Appendix F.8

Beaver Dam Gold Project Assimilative Capacity Study of Moose River – Touquoy Pit Discharge - April 12, 2021
Completed for the Updated 2021 Beaver Dam Mine EIS

Stantec

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

FINAL REPORT

April 12, 2021

File: 121619250

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April 12, 2021

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 exhausted Touquoy pit as part of the Beaver Dam Gold project. The Touquoy pit is a part of the existing Touquoy Gold Mine which is located in Halifax County, Nova Scotia, approximately 60 km northeast of Halifax. The study is focused on the water surplus in the exhausted Touquoy pit during reclamation/closure phase discharged via a proposed spillway to Moose River at the final discharge point, considering two scenarios:

1. the tailings deposited in the pit from the Beaver Dam deposit
2. the cumulative deposition of tailings from the Beaver Dam, Fifteen Mile Stream, Cochrane Hill, and Touquoy mine sites

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 limits for the parameters of potential concern.

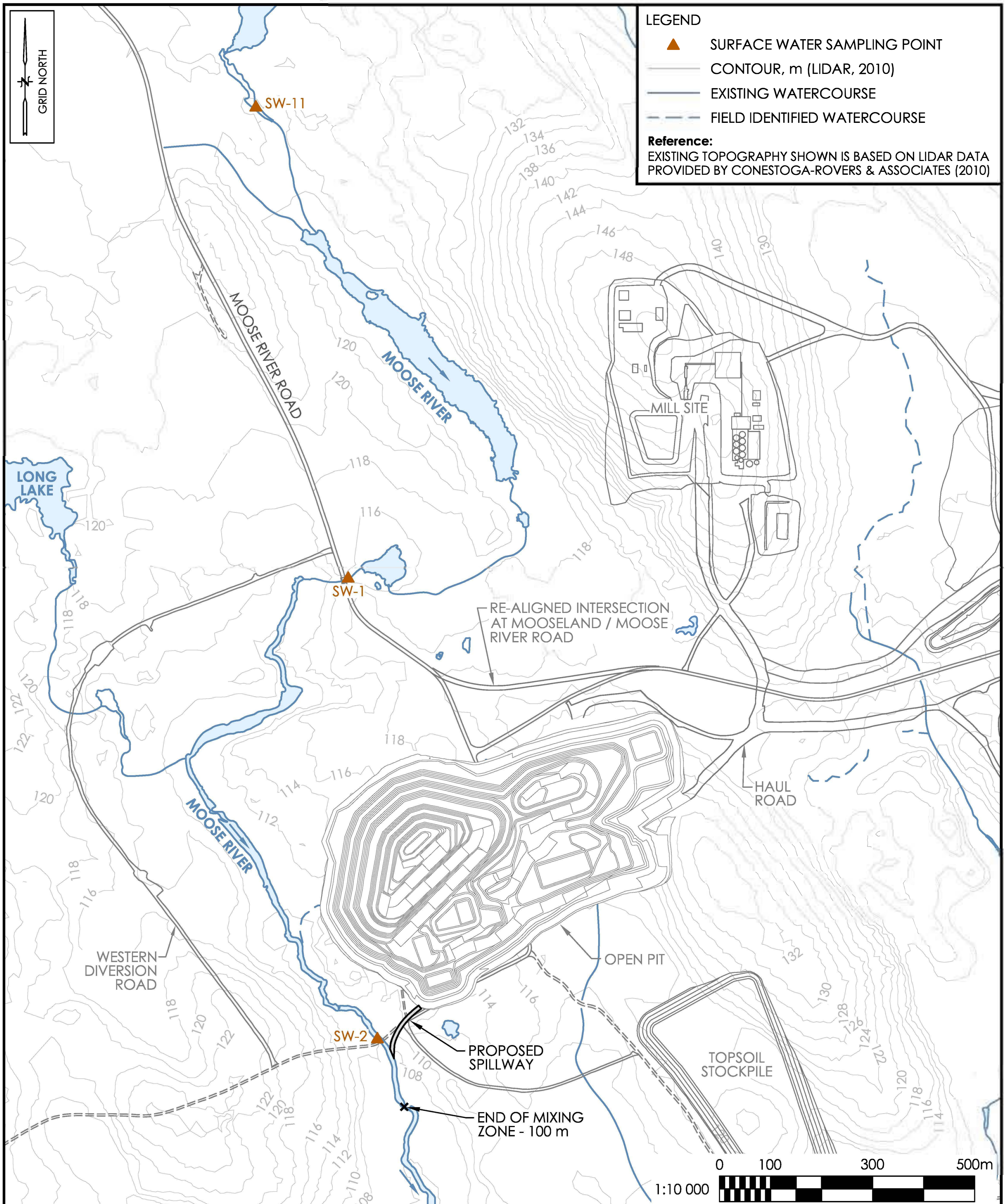
2.0 BACKGROUND

The Touquoy Mine Site in Halifax County, Nova Scotia comprises an area approximately 176 hectares (ha); of that area the existing Touquoy pit is approximately 40 ha. Site areas associated with major project components include the Mill Site, Touquoy pit, Tailings Management Facility (TMF), Waste Rock Storage Area, and ancillary facilities. The Touquoy pit is located between Moose River on the west and Watercourse No. 4 on the east that each flow north to south adjacent to the limits of the Touquoy pit.

The existing Touquoy pit is actively dewatered and pumped to the TMF. Water in the TMF is decanted to the effluent treatment plant for treatment.

Over several years, the pit will be allowed to naturally fill through runoff, direct precipitation, and groundwater inflow resulting in a water cover over the tailings surface. Once water quality in the pit lake meets the MDMER discharge criteria, water surplus from natural processing (e.g., snowmelt or rainfall events) will be released to Moose River via a spillway/channel.

Figure 1 presents the study area including the Touquoy pit, surface water monitoring station SW-2 and proposed spillway to convey overflow from the pit to Moose River. The spillway is 110 m long with an invert elevation of 108.0 m at the Touquoy 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**).



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SITE MAP

BEAVER DAM GOLD PROJECT

NOVA SCOTIA

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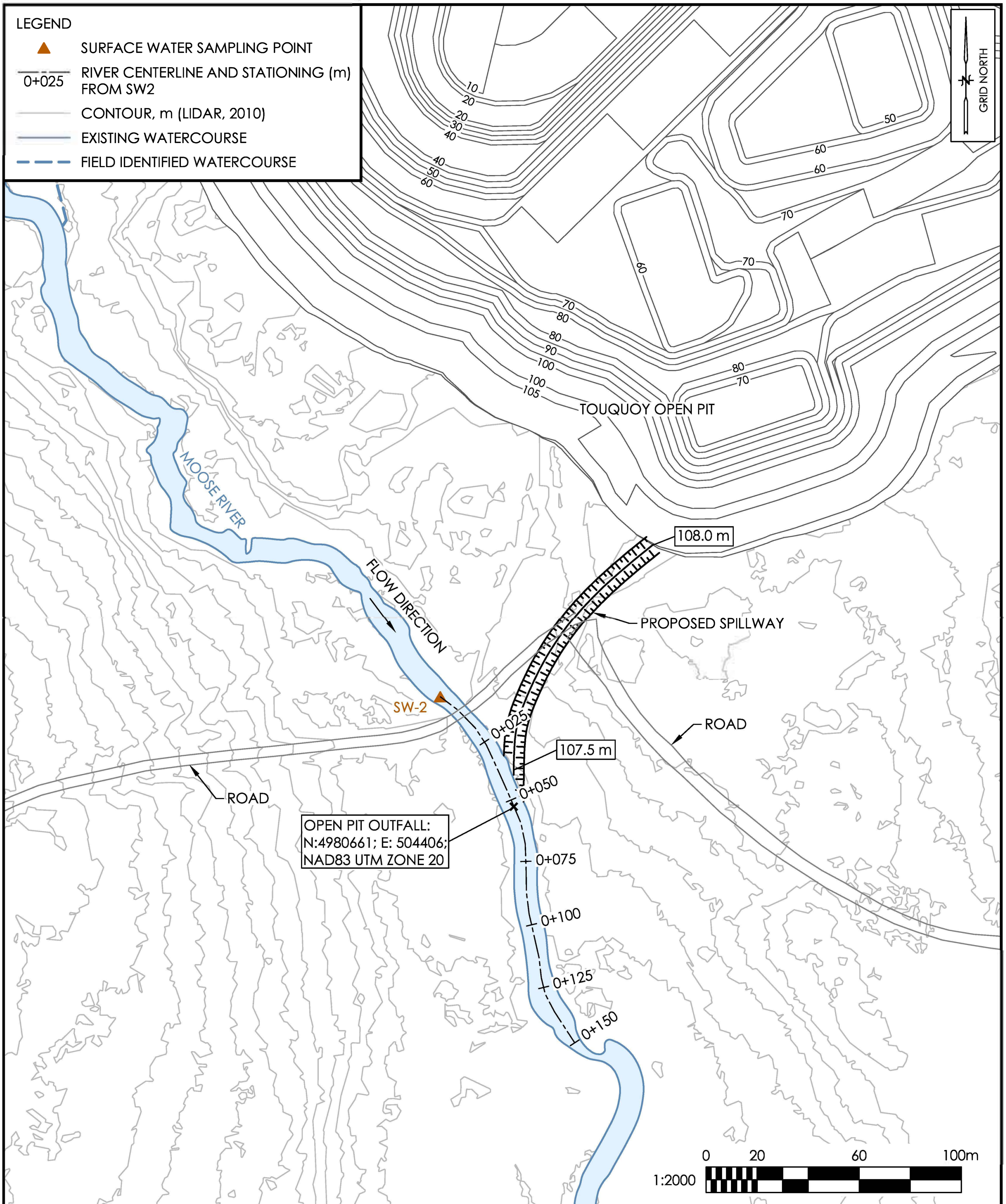

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LOCATION OF OPEN PIT OUTFALL

BEAVER DAM GOLD PROJECT

NOVA SCOTIA

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3.0 REGULATORY FRAMEWORK

Effluent discharge from the Touquoy pit is regulated by the *Metal and Diamond Mining Effluent Regulation* (MDMER). The new revised Schedule 4 - Table 2 of MDMER will be applicable to existing mines starting June 1, 2021. These new MDMER limits are presented in **Table 1** and anticipated to be in force at the time the Touquoy pit discharges are likely to begin. Waste water treatment will be required for parameters which exceed the MDMER limits in the effluent.

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

Parameter	MDMER, Table 2, Schedule 4 (mg/L)
Arsenic	0.3
Copper	0.3
Cyanide	0.5
Lead	0.1
Nickel	0.5
Zinc	0.5
Un-ionized ammonia (as N)	0.5

The Canadian Council Ministers of the Environment (CCME) framework for assessing assimilative capacity of the receiver (CCME 2003) was used in this study. The key steps outlined in the CCME guidance are as follows:

1. Identifying physical/chemical and/or biological parameters of potential concern for the proposed discharge. Parameters of potential concern are defined as those which exceed the applicable regulatory limits in the Touquoy pit overflow effluent.

2. Establishing appropriate (i.e. freshwater) ambient Water Quality Objectives (WQOs) for receiving waters. The NSE Tier 1 Environmental Quality Standards (NSEQS 2010) and CCME limits were used as WQOs for this study.

3. If the background concentration of a parameters of potential concern in the receiving environment is higher than the WQO 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 WQOs 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.

4.0 RECEIVING WATER HYDROLOGY

The Touquoy pit effluent will reach Moose River in close proximity to SW-2. The upstream Moose River catchment area at SW-2 is 39.03 km^2. No long-term hydrometric stations exist on Moose River around the project site.

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 project 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.

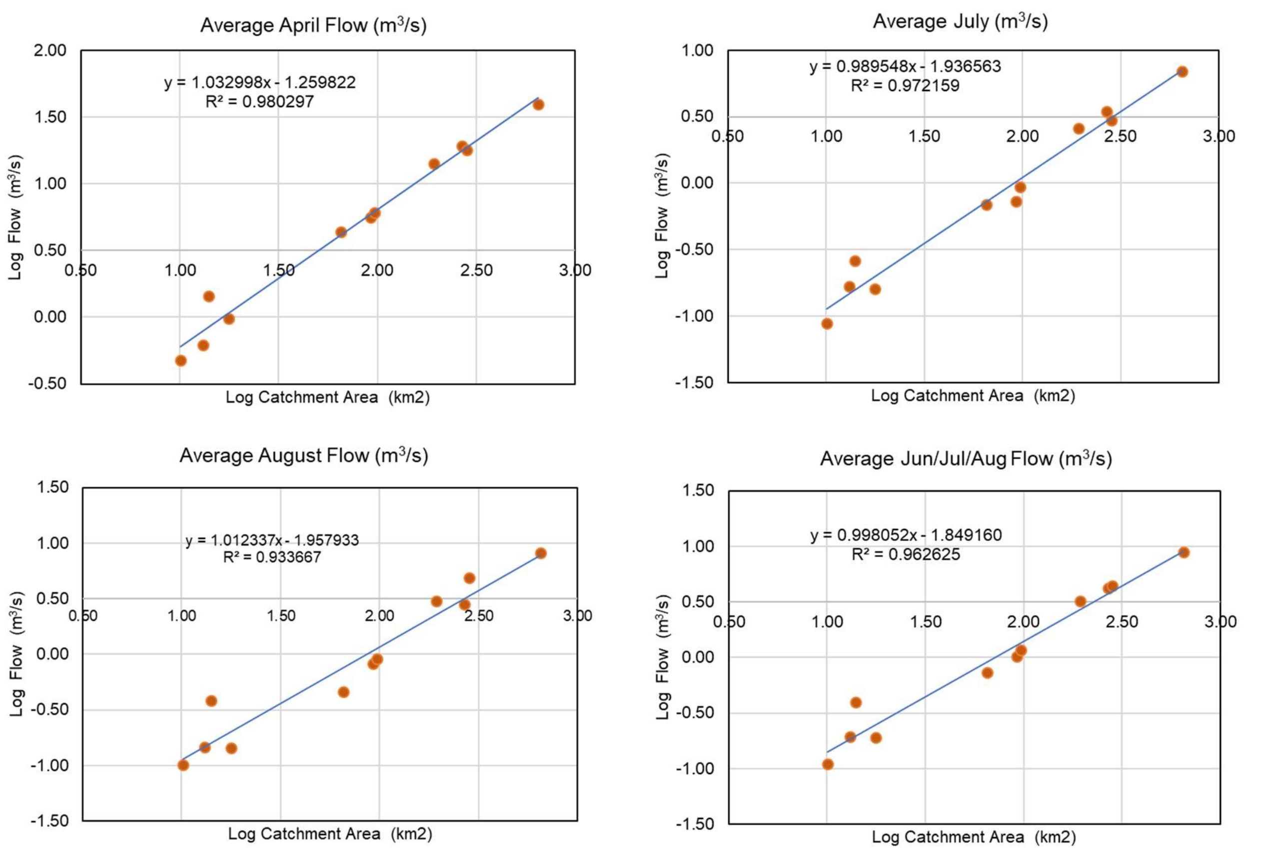
There are limited gauging station datasets available in Nova Scotia near the site that meet the primary selection criteria (e.g., catchment area, distance to project site). The WSC stations selected for the regional hydrology assessment are summarized in **Table 2**.

Table 2: WSC Regional Hydrology Stations

Station ID	Station Name	Drainage Area (km^2)	Years of Record	Record Period	Distance to Site (km)
01DH003	FRASER BROOK NEAR ARCHIBALD	10.1	26	1965-1990	45
01EJ004	LITTLE SACKVILLE RIVER AT MIDDLE SACKVILLE	13.1	39	1980-2018	65
01FG001	RIVER DENYS AT BIG MARSH	14.0	14	2005-2018	167
01EE005	MOOSE PIT BROOK AT TUPPER LAKE	17.7	38	1981-2018	192
01EH006	CANAAN RIVER AT OUTLET OF CONNAUGHT LAKE	65.4	11	1986-1996	107
01DP004	MIDDLE RIVER OF PICTOU AT ROCKLIN	92.2	54	1965-2018	58
01DG003	BEAVERBANK RIVER NEAR KINSAC	96.9	98	1921-2018	60
01FA001	RIVER INHABITANTS AT GLENORA	193	54	1965-2018	150
01ED013	SHELBURNE RIVER AT POLLARD'S FALLS BRIDGE	268	20	1999-2018	202
01EO003	EAST RIVER ST. MARYS AT NEWTOWN	282	15	1965-1979	75
01EK001	MUSQUODOBOIT RIVER AT CRAWFORD FALLS	650	82	1915-1996	27

Average monthly flows for Moose River at SW-2 were derived using the regional relationships. **Figure 3** presents the regression analysis completed to determine the relationship between catchment areas and average flow in April, August and June-July-August for the selected WSC stations. April was selected as this month corresponds to the highest flows in the region and summer months typically correspond to the lowest flows.

Figure 3: Regional Regression Analysis



As presented on **Figure 3**, strong linear trends exist between the average monthly flow rates of the selected monitoring stations and drainage area for April, August, and June to August with a correlation coefficient R^2 of 0.98, 0.93, and 0.96, respectively. From these regional relationships, it can be inferred that the average April and August flows for SW-2 in Moose River (catchment area of 39.03 km^2) are estimated to be 2.42 m^3/s and 0.45 m^3/s, respectively. Results of the statistical analysis on the regional flow records indicated that generally the peak and low flow events occur in April and August, respectively.

5.0 RECEIVING WATER QUALITY

The effluent will be discharged to Moose River via a spillway as presented on **Figure 2**. A monitoring program has been ongoing since 2016 to monitor background water quality in Moose River at three monitoring stations SW-1, SW-2, and SW-11. **Table 3** summarizes the location of each monitoring station.

Table 3: Water Quality Monitoring Stations on Moose River

Site	Location	Rationale	Location Description
SW-1	504325E, 4981604N	Background	Moose River – adjacent to site and upstream of Moose River road culvert and Touquoy pit
SW-2	504378E, 4980703N	Downstream – Near-field	Moose River – downstream of Facility and upstream of Bridge, just below the Touquoy pit
SW-11	504140E, 4982529N	Background	Moose River – upstream of the Site to represent relatively un-impacted conditions upstream of the facility

Surface water monitoring station SW-2 is located immediately upstream of the proposed effluent location (**Figure 1**) and therefore was used to characterize ambient water quality.

Table 4 summarizes the 2016 and 2017 water quality data at SW-2 for total metals, cyanides. The table also presents the NSE Tier 1 Environmental Quality Standards (EQS) and CCME guidelines for the protection of freshwater aquatic life (FAL). The background water quality for Moose River at SW-2 has four parameters which exceed either the NSE Tier 1 EQS or CCME FAL guidelines: aluminum, arsenic, cadmium and iron.

Tables A-1 to A-3 in **Appendix A** present a complete list of monitored water quality parameters and statistics.

Table 4: Background Water Quality at SW-2

Water Quality Parameter	Average Concentration mg/L	75th Percentile mg/L	NSE Tier 1 EQS Freshwater mg/L	CCME FAL mg/L
Aluminum	**0.169**	**0.187**	**0.005**	0.1
Arsenic	**0.012**	**0.018**	**0.005**	**0.005**
Calcium	1.2	1.3		
Cadmium	**0.000014**	**0.000019**	**0.00001**	0.0009
Cobalt	<0.0004	<0.0004	0.01	
Chromium	<0.001	<0.001		
Copper	<0.002	<0.002	0.002	0.002
Iron	**0.48**	**0.62**	**0.3**	**0.3**
Lead	<0.0005	<0.0005	0.001	0.001
Mercury	<0.000013	<0.000013	0.000026	0.000026

Table 4: Background Water Quality at SW-2

Water Quality Parameter	Average Concentration mg/L	75th Percentile mg/L	NSE Tier 1 EQS Freshwater mg/L	CCME FAL mg/L
Magnesium	0.488	0.52		
Manganese	0.06	0.07	0.82	
Molybdenum	<0.002	<0.002	0.073	0.073
Nickel	<0.002	<0.002	0.025	0.025
Tin	<0.001	<0.001	0.02	
Selenium	<0.001	<0.001	0.001	0.001
Silver	<0.0001	<0.0001	0.0001	0.00025
Sulphate	<2	<2		
Thallium	<0.0001	<0.0001	0.0008	0.0008
Uranium	<0.0001	<0.0001	0.3	0.15
Zinc	<0.005	<0.005	0.03	0.007
WAD Cyanide	<0.003	<0.003	0.005*	0.005*
Total Cyanide	<0.005	<0.005		
Nitrate (as N)	<0.05	0.054		13
Nitrite (as N)	<0.01	<0.01		0.06
Ammonia (as N)	<0.05	0.062		

Note: Bold values indicate exceedance of water quality objectives, empty field indicates no water quality value.
* Free form of cyanide

6.0 EFFLUENT WATER QUANTITY AND QUALITY

An environmental water balance was used to predict the Touquoy pit effluent overflow to Moose River at mine closure (Stantec 2021b). Two potential scenarios were considered:

a. Base Scenario: The tailings deposited in the Touquoy pit from processing the ore from the Beaver Dam deposit only

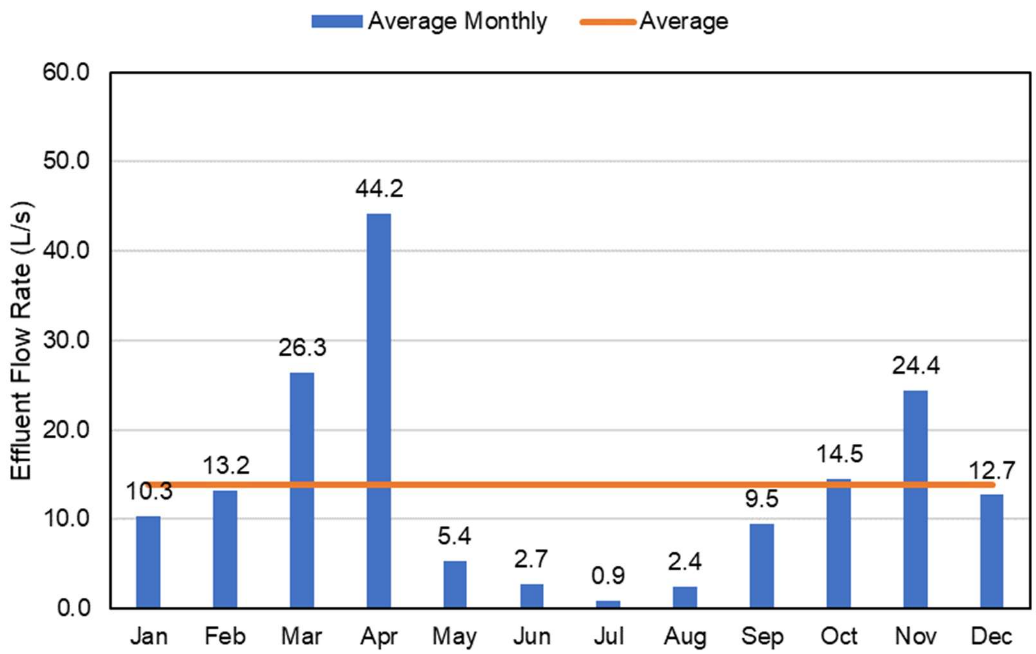
b. Cumulative Effects Scenario: The tailings deposited in the Touquoy pit from processing the Beaver Dam ore with ore from the Touquoy mine project, and ore concentrates from the Fifteen Mile Stream and Cochrane Hill projects.

6.1 BASE SCENARIO: BEAVER DAM ONLY

Figure 4 shows the average predicted monthly Touquoy pit overflow under climate normal conditions for the Base Scenario (i.e., Beaver Dam deposit only). As shown in the figure, average monthly effluent flow will vary seasonally from 0.9 L/s in July to 44.2 L/s in April. The average monthly effluent flow rate to Moose River will be 13.9 L/s.

The Touquoy pit seepage rate to the river was simulated using a groundwater flow model (Stantec 2021a). Average daily seepage rate to Moose River was estimated at 258 m^3/day, or 3.0 L/s.

Figure 4: Monthly Effluent Flow Rates for Base Scenario



Effluent water quality was predicted using the water quality and quantity model and groundwater flow model (Stantec 2021a and Stantec 2021b). 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. **Table 5** presents a list of predictions of the average and maximum concentrations in the effluent for metal parameters and nitrogen species for the Base Scenario. Concentrations of aluminum, arsenic, cobalt, copper, WAD cyanide, and nitrite in the effluent water quality have exceedance of one or both of the NSE Tier 1 EQS or CCME FAL guidelines. In addition, the effluent concentrations of arsenic and ammonia are predicted to slightly exceed the 2021 MDMER discharge limit for an existing mine, therefore, arsenic and ammonia treatment will be required prior to release of the effluent to environment.

Total cyanide and weak acid-dissociable (WAD) cyanide have relatively high concentrations in the effluent, although they are below the MDMER discharge limit for cyanide (i.e., 0.5 mg/L for total cyanide). There are no NSE Tier 1 EQS or CCME FAL guidelines for these forms of cyanide. Further discussion about cyanide is presented in Section 10.0.

Table 5: Predicted Effluent Water Quality Parameters and Limits, Base Scenario

Water Quality Parameter	Average Concentration in Touquoy Pit Discharge mg/L	Maximum Concentration in Touquoy Pit Discharge mg/L	MDMER (after 2021) mg/L	NSE Tier 1 EQS Freshwater mg/L	CCME FAL mg/L
Aluminum	**0.015**	**0.033**		**0.005**	0.1
Arsenic	**0.178**	**0.616**	**0.3**	**0.005**	**0.005**
Calcium	24.5	49.4			
Cadmium	0.000005	0.000008		0.00001	0.0009
Cobalt	0.009	**0.046**		**0.01**	
Chromium	0.00015	0.00031			
Copper	**0.005**	**0.026**	0.3	**0.002**	**0.002**
Iron	0.012	0.029		0.3	0.3
Lead	0.00008	0.00020	0.1	0.001	0.001
Mercury	0.000012	0.000016		0.000026	0.000026
Magnesium	3.24	4.89			
Manganese	0.062	0.102		0.82	
Molybdenum	0.003	0.007		0.073	0.073
Nickel	0.006	0.013	0.5	0.025	0.025
Tin	0.001	0.003		0.02	
Selenium	0.00020	0.00056		0.001	0.001
Silver	0.00001	0.00003		0.0001	0.00025
Sulphate	69.0	166			
Thallium	0.00001	0.00003		0.0008	0.0008
Uranium	0.0028	0.0032		0.3	0.15
Zinc	0.0009	0.0019	0.5	0.03	0.007
WAD Cyanide	**0.016**	**0.087**		**0.005***	**0.005***
Total Cyanide	0.048	0.249	0.5		
Nitrate (as N)	1.36	3.98			13
Nitrite (as N)	**0.144**	**0.693**			**0.06**
Ammonia (as N)	0.070	0.721			
Unionized Ammonia (as N)	0.002	0.011	0.5		0.019

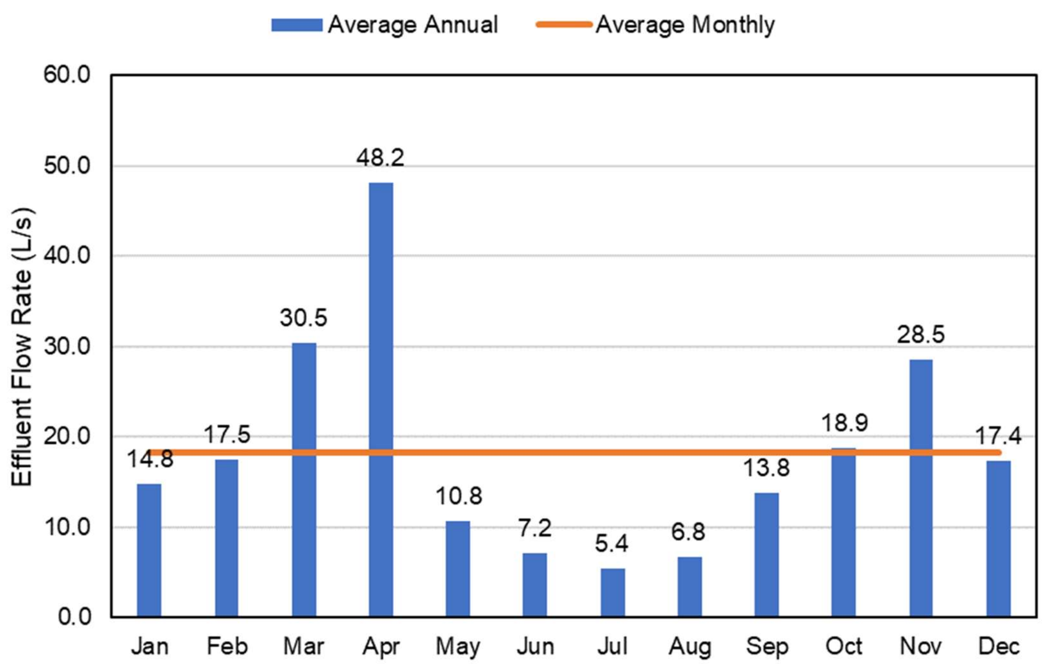
Note: Bold values indicate exceedance of water quality objectives, empty field indicates no water quality value.
* Free form of cyanide
** Unionized ammonia estimated using maximum summer temperature and pH observed at SW-2

6.2 CUMULATIVE EFFECTS SCENARIO

Figure 5 shows the average predicted monthly Touquoy pit overflow under climate normal conditions for the Cumulative Effects Scenario (i.e., Beaver Dam, Fifteen Mile Stream, Cochrane Hill, and Touquoy deposits). As shown in the figure, average monthly effluent flow will seasonally vary from 5.4 L/s in July to 48.2 L/s in April, based on the larger pit size compared to the baseline conditions. The average monthly effluent flow rate to Moose River will be 18.3 L/s.

The Touquoy pit seepage rate to the river was simulated using a groundwater flow model (Stantec 2021a). Average daily seepage rate to Moose River was estimated at 249 m^3/day or 2.9 L/s.

Figure 5: Monthly Effluent Flow Rates for Cumulative Effects Scenario



Effluent water quality was predicted using the water quality and quantity model and groundwater flow model (Stantec 2021b and Stantec 2021a). 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. **Table 6** presents a list of predictions of the average and maximum concentrations in the effluent for metal parameters and nitrogen species for the Cumulative Effects Scenario. Concentrations of aluminum, arsenic, cobalt, copper, WAD cyanide, and nitrite in the effluent water quality have exceedance of one or both of the NSE Tier 1 EQS or CCME FAL guidelines. In addition, the effluent concentration of arsenic and ammonia are predicted to exceed the 2021 MDMER discharge limits for an existing mine, therefore, arsenic and ammonia treatment will be required prior to release of the effluent to environment.

Total cyanide and WAD cyanide have relatively high concentrations in the effluent, although they are below the MDMER discharge limit for cyanide (i.e., 0.5 mg/L for total cyanide). There are no NSE Tier 1 EQS or CCME FAL guidelines for these forms of cyanide. Further discussion about cyanide is presented in Section 10.0.

Table 6: Predicted Effluent Water Quality Parameters and Limits, Cumulative Effects

Water Quality Parameter	Average Concentration in Pit Discharge mg/L	Maximum Concentration in Pit Discharge mg/L	MDMER (after 2021) mg/L	NSE Tier 1 EQS Freshwater mg/L	CCME FAL mg/L
Aluminum	**0.024**	**0.044**		**0.005**	0.1
Arsenic	**0.281**	**0.943**	**0.3**	**0.005**	**0.005**
Calcium	42.1	68.9			
Cadmium	0.000006	0.000011		0.00001	0.0009
Cobalt	**0.020**	**0.071**		**0.01**	
Chromium	0.00027	0.00043			
Copper	**0.011**	**0.039**	0.3	**0.002**	**0.002**
Iron	0.026	0.037		0.3	0.3
Lead	0.00015	0.00029	0.1	0.001	0.001
Mercury	0.000021	0.000021		0.000026	0.000026
Magnesium	5.40	6.39			
Manganese	0.097	0.139		0.82	
Molybdenum	0.005	0.009		0.073	0.073
Nickel	0.010	0.018	0.5	0.025	0.025
Tin	0.002	0.004		0.02	
Selenium	0.00037	0.00082		0.001	0.001
Silver	0.00002	0.00004		0.0001	0.00025
Sulphate	108	244			
Thallium	0.00003	0.00004		0.0008	0.0008
Uranium	0.0038	0.0046		0.3	0.15
Zinc	0.0014	0.0027	0.5	0.03	0.007
WAD Cyanide	**0.036**	**0.134**		0.005*	0.005*
Total Cyanide	0.103	0.384	0.5		
Nitrate (as N)	1.95	5.90			13
Nitrite (as N)	**0.118**	**0.632**			0.06
Ammonia (as N)	0.30	1.12			
Unionized Ammonia (as N)**	0.002	0.011	0.5		0.019

Note: Bold values indicate exceedance of water quality objectives, empty field indicates no water quality value.
* Free form of cyanide
** Unionized ammonia estimated using maximum summer temperature and pH observed at SW-2

7.0 GROUNDWATER SEEPAGE FROM TOUQUOY PIT TO MOOSE RIVER

Groundwater seepage from the Touquoy pit discharging directly to Moose River was predicted using a groundwater model (Stantec 2021a). The groundwater seepage from the Touquoy pit to Moose River is estimated to be 5.5 L/s, based on climate normal conditions for both the Base and Cumulative Effects scenarios. **Table 7** presents a list of average water quality concentrations in the groundwater seepage based on the water quality source terms predicted for the tailings. The seepage quality is predicted to be the same for both the Base and Cumulative Effects scenarios. As shown on **Table 7**, no parameters in the seepage are predicted to exceed the MDMER, NSE Tier 1 EQS or CCME.

Table 7: Predicted Water Quality of Seepage from Touquoy Pit

Water Quality Parameter	Average Concentration in Seepage mg/L	MDMER (after 2021) mg/L	NSE Tier 1 EQS Freshwater mg/L	CCME FAL mg/L
Aluminum	6.6×10^{-8}		0.005	0.1
Arsenic	4.3×10^{-6}	0.3	0.005	0.005
Calcium	1.2×10^{-4}			
Cadmium	2.8×10^{-11}		0.00001	0.0009
Cobalt	3.7×10^{-8}		0.01	
Chromium	2.8×10^{-10}			
Copper	1.3×10^{-8}	0.3	0.002	0.002
Iron	4.6×10^{-8}		0.3	0.3
Lead	3.5×10^{-11}	0.1	0.001	0.001
Mercury	7.1×10^{-12}		0.000026	0.000026
Magnesium	2.1×10^{-5}			
Manganese	5.2×10^{-7}		0.82	
Molybdenum	8.5×10^{-8}		0.073	0.073
Nickel	9.7×10^{-9}	0.5	0.025	0.025
Tin	8.5×10^{-9}		0.02	
Selenium	2.7×10^{-10}		0.0001	0.00025
Silver	1.4×10^{-11}		0.0001	0.0001
Sulphate	1.3×10^{-3}			
Thallium	2.2×10^{-11}		0.0008	0.0008
Uranium	2.9×10^{-9}		0.3	0.15
Zinc	1.4×10^{-8}	0.5	0.03	0.007
WAD Cyanide	7.1×10^{-9}		0.005*	0.005*
Total Cyanide	1.2×10^{-7}	0.5		
Nitrate (as N)	7.5×10^{-8}			

Table 7: Predicted Water Quality of Seepage from Touquoy Pit

Water Quality Parameter	Average Concentration in Seepage mg/L	MDMER (after 2021) mg/L	NSE Tier 1 EQS Freshwater mg/L	CCME FAL mg/L
Nitrite (as N)	$1.6{\times}10^{-7}$			0.06
Total Ammonia (as N)	$4.8{\times}10^{-5}$			

* Free form of cyanide

8.0 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 Touquoy 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 Touquoy pit. The same relationship will exist with high flows.

Table 8 presents the dilution ratios of the effluent with the receiver water assuming full mixing for the Base Scenario. **Table 9** presents the dilution ratios of the effluent with the receiver water assuming full mixing for the Cumulative Effects Scenario. 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 km^2) and catchment area of the Touquoy pit (0.41 km^2) is 95 to 1.

Table 8: Dilution Ratio in the Receiver at Full Mixing, Base Scenario

Month	Receiver Flow (L/s)	Effluent Flow (L/s)	Dilution Ratio
June/July/August	548	2.0	274
July	435	0.9	483
August	450	2.4	187
April	2,420	44.2	54

Table 9: Dilution Ratio in the Receiver at Full Mixing, Cumulative Effects Scenario

Month	Receiver Flow (L/s)	Effluent Flow (L/s)	Dilution Ratio
June/July/August	548	6.5	84
July	435	5.4	81
August	450	6.8	66
April	2,420	48.2	50

For the Base Scenario the minimum dilution ratio of 54 is observed in April when Moose River and effluent have high flows. This occurs because the Touquoy pit effluent and river flow are driven by the same meteorological factors. Similarly, the minimum dilution ratio for the Cumulative Effects Scenario of 50 is also observed in April.

9.0 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 behavior 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.

9.1 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:

- For the higher flow condition, the average flow in Moose river in April is 2,420 L/s and the climate normal effluent flow is 48.5 L/s in April.
- For the lower flow condition, the average flow in Moose river in April is 2,420 L/s and the climate normal effluent flow is 44.2 L/s in April.
- 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 operations. Channel width with active flow at the discharge point is 8 m. The average water depth used in the model is 1.0 for low flow conditions and 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.
- 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.

9.2 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.

10.0 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 NSE (Environment Canada 2006).

For the Base Scenario (i.e., Beaver Dam deposit only), the CORMIX model showed that a full-mixing dilution ratio of 56 is achieved within 120 m from the outfall. A dilution ratio of 51 is achieved at the end of the mixing zone, i.e., 100 m from the outfall.

For the Cumulative Effects Scenario, the CORMIX model showed that a dilution mixing ratio of 46 is achieved within 100 m from the outfall. The full-mixing dilution ratio of 51 is achieved within 120 m from the outfall.

Concentrations of the parameters of potential concern at the end of the mixing zone were calculated conservatively. The maximum Touquoy pit concentrations were used to define the effluent and the 75th percentile was used to define the ambient water quality conditions. The seepage load (concentration times seepage rate) was excluded to be conservative, due to the low predicted groundwater quality which would dilute the effluent.

The focus of assessment was on six parameters of potential concern with concentrations predicted to exceed the NSE Tier 1 EQS or CCME limits: aluminum, arsenic, cobalt, copper, nitrite, and cyanide. Concentrations of the parameters of potential concern at the end of the mixing zone for Base Scenario are presented in Error! Reference source not found. and for Cumulative Effects Scenario are presented in **Table 11**.

Table 10: Base Scenario – Water Quality Modelling Results, mg/L

WQ Parameter	Effluent Max, mg/L	Receiver, 75th Percentile	NSE Tier 1 EQS	CCME	MDMER	Concentration at End of 100 m Mixing Zone	Concentration at 120 m. Fully Mixed
Aluminum	0.03	0.187	0.005	0.1		0.1837	0.1840
Arsenic	0.3	0.018	0.005	0.005	0.3	0.0233	0.0228
WAD Cyanide	0.087	<0.003	0.005*	0.005*		0.0032	0.0030
Total Cyanide	0.249	<0.003			0.5	0.0074	0.0069
Cobalt	0.046	<0.0004	0.01			0.00110	0.00102
Copper	0.026	<0.002	0.002	0.002	0.3	0.00148	0.00144
Nitrite (as N)	0.693	<0.01		0.06		0.019	0.017

* Free form of cyanide

Table 11: Cumulative Effects Scenario – Water Quality Modelling Results, mg/L

WQ Parameter	Effluent Max, mg/L	Receiver, 75th Percentile	NSE Tier 1 EQS	CCME	MDMER	Concentration at End of 100 m Mixing Zone	Concentration at 120 m. Fully Mixed
Aluminum	0.04	0.187	0.005	0.1		0.1839	0.1841
Arsenic	0.3	0.018	0.005	0.005	0.3	0.0238	0.0233
WAD Cyanide	0.134	<0.003	0.005*	0.005*		0.0044	0.0041
Total Cyanide	0.384	<0.003			0.5	0.011	0.010
Cobalt	0.071	<0.0004	0.01			0.00172	0.00158
Copper	0.039	<0.002	0.002	0.002	0.3	0.00183	0.00175
Nitrite (as N)	0.632	<0.01		0.06		0.019	0.017

* Free form of cyanide

For both scenarios, 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 NSE Tier 1 EQS and CCME limits, resulting in a slight improvement in ambient aluminum concentrations.

Predicted maximum concentration of arsenic in the effluent for the Base Scenario is 0.616 mg/L and for the Cumulative Effects Scenario is 0.851 mg/L. The MDMER limit after June 1, 2021 is 0.30 mg/L, therefore, arsenic will require treatment prior to discharge for both Scenarios. After arsenic treatment to the MDMER limit of 0.30 mg/L its concentration at the end of the mixing zone is predicted at 0.023 mg/L for the Base Scenario and 0.024 mg/L for the Cumulative Effects Scenario. High arsenic background concentration limits mixing potential of this parameter. The arsenic concentration at the 100 m mixing zone boundary is above the NSE Tier 1 EQS and CCME limits, therefore, an environmental effects assessment will be required. Based on the CCME guideline (2001), the predicted arsenic concentrations are below the reported lowest toxic levels for fish, algae and aquatic plants.

Cyanide is presented in water in three forms: total, WAD, and free. There are no provincial or federal limits for total and WAD cyanide, however, there is a limit of 0.005 mg/L for free cyanide. The maximum WAD concentration in the effluent is 0.087 for the Base Scenario and 0.121 mg/L for the Cumulative Effects Scenario. Conservatively assuming that WAD is equal to the free form, the resulting concentration of free cyanide at the end of the mixing zone will be 0.0030 mg/L for the Base Scenario and 0.0041 mg/L for the Cumulative Effects Scenario which is less that applicable provincial and federal limits for free cyanide.

Predicted maximum total cyanide concentration in the effluent is 0.249 mg/L for the Base Scenario and 0.384 mg/L for the Cumulative Effects Scenario. These effluent concentrations are below the MDMER limit of 0.5 mg/L for total cyanide.

11.0 CONCLUSIONS

It was determined that a 100-m mixing zone would be appropriate for the Touquoy pit effluent on the basis of requirements of Nova Scotia Environment.

Ambient water quality was characterized using the 2016 and 2017 water quality data at SW-2. Background water quality in Moose River at SW-2 has four parameters which exceed either the NSE Tier 1 EQS or CCME: total aluminum, arsenic, cadmium and iron.

Two potential effluent water quantity and quality scenarios were considered. The Base Scenario characterizes the Touquoy pit effluent overflow to Moose River at mine closure after the tailings deposited to the pit from the Beaver Dam deposit only. The Cumulative Effects Scenario characterizes the Touquoy pit overflow after the tailings deposited in the pit from ore processing and from the Beaver Dam, Fifteen Mile Stream, Cochrane Hill, Beaver Dam, and Touquoy projects.

For both scenarios, total aluminum, arsenic, cobalt, copper, and nitrite were identified to have exceedances of either the NSE Tier 1 EQS or CCME in the Touquoy pit effluent. Arsenic concentrations for both scenarios, and ammonia for the cumulative effects scenario exceed the MDMER limit for existing mines. Therefore, arsenic treatment will be required for both scenarios, and ammonia treatment for the cumulative effects scenario, 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.

Concentrations of the parameters of potential concern at the end of the mixing zone for both scenarios are presented in Error! Reference source not found. and **Table 11**. The predicted aluminum concentration at the end of the mixing zone will be slightly lower than background, but above the NSE Tier 1 EQS and

CCME limits. The predicted arsenic concentration is above the NSE Tier 1 EQS and CCME limits but below the reported lowest toxic levels for fish, algae and aquatic plants. Conservatively assuming that WAD cyanide is equal to the free form, the resulting concentration of free cyanide at the end of the mixing zone will be 0.0030 mg/L for the Base Scenario and 0.0041 mg/L for the Cumulative Effects Scenario, which is less than applicable provincial and federal limits for free cyanide. Concentrations of cobalt, copper, and nitrite at the end of the mixing zone for both Scenarios are predicted to be below the NSE Tier 1 EQS and CCME limits.

12.0 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.

13.0 REFERENCES

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APPENDIX A
Water Quality Parameters and Statistics

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Table A.1 Surface Water Analytical Data - SW-2

Parameter	Units	2016-2017 Statistics						2016 Statistics			2017 Statistics			NSE Tier 1 EQS Freshwater
	Units	Minimum	Mean	Maximum	Median	75th	Count	Minimum	Mean	Maximum	Minimum	Mean	Maximum	
Anion Sum	me/L	0.10	0.14	0.21	0.14	0.165	22	0.12	0.149	0.21	0.1	0.14	0.17	-
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	22	<1	<1	<1	<1	<1	<1	-
Calculated TDS	mg/L	8.00	11.25	14.00	11.00	13	12	-	-	-	8	11.3	14	-
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	22	<1	<1	<1	<1	<1	<1	-
Cation Sum	me/L	0.18	0.25	0.31	0.26	0.28	22	0.18	0.256	0.31	0.18	0.239	0.3	-
Colour	TCU	23.00	66.27	140.00	60.00	74	22	23	62.6	140	44	69.3	110	-
Conductivity	µS/cm	21.00	26.00	35.00	24.50	28	22	22	26.2	35	21	25.8	33	-
Dissolved Chloride (Cl)	mg/L	3.60	4.80	5.90	4.75	5.275	22	4.2	4.84	5.3	3.6	4.77	5.9	-
Dissolved Fluoride (F-)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	22	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-
Dissolved Sulphate (SO4)	mg/L	<2.0	<2.0	2.6	<2.0	<2.0	22	<2	<2	2.6	<2	<2	2	-
Hardness (CaCO3)	mg/L	3.50	5.00	7.30	4.85	5.25	22	3.5	5.14	7.3	3.8	4.89	6.7	-
Ion Balance (% Difference)	%	10.50	26.35	40.90	27.55	30.15	22	14.3	26.4	40.9	10.5	26.3	40.5	-
Langelier Index (@ 20C)	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-
Langelier Index (@ 4C)	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate (N)	mg/L	<0.050	<0.050	0.18	<0.050	0.054	22	<0.05	0.0507	0.18	<0.05	<0.05	0.12	-
Nitrate + Nitrite (N)	mg/L	<0.050	<0.050	0.18	<0.050	0.054	22	<0.05	0.0507	0.18	<0.05	<0.05	0.12	-
Nitrite (N)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	22	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050	<0.050	0.14	<0.050	0.062	21	<0.05	<0.05	0.095	<0.05	<0.05	0.14	-
Orthophosphate (P)	mg/L	<0.010	<0.010	0.011	<0.010	<0.010	22	<0.01	<0.01	0.011	<0.01	<0.01	0.011	-
pH	pH	4.90	6.05	6.89	6.05	6.2375	22	4.9	6.03	6.89	5.63	6.07	6.47	-
Reactive Silica (SiO2)	mg/L	<0.50	1.16	2.50	1.090	1.875	22	<0.5	1.02	2.5	<0.5	1.27	2.2	-
Saturation pH (@ 20C)	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-
Saturation pH (@ 4C)	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Alkalinity (Total as CaCO3)	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0	22	<5	<5	<5	<5	<5	<5	-
Total Chemical Oxygen Demand	mg/L	14.00	27.36	67.00	24.50	27.75	22	14	27.8	67	20	27	43	-
Total Mercury (Hg)	µg/L	<0.013	<0.013	0.02	<0.013	<0.013	22	<0.013	<0.013	<0.013	<0.013	<0.013	0.02	0.026
Total Organic Carbon (C)	mg/L	3.90	7.90	19.00	6.95	9.375	22	3.9	7.49	19	4.4	8.25	13	-
Total Suspended Solids	mg/L	<1.0	2.68	32	<1.0	1.2	22	<1	4.86	32	<1	<1	<2	-
Total Dissolved Solids	mg/L	9.00	11.90	15.00	11.00	13.5	10	9	11.9	15	-	-	-	-
Turbidity	NTU	0.43	1.17	3.30	1.10	1.375	22	0.58	1.34	3.3	0.43	1.02	1.8	-
Dissolved Aluminum (Al)	mg/L	70.00	176.00	270.00	170.00	220	5	-	-	-	70	176	270	10
Dissolved Antimony (Sb)	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	5	-	-	-	<1	<1	<1	20
Dissolved Arsenic (As)	mg/L	5.10	8.64	13.00	6.90	13	5	-	-	-	5.1	8.64	13	5
Dissolved Barium (Ba)	mg/L	2.80	4.58	6.50	4.70	5.2	5	-	-	-	2.8	4.58	6.5	1000
Dissolved Beryllium (Be)	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	5	-	-	-	<1	<1	<1	5.3
Dissolved Bismuth (Bi)	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	5	-	-	-	<2	<2	<2	-
Dissolved Boron (B)	mg/L	<50	<50	<50	<50	<50	5	-	-	-	<50	<50	<50	1200
Dissolved Cadmium (Cd)	mg/L	<0.010	0.014	0.027	0.017	0.018	5	-	-	-	<0.01	0.0144	0.027	0.01
Dissolved Calcium (Ca)	mg/L	1100.00	1340.00	1700.00	1300.00	1500	5	-	-	-	1100	1340	1700	-
Dissolved Chromium (Cr)	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	5	-	-	-	<1	<1	<1	-
Dissolved Cobalt (Co)	mg/L	<0.40	<0.40	<0.40	<0.40	<0.40	5	-	-	-	<0.4	<0.4	<0.4	10
Dissolved Copper (Cu)	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	5	-	-	-	<2	<2	<2	2
Dissolved Iron (Fe)	mg/L	310.00	438.00	660.00	450.00	450	5	-	-	-	310	438	660	300
Dissolved Lead (Pb)	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	5	-	-	-	<0.5	<0.5	<0.5	1
Dissolved Magnesium (Mg)	mg/L	450.00	538.00	620.00	510.00	620	5	-	-	-	450	538	620	-
Dissolved Manganese (Mn)	mg/L	20.00	51.60	84.00	57.00	66	5	-	-	-	20	51.6	84	820
Dissolved Molybdenum (Mo)	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	5	-	-	-	<2	<2	<2	73
Dissolved Nickel (Ni)	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	5	-	-	-	<2	<2	<2	25
Dissolved Phosphorus (P)	mg/L	<100	<100	<100	<100	<100	5	-	-	-	<100	<100	<100	-

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Parameter	Units	2016-2017 Statistics						2016 Baseline Statistics			2017 Statistics			NSE Tier 1 EQS Freshwater
	Units	Minimum	Mean	Maximum	Median	75th	Count	Minimum	Mean	Maximum	Minimum	Mean	Maximum	
Dissolved Potassium (K)	mg/L	180.00	220.00	320.00	210.00	210	5	-	-	-	180	220	320	-
Dissolved Selenium (Se)	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	5	-	-	-	<1	<1	<1	1
Dissolved Silver (Ag)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	5	-	-	-	<0.1	<0.1	<0.1	0.1
Dissolved Sodium (Na)	mg/L	2600.00	2860.00	3100.00	3000.00	3000	5	-	-	-	2600	2860	3100	-
Dissolved Strontium (Sr)	mg/L	5.40	6.88	8.80	6.40	7.9	5	-	-	-	5.4	6.88	8.8	21000
Dissolved Thallium (Tl)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	5	-	-	-	<0.1	<0.1	<0.1	0.8
Dissolved Tin (Sn)	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	5	-	-	-	<2	<2	<2	-
Dissolved Titanium (Ti)	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	5	-	-	-	<2	<2	<2	-
Dissolved Uranium (U)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	5	-	-	-	<0.1	<0.1	<0.1	300
Dissolved Vanadium (V)	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	5	-	-	-	<2	<2	<2	6
Dissolved Zinc (Zn)	mg/L	<5.0	<5.0	5.60	<5.0	<5.0	5	-	-	-	<5	<5	5.6	30
Cyanate	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	22	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-
Strong Acid Dissoc. Cyanide (CN)	mg/L	<0.0010	<0.0010	0.002	<0.0010	<0.0010	22	<0.001	<0.001	0.0012	<0.001	<0.001	0.0018	0.005
Thiocyanate	mg/L	<0.17	<0.17	<0.17	<0.17	<0.17	22	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	-
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.003	<0.003	0.004	<0.003	<0.003	22	<0.003	<0.003	0.004	<0.003	<0.003	<0.003	-
Benzene	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	22	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0013	2100
Toluene	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	22	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0013	700
Ethylbenzene	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	22	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0013	320
Total Xylenes	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	22	<0.002	<0.002	<0.002	<0.002	<0.002	<0.0026	330
>C10-C16 Hydrocarbons	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	22	<0.05	<0.05	<0.05	<0.01	<0.01	<0.013	-
C6 - C10 (less BTEX)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	22	<0.01	<0.01	<0.01	<0.05	<0.05	<0.05	-
>C16-C21 Hydrocarbons	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	22	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-
>C21-<C32 Hydrocarbons	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	22	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-
Modified TPH (Tier1)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	22	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.15
Hydrocarbon Resemblance	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-
Radium-226		<0.050	<0.050	<0.050	<0.050	<0.050	2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0
Total Aluminum (Al)	µg/L	73.00	169.23	350.00	165.00	187.5	22	73	171	350	100	168	260	10
Total Antimony (Sb)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	22	<1	<1	<1	<1	<1	<1	20
Total Arsenic (As)	µg/L	4.00	12.25	30.00	7.85	17.75	22	4	14.7	30	4.6	10.2	19	5
Total Barium (Ba)	µg/L	2.50	4.11	8.60	3.80	4.375	22	2.5	4.3	8.6	3	3.96	5.8	1000
Total Beryllium (Be)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	22	<1	<1	<1	<1	<1	<1	5.3
Total Bismuth (Bi)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	22	<2	<2	<2	<2	<2	<2	-
Total Boron (B)	µg/L	<50	<50	<50	<50	<50	22	<50	<50	<50	<50	<50	<50	1200
Total Cadmium (Cd)	µg/L	<0.010	0.014	0.04	0.014	0.019	22	<0.01	0.0162	0.04	0.01	0.0128	0.022	0.01
Total Calcium (Ca)	µg/L	840.00	1198.18	1700.00	1200.00	1300	22	840	1230	1700	920	1170	1600	-
Total Chromium (Cr)	µg/L	<1.0	<1.0	1.7	<1.0	<1.0	22	<1	<1	1.7	<1	<1	<1	-
Total Cobalt (Co)	µg/L	<0.40	<0.40	0.71	<0.40	<0.40	22	<0.4	<0.4	0.71	<0.4	<0.4	<0.4	10
Total Copper (Cu)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	22	<2	<2	<2	<2	<2	<2	2
Total Iron (Fe)	µg/L	190.00	483.18	850.00	485.00	617.5	22	190	481	810	200	485	850	300
Total Lead (Pb)	µg/L	<0.50	<0.50	0.86	<0.50	<0.50	22	<0.5	<0.5	0.86	<0.5	<0.5	<0.5	1
Total Magnesium (Mg)	µg/L	350.00	488.18	750.00	460.00	520	22	350	503	750	370	476	630	-
Total Manganese (Mn)	µg/L	29.00	60.00	180.00	54.00	68.5	22	35	70.1	180	29	51.6	88	820
Total Molybdenum (Mo)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	22	<2	<2	<2	<2	<2	<2	73
Total Nickel (Ni)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	22	<2	<2	<2	<2	<2	<2	25
Total Phosphorus (P)	µg/L	<100	<100	<100	<100	<100	22	<100	<100	<100	<100	<100	<100	-
Total Potassium (K)	µg/L	130.00	215.91	530.00	190.00	240	22	150	256	530	130	183	310	-
Total Selenium (Se)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	22	<1	<1	<1	<1	<1	<1	1
Total Silver (Ag)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	22	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Total Sodium (Na)	µg/L	2100.00	2772.73	3500.00	2800.00	3000	22	2200	2850	3500	2100	2710	3400	-
Total Strontium (Sr)	µg/L	4.50	6.30	11.00	5.85	6.65	22	4.5	6.39	11	4.6	6.22	8.8	21000

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Parameter	Units	2016-2017 Statistics						2016 Baseline Statistics			2017 Statistics			NSE Tier 1
	Units	Minimum	Mean	Maximum	Median	75th	Count	Minimum	Mean	Maximum	Minimum	Mean	Maximum	
Total Thallium (Tl)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	22	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.8
Total Tin (Sn)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	22	<2	<2	<2	<2	<2	<2	-
Total Titanium (Ti)	µg/L	<2.0	<2.0	3.70	2.15	2.5	22	2	<2	3.5	<2	2.07	3.7	-
Total Uranium (U)	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10	22	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	300
Total Vanadium (V)	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	22	<2	<2	<2	<2	<2	<2	6
Total Zinc (Zn)	µg/L	<5.0	<5.0	6.1	<5.0	<5.0	22	<5	<5	6.1	<5	<5	6	30

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Table A.2 2016 Surface Water Monitoring - SW-2

Parameter	March	April	May	June	July	August	September	October	November	December
Anion Sum	0.15	0.12	0.14	0.14	0.13	0.15	0.21	0.13	0.19	0.13
Bicarb. Alkalinity (calc. as CaCO3)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Calculated TDS	-	-	-	-	-	-	-	-	-	-
Carb. Alkalinity (calc. as CaCO3)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	0.21	0.18	0.26	0.25	0.28	0.28	0.28	0.31	0.28	0.23
Colour	49	57	52	68	53	33	23	140	74	77
Conductivity	22	22	23	23	24	28	31	35	27	27
Dissolved Chloride (Cl)	5.3	4.2	5	4.8	4.5	5.3	5.1	4.7	5	4.5
Dissolved Fluoride (F-)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Sulphate (SO4)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.6	<2.0	2.2	<2.0
Hardness (CaCO3)	4.4	3.5	4.6	5	5.5	5.1	4.9	7.3	6	5.1
Ion Balance (% Difference)	16.7	20	30	28.2	36.6	30.2	14.3	40.9	19.2	27.8
Langelier Index (@ 20C)	-	-	-	-	-	-	-	-	-	-
Langelier Index (@ 4C)	-	-	-	-	-	-	-	-	-	-
Nitrate (N)	<0.050	<0.050	<0.050	<0.050	0.055	0.052	0.18	<0.050	<0.050	0.07
Nitrate + Nitrite (N)	<0.050	<0.050	<0.050	<0.050	0.055	0.052	0.18	<0.050	<0.050	0.07
Nitrite (N)	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	<0.050	<0.050	0.062	<0.050	0.095	<0.050	0.062	<0.050	0.091	<0.050
Orthophosphate (P)	0.01	<0.010	<0.010	0.011	0.01	0.011	<0.010	<0.010	<0.010	0.011
pH	6.17	5.62	6.24	5.93	6.66	6.16	6.89	4.9	5.86	5.82
Reactive Silica (SiO2)	1.3	0.88	<0.50	<0.50	0.52	<0.50	<0.50	2.5	1.8	2.2
Saturation pH (@ 20C)	-	-	-	-	-	-	-	-	-	-
Saturation pH (@ 4C)	-	-	-	-	-	-	-	-	-	-
Total Alkalinity (Total as CaCO3)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Total Chemical Oxygen Demand	21	17	22	23	24	27	14	67	38	25
Total Mercury (Hg)	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Total Organic Carbon (C)	5	4.9	5.5	6.2	7.1	4.6	3.9	19	9.4	9.3
Total Suspended Solids	<1.0	<1.0	<1.0	2.4	<1.0	<1.0	32	1.2	<1.0	10
Total Dissolved Solids	11	9	11	10	11	11	15	14	15	12
Turbidity	1.4	1.3	1.1	1	1.4	1	0.58	3.3	1.4	0.91
Dissolved Aluminum (Al)	-	-	-	-	-	-	-	-	-	-
Dissolved Antimony (Sb)	-	-	-	-	-	-	-	-	-	-
Dissolved Arsenic (As)	-	-	-	-	-	-	-	-	-	-
Dissolved Barium (Ba)	-	-	-	-	-	-	-	-	-	-
Dissolved Beryllium (Be)	-	-	-	-	-	-	-	-	-	-
Dissolved Bismuth (Bi)	-	-	-	-	-	-	-	-	-	-
Dissolved Boron (B)	-	-	-	-	-	-	-	-	-	-
Dissolved Cadmium (Cd)	-	-	-	-	-	-	-	-	-	-
Dissolved Calcium (Ca)	-	-	-	-	-	-	-	-	-	-
Dissolved Chromium (Cr)	-	-	-	-	-	-	-	-	-	-
Dissolved Cobalt (Co)	-	-	-	-	-	-	-	-	-	-
Dissolved Copper (Cu)	-	-	-	-	-	-	-	-	-	-
Dissolved Iron (Fe)	-	-	-	-	-	-	-	-	-	-
Dissolved Lead (Pb)	-	-	-	-	-	-	-	-	-	-
Dissolved Magnesium (Mg)	-	-	-	-	-	-	-	-	-	-

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Parameter	March	April	May	June	July	August	September	October	November	December
Dissolved Manganese (Mn)	-	-	-	-	-	-	-	-	-	-
Dissolved Molybdenum (Mo)	-	-	-	-	-	-	-	-	-	-
Dissolved Nickel (Ni)	-	-	-	-	-	-	-	-	-	-
Dissolved Phosphorus (P)	-	-	-	-	-	-	-	-	-	-
Dissolved Potassium (K)	-	-	-	-	-	-	-	-	-	-
Dissolved Selenium (Se)	-	-	-	-	-	-	-	-	-	-
Dissolved Silver (Ag)	-	-	-	-	-	-	-	-	-	-
Dissolved Sodium (Na)	-	-	-	-	-	-	-	-	-	-
Dissolved Strontium (Sr)	-	-	-	-	-	-	-	-	-	-
Dissolved Thallium (Tl)	-	-	-	-	-	-	-	-	-	-
Dissolved Tin (Sn)	-	-	-	-	-	-	-	-	-	-
Dissolved Titanium (Ti)	-	-	-	-	-	-	-	-	-	-
Dissolved Uranium (U)	-	-	-	-	-	-	-	-	-	-
Dissolved Vanadium (V)	-	-	-	-	-	-	-	-	-	-
Dissolved Zinc (Zn)	-	-	-	-	-	-	-	-	-	-
Cyanate	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strong Acid Dissoc. Cyanide (CN)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010
Thiocyanate	<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-)	<0.003	<0.003	<0.003	<0.003	0.004	<0.003	<0.003	<0.003	<0.003	<0.003
Benzene	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Toluene	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ethylbenzene	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Xylenes	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
>C10-C16 Hydrocarbons	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
C6 - C10 (less BTEX)	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
>C16-C21 Hydrocarbons	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
>C21-<C32 Hydrocarbons	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Modified TPH (Tier1)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Hydrocarbon Resemblance	-	-	-	-	-	-	-	-	-	-
Radium-226	-	-	-	-	-	<0.050	-	-	-	-
Total Aluminum (Al)	150	140	170	140	170	100	73	350	210	210
Total Antimony (Sb)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic (As)	5.2	4	30	23	29	20	17	8	5.7	4.9
Total Barium (Ba)	3.6	3.9	3.9	3.6	3.2	3	2.5	8.6	5.8	4.9
Total Beryllium (Be)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth (Bi)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron (B)	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	0.015	0.016	0.025	<0.010	<0.010	<0.010	<0.010	0.04	0.024	0.022
Total Calcium (Ca)	1000	840	1200	1200	1400	1200	1200	1700	1400	1200
Total Chromium (Cr)	<1.0	<1.0	1.6	<1.0	<1.0	<1.0	1.7	<1.0	<1.0	<1.0
Total Cobalt (Co)	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.71	<0.40	<0.40
Total Copper (Cu)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Iron (Fe)	240	190	580	530	810	480	490	690	430	370
Total Lead (Pb)	<0.50	<0.50	0.86	<0.50	<0.50	<0.50	<0.50	0.52	<0.50	<0.50
Total Magnesium (Mg)	430	350	420	470	520	500	450	750	590	550
Total Manganese (Mn)	43.00	35.00	89.00	55.00	64.00	37.00	53.00	180.00	75.00	70.00

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Parameter	March	April	May	June	July	August	September	October	November	December
Total Molybdenum (Mo)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel (Ni)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Phosphorus (P)	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Total Potassium (K)	240	210	300	180	150	160	240	530	310	240
Total Selenium (Se)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver (Ag)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Sodium (Na)	2400	2200	3100	2800	3000	3500	3500	2700	2900	2400
Total Strontium (Sr)	5.1	4.5	5.2	5.6	6.7	5.9	5.4	11	7.8	6.7
Total Thallium (Tl)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin (Sn)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium (Ti)	2.1	<2.0	2.8	<2.0	2.5	<2.0	<2.0	3.5	<2.0	2
Total Uranium (U)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Vanadium (V)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc (Zn)	<5.0	<5.0	6.1	<5.0	<5.0	<5.0	<5.0	6.1	<5.0	<5.0

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Table A.3 2017 Surface Water Monitoring - SW-2

Parameter	January	February	March	April	May	June	July	August	September	October	November	December
Anion Sum	0.17	0.12	0.17	0.1	0.12	0.12	0.11	0.13	0.15	0.15	0.17	0.17
Bicarb. Alkalinity (calc. as CaCO3)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Calculated TDS	13	10	12	8	10	9	10	10	14	12	14	13
Carb. Alkalinity (calc. as CaCO3)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	0.26	0.21	0.21	0.18	0.21	0.24	0.26	0.23	0.3	0.26	0.28	0.23
Colour	61	55	44	52	74	63	59	48	110	72	110	84
Conductivity	29	24	25	21	22	24	24	24	29	27	33	28
Dissolved Chloride (Cl)	5.8	4.3	4.6	3.6	4	4.3	3.9	4.3	5.4	5.2	5.9	5.9
Dissolved Fluoride (F-)	<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 Sulphate (SO4)	<2.0	<2.0	2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Hardness (CaCO3)	4.7	4.5	4.3	3.8	4.3	4.4	5	4.7	6.7	5.3	6.2	4.8
Ion Balance (% Difference)	20.9	27.3	10.5	28.6	27.3	33.3	40.5	27.8	33.3	26.8	24.4	15
Langelier Index (@ 20C)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Langelier Index (@ 4C)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrate (N)	0.073	<0.050	<0.050	<0.050	0.12	<0.050	<0.050	0.092	<0.050	<0.050	<0.050	<0.050
Nitrate + Nitrite (N)	0.073	<0.050	<0.050	<0.050	0.12	<0.050	<0.050	0.092	<0.050	<0.050	<0.050	<0.050
Nitrite (N)	<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)	0.082	<0.050	<0.050	-	0.14	0.05	<0.050	0.062	<0.050	<0.050	<0.050	<0.050
Orthophosphate (P)	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010
pH	5.63	6.03	5.96	5.92	6.28	6.33	6.47	6.23	6.18	6.06	5.84	5.97
Reactive Silica (SiO2)	1.9	1.8	1.3	0.74	0.71	<0.50	0.51	0.52	2.1	1.3	2.2	1.9
Saturation pH (@ 20C)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Saturation pH (@ 4C)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Total Alkalinity (Total as CaCO3)	<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 Chemical Oxygen Demand	27	23	21	24	20	27	22	26	35	28	43	28
Total Mercury (Hg)	<0.013	<0.013	<0.013	<0.013	<0.013	0.02	<0.013	<0.013	0.013	<0.013	<0.013	<0.013
Total Organic Carbon (C)	6.5	5.7	4.4	4.7	6.9	7.2	7.6	7	13	10	13	13
Total Suspended Solids	<1.0	<1.0	<1.0	1.6	<2.0	1.4	<2.0	<1.0	1.2	<1.0	1.2	<1.0
Total Dissolved Solids	-	-	-	-	-	-	-	-	-	-	-	-
Turbidity	1.2	1.1	0.96	1.2	1.4	1.1	0.66	0.43	0.7	0.71	1.8	1
Dissolved Aluminum (Al)	-	-	-	-	-	-	-	70	220	150	270	170
Dissolved Antimony (Sb)	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Arsenic (As)	-	-	-	-	-	-	-	13	13	6.9	5.2	5.1
Dissolved Barium (Ba)	-	-	-	-	-	-	-	2.8	5.2	3.7	6.5	4.7
Dissolved Beryllium (Be)	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Bismuth (Bi)	-	-	-	-	-	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Boron (B)	-	-	-	-	-	-	-	<50	<50	<50	<50	<50
Dissolved Cadmium (Cd)	-	-	-	-	-	-	-	<0.010	0.018	<0.010	0.027	**0.017**
Dissolved Calcium (Ca)	-	-	-	-	-	-	-	1100	1700	1300	1500	1100
Dissolved Chromium (Cr)	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Cobalt (Co)	-	-	-	-	-	-	-	<0.40	<0.40	<0.40	<0.40	<0.40
Dissolved Copper (Cu)	-	-	-	-	-	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Iron (Fe)	-	-	-	-	-	-	-	320	660	450	450	310
Dissolved Lead (Pb)	-	-	-	-	-	-	-	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved Magnesium (Mg)	-	-	-	-	-	-	-	450	620	490	620	510

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Parameter	January	February	March	April	May	June	July	August	September	October	November	December
Dissolved Manganese (Mn)	-	-	-	-	-	-	-	20	66	31	84	57
Dissolved Molybdenum (Mo)	-	-	-	-	-	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Nickel (Ni)	-	-	-	-	-	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Phosphorus (P)	-	-	-	-	-	-	-	<100	<100	<100	<100	<100
Dissolved Potassium (K)	-	-	-	-	-	-	-	180	210	180	320	210
Dissolved Selenium (Se)	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Silver (Ag)	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Sodium (Na)	-	-	-	-	-	-	-	2600	3100	3000	3000	2600
Dissolved Strontium (Sr)	-	-	-	-	-	-	-	5.4	8.8	6.4	7.9	5.9
Dissolved Thallium (Tl)	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Tin (Sn)	-	-	-	-	-	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Titanium (Ti)	-	-	-	-	-	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Uranium (U)	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Vanadium (V)	-	-	-	-	-	-	-	<2.0	<2.0	<2.0	<2.0	<2.0
Dissolved Zinc (Zn)	-	-	-	-	-	-	-	<5.0	<5.0	<5.0	5.6	<5.0
Cyanate	<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)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0018	<0.0010	0.001	0.0013	<0.0010	<0.0010	<0.0010
Thiocyanate	<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-)	<0.003	<0.003	<0.003	<0.003	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Benzene	<0.0010	<0.0010	<0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Toluene	<0.0010	<0.0010	<0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Ethylbenzene	<0.0010	<0.0010	<0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Xylenes	<0.0020	<0.0020	<0.0026	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
>C10-C16 Hydrocarbons	<0.010	<0.010	<0.013	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
C6 - C10 (less BTEX)	<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	<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	<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)	<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	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Radium-226	-	-	-	<0.050	-	-	-	-	-	-	-	-
Total Aluminum (Al)	190	150	140	130	170	160	140	100	220	170	260	180
Total Antimony (Sb)	<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)	4.6	4.7	6.9	6.2	11	18	19	17	16	7.7	6.1	5.5
Total Barium (Ba)	4.3	3.9	3.7	3.2	3.9	3.4	3.4	3	5.1	3.4	5.8	4.4
Total Beryllium (Be)	<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)	<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)	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	0.018	0.012	0.016	0.018	0.013	<0.010	<0.010	<0.010	0.01	**0.011**	**0.022**	**0.019**
Total Calcium (Ca)	1100	1100	1000	920	1000	1100	1300	1200	1600	1300	1400	1000
Total Chromium (Cr)	<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)	<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)	<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 Iron (Fe)	320	290	250	200	340	630	750	610	850	590	620	370
Total Lead (Pb)	<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 Magnesium (Mg)	490	460	420	370	430	420	460	460	600	520	630	450
Total Manganese (Mn)	61	51	42	35	58	52	41	29	71	35	88	56

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Parameter	61	51	42	35	58	52	41	29	71	35	88	56
Total Molybdenum (Mo)	<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)	<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)	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Total Potassium (K)	150	150	170	200	170	170	130	150	220	160	310	210
Total Selenium (Se)	<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)	<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)	3200	2400	2500	2100	2300	2800	2900	2600	3400	3000	3000	2300
Total Strontium (Sr)	6.1	5.8	5.6	4.6	5.6	5.6	6.5	5.7	8.8	6.4	7.5	6.4
Total Thallium (Tl)	<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)	<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)	<2.0	<2.0	<2.0	<2.0	2.2	2.4	2.7	2.2	3.7	3	2.2	2.5
Total Uranium (U)	<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)	<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)	<5.0	<5.0	<5.0	<5.0	6	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0