eos*)	56	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Northern Redbelly Dace (*Chrosomus eos*)	75	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	98	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Brook Trout (*Salvelinus fontinalis*)	60	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Brown Bullhead (*Ameiurus nebulosus*)	134	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Northern Redbelly Dace (*Chrosomus eos*)	52	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Lake chub (*Couesius plumbeus*)	83	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Lake chub (*Couesius plumbeus*)	89	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Lake chub (*Couesius plumbeus*)	89	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Lake chub (*Couesius plumbeus*)	97	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	White Sucker (*Catostomus commersoni*)	48	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	White Sucker (*Catostomus commersoni*)	50	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	White Sucker (*Catostomus commersoni*)	54	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Lake chub (*Couesius plumbeus*)	55	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	White Sucker (*Catostomus commersoni*)	56	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	White Sucker (*Catostomus commersoni*)	56	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	White Sucker (*Catostomus commersoni*)	60	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	White Sucker (*Catostomus commersoni*)	61	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	White Sucker (*Catostomus commersoni*)	64	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	White Sucker (*Catostomus commersoni*)	65	nd	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	White Sucker (*Catostomus commersoni*)	67	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	155	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	163	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	240	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	245	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	250	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	305	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	320	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	323	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	325	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	340	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	American eel (*Anguilla rostrata*)	480	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	Banded Killifish (*Fundulus diaphanus*)	70	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	Banded Killifish (*Fundulus diaphanus*)	71	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	Banded Killifish (*Fundulus diaphanus*)	80	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	44	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	Lake chub (*Couesius plumbeus*)	44	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	47	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	50	nd	Red spots
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	54	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	55	nd	Red dorsal spots
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	Northern Redbelly Dace (*Chrosomus eos*)	58	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	Lake chub (*Couesius plumbeus*)	55	nd	
September	Moose River	MR-03	44.983627	-62.948257	2022-09-12	Backpack Electrofisher	Yellow Perch (*Perca flavescens*)	nd	9.4	
September	Moose River	MR-04	44.980289	-62.945377	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	148	4	
September	Moose River	MR-04	44.980289	-62.945377	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	169	7	
September	Moose River	MR-04	44.980289	-62.945377	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	284	36	
September	Moose River	MR-04	44.980289	-62.945377	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	340	68	
September	Moose River	MR-04	44.980289	-62.945377	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	199	15	
September	Moose River	MR-04	44.980289	-62.945377	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	237	19	
September	Moose River	MR-04	44.980289	-62.945377	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	250	27	
September	Moose River	MR-04	44.980289	-62.945377	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	147	5	
September	Moose River	MR-04	44.980289	-62.945377	2022-09-13	Backpack Electrofisher	Northern Redbelly Dace (*Chrosomus eos*)	54	2	
September	Moose River	MR-04	44.980289	-62.945377	2022-09-13	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	55	3	
September	Moose River	MR-04	44.980289	-62.945377	2022-09-13	Backpack Electrofisher	Northern Redbelly Dace (*Chrosomus eos*)	55	2	
September	Moose River	MR-04	44.980289	-62.945377	2022-09-13	Backpack Electrofisher	Lake chub (*Couesius plumbeus*)	91	9	
September	Moose River	MR-04	44.980289	-62.945377	2022-09-13	Backpack Electrofisher	White Sucker (*Catostomus commersoni*)	65	3	
September	Moose River	MR-05	44.97782	-62.943796	2022-09-14	Backpack Electrofisher	American eel (*Anguilla rostrata*)	110	3	
September	Moose River	MR-05	44.97782	-62.943796	2022-09-14	Backpack Electrofisher	American eel (*Anguilla rostrata*)	240	21	
September	Moose River	MR-05	44.97782	-62.943796	2022-09-14	Backpack Electrofisher	American eel (*Anguilla rostrata*)	250	21	
September	Moose River	MR-05	44.97782	-62.943796	2022-09-14	Backpack Electrofisher	American eel (*Anguilla rostrata*)	330	58	
September	Moose River	MR-05	44.97782	-62.943796	2022-09-14	Backpack Electrofisher	Atlantic salmon (*Salmo salar*)	145	35	
September	Moose River	MR-05	44.97782	-62.943796	2022-09-14	Backpack Electrofisher	Atlantic salmon (*Salmo salar*)	148	32	
September	Moose River	MR-05	44.97782	-62.943796	2022-09-14	Backpack Electrofisher	Atlantic salmon (*Salmo salar*)	150	38	
September	Moose River	MR-05	44.97782	-62.943796	2022-09-14	Backpack Electrofisher	Atlantic salmon (*Salmo salar*)	154	43	
September	Moose River	MR-05	44.97782	-62.943796	2022-09-14	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	103	8	
September	Moose River	MR-05	44.97782	-62.943796	2022-09-14	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	48	1	
September	Moose River	MR-05	44.97782	-62.943796	2022-09-14	Backpack Electrofisher	Yellow Perch (*Perca flavescens*)	66	3	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	178	8	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	330	58	

Table B.3 Morphometric Fish Data for Fish Surveys in Moose River, NS, 2022
Touquoy Gold Modifications: 2022 Aquatic Survey
File: 121619250

Survey Timing	Location	StationID	Latitude	Longitude	Date	Fishing Method	Common Name	Fork Length(mm)	Weight (g)	Comments
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	273	29	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	185	8	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	323	55	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	110	2	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	259	25	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	118	2	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	238	18	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	105	2	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	American eel (*Anguilla rostrata*)	113	2	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	45	2	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	45	1	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	Creek Chub (*Semotilus atromaculatus*)	74	4	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	Atlantic salmon (*Salmo salar*)	136	33	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	Brook Trout (*Salvelinus fontinalis*)	170	48	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	Brown Bullhead (*Ameiurus nebulosus*)	168	54	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	White Sucker (*Catostomus commersoni*)	56	2	
September	Moose River	MR-06	44.973118	-62.945841	2022-09-13	Backpack Electrofisher	White Sucker (*Catostomus commersoni*)	67	3	
September	Moose River	MR-07	44.969017	-62.941508	2022-09-14	Backpack Electrofisher	American eel (*Anguilla rostrata*)	264	28	
September	Moose River	MR-07	44.969017	-62.941508	2022-09-14	Backpack Electrofisher	American eel (*Anguilla rostrata*)	295	54	
September	Moose River	MR-07	44.969017	-62.941508	2022-09-14	Backpack Electrofisher	American eel (*Anguilla rostrata*)	310	54	
September	Moose River	MR-07	44.969017	-62.941508	2022-09-14	Backpack Electrofisher	American eel (*Anguilla rostrata*)	370	65	
September	Moose River	MR-07	44.969017	-62.941508	2022-09-14	Backpack Electrofisher	American eel (*Anguilla rostrata*)	390	80	
September	Moose River	MR-07	44.969017	-62.941508	2022-09-14	Backpack Electrofisher	American eel (*Anguilla rostrata*)	460	184	
September	Moose River	MR-07	44.969017	-62.941508	2022-09-14	Backpack Electrofisher	Banded Killifish (Fundulus diaphanus)	76	6	
September	Moose River	MR-07	44.969017	-62.941508	2022-09-14	Backpack Electrofisher	Northern Redbelly Dace (*Chrosomus eos*)	54	1	
September	Moose River	MR-07	44.969017	-62.941508	2022-09-14	Backpack Electrofisher	Northern Redbelly Dace (*Chrosomus eos*)	54	2	
September	Moose River	MR-07	44.969017	-62.941508	2022-09-14	Backpack Electrofisher	Lake chub (*Couesius plumbeus*)	49	2	
September	Moose River	MR-02	44.987459	-62.946504	2022-09-12	Backpack Electrofisher	Atlantic salmon (*Salmo salar*)	165	nd	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Yellow Perch (*Perca flavescens*)	87	7	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Northern redbelly dace (*Chrosomus eos*)	49	1	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Lake chub (*Couesius plumbeus*)	84	6	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Brown Bullhead (*Ameiurus nebulosus*)	131	27	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Northern redbelly dace (*Chrosomus eos*)	54	2	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Northern redbelly dace (*Chrosomus eos*)	47	1	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Yellow Perch (*Perca flavescens*)	106	11	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Brown Bullhead (*Ameiurus nebulosus*)	136	30	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Northern redbelly dace (*Chrosomus eos*)	57	2	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	White sucker (*Catostomus commersoni*)	46	1	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Northern redbelly dace (*Chrosomus eos*)	59	1	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Yellow Perch (*Perca flavescens*)	106	11	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Northern redbelly dace (*Chrosomus eos*)	53	2	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Northern redbelly dace (*Chrosomus eos*)	52	2	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Northern redbelly dace (*Chrosomus eos*)	53	2	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Brown Bullhead (*Ameiurus nebulosus*)	122	21	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	American eel (*Anguilla rostrata*)	500	21.3	
September	Moose River	MR-02	44.987894	-62.945869	2022-09-13	Minnow Traps	Northern redbelly dace (*Chrosomus eos*)	53	2	
September	Moose River	MR-04	44.979923	-62.944610	2022-09-13	Minnow Traps	Northern redbelly dace (*Chrosomus eos*)	53	1	
September	Moose River	MR-04	44.979923	-62.944610	2022-09-13	Minnow Traps	Banded Killifish (*Fundulus diaphanus*)	80	4	
September	Moose River	MR-04	44.979923	-62.944610	2022-09-13	Minnow Traps	Northern redbelly dace (*Chrosomus eos*)	53	1	
September	Moose River	MR-04	44.979923	-62.944610	2022-09-13	Minnow Traps	Northern redbelly dace (*Chrosomus eos*)	53	1	
September	Moose River	MR-04	44.979923	-62.944610	2022-09-13	Minnow Traps	Northern redbelly dace (*Chrosomus eos*)	50	1	

Note: nd indicates no weight as the balance broke in the field

Table B.4 In Situ Water Quality Parameters in Moose River, NS, 2022
Touquoy Gold Modifications: 2022 Aquatic Survey
File: 121619250

Survey Timing	Location	Station ID	Latitude	Longitude	Date	Time	Water Clarity	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Specific Conductivity (µs/cm)	pH
June	Moose River	MR-02	44.98789	-62.94666	2022-06-30	13:36:12	Brown/Yellow	20.4	8.1	89	25.9	5.20
	Moose River	MR-03	44.98369	-62.9484	2022-06-29	18:35:33	Brown/Yellow	22.0	8.5	99	28.3	5.37
	Moose River	MR-04	44.98053	-62.94585	2022-06-30	12:14:04	Brown/Yellow	19.5	8.4	92	23.6	5.25
	Moose River	MR-05	44.97812	-62.94388	2022-06-29	16:20:21	Brown/Yellow	21.7	8.4	95	26.2	5.34
	Moose River	MR-06	44.97278	-62.94584	2022-06-28	17:22:20	Brown/Yellow	19.7	8.4	92	27	5.83
	Moose River	MR-07	44.96871	-62.94193	2022-06-28	15:15:32	Brown/Yellow	19.6	8.7	95	25.6	5.20
September	Moose River	MR-02	44.987905	-62.945979	2022-09-14	12:46:32	Clear	19.6	7.7	84	32.4	6.15
	Moose River	MR-03	44.983649	-62.94829	2022-09-12	14:01:39	Clear	18.7	7.4	80	40.5	6.67
	Moose River	MR-04	44.968956	-62.941798	2022-09-14	15:12:13	Clear	19.8	7.9	87	35.9	-
	Moose River	MR-05	44.978187	-62.943595	2022-09-15	16:04:00	Clear	21.4	9.6	109	36.2	6.26
	Moose River	MR-06	-	-	-	-	-	-	-	-	-	-
	Moose River	MR-07	44.980366	-62.945568	2022-09-13	15:11:17	Clear	20.7	8.6	95	38.1	6.47

Note: "-" No Data collected