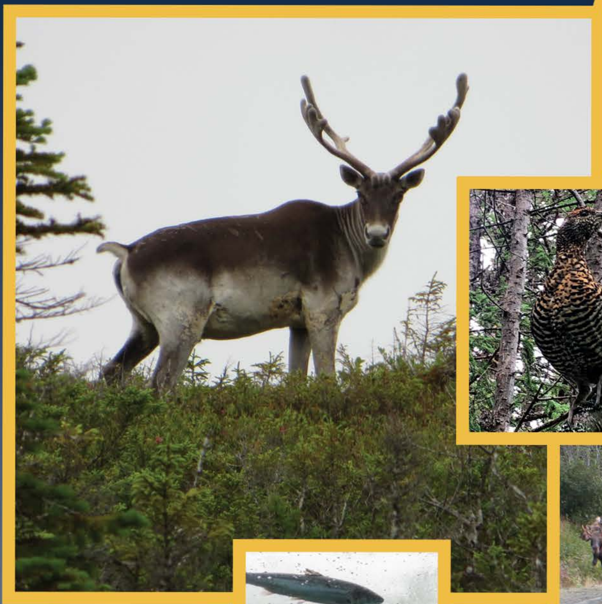
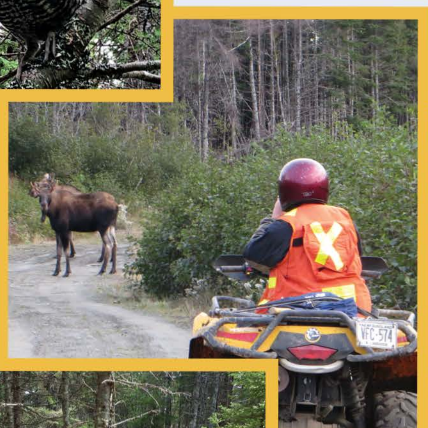
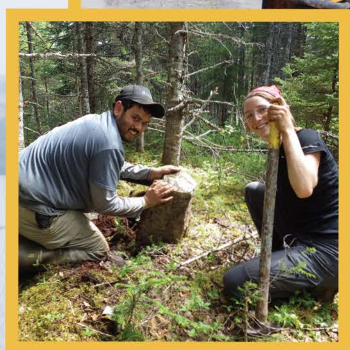
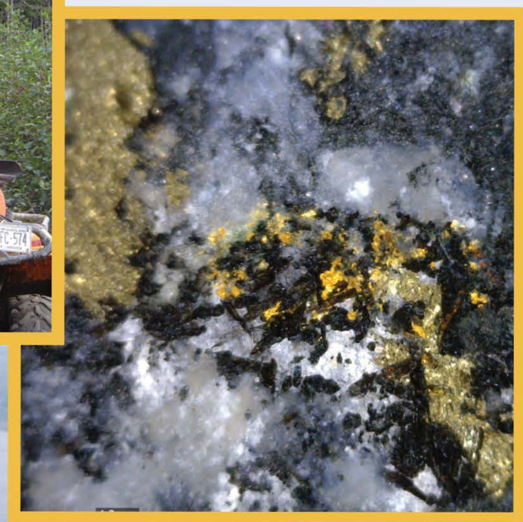
Valentine Gold Project
Baseline Study Appendix 3: Water Resources

September 2020









Valentine Gold Project
Environmental Impact Statement

Final Report

Baseline Study Appendix 3: Water Resources (BSA.3)

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September 25, 2020

Table of Contents

Abbreviations and Acronyms

BFI	baseflow index
BSA	Baseline Study Appendix
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
FAL	Freshwater Aquatic Life
GCDWQ	Guidelines for Canadian Drinking Water Quality
GWQG	Canadian Water Quality Guidelines
IDF	Intensity-Duration Frequency
km	kilometres
km^2	Kilometres squared
L/min	litres per minute
m	metres
Marathon	Marathon Gold Corporation
mbgs	metres below ground surface
mm	millimetres
m/s	metres per second
m/year	metres per year
NL	Newfoundland and Labrador
NLDECCM	NL Department of Environment, Climate Change and Municipalities
NLEPA	*NL Environmental Protection Act*
TMF	Tailings Management Facility
TSS	Total Suspended Solids
VC	Valued Components
WRMD	Water Resources Management Division
WSC	Water Survey of Canada

1.0 INTRODUCTION

Marathon Gold Corporation (Marathon) is planning to develop an open pit gold mine south of Valentine Lake, located in the Central Region of the Island of Newfoundland, approximately 60 kilometres (km) southwest of the town of Millertown, Newfoundland and Labrador (NL) (Figure 1-1). The Valentine Gold Project (the Project) will consist primarily of open pits, waste rock piles, crushing and stockpiling areas, conventional milling and processing facilities (the mill), a tailings management facility, personnel accommodations, and supporting infrastructure including roads, on-site power lines, buildings, and water and effluent management facilities. The mine site is accessed by an existing public access road that extends south from Millertown approximately 88 km to Marathon's existing exploration camp. Marathon will upgrade and maintain the access road from a turnoff approximately 8 km southwest of Millertown to the mine site, a distance of approximately 76 km.

The Minister of the NL Department of Environment, Climate Change and Municipalities (NLDECCM) has determined that the Project will require preparation of an Environmental Impact Statement (EIS) under the provincial *Environmental Protection Act* (NLEPA). The Provincial EIS Guidelines require the preparation of a number of baseline studies to describe and provide data on specific components of the EIS; to address baseline data requirements to support the assessment of one or more Valued Components (VCs); and to support the development of mitigation measures and follow-up monitoring programs. Each has been prepared as a stand-alone Baseline Study Appendix (BSA) to the EIS:

- BSA.1: Dam Safety
- BSA.2: Woodland Caribou
- BSA.3: Water Resources
- BSA.4: Fish, Fish Habitat and Fisheries
- BSA.5: Acid Rock Drainage / Metal Leaching (ARD/ML)
- BSA.6: Atmospheric Environment
- BSA.7: Avifauna, Other Wildlife and Their Habitats
- BSA.8: Species at Risk / Species of Conservation Concern (SAR / SOCC)
- BSA.9: Community Health, Services and Infrastructure / Employment and Economy
- BSA.10: Historic Resources

Table 1.1 outlines the organization for BSA.3: Water Resources.

Table 1.1 BSA.3: Water Resources

Number	Baseline Study Appendix	Attachment Number	Attachment Name
BSA.3	Water Resources	3-A	Valentine Lake Project: Preliminary Baseline Hydrogeology Assessment (2017)
		3-B	Valentine Lake Project: Preliminary Hydrogeology Assessment, Water Level Data (2019)
		3-C	Valentine Gold Project Hydrology and Water Quality Monitoring Baseline Report (2020)
		3-D	Hydrogeology Baseline Report (2020) (GEMTEC)

Note that the BSAs consist of data reports that have been prepared for Marathon over several years (i.e., 2011 to 2020), during which the Project has gone through a series of refinements. The study areas and Project references in these data reports reflect the Project description at the time of preparation of these reports. The current Project description for the purposes of environmental assessment is found in Section 2 of the EIS.

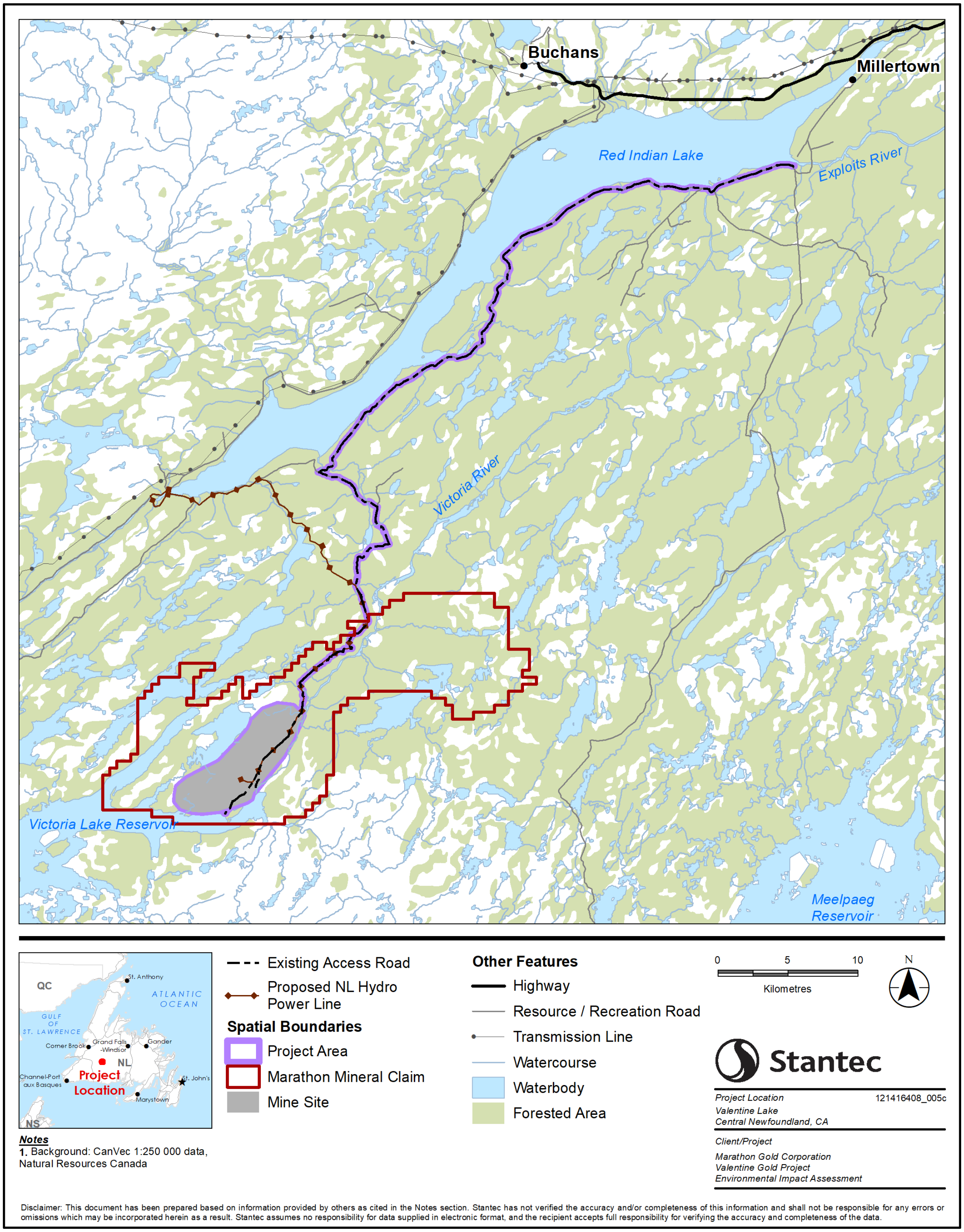

Figure 1-1 Project Area

2.0 SUMMARY OF WATER RESOURCES BSA ATTACHMENTS

Six field programs were completed by Stantec Consulting Inc. (Stantec) and Gemtec in support of the assessment of water resources for the Project:

- a 2017 hydrogeology field program as reported in *Valentine Project; Preliminary Baseline Hydrogeology Assessment (2017)*
- a preliminary hydrogeology field program as reported in *Valentine Project: Preliminary Hydrogeology Assessment, Water Level Data (2019)*
- a hydrology and water quality field program as reported in the *Hydrology and Surface Water Quality Monitoring Baseline Report (2019)*
- a 2019 hydrogeology survey as reported in *Hydrogeology Baseline Report (2020)*

Table 2.1 provides a summary of the objectives, study area, methods, and results of each of these programs and studies.

Table 2.1 Summary of Water Resources BSA Attachments

Rationale / Objectives and Study Area	Methods	Results
Attachment 3-A - Preliminary Baseline Hydrogeology Assessment (2017)		
Rationale / Objectives The preliminary baseline hydrogeology assessment was conducted to begin characterization of current groundwater conditions at the Valentine Lake site in support of mine development and to describe and present information collected to date. **Study Area** The Study Area is within the Marathon Mineral Claim Area (Figure 1-1).	**Desktop assessment** included review and selection of existing exploratory boreholes to test for transmissivity and water quality. **Field Program** was conducted in October 2017 and involved the hydraulic development, hydraulic testing, and water quality sampling at six boreholes selected to represent a range of depths. In addition, one sample of water used during exploration drilling was collected for comparison with groundwater chemistry. Water quality analysis included general chemistry, dissolved metals, dissolved mercury, weak and strong acid-dissociable cyanide, and radium-226.	The majority of the Leprechaun and Marathon deposits are located in what is referred to as Hydrogeological Unit 5, which consists of plutonic strata and includes mostly major granites, granodiorite, diabase, and diorite intrusions. Yields of wells drilled in Unit 5 are typically low to moderate with a median sustainable pumping rate of 14 L/min. Hydraulic conductivities calculated for the Marathon Deposit, based on preliminary hydraulic testing of three boreholes, range from 1.2×10^{-8} m/s to 1.5×10^{-7} with an average of 7.8×10^{-8}. Hydraulic conductivities were slightly lower in the Leprechaun Deposit, ranging from 5.1×10^{-9} m/s to 6.0×10^{-8} m/s and an average of 3.4×10^{-8}. Based on comparison of the chemical results of the analyses of the drill water with the water samples collected from the boreholes, as well as the distance between the drill site and the nearest sampled borehole, water used for drilling operations is not expected to have an influence on water quality in the boreholes sampled during the preliminary baseline hydrogeology assessment. Water quality testing provides a “snapshot” reference for future change in groundwater chemistry related to site activities; analytical results of the current assessment are not compared to regulatory guidelines.

Table 2.1 Summary of Water Resources BSA Attachments

Rationale / Objectives and Study Area	Methods	Results
Attachment 3-B - Valentine Project: Preliminary Hydrogeology Assessment, Water Level Data		
Rationale / Objectives The study's objective was to provide an update on hydrogeological data that has been collected since November 2017. **Study Area** The Study Area is within the Marathon Mineral Claim Area (Figure 1-1).	The field component of water logger retrieval and the water level survey at the Valentine Lake Project was completed between November 23, 2018 and November 26, 2018. **Manual water level** survey was carried out between November 24, 2018 to November 26, 2018. Measurements were collected and recorded. **Water level loggers:** Water level data was recorded by water level loggers from November 14, 2017 to November 24, 2018. Loggers were retrieved between November 23, 2018 and November 26, 2018 from each borehole and data was downloaded. One water level logger and barometric logger were lost in the borehole during the monitoring period, therefore, hourly atmospheric pressure data reported at the nearby weather station was used to correct the water level data for barometric pressure fluctuations.	**Manual water level:** Depth to groundwater ranged from -0.837 metres below ground surface (mbgs) (i.e., a flowing artesian well) to 8.928 mbgs. A groundwater elevation change of 100 m was observed between the topographic highs of the Sprite Deposit down to Valentine Lake and Victoria Lake. **Water level loggers:** In general, there does not appear to be a strong correlation between precipitation and groundwater levels. Annual fluctuation of water levels in the five measured wells is less than 0.8 m. Based on the water level response to precipitation events, one borehole appeared to be influenced by surface runoff. Minimal fluctuation was observed in another borehole due to continuous flowing conditions.
Attachment 3-C - Hydrology and Surface Water Quality Monitoring Baseline Report (2019)		
Rationale / Objective The objective of the hydrology and water quality baseline study was to describe and present the available information and characterize the baseline conditions of climate, hydrology and water quality near the project site. **Study Area** The Study Area is within the Marathon Mineral Claim Area (Figure 1-1).	**Desktop assessment** used longer-term regional records as well as shorter duration Project field monitoring results to characterize physiographic parameters (i.e., climate, watershed delineation, and groundwater); regional hydrology; local water users; and regional water quality. **Field Program** involved an assessment of **hydrology** using a total of twelve water level monitoring stations, nine of which used leveloggers to monitor continuous water level, water temperature and allow the development of continuous stream flow records, with two	Desktop assessment of annual temperature and precipitation was conducted and showed no deviation from averages and ranges presented above in Attachment 3-A, summary of results. Potential effects of climate change on the Intensity-Duration Frequency (IDF) curve projected an increase in rainfall intensity. The average observed water levels recorded in Victoria Lake were determined and presented. Runoff rate for the Study Area was calculated to be 62.5%, based on climate normal precipitation and expected evapotranspiration.

Table 2.1 Summary of Water Resources BSA Attachments

Rationale / Objectives and Study Area	Methods	Results
	stations equipped with Solinst Barologgers to collect barometric pressure. The three remaining stations were established as in-situ spot flow measurement stations, collecting velocity measurements and discharge. A **bathymetric survey** was conducted near potential effluent discharge locations in Victoria and Valentine Lakes at three locations within each lake with lines spaced approximately 50 m apart. **Water quality** samples taken from Victoria and Valentine Lakes were collected in July, September and November 2019. Three water samples were collected at each of these locations; at the surface, in the thermocline and below the thermocline and analyzed for general water quality parameters, metals mercury and TSS.	Annual flow regression was developed based on selected regional Water Survey of Canada (WSC) stations. The mean unit flow varying between 0.020 $m^3/s/km^2$ and 0.036 $m^3/s/km^2$, with lowest monthly flows in July and highest flows in April and May. The regional relationships for peak flows and low flows were provided. Flow duration curves for selected WSC stations showed reasonable regional homogeneity. An environmental water balance for the Study Area was developed for climate normal, wet-year, and dry-year conditions. Monthly baseflow index (BFI) for a representative WSC station of the Study Area showed mean BFI of 35% In-situ flow measurement results, rating curves, and station hydrographs for each applicable hydrometric station (2012 – 2019 data) were developed and presented. Hydrometric station watershed areas ranged from 0.4 to 5.3 km^2. A minimum of seven in-situ flow measurements were collected at each hydrometric station that a rating curve was developed for. Regional water quality was assessed using Environmental and Climate Change Canada (ECCC) and Water Resources Management Division (WRMD) managed locations. Local water quality conditions were presented using the water quality data from the 26 locations in the Study Area. Local and regional water quality was found to be quite similar, with low acid buffering potential, and naturally elevated metals (aluminum, cadmium, copper, iron, and lead).

Table 2.1 Summary of Water Resources BSA Attachments

Rationale / Objectives and Study Area	Methods	Results
Attachment 3-D – Hydrogeology Baseline Report (2020) (GEMTEC)		
Rationale / Objective The overarching objective of this study was to characterize the hydrogeology baseline conditions (i.e., hydrostratigraphy, hydraulic properties and gradients, groundwater flow directions and velocity, and groundwater quality) at the Study Area in support of the EA. **Study Area** The Study Area is within the Marathon Mineral Claim Area (Figure 1-1), specifically, areas near Marathon, Leprechaun, and Victory deposits.	Field methods were conducted during two site visits (from September 30 to October 12, 2019; and from February 27 to 29, 2020). Methods involved diamond drilling of eight vertical hydrogeological boreholes; detailed borehole logging Installation and development of 51mm-diameter PVC, screened monitoring wells within each of the eight hydrogeological boreholes; hydraulic conductivity testing; static water level measurements; Installation of water level data loggers; collection of groundwater quality samples in each of the eight new hydrogeological monitoring wells during the October 2019 program, and five of the monitoring wells (those free from ice) during the February 2020 program.	Boreholes for the six shallow monitoring wells were advanced to depths ranging from 5.64 mbgs to 10.10 mbgs; while the two deeper monitoring wells were advanced to depths ranging from 30.05 mbgs to 31.90 mbgs. Bedrock was encountered in all monitoring wells except one; with inferred trondhjemite in four wells; quartz porphyry monzonite in one; and siltstone in two wells. Overburden thickness ranged from 0.1 m to 17.1 m, and with an average thickness of 3.8 m across the Study Area. A trend of decreasing hydraulic conductivity with depth is apparent and was attributed to decreasing bedrock weathering and fracturing with depth. No relation between hydraulic conductivity and bedrock type was apparent, indicating that secondary porosity (faults and fractures) likely controls permeability. The mean hydraulic conductivity was estimated at 4.7×10^{-6} m/s for overburden and 5.7×10^{-7} m/s for bedrock. The Study Area is underlain by an unconfined aquifer contained within the saturated overburden and shallow bedrock units, with semi-confined groundwater flow conditions present at depth within the bedrock. The overall direction of groundwater flow within the unconfined aquifer system follows topography and surface water flow. Typical horizontal hydraulic gradients range from 8 % to 1 %.

Table 2.1 Summary of Water Resources BSA Attachments

Rationale / Objectives and Study Area	Methods	Results
		Groundwater flow was found to be upward in the relatively low-lying areas, flowing at a slight vertical hydraulic gradient ranging from 1 % to 2.5 % from the bedrock to the overburden material; and downward in the relatively high-ground areas, flowing at a moderate gradient of 22 % to 27 % from the overburden material to the bedrock. The average linear groundwater velocity is estimated to range between 0.126 m/year to 12.61 m/year but varied based on the local hydraulic conductivity, hydraulic gradient, and porosity. Groundwater quality samples were classified as being calcium-carbonate type, likely of meteoric origin. Hardness varied from soft to hard. In two wells, groundwater was slightly acidic; in other wells, it was near-neutral to slightly basic. Several exceedances of the Canadian Water Quality Guidelines (GWQG) for the Protection of Freshwater Aquatic Life (FAL) and Guidelines for Canadian Drinking Water Quality (GCDWQ) were noted in at least one sample for pH, dissolved oxygen, turbidity, true color, aluminum, arsenic, copper, iron, and manganese. One well was noted to have the highest number of exceedances.

ATTACHMENT 3-A

Valentine Lake Project: Preliminary Baseline Hydrogeology Assessment (2017)

Valentine Lake Project: Preliminary Baseline Hydrogeology Assessment

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Final Report

December 15, 2017

Sign-off Sheet

This document entitled Valentine Lake Project: Preliminary Baseline Hydrogeology Assessment was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Marathon Gold Corporation (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.

Table of Contents

Executive Summary

Stantec Consulting Ltd. was retained by Marathon Gold Corporation to conduct a number of environmental surveys at the Valentine Lake Project site, including characterization of site hydrogeology. The preliminary baseline hydrogeology assessment was conducted to begin characterization of current groundwater conditions at the Valentine Lake site in support of mine development. The results of the baseline surveys will be used to support the Environmental Assessment Registration for the Project.

The desktop assessment included review and selection of existing exploratory boreholes to test for transmissivity and water quality. The field component of the assessment included borehole development, hydraulic testing, and water quality sampling at six (6) boreholes selected to represent a range of depths. In addition, one (1) sample of water used for drilling operations was collected for comparison with groundwater chemistry. Water quality analysis included general chemistry, dissolved metals, dissolved mercury, weak and strong acid-dissociable cyanide, and radium-226. These parameters are relevant to the analytical requirements of the *Metal Mining Effluent Regulations* (Government of Canada 2017) and *Canadian Environmental Quality Guidelines* (Canadian Council of Ministers of the Environment 2017).

The conclusions of the preliminary baseline hydrogeology assessment are:

- The majority of the Leprechaun and Marathon Deposits are located in what is referred to as hydrogeological Unit 5, which consists of plutonic strata and includes mostly major granites, granodiorite, diabase, and diorite intrusions. Yields of wells drilled in Unit 5 are typically low to moderate with a median sustainable pumping rate of 14 L/min

- Hydraulic conductivities calculated for the Marathon Deposit, based on preliminary hydraulic testing of three (3) boreholes, range from 1.2 E-08 m/s to 1.5 E-07 m/s with an average K value of 7.8 E-08 m/s. Hydraulic conductivities were slightly lower in the Leprechaun Deposit, ranging from 5.1 E-09 m/s to 6.0 E-08 m/s and an average K value of 3.4 E-08 m/s

- Based on comparison of the chemical results of the analyses of the drill water will the water samples collected from the boreholes, as well as the distance between the drill site and the nearest sampled borehole, water used for drilling operations is not expected to have an influence on water quality in the boreholes sampled during the preliminary baseline hydrogeology assessment

- Water quality testing provides a "snapshot" reference for future change in groundwater chemistry related to site activities; analytical results of the current assessment are not compared to regulatory guidelines

Abbreviations

ARD	Acid Rock Drainage
EA	Environmental Assessment
EIS	Environmental Impact Statement
LSI	Langelier Saturation Index
mbgs	Meters Below Ground Surface
mbtoc	Meters Below Top of Casing

Glossary

Acid Rock Drainage	Outflow of acidic waters related to mine development
Borehole Development	Continuous pumping of groundwater from a borehole to reduce formational intrusion of sand, silt, and clay
Hydraulic Conductivity	A coefficient describing the rate of flow for water through a permeable medium (aquifer)
Langelier Saturation Index	A measure of the degree of saturation of calcium carbonate ($CaCO_3$) in water
Theis Recovery Solution	Analytical method for determining transmissivity of a permeable medium (aquifer) using borehole pumping and recovery data
Transmissivity	The rate of flow for water through a unit width of permeable medium (aquifer)

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Marathon Gold Corporation (Marathon) to conduct a number of environmental surveys at the Valentine Lake Project site, including characterization of site hydrogeology. The preliminary baseline hydrogeology assessment was conducted to begin characterization of current groundwater conditions at the Valentine Lake site in support of mine development (the Project). The results of the baseline surveys will be used to support the Environmental Assessment (EA) Registration for the Project.

At the time of this study (November 2017), Marathon's Valentine Lake Project included four (4) near-surface, mainly pit-shell constrained, gold deposits: Marathon Deposit, Leprechaun Deposit, Sprite Deposit, and Victory Deposit (Figure 1-1). Additional gold-mineralized zones have been identified immediately to the southwest of the Leprechaun deposit and approximately 1 km northeast of the Victory deposit. The overall site includes a gold system approximately 20 km long and 240 km^2 in central Newfoundland, approximately 57 km south of Buchans. The preliminary baseline hydrogeology assessment focused on the Marathon and Leprechaun Deposits.

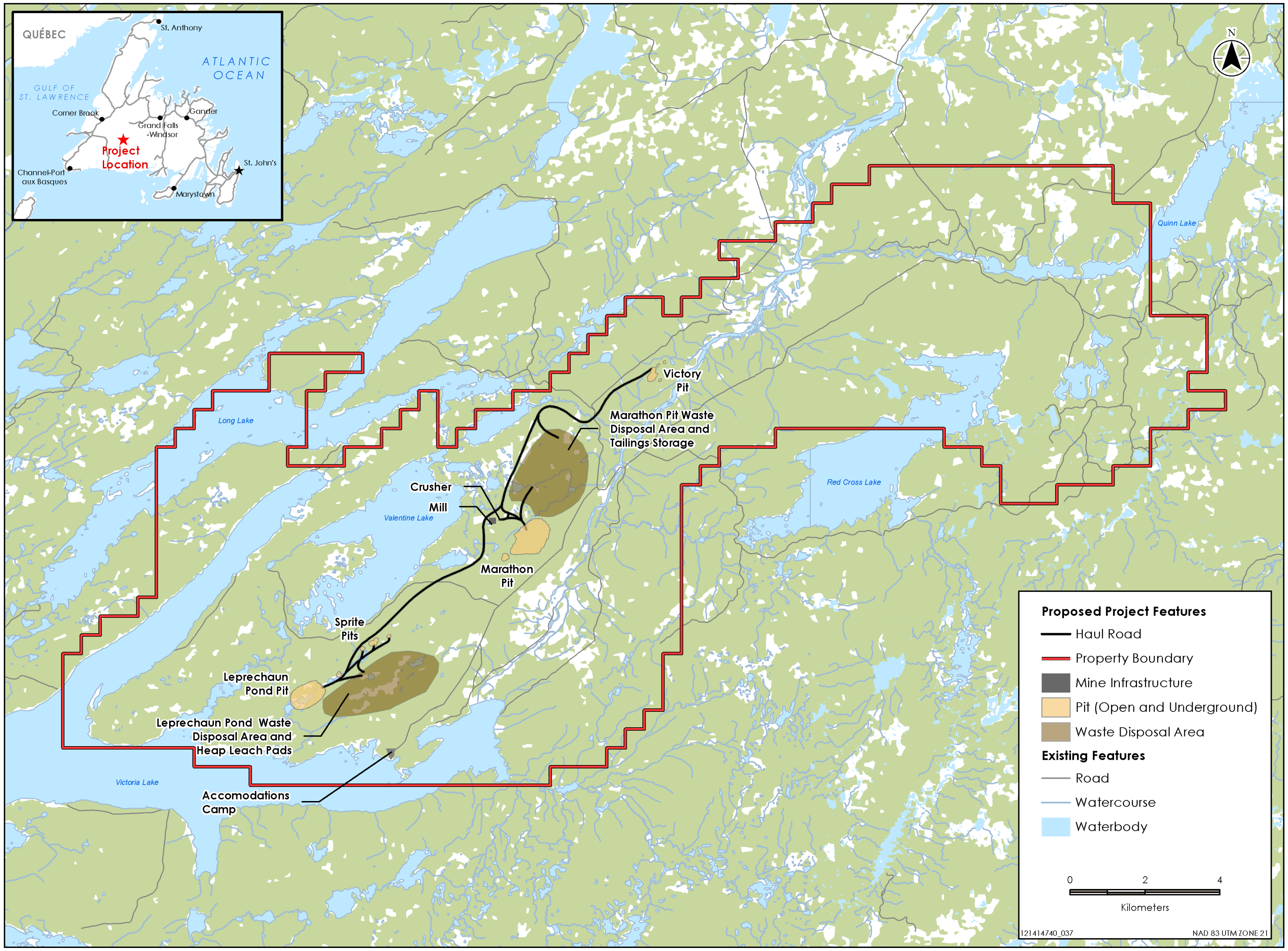

Figure 1-1 Valentine Lake Project Site Plan – May 2017

2.0 HYDROGEOLOGY BACKGROUND AND REGULATORY CONTEXT

The overall baseline hydrogeology program, once completed, will provides information required to complete the Environmental Impact Statement (EIS) for the Project. The objective of this preliminary hydrogeology baseline assessment is to describe and present information collected to date. The scope of this preliminary hydrogeology baseline assessment includes:

- Collect and review available information and data
- Conduct a field study
- Analyze baseline hydrogeological and water quality conditions to date
- Prepare a report on the results of the preliminary survey of existing boreholes

The Project will require approval from the Government of Newfoundland and Labrador and will be subject to an environmental assessment (EA) under the provincial and/or federal EA processes.

The overall baseline hydrogeology program was designed to support the assessment of environmental effects of the Project on water quantity and water quality; to support other technical evaluations such as mine water balance assessment; assimilative capacity assessment; to support the design of mine infrastructure; and also, to support the mine planning activities related to water management and discharge. The overall baseline hydrogeology program will form part of the supporting documentation for the EA completed for the Project. This preliminary baseline hydrogeology assessment acts as a progress report for the overall baseline hydrogeology program.

3.0 METHODS

3.1 Desktop Assessment/Study Area

Based on a review of geological maps and aerial photographs, the overburden material in the vicinity of the Project generally consists of a discontinuous layer of till of variable thickness over exposed bedrock. The general bedrock geology surrounding the site is comprised of Cambrian to mid-Ordovician rocks of the Victoria Lake Group which consists of dark grey to black shale and siltstone that contains thin, felsic, tuffaceous beds. The black shale layers transform into a mélange with felsic volcanic blocks near major faults. A well-defined northeast trending thrust fault crosses the center of the Leprechaun Deposit. The Leprechaun Deposit lies along the boundary of the Neoproterozoic Valentine Lake intrusive complex and the Silurian Rogerson Lake Formation of the exploits subzone. The Marathon Deposit is located in the Valentine Lake intrusive complex (Van Staal et. al. 2005).

Regional hydrogeological data was collected from *The Hydrogeology of Eastern Newfoundland* (AMEC 2013). The majority of the Leprechaun and Marathon Deposits are located in what is referred to as hydrogeological Unit 5, which consists of plutonic strata and includes mostly major granites, granodiorite, diabase, and diorite intrusions. Yields of wells drilled in Unit 5 are typically low to moderate with a median sustainable pumping rate of 14 L/min. Hydrogeological Unit 2 lies along the southern boundary of the Leprechaun Pit and consists largely of sandstone, conglomerate, breccia, greywacke, and minor volcanic flows and tuff. Yields of wells drilled in Unit 2 are also low to moderate with a median sustainable pumping rate of 9 L/min.

The direction of groundwater flow in the area is assumed to follow topography, which regionally would be to the south towards Victoria Lake. Locally, drainage from the Marathon Deposit is expected to travel east to north-east to Victoria River, draining into Victoria Lake to the south. Groundwater is thought to be recharging along the topographic highs and discharging along local surface water bodies including Victoria Lake. It is expected that the shallow groundwater system in the area will be largely controlled by surface runoff and local recharge, while at moderate depths the flow system may be influenced by recharge at higher elevations. Groundwater levels are generally assumed to be close to ground surface and to be a subdued reflection of the topography. Measured groundwater levels at the site ranged from surface (zero meters below ground surface (mbgs)) to approximately 2 mbgs. The movement of groundwater through the underlying bedrock can be expected to mainly occur within secondary openings, such as fractures and joints, and will be variable depending on the frequency and interconnection of these structural features. The underlying bedrock aquifer is likely to be under semi-confining conditions with recharge dominantly from lateral inflow of groundwater from adjacent upland areas.

Initial information on the hydrogeology of the area was collected from existing exploration boreholes. Stantec was provided with the information on exploration boreholes drilled to define the Leprechaun Pit and Marathon Pit. The Leprechaun Pit information includes records for 357 NQ-size (75 mm-diameter) boreholes ranging in length from 17 to 506 m, and dip from 16 to 90 degrees from ground surface. The Marathon Pit data includes the records for 178 boreholes drilled to lengths ranging between 30 and 1001 m, with dips ranging between 42.5 and 86.3 degrees from ground surface. However, many of these boreholes are not suitable for a hydrogeological investigation due to their low dip angle. Stantec selected six (6) exploration boreholes associated with the Leprechaun Pond Pit and the Marathon Pit to conduct hydraulic testing, water sampling and groundwater monitoring. Due to damaged, destroyed, or missing borehole casing, three (3) of the selected boreholes were modified from the original proposal during the field investigation. The boreholes tested in October 2017 are provided in Table 1 and shown on Figure 3-1.

Table 1 Existing Exploration Boreholes

Borehole ID	Length (m)	Dip (degrees below horizontal)	Location
VL-09-134	25	90	Leprechaun Pond Pit
VL-11-248	248	81.5	Leprechaun Pond Pit
VL-17-650	488	80.0	Leprechaun Pond Pit
MA-17-158	317	86.3	Marathon Pit
MA-17-218	974	82.0	Marathon Pit
MA-17-250	600	80.0	Marathon Pit

3.2 Field Program

3.2.1 Borehole Development

Each borehole was developed using a 30 m, 12V, submersible pump capable of handling turbid water. After verification that the static water level was near ground surface (maximum static water level depth observed at 2.050 m below top of casing (mbtoc)), the pump intake was set to 10 mbtoc and the well was pumped at a rate of between 10 and 13 L/min for a period of approximately 30 minutes or until water levels were drawn down to the pump intake. Exceptions include borehole MA-17-218, where an obstruction in the borehole limited the placement of the pump to a depth of 3 mbtoc. Discharge rates were measured by recording the time to fill a container of known volume (20 L). Water was discharged down-gradient and away from the borehole during testing. Development was continued until the water was as clear of sediment as was practical and three (3) consecutive discharge readings of pH/electrical conductivity were within 10% of each other.

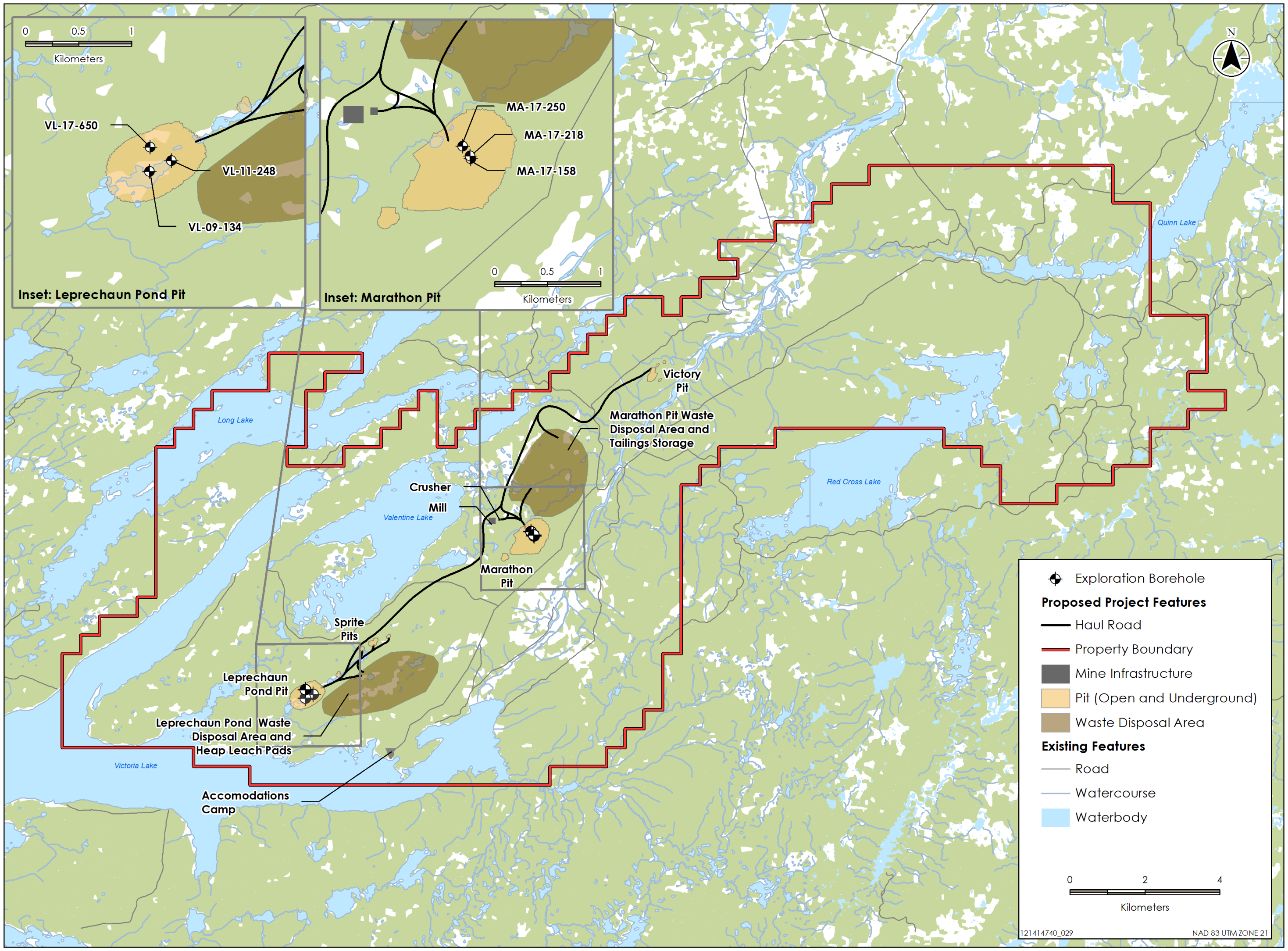

Figure 3-1 Valentine Lake Project Borehole Location Plan – November 2017

3.2.2 Hydraulic Testing

Prior to development of each well, a HOBO U20 water level data logger (Onset, Cape Cod, MA) was installed and programmed to record water levels at 30-second intervals. The drawdown data recorded by the loggers during pumping, combined with recovery data after the pump was shut off, was used to estimate the transmissivity of the portion of the aquifer intersected by the borehole. Recovery was monitored until the water level had returned to at least 80% of its initial static water level. Water levels were verified by manual water level measurements with a Solinst Water Level Meter. The data logger was removed following hydraulic testing.

3.2.3 Water Quality Monitoring

The preliminary baseline hydrogeology assessment considers one (1) monitoring event. Water level and sampling at all boreholes conducted in one (1) event only provides a "snapshot" of aquifer conditions. The initial monitoring program consisted of measurements of water levels and collection of water samples from the six (6) exploration boreholes identified in Section 3.1. A sample of water pumped into the borehole while drilling was collected from a drill rig that that was actively drilling borehole MA-17-256 approximately 140 m southwest from MA-17-158. The drill water was sourced from an unnamed pond located approximately 100 m west and downgradient from MA-17-250. Water samples were collected in clean laboratory-prepared glass and plastic containers specific to each analysis, and were stored on ice in coolers until delivered to the lab. Water samples were submitted to Maxxam Analytics Inc. in Bedford, NS for laboratory analysis of the following parameters:

- General chemistry and dissolved metals
- Low-level dissolved mercury
- Cyanide (strong and weak acid dissociable)
- Radium-226

These parameters are relevant to the analytical requirements of the *Metal Mining Effluent Regulations* (Government of Canada 2017) and *Canadian Environmental Quality Guidelines* (Canadian Council of Ministers of the Environment 2017).

The sampling program included one (1) field duplicate sample for each parameter for QA/QC purposes. Field duplicates samples were collected from boreholes MA-17-158, MA-17-218, VL-11-248, and VL-17-650.

3.2.4 Monitoring Equipment Deployment

While the reporting from the preliminary baseline hydrogeology assessment only considers manual water level data collected during the groundwater sampling event, Stantec recommended the deployment of data loggers to initiate the collection of a longer-term dataset of local hydrogeological conditions to be used to support future project work. The dataloggers can be retrieved, downloaded, and redeployed during future monitoring events.

Following sampling at each of the six (6) boreholes, a HOBO U20 water level data logger was installed at 15 mbtoc to record water levels at a 1-hour interval. A seventh logger was installed near the top of the casing in MA-17-250, in the Marathon Pit, to record barometric pressure at the site. Automated loggers allow for a better understanding of temporal variability of aquifer water levels between manual water level monitoring events.

4.0 RESULTS

4.1 Hydraulic Testing

Results of hydraulic testing in each borehole are presented in the following section and time-drawdown plots are presented in Appendix A. Analysis of hydraulic testing was performed using the Theis Recovery method with the aid of the computer program AQTESOLV® Version 4.50.002 (HydroSOLVE Inc. 2007). The analytical results are presented in Table 2 and graphical displays are presented in Appendix B.

The pumping boreholes provide an indication of "apparent" transmissivity since the boreholes are not considered to be 100% hydraulically efficient relative to the host aquifer. Data from the pumping boreholes are used to determine apparent transmissivity and estimate hydraulic conductivity. Note that boreholes were pumped at rates between 10 and 13 L/min.

Table 2 Summary of Hydraulic Testing

Borehole ID	Static WL (mbtoc)	Pumping Interval (min)	Drawdown Response (15 min) (m)	Recovery Time (min)	Recovery max (%)	Transmissivity (m^2/s)
MA-17-158	0.336	23.5	3.046	23.5	91%	2.3 E-05
MA-17-218	1.186	7	2.046[1]	25	80%	1.2 E-05
MA-17-250	0.214	33.5	1.716	19	88%	9.1 E-05
VL-11-248	Flowing	28	4.758	7.5	100%	9.0 E-06 [2]
VL-17-650	1.840	10	9.787	44.5	90%	2.5 E -06
VL-09-134	2.050	5	9.347	27	92%	1.5 E-06

1 – Obstruction in borehole prevented intake from being deployed below approximately 2 m below static water level

2 – Without performing modified test (e.g., shut-in test, added casing) to correct for flowing conditions, transmissivity is likely underestimated

Due to the relatively short duration of pumping in each well, data collected during the pumping portion of the hydraulic test was not analyzed. The Theis recovery solution was instead used to estimate transmissivity values. The recovery solution is less sensitive to parameters such as variability in pumping rate or water levels falling below the pump intake. A range of corresponding hydraulic conductivities (K) for the Marathon and Leprechaun Deposits are shown in Table 3.

Table 3 Range of Hydraulic Conductivity

Location ID		Depth (m)	Transmissivity (m^2/s)	Hydraulic Conductivity (m/s)	Average Hydraulic Conductivity (m/s)
Marathon Deposit	MA-17-158	317	2.3 E-05	7.3 E-08	7.8 E-08
	MA-17-218	974	1.2 E-05	1.2 E-08	
	MA-17-250	600	9.1 E-05	1.5 E-07	
Leprechaun Deposit	VL-11-248	248	9.0 E-06	3.6 E-08	3.4 E-08
	VL-17-650	488	2.5 E -06	5.1 E-09	
	VL-09-134	25	1.5 E-06	6.0 E-08	

Hydraulic conductivities calculated for the Marathon Deposit, based on preliminary hydraulic testing of three (3) boreholes, range from 1.2 E-08 m/s to 1.5 E-07 m/s with an average K value of 7.8 E-08 m/s. Hydraulic conductivities were slightly lower in the Leprechaun Deposit, ranging from 5.1 E-09 m/s to 6.0 E-08 m/s and an average K value of 3.4 E-08 m/s.

4.2 Water Quality

The results of laboratory analysis for general chemistry, dissolved metals, dissolved mercury, cyanide, and radium in the water samples collected during hydraulic testing are summarized in Tables C-1 and C-2 in Appendix C. Full analytical results for the chemical analysis are presented in certificates of analysis from Maxxam Analytics also in Appendix C. Water quality testing is meant to identify seasonal trends and to provide a reference for future change in groundwater chemistry related to site activities; analytical results for the current assessment are not compared to regulatory guidelines.

4.2.1 Marathon Deposit

Lab results indicate groundwater samples collected from the Marathon Deposit are slightly alkaline with pH values ranging from 7.65 to 7.71 and total alkalinity (as $CaCO_3$) ranging from 72 mg/L to 100 mg/L. Alkalinity values at the Marathon deposit suggest moderate acid buffering potential in groundwater. Hardness (as $CaCO_3$) values range from 100 mg/L (moderately hard) to 450 mg/L (very hard).

Langelier Saturation Index (LSI) values for all monitoring locations at the Marathon Deposit are close to zero which is indicative of near-saturation and tends to neither be strongly corrosive or scale-forming with respect to solid $CaCO_3$. The potential for scale formation is an important consideration in the selection and design of water infrastructure as well as in the use of lime and limestone in the potential treatment of acid rock drainage (ARD).

Electrical conductivity values for samples collected from the Marathon Deposit range from as low as 220 µS/cm to 1,300 µS/cm, total dissolved solids ranged from 130 mg/L to 880 mg/L, turbidity measurements ranged from 12 NTU to 99 NTU, and colour measurements ranged from non-detect (<5 TCU) to 25 TCU. With the exception of turbidity, the highest values of the above-referenced parameters correspond to the deeper boreholes MA-17-218 (974 m) and MA-17-250 (600 m).

Ionic balances for all monitoring locations were slightly positive and range from 0.88% to 5.15%. Concentrations of major cations such as calcium, sodium, potassium, magnesium, manganese, ammonium, iron, and aluminum were balanced with concentrations of major anions such as chloride, fluoride, sulphate, and nitrate resulting in relatively weak ionic strength.

Concentrations of sodium, chloride, and sulphate were significantly higher in deeper boreholes MA-17-218 (974 m) and MA-17-250 (600 m) compared to the relatively shallow borehole MA-17-158 (317 m). Other metals parameters were relatively low with the exception of iron, manganese, and strontium.

Tested parameters Radium-226, cyanide (strong and weak acid-dissociable), and dissolved mercury were below the reportable laboratory detection limit.

4.2.2 Leprechaun Deposit

Lab results indicate groundwater samples collected from the Leprechaun Deposit are slightly alkaline with pH values ranging from 7.46 to 7.67 and total alkalinity (as $CaCO_3$) ranging from 81 mg/L to 140 mg/L. Alkalinity values at the Leprechaun deposit suggest moderate acid buffering potential in groundwater. Hardness (as $CaCO_3$) values range from 89 mg/L (moderately hard) to 140 mg/L (hard).

LSI values for all monitoring locations at the Leprechaun Deposit are close to zero which is indicative of near-saturation and tends to neither be strongly corrosive or scale-forming with respect to solid $CaCO_3$. The potential for scale formation is an important consideration in the selection and design of water infrastructure as well as in the use of lime and limestone in the potential treatment of ARD.

Electrical conductivity values for samples collected from the Leprechaun Deposit range from as low as 190 µS/cm to 280 µS/cm, total dissolved solids ranged from 110 mg/L to 160 mg/L, turbidity measurements ranged from 60 NTU to 210 NTU, and colour measurements ranged from non-detect (<5 TCU) to 7.7 TCU. Based on the three (3) boreholes sampled at the Leprechaun Deposit, no clear trend of chemical parameters with respect to borehole depth exists.

Ionic balances for all monitoring locations were slightly positive and range from 0.52% to 2.71%. Concentrations of major cations such as calcium, sodium, potassium, magnesium, manganese, ammonium, iron, and aluminum were balanced with concentrations of major anions such as chloride, fluoride, sulphate, and nitrate resulting in relatively weak ionic strength.

Metals parameters were relatively low with the exception of iron and manganese.

Tested parameters Radium-226, cyanide (strong and weak acid-dissociable), and dissolved mercury were below the reportable laboratory detection limit.

4.2.3 Injection Water

During hydraulic testing and sampling events, a drill was advancing an exploratory borehole (MA-17-249) approximately 140 m southwest of MA-17-158. Surface water from an unnamed pond approximately 100 m west and downgrade from MA-17-250 was being injected at approximately 30 L/min down the borehole. A sample of water used during drilling operations was collected from the holding tank of the drill for comparison to groundwater collected from the Marathon Deposit. Based on comparison of the chemical results of the analyses of the drill water with the water samples collected from the boreholes, as well as the distance between the drill site and the nearest sampled borehole, water used for drilling operations is not expected to have an influence on water quality or quantity in the boreholes sampled during the preliminary baseline hydrogeology assessment.

5.0 SUMMARY

This preliminary baseline hydrogeology assessment describes the desktop and field studies completed to date at the Marathon and Leprechaun Deposits. The desktop assessment included review and selection of existing exploratory boreholes to test for transmissivity and water quality. The field component of the assessment included borehole development, hydraulic testing, and water quality sampling at six (6) boreholes selected to represent a range of depths. In addition, one (1) sample of water used for drilling operations was collected for comparison with groundwater chemistry. Water quality analysis included general chemistry, dissolved metals, dissolved mercury, weak and strong acid-dissociable cyanide, and radium-226. These parameters are relevant to the analytical requirements of the *Metal Mining Effluent Regulations* (Government of Canada 2017) and *Canadian Environmental Quality Guidelines* (Canadian Council of Ministers of the Environment 2017).

The conclusions of the preliminary baseline hydrogeology assessment are:

- The majority of the Leprechaun and Marathon Deposits are located in what is referred to as hydrogeological Unit 5, which consists of plutonic strata and includes mostly major granites, granodiorite, diabase, and diorite intrusions. Yields of wells drilled in Unit 5 are typically low to moderate with a median sustainable pumping rate of 14 L/min

- Hydraulic conductivities calculated for the Marathon Deposit, based on preliminary hydraulic testing of three (3) boreholes, range from 1.2 E-08 m/s to 1.5 E-07 m/s with an average K value of 7.8 E-08 m/s. Hydraulic conductivities were slightly lower in the Leprechaun Deposit, ranging from 5.1 E-09 m/s to 6.0 E-08 m/s and an average K value of 3.4 E-08 m/s

- Based on comparison of the chemical results of the analyses of the drill water will the water samples collected from the boreholes, as well as the distance between the drill site and the nearest sampled borehole, water used for drilling operations is not expected to have an influence on water quality in the boreholes sampled during the preliminary baseline hydrogeology assessment

- Water quality testing provides a "snapshot" reference for future change in groundwater chemistry related to site activities; analytical results of the current assessment are not compared to regulatory guidelines

6.0 REFERENCES

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Canadian Council of Ministers of the Environment, 2017. *Canadian Environmental Quality Guidelines*. Accessed online at http://st-ts.ccme.ca/en/index.html.

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Theis, C.V. 1935. The Relationship Between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well using Groundwater Storage. Trans. Amer. Geophysical Union 2, pp. 519-524.

Van Staal, C.R., Valverde-Vaquero, P., Zagorevski, A., Rogers, N., Lissenberg, C.J., and McNicoll, V.J. 2005. Geology, Victoria Lake, Newfoundland and Labrador; Geological Survey of Canada, Open File 1667, scale 1:50 000.

APPENDIX A

Plots of Hydraulic Testing Data

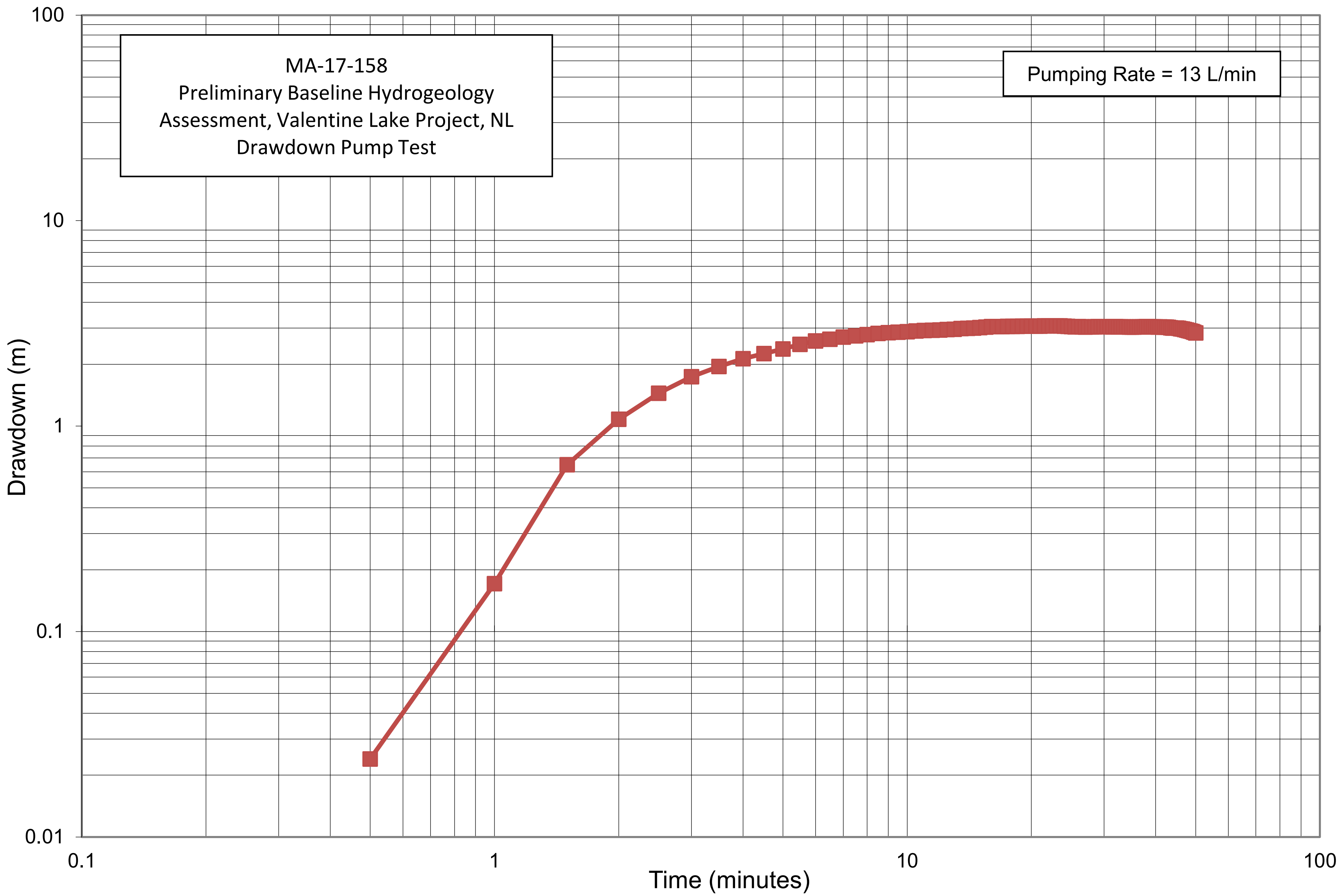


Figure A-1 Pump Test Log-Log Time-Drawdown Response (MA-17-158)

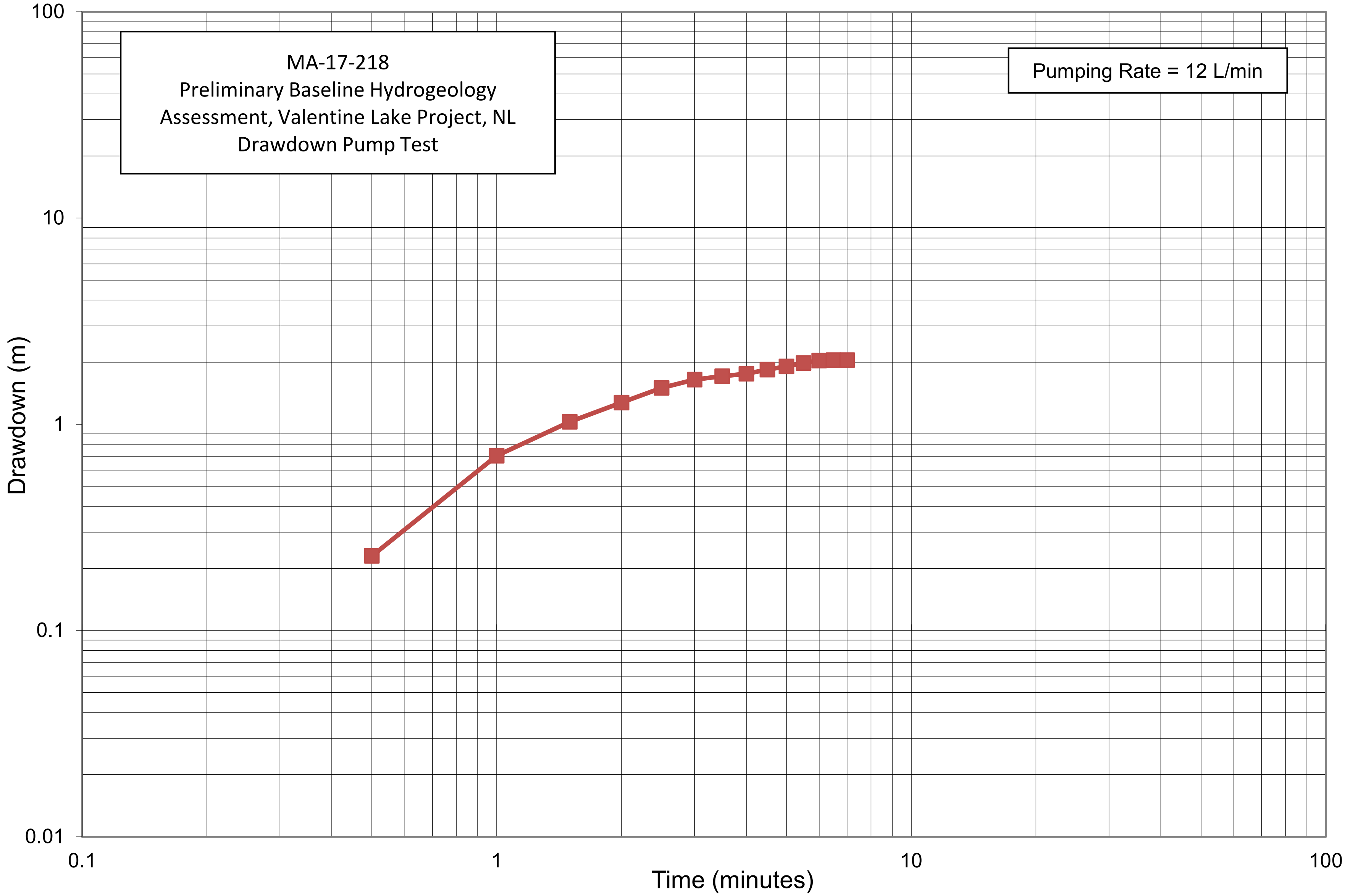


Figure A-2 Pump Test Log-Log Time-Drawdown Response (MA-17-218)

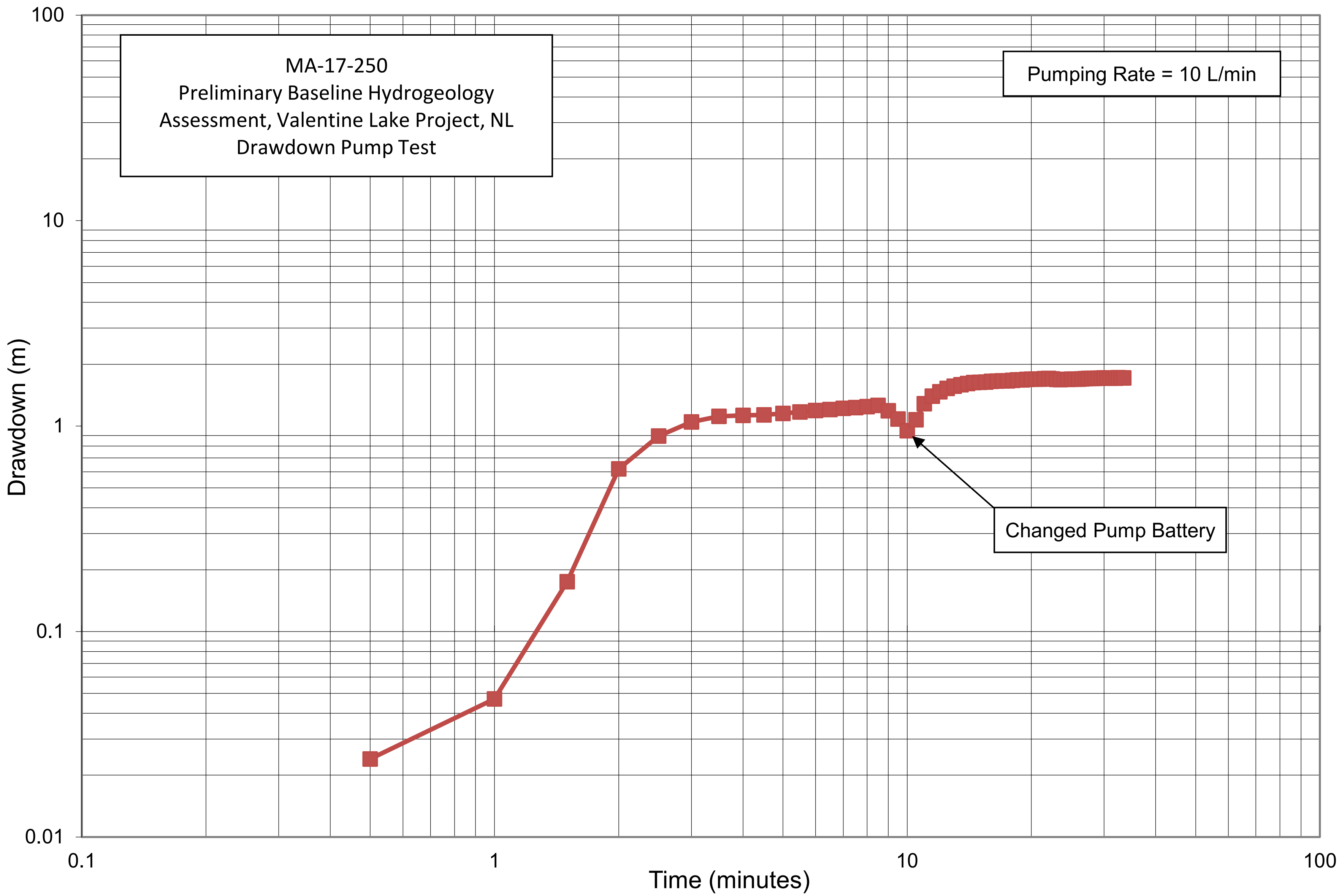


Figure A-3 Pump Test Log-Log Time-Drawdown Response (MA-17-250)

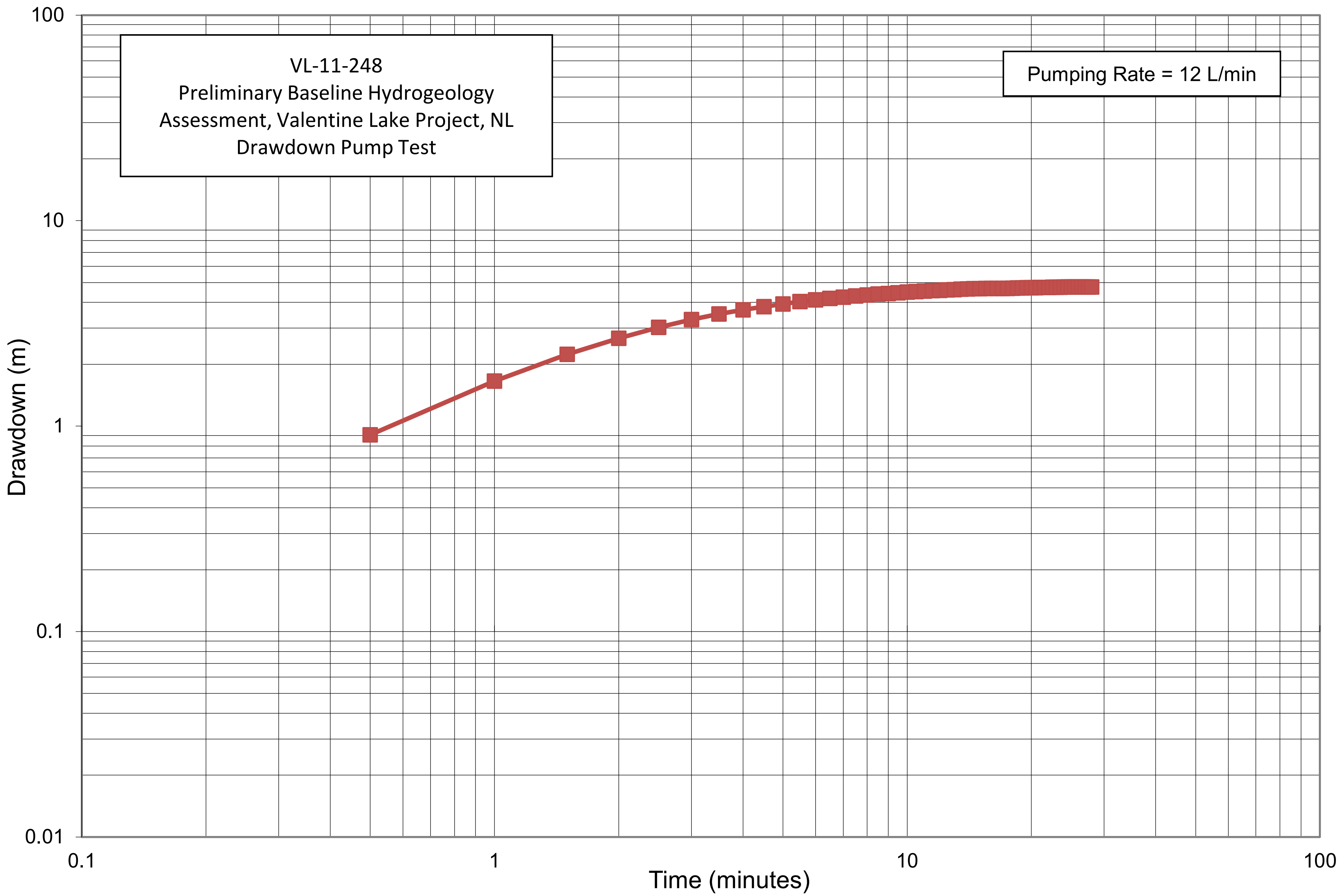


Figure A-4 Pump Test Log-Log Time-Drawdown Response (VL-11-248)

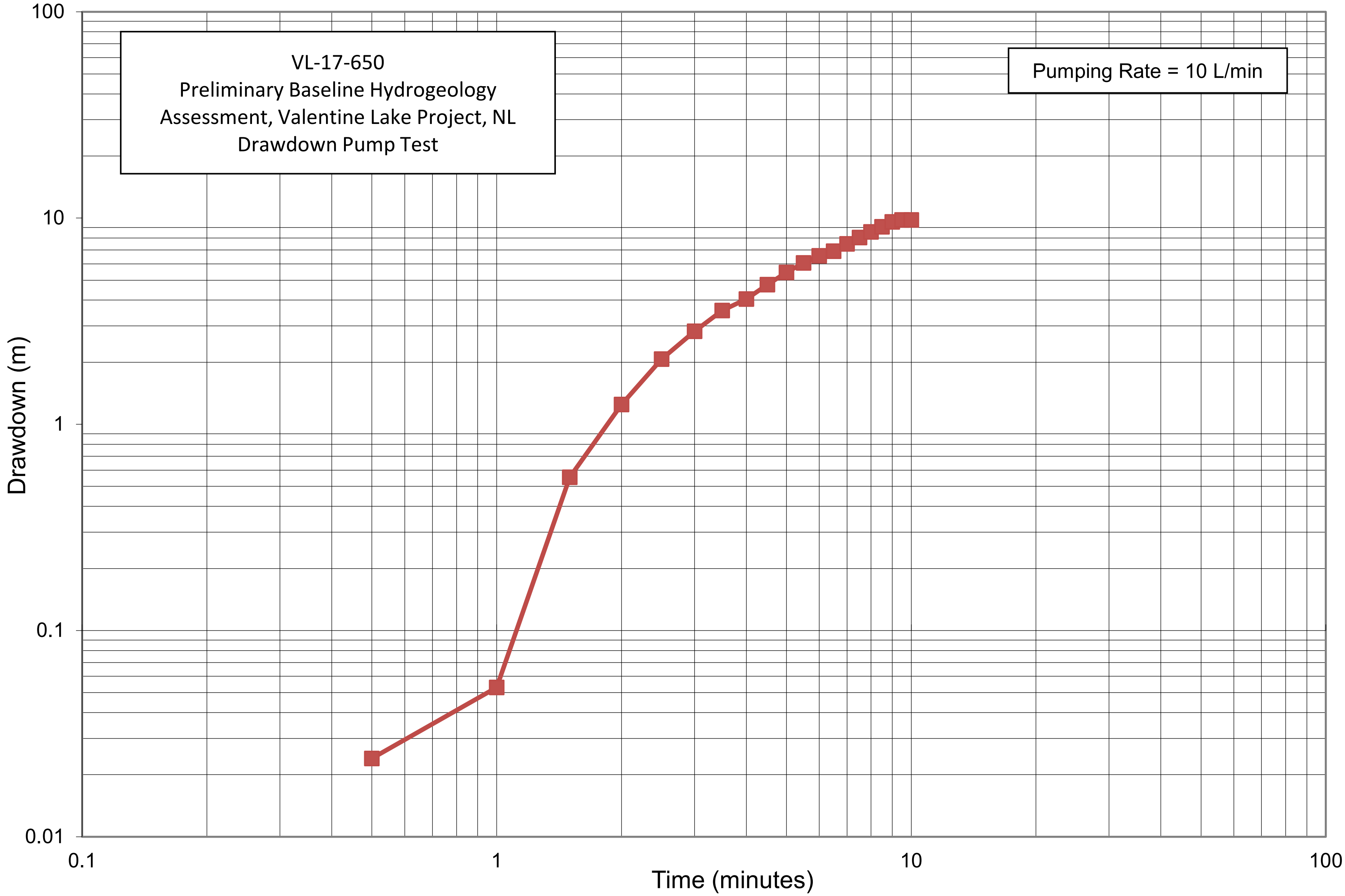


Figure A-5 Pump Test Log-Log Time-Drawdown Response (VL-17-650)

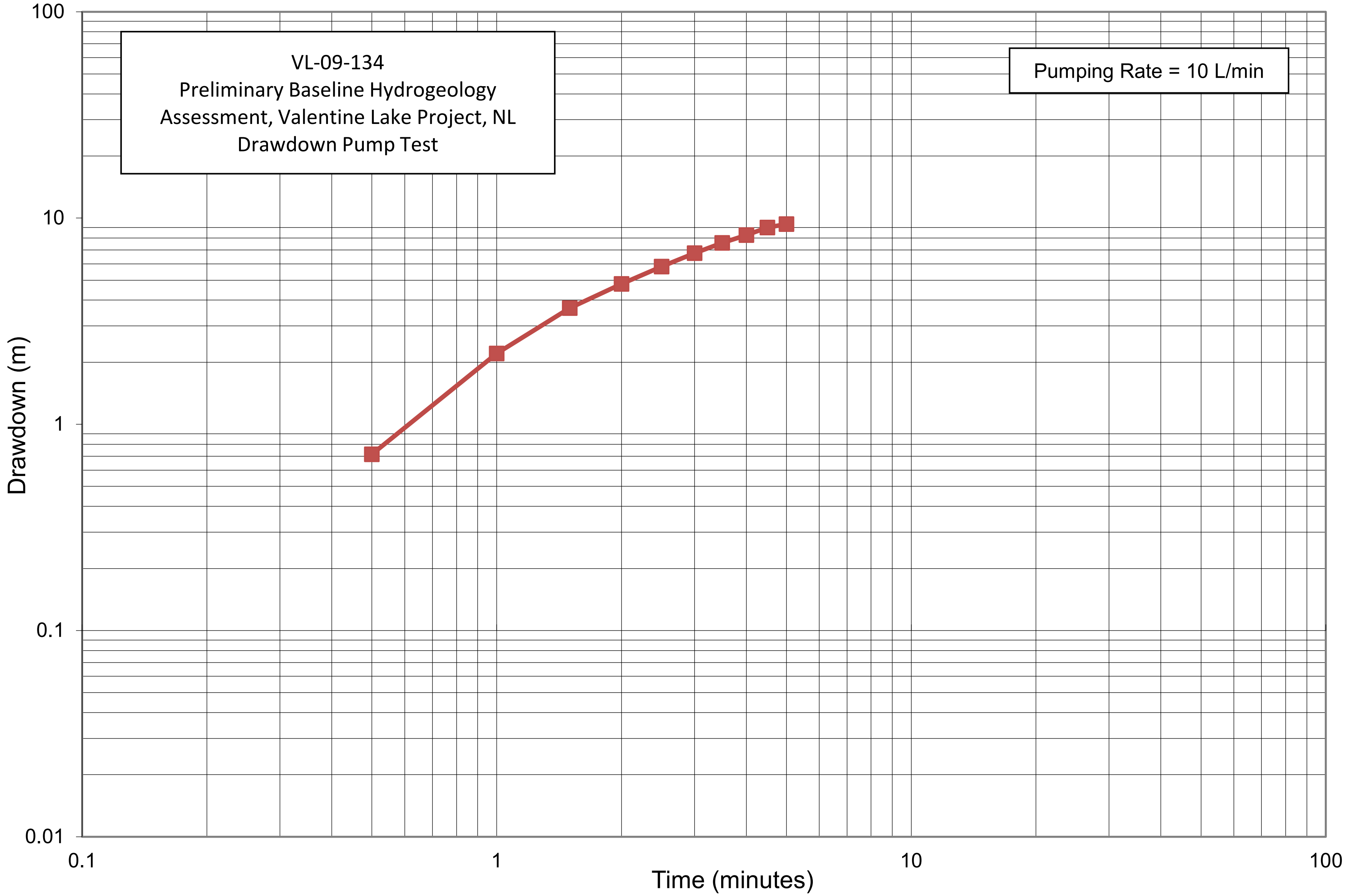


Figure A-6 Pump Test Log-Log Time-Drawdown Response (VL-09-134)

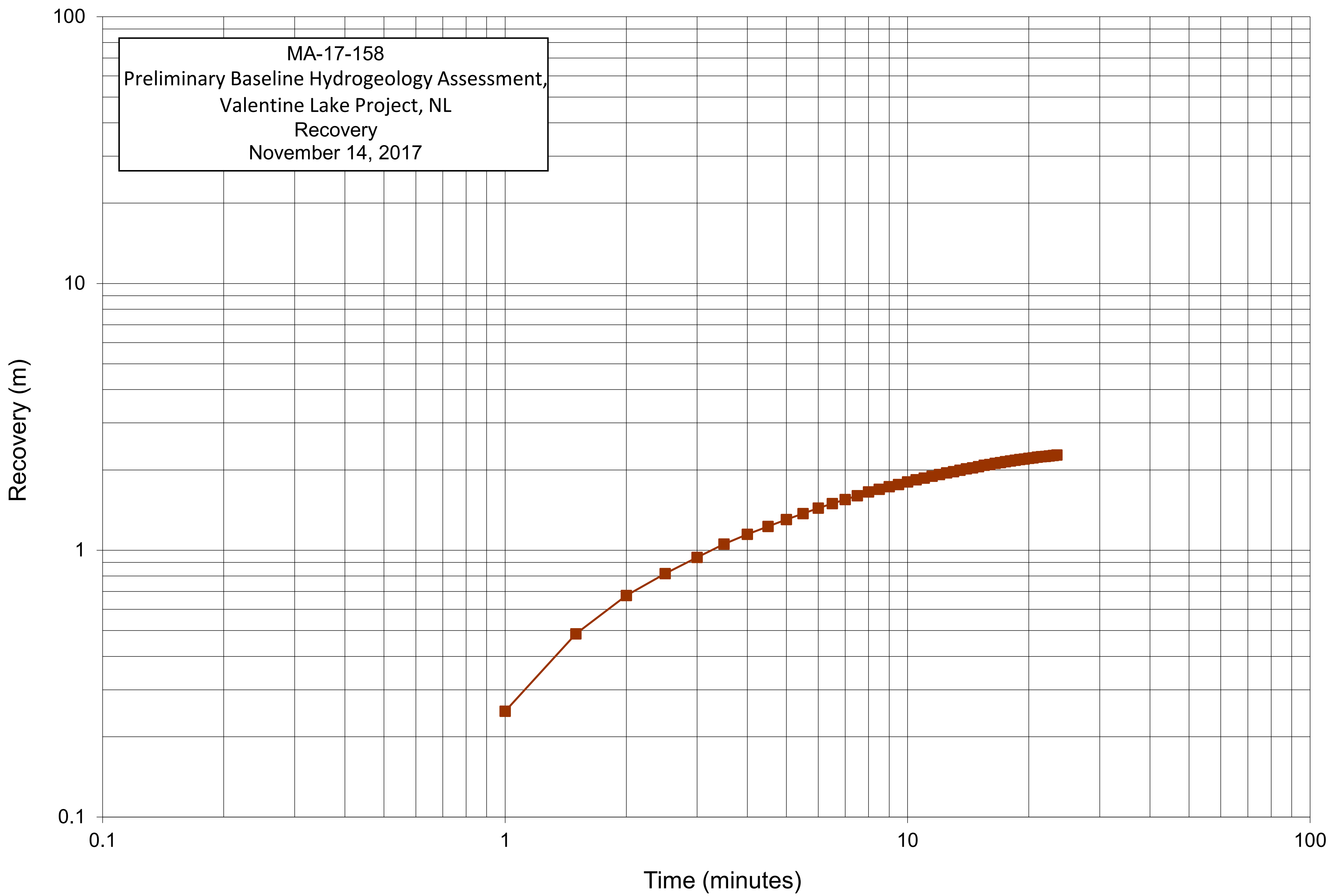


Figure A-7 Recovery Log-Log Time-Drawdown Response (MA-17-158)

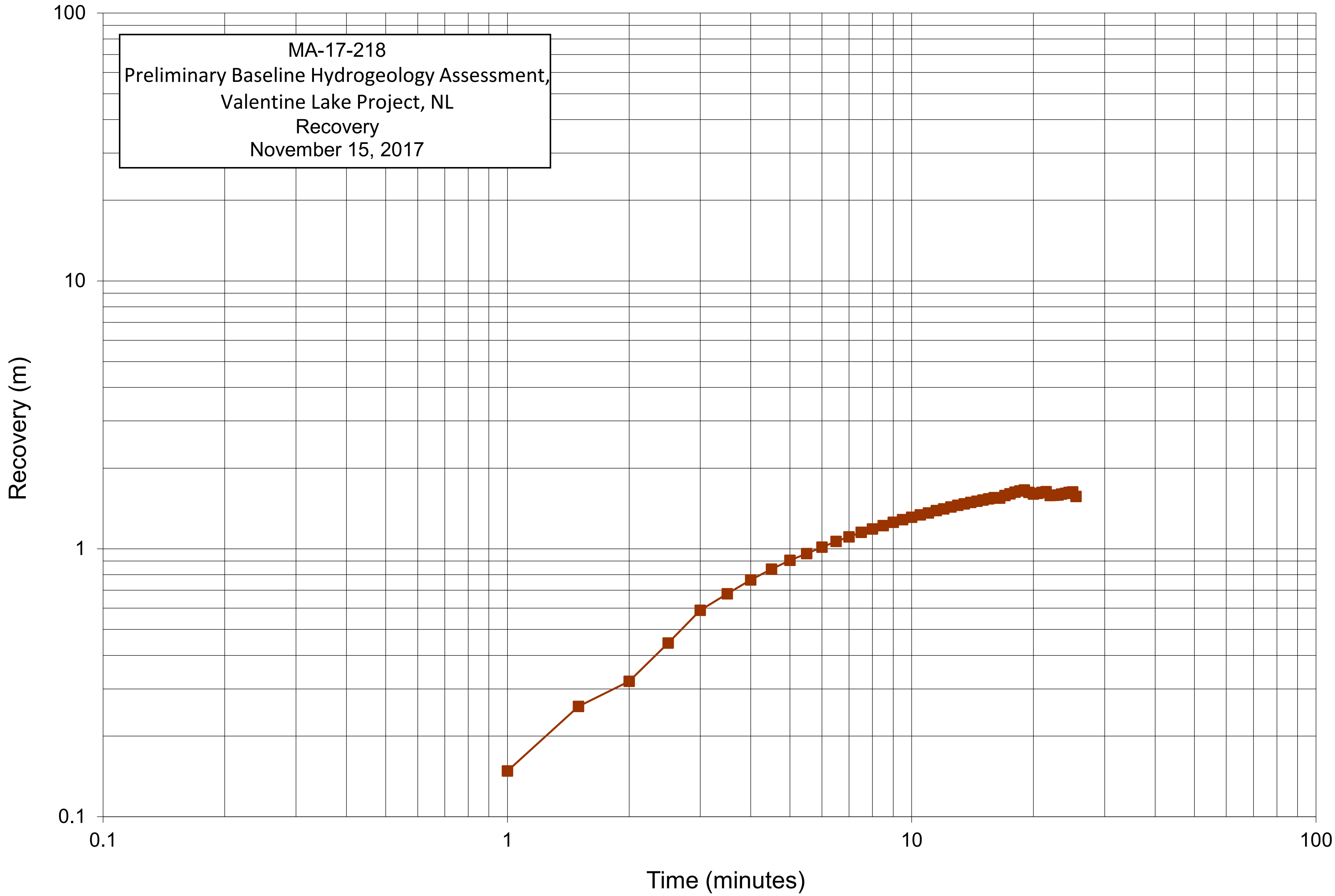


Figure A-8 Recovery Log-Log Time-Drawdown Response (MA-17-218)

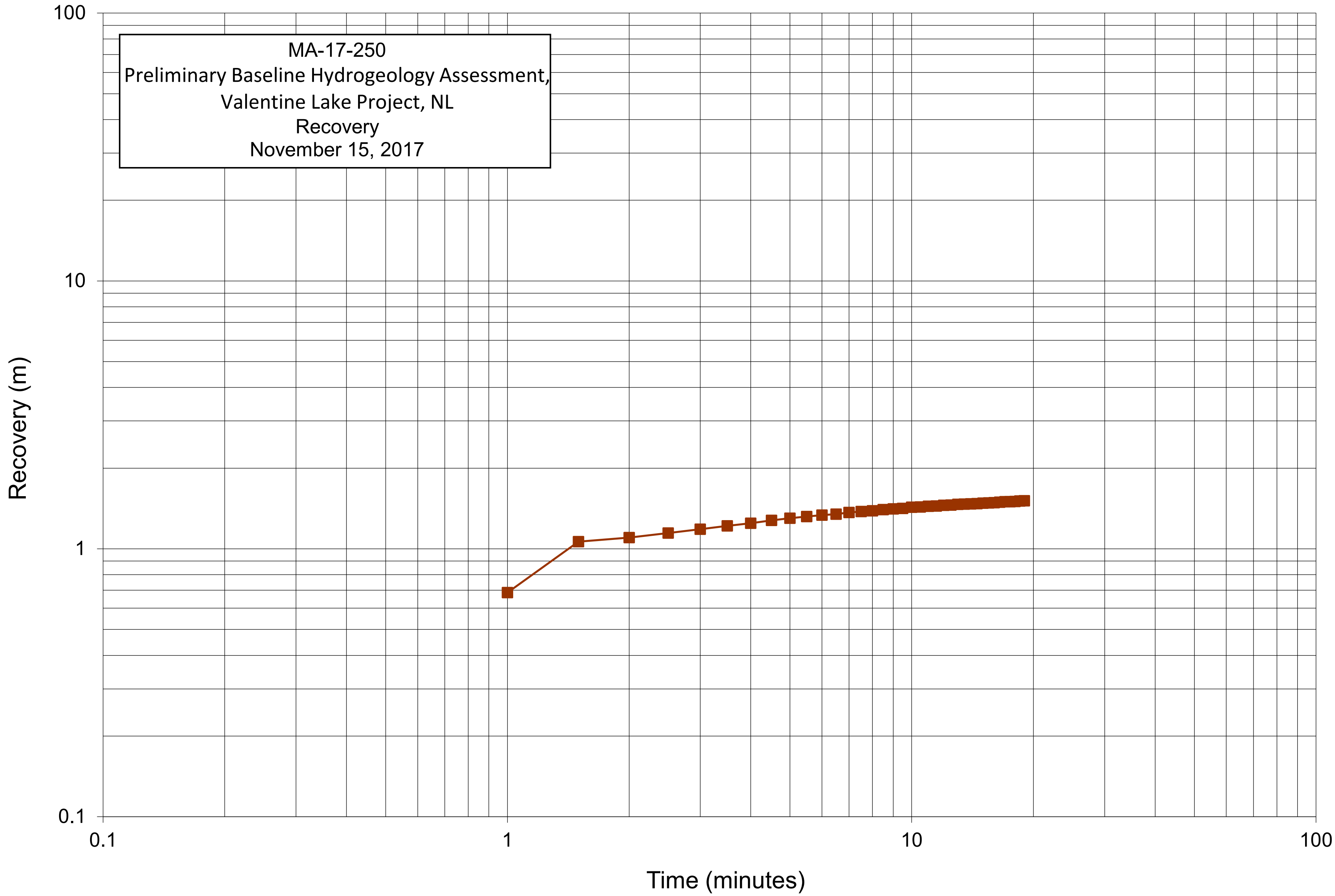


Figure A-9 Recovery Log-Log Time-Drawdown Response (MA-17-250)

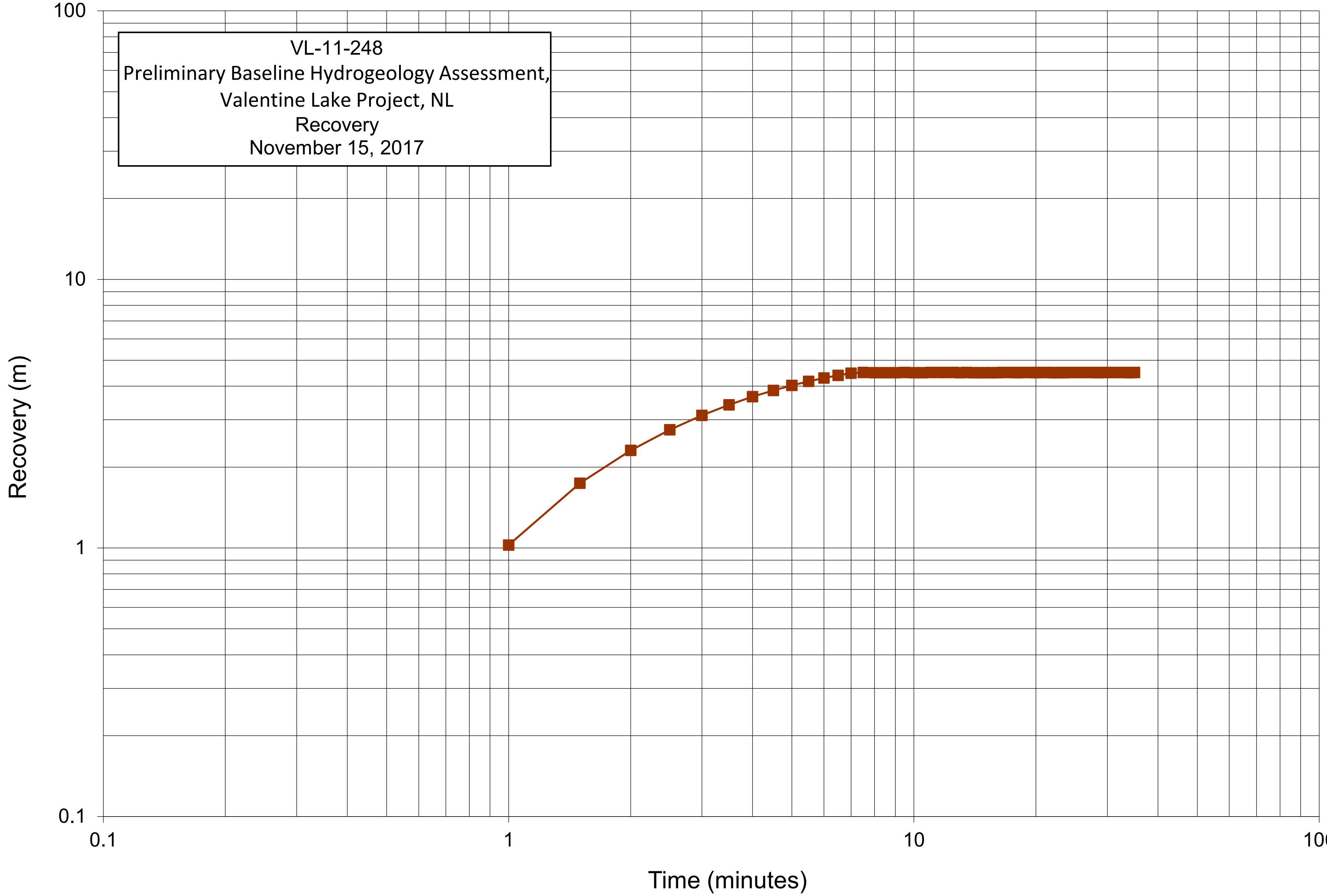


Figure A-10 Recovery Log-Log Time-Drawdown Response (VL-11-248)

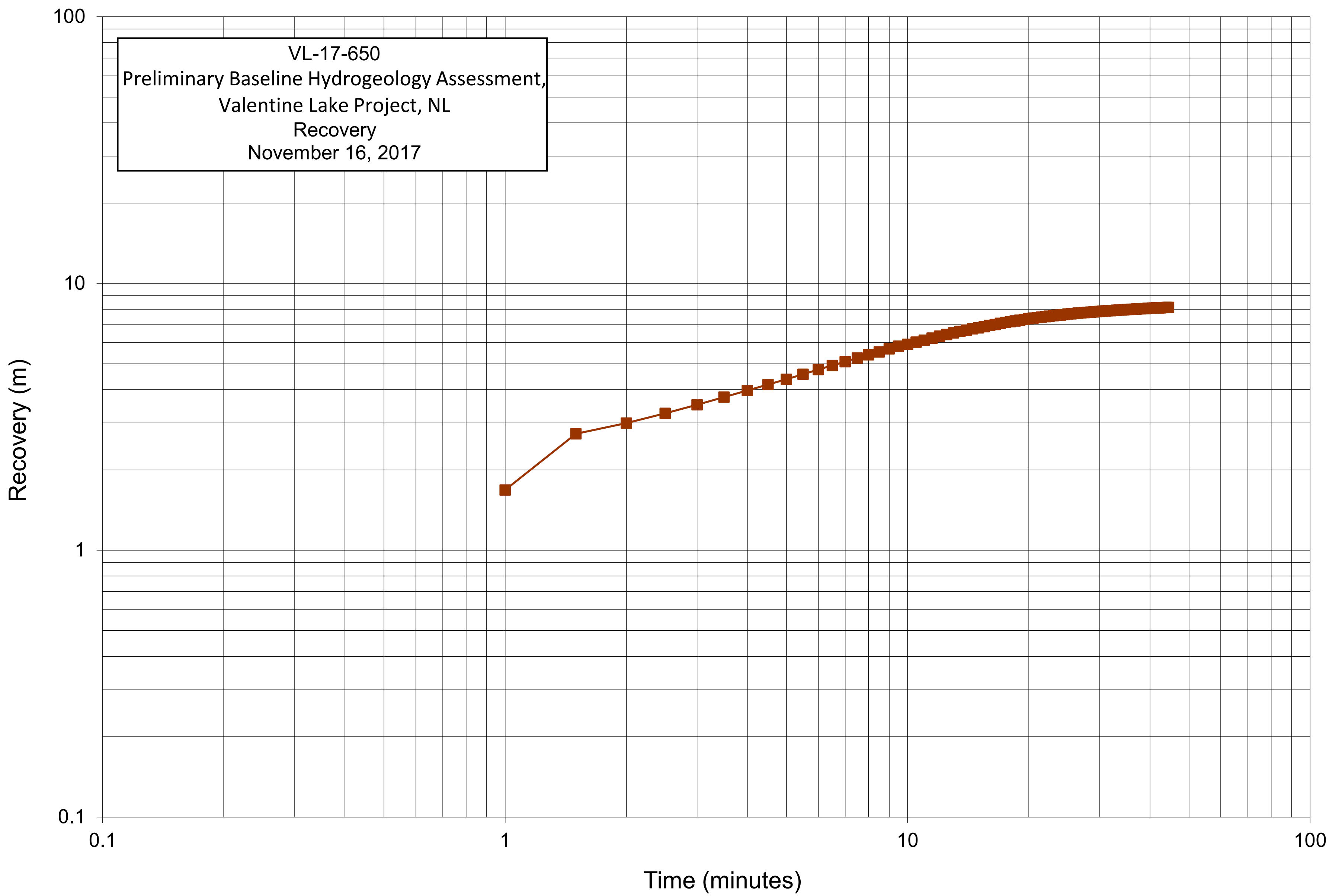


Figure A-11 Recovery Log-Log Time-Drawdown Response (VL-17-650)

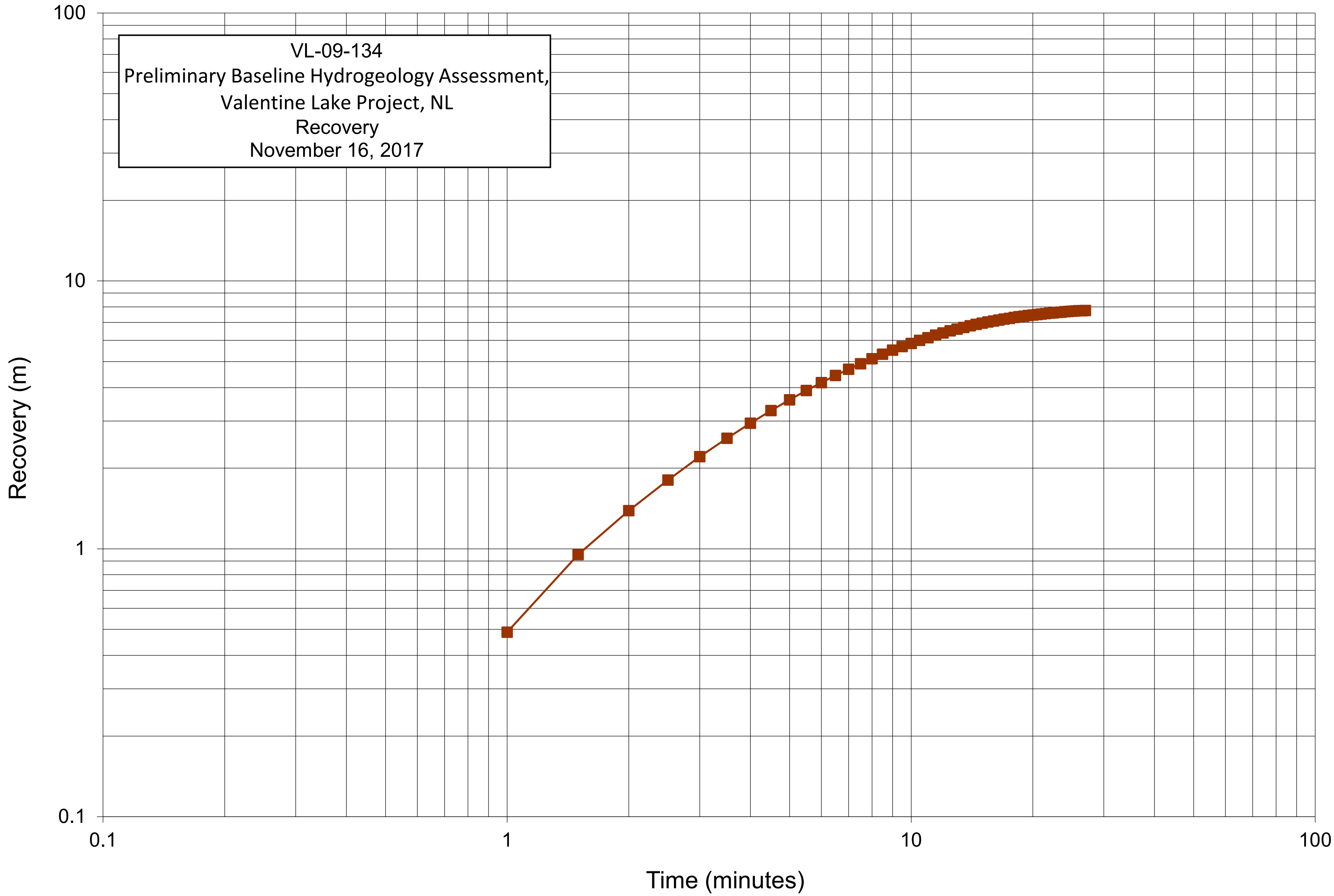
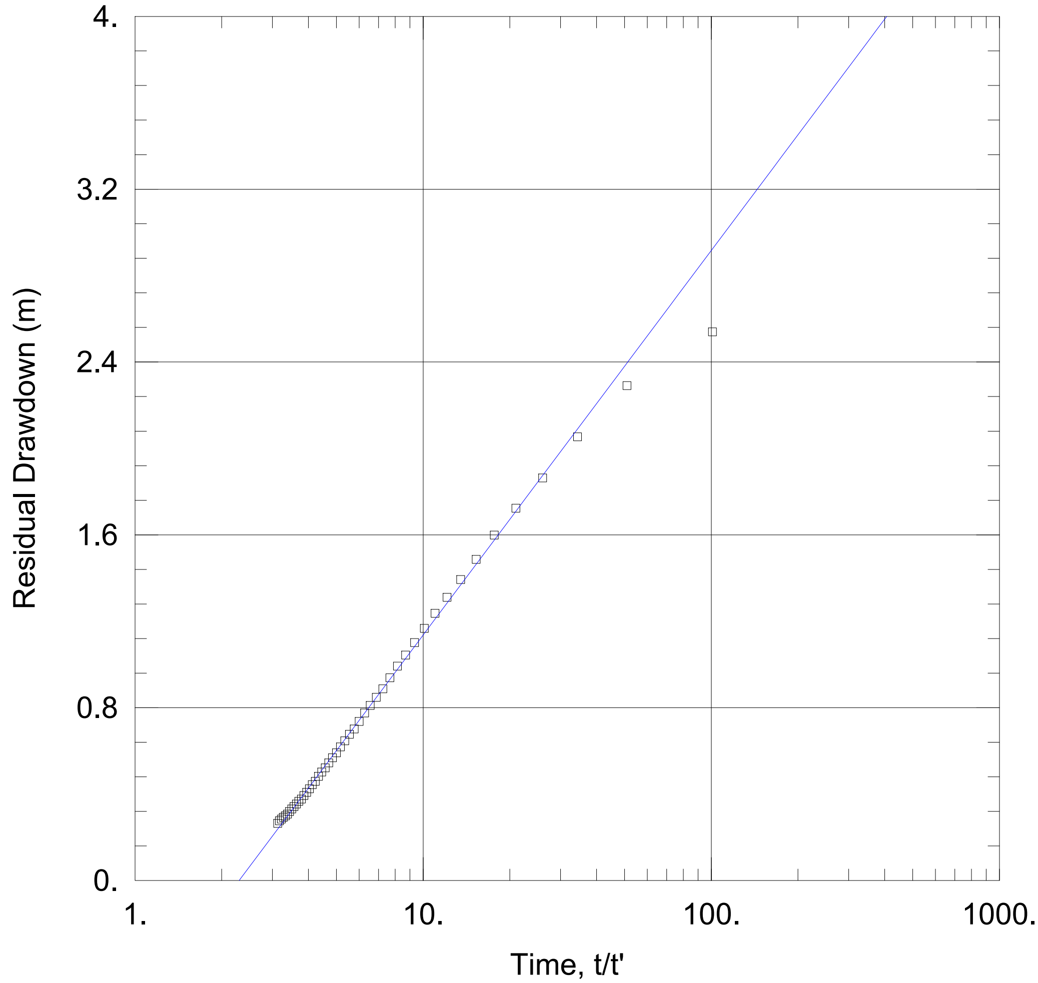


Figure A-12 Recovery Log-Log Time-Drawdown Response (VL-09-134)

APPENDIX B

Graphical Results of AQTESOLV® Analysis



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: Stantec Consulting Ltd.
Client: Marathon Gold Corp.
Project: 121414740.170
Location: Marathon Pit
Test Well: MA-17-158
Test Date: 14-Nov-17

AQUIFER DATA

Saturated Thickness: 317. m

Anisotropy Ratio (Kz/Kr): 1.

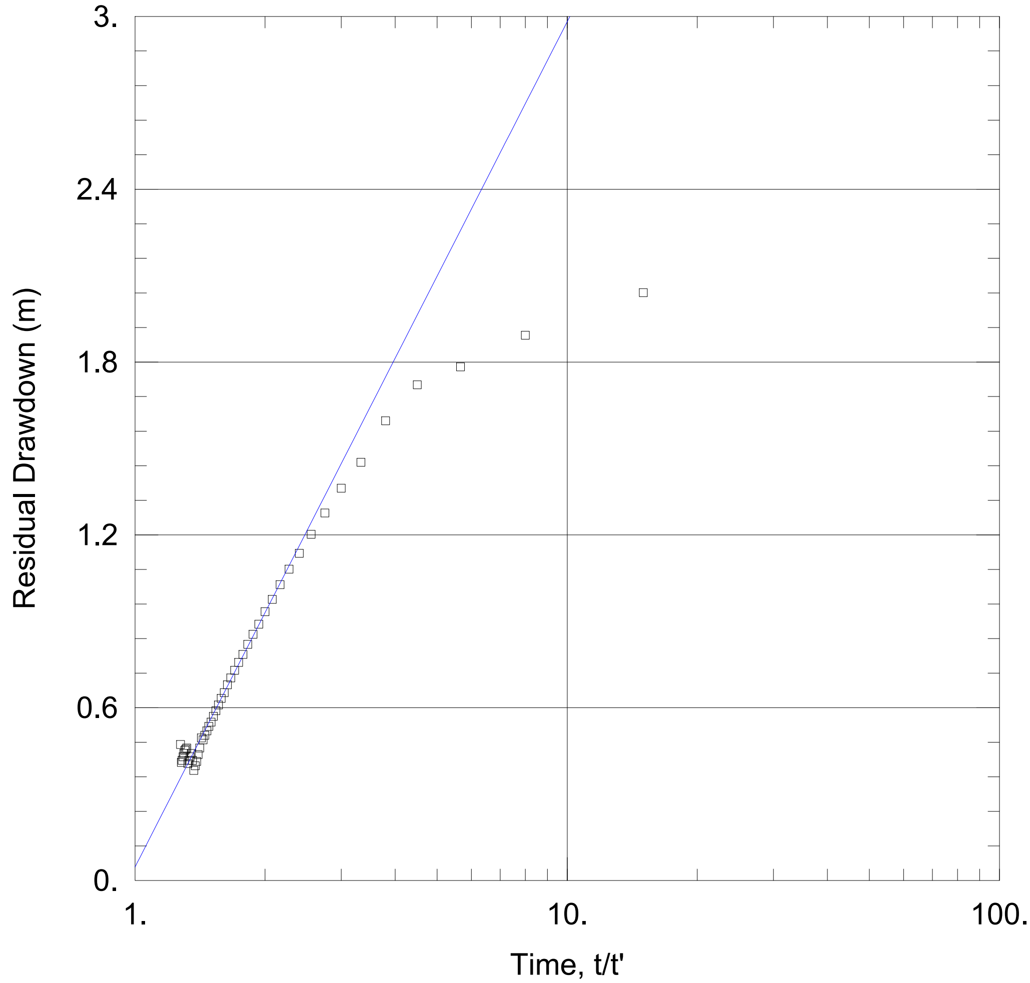
SOLUTION

Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 2.288E-5 m^2/sec

S/S' = 2.3



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: Stantec Consulting Ltd.
Client: Marathon Gold Corp.
Project: 121414740.170
Location: Marathon Pit
Test Well: MA-17-218
Test Date: 15-Nov-17

AQUIFER DATA

Saturated Thickness: 974. m

Anisotropy Ratio (Kz/Kr): 1.

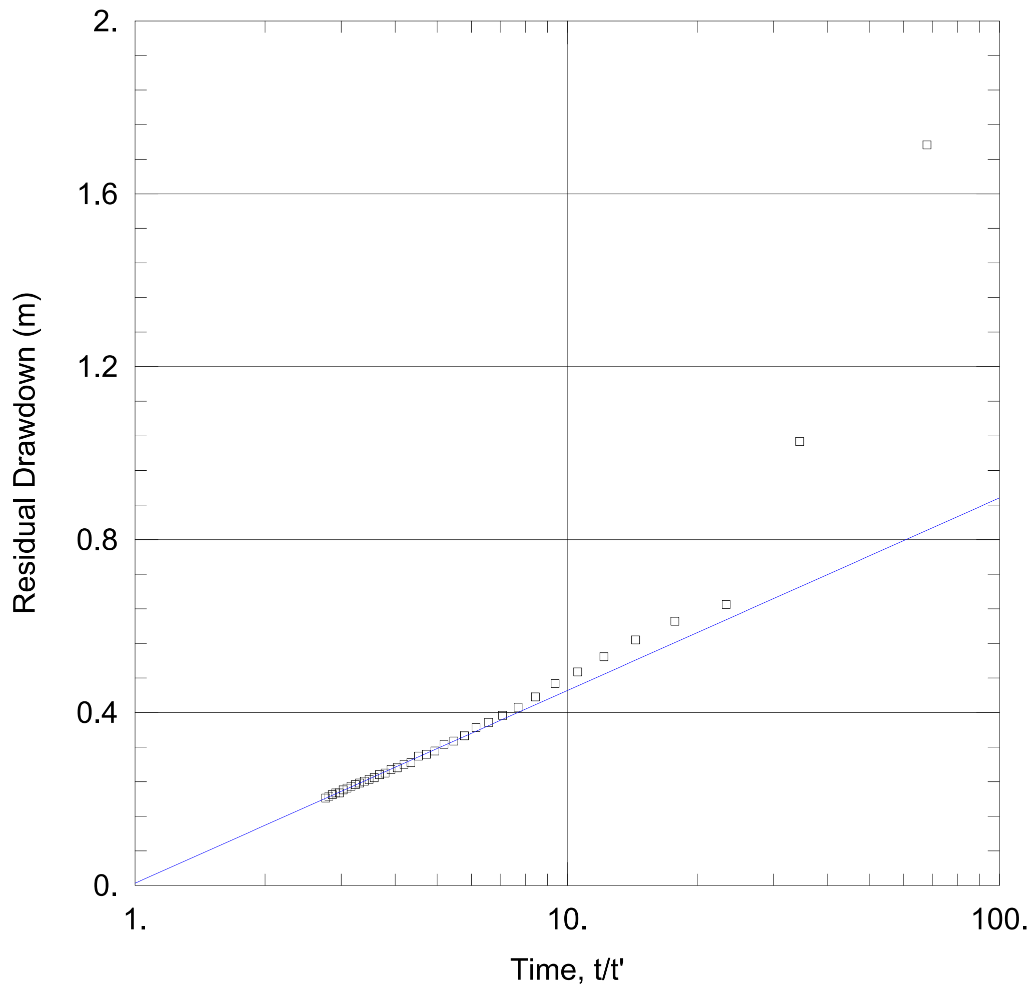
SOLUTION

Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 1.249E-5 m^2/sec

S/S' = 0.9642



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: Stantec Consulting Ltd.
Client: Marathon Gold Corp.
Project: 121414740.170
Location: Marathon Pit
Test Well: MA-17-250
Test Date: 15-Nov-17

AQUIFER DATA

Saturated Thickness: 600. m

Anisotropy Ratio (Kz/Kr): 1.

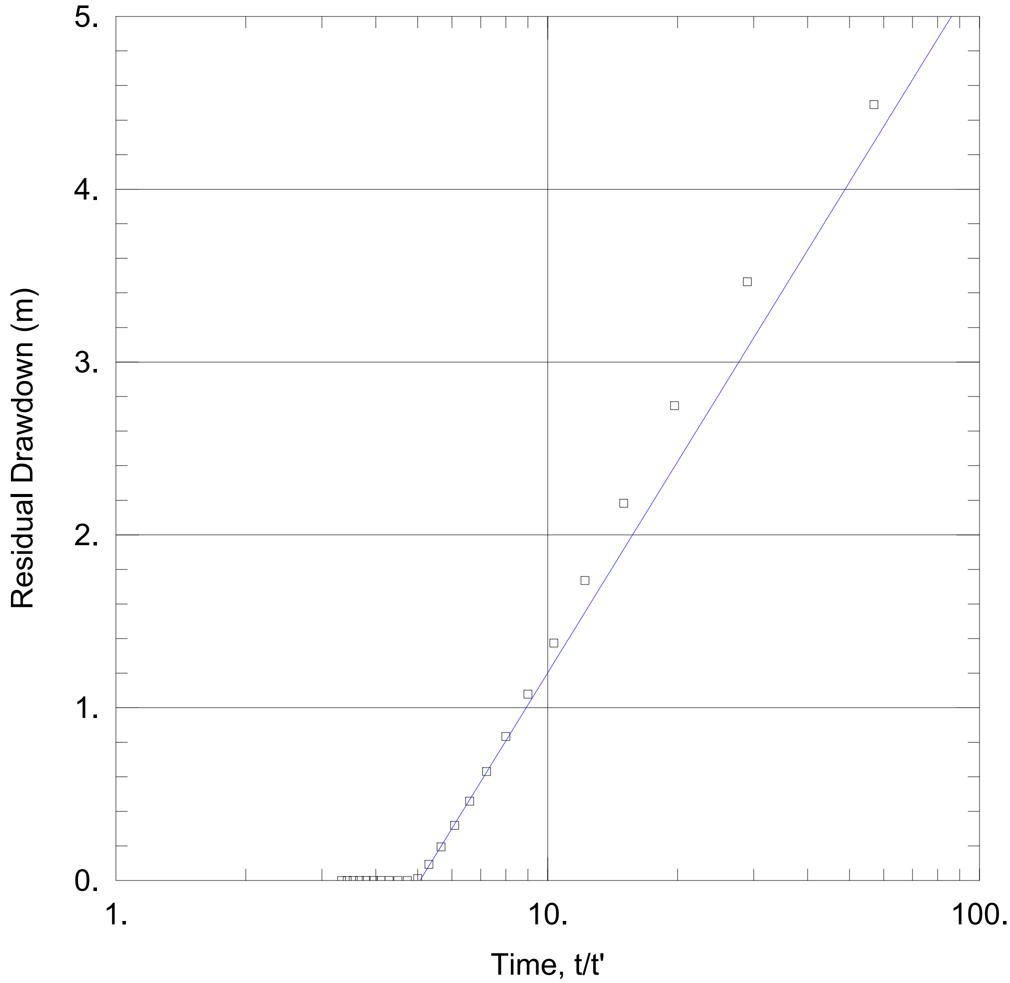
SOLUTION

Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 9.134E-5 m^2/sec

S/S' = 0.975



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: Stantec Consulting Ltd.
Client: Marathon Gold Corp.
Project: 121414740.170
Location: Leprechaun Pit
Test Well: VL-11-248
Test Date: 15-Nov-17

AQUIFER DATA

Saturated Thickness: 248. m

Anisotropy Ratio (Kz/Kr): 1.

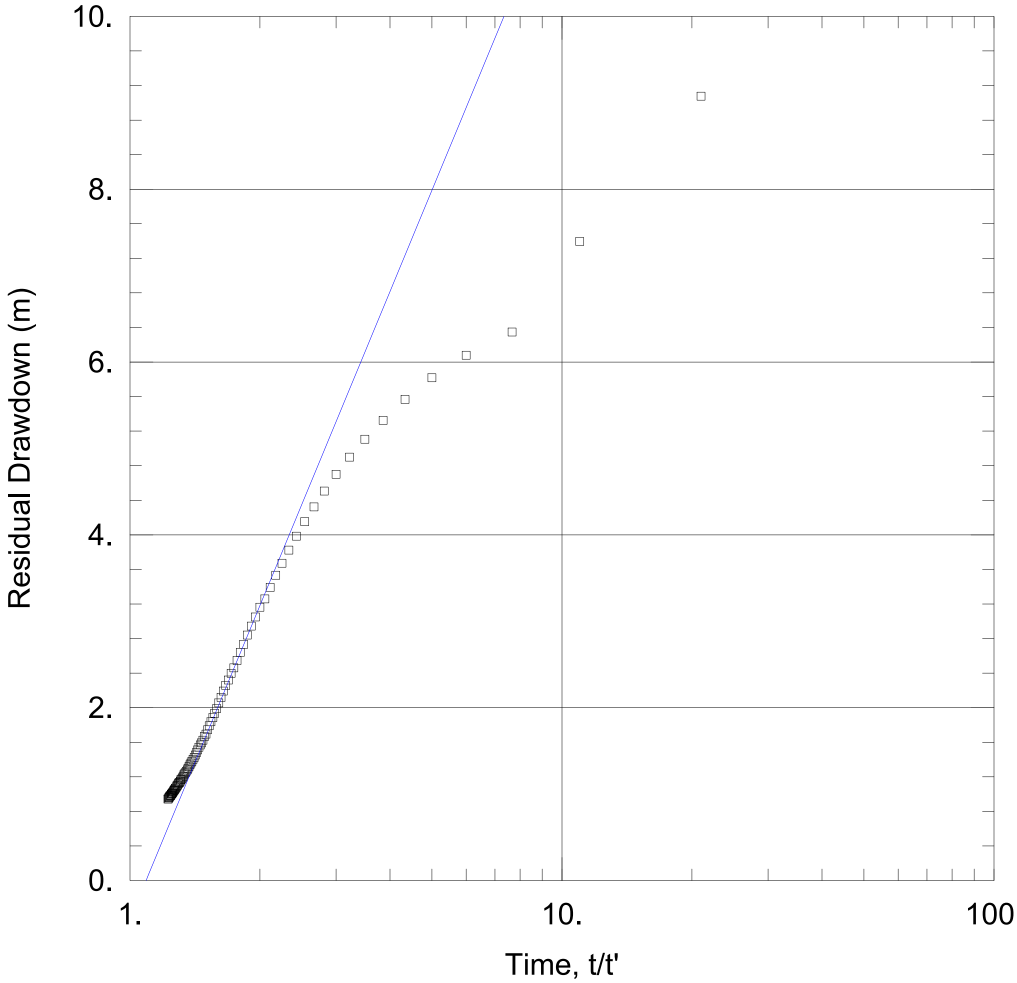
SOLUTION

Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 9.022E-6 m^2/sec

S/S' = 5.063



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: Stantec Consulting Ltd.
Client: Marathon Gold Corp.
Project: 121414740.170
Location: Leprechaun Pit
Test Well: VL-17-650
Test Date: 16-Nov-17

AQUIFER DATA

Saturated Thickness: 488. m

Anisotropy Ratio (Kz/Kr): 1.

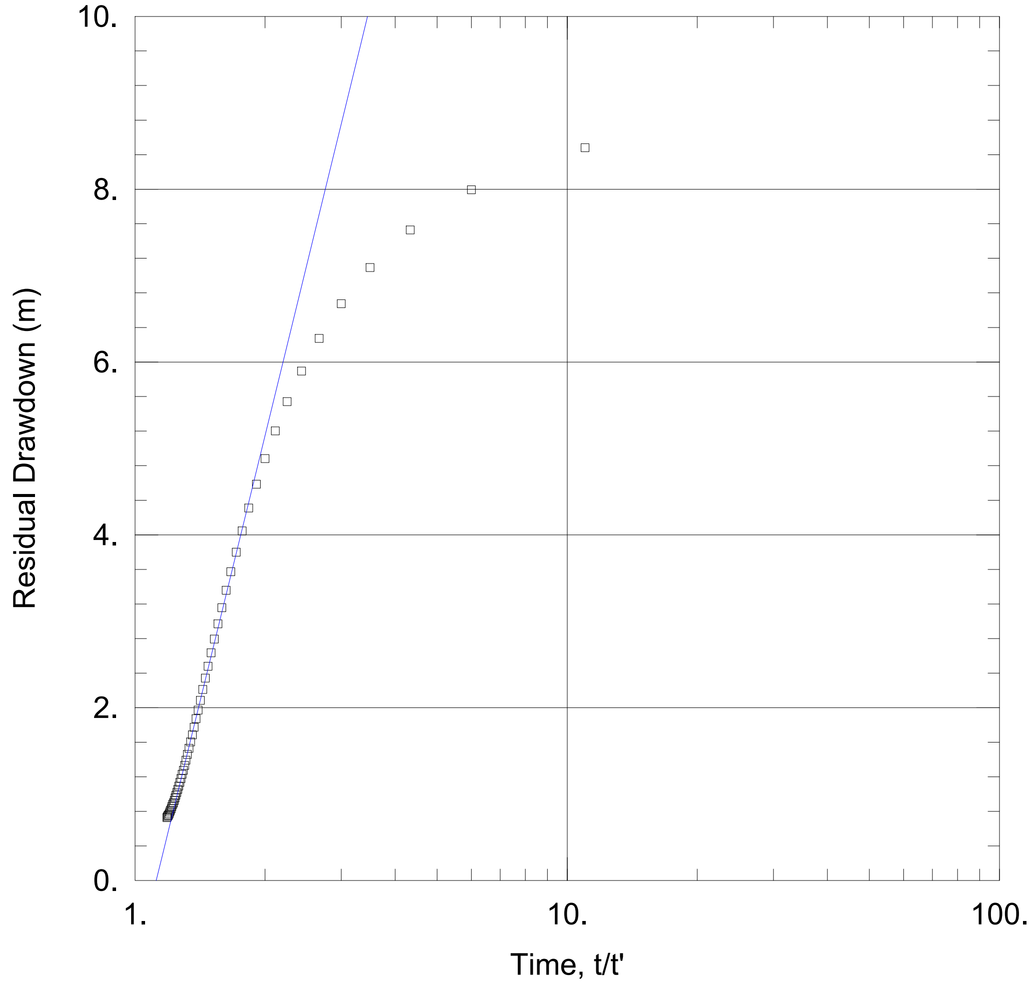
SOLUTION

Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 2.53E-6 m^2/sec

S/S' = 1.09



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: Stantec Consulting Ltd.
Client: Marathon Gold Corp.
Project: 121414740.170
Location: Leprechaun Pit
Test Well: VL-09-134
Test Date: 16-Nov-17

AQUIFER DATA

Saturated Thickness: 25. m

Anisotropy Ratio (Kz/Kr): 1.

SOLUTION

Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 1.493E-6 m^2/sec

S/S' = 1.12

APPENDIX C

Laboratory Analytical Results & Laboratory Certificates of Analysis

Table C-1 - General Chemistry in Groundwater
Preliminary Baseline Hydrogeology Assessment,
Valentine Lake Project, NL
Stantec Project No. 121414740.170

		Location	MA-17-158-2017	MA-17-158-2017 Lab-Dup	FLD-DUP-1-2017	INJECTION WATER	MA-17-218-2017	MA-17-250-2017	VL-11-248-2017	VL-11-248-2017 Lab-Dup	FLD-DUP-4-2017	VL-17-650-2017	FLD-DUP-5-2017	FLD-DUP-5-2017 Lab-Dup	VL-09-134-2017
Parameters	**Units**	**RDL**	**14-Nov-17**	**-**	**14-Nov-17**	**14-Nov-17**	**15-Nov-17**	**15-Nov-17**	**15-Nov-17**	**-**	**15-Nov-17**	**16-Nov-17**	**16-Nov-17**	**-**	**16-Nov-17**
Sodium (Na)	mg/L	0.1	3.80	-	-	4.5	54.0	110.0	2.5	2.5	-	3.7	4.0	4.0	3.1
Potassium (K)	mg/L	0.1	0.34	-	-	0.55	0.72	1.30	0.31	0.31	-	0.40	0.43	0.42	0.48
Calcium (Ca)	mg/L	0.1	37.0	-	-	6.5	82.0	150.0	51.0	51.0	-	43.0	47.0	46.0	32.0
Magnesium (Mg)	mg/L	0.1	2.2	-	-	1.8	8.5	15.0	2.6	2.6	-	4.3	4.9	4.8	2.3
Total Alkalinity (Total as CaCO3)	mg/L	5.0	100.0	100.0	-	21	100.0	72	140.0	-	-	130.0	140.0	130.0	81
Dissolved Chloride (Cl)	mg/L	1.0	4.5	4.6	-	6.3	48	92	3.0	-	-	3.3	3.2	3.0	3.6
Dissolved Sulphate (SO4)	mg/L	2.0	3.3	3.6	-	2.5	220.0	460	nd	-	-	2.4	2.5	2.4	12
Reactive Silica (SiO2)	mg/L	0.50	12	12	-	5.3	9.9	8.2	11	-	-	10	10	10	7.2
Orthophosphate (P)	mg/L	0.010	0.012	0.012	-	nd	0.018	0.011	0.012	-	-	0.011	0.011	0.010	0.011
Total Phosphorus (P)	mg/L	0.1	nd	-	-	nd	nd	nd	nd	nd	-	nd	nd	nd	nd
Nitrate + Nitrite	mg/L	0.050	nd	nd	-	0.099	nd	nd	nd	-	-	0.053	0.066	nd	nd
Nitrate (N)	mg/L	0.050	nd	-	-	0.099	nd	nd	nd	-	-	0.053	0.066	-	nd
Nitrite (N)	mg/L	0.010	nd	nd	-	nd	nd	nd	nd	-	-	nd	nd	nd	nd
Nitrogen (Ammonia Nitrogen)	mg/L	0.050	nd	-	-	nd	0.33	0.82	nd	-	-	nd	nd	-	nd
Colour	TCU	5.0	nd	nd	-	17	25	6.4	nd	-	-	5.1	7.5	5.9	7.7
Turbidity	NTU	3.0	99	-	-	0.30	53	12	60	-	-	170	160	160	210
pH	pH	0.01	7.65	7.71	-	7.13	7.76	7.68	7.67	-	-	7.46	7.62	-	7.48
Conductivity	µS/cm	1.0	220	220	-	71	830	1300	280	-	-	270	270	-	190
Total Organic Carbon (C)	mg/L	5.0	1.4	-	-	5.4	4.6	11.0	nd	-	-	3.9	7.6	-	2.6
Strong Acid Dissoc. Cyanide (CN)	mg/L	0.001	nd	nd	nd	-	nd	nd	nd	-	-	nd	-	-	nd
Weak Acid Dissoc. Cyanide (CN)	mg/L	0.003	nd	-	nd	-	nd	nd	nd	-	-	nd	-	-	nd
Hardness (CaCO3)	mg/L	1.0	100	-	-	23	240	450	140	-	-	130	140	-	89
Calculated TDS	mg/L	1.0	130	-	-	40	490	880	160	-	-	150	150	-	110
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	1.0	100	-	-	21	100	72	140	-	-	130	140	-	80
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.0	nd	-	-	nd	nd	nd	nd	-	-	nd	nd	-	nd
Cation Sum	me/L	-	2.20	-	-	0.680	7.19	13.8	2.88	-	-	2.69	2.92	-	1.93
Anion Sum	me/L	-	2.27	-	-	0.650	7.97	13.6	2.95	-	-	2.84	2.86	-	1.95
Ion Balance (% Difference)	%	-	1.57	-	-	2.26	5.15	0.880	1.20	-	-	2.71	1.04	-	0.520
Langelier Index (@ 4C)	N/A	-	-0.127	-	-	-2.05	0.206	0.187	0.165	-	-	-0.144	0.0540	-	-0.462
Langelier Index (@ 20C)	N/A	-	-0.378	-	-	-2.30	-0.0420	-0.0590	-0.0860	-	-	-0.395	-0.196	-	-0.713
Saturation pH (@ 4C)	N/A	-	7.78	-	-	9.18	7.55	7.49	7.51	-	-	7.60	7.57	-	7.94
Saturation pH (@ 20C)	N/A	-	8.03	-	-	9.43	7.80	7.74	7.76	-	-	7.86	7.82	-	8.19
Radium-226	Bq/L	0.01	nd	nd	-	-	nd	nd	nd	-	nd	nd	-	-	nd

Notes:
mg/L - milligrams per liter; uS/cm - microseimens per centimeter; me/L - milliequivalents/Liter; NTU - nephelometer turbidity units; TCU - True Color Units

"-" = not analysed, not applicable or no applicable guideline

nd = Not Detected above the RDL
RDL = Reportable Detection Limit
Lab-Dup = Laboratory QA/QC duplicate sample

Table C-2 - Dissolved Metals in Groundwater
Preliminary Baseline Hydrogeology
Assessment, Valentine Lake Project, NL
Stantec Project No. 121414740.170

		Location	MA-17-158-2017	INJECTION WATER	MA-17-218-2017	FLD-DUP-2-2017	MA-17-250-2017	VL-11-248-2017	VL-11-248-2017 Lab-Dup	VL-17-650-2017	FLD-DUP-5-2017	FLD-DUP-5-2017 Lab-Dup	VL-09-134-2017
Parameter	**Units**	**RDL**	**14-Nov-17**	**14-Nov-17**	**15-Nov-17**	**15-Nov-17**	**15-Nov-17**	**15-Nov-17**	**-**	**16-Nov-17**	**16-Nov-17**	**-**	**16-Nov-17**
Aluminum (Al)	µg/L	5.0	12	19	12	-	42	nd	nd	15	33	23	15
Antimony (Sb)	µg/L	1.0	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd
Arsenic (As)	µg/L	1.0	nd	1.4	1.5	-	2.9	nd	nd	4.4	2.3	2.4	nd
Barium (Ba)	µg/L	1.0	1.6	nd	6.7	-	11	3.4	3.2	58	62	61	62
Beryllium (Be)	µg/L	1.0	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd
Bismuth (Bi)	µg/L	2.0	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd
Boron (B)	µg/L	50	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd
Cadmium (Cd)	µg/L	0.017	nd	nd	nd	-	0.022	nd	nd	nd	0.026	0.025	0.037
Chromium (Cr)	µg/L	1.0	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd
Cobalt (Co)	µg/L	0.40	nd	nd	nd	-	nd	nd	nd	0.81	0.54	0.61	1.0
Copper (Cu)	µg/L	2.0	nd	nd	nd	-	2.0	nd	nd	nd	nd	nd	nd
Iron (Fe)	µg/L	50	190	51	1400	-	120	nd	nd	520	nd	nd	130
Lead (Pb)	µg/L	0.50	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd
Manganese (Mn)	µg/L	2.0	1700	100	500	-	250	11	11	550	580	570	1400
Mercury (Hg)	µg/L	0.013	nd	-	nd	nd	nd	nd	-	nd	-	-	nd
Molybdenum (Mo)	µg/L	2.0	2.7	nd	7.4	-	12	nd	nd	nd	nd	nd	2.5
Nickel (Ni)	µg/L	2.0	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd
Selenium (Se)	µg/L	1.0	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd
Silver (Ag)	µg/L	0.10	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd
Strontium (Sr)	µg/L	2.0	64	14	1000	-	2000	100	100	94	100	99	260
Thallium (Tl)	µg/L	0.10	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd
Tin (Sn)	µg/L	2.0	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd
Titanium (Ti)	µg/L	2.0	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd
Uranium (U)	µg/L	0.10	0.86	nd	0.92	-	1.3	1.6	1.6	1.3	1.0	0.96	0.27
Vanadium (V)	µg/L	2.0	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd
Zinc (Zn)	µg/L	5.0	nd	nd	nd	-	nd	nd	nd	nd	nd	nd	nd

Notes:
ug/L - micrograms per liter;
"-" = not analysed, not applicable or no applicable guideline
nd = Not Detected above RDL
RDL = Reportable Detection Limit

Maxxam
A Bureau Veritas Group Company

Your Project #: 121414740
Site Location: MARATHON
Your C.O.C. #: 637611-01-01

Attention:Aaron Power

Stantec Consulting Ltd
141 Kelsey Drive
St. John's, NL
A1B 0L2

Report Date: 2017/12/06
Report #: R4896047
Version: 2 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7Q1410
Received: 2017/11/20, 09:16

Sample Matrix: Water
Samples Received: 11

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Carbonate, Bicarbonate and Hydroxide (1)	8	N/A	2017/11/23	N/A	SM 22 4500-CO2 D
Alkalinity (1)	4	N/A	2017/11/27	ATL SOP 00013	EPA 310.2 R1974 m
Alkalinity (1)	4	N/A	2017/11/28	ATL SOP 00013	EPA 310.2 R1974 m
Chloride (1)	8	N/A	2017/11/28	ATL SOP 00014	SM 22 4500-Cl- E m
Cyanide free in Water (2)	7	2017/11/27	2017/11/28		
Str. Acid Diss. Cyanide water (1, 4)	7	N/A	2017/11/22	ATL SOP 00040	EPA 335.3 m
Colour (1)	8	N/A	2017/11/27	ATL SOP 00020	SM 22 2120C m
Conductance - water (1)	8	N/A	2017/11/22	ATL SOP 00004	SM 22 2510B m
Hardness (calculated as CaCO3) (1)	7	N/A	2017/11/24	ATL SOP 00048	SM 22 2340 B
Hardness (calculated as CaCO3) (1)	1	N/A	2017/11/27	ATL SOP 00048	SM 22 2340 B
Mercury - Dissolved (CVAA,LL) (1)	7	2017/11/22	2017/11/23	ATL SOP 00026	EPA 245.1 R3 m
Metals Water Diss. MS (1, 5)	2	N/A	2017/11/23	ATL SOP 00058	EPA 6020A R1 m
Metals Water Diss. MS (1, 5)	1	N/A	2017/11/24	ATL SOP 00058	EPA 6020A R1 m
Metals Water Diss. MS (as rec'd) (1)	5	N/A	2017/11/23	ATL SOP 00058	EPA 6020A R1 m
Ion Balance (% Difference) (1)	8	N/A	2017/11/29	N/A	Auto Calc.
Anion and Cation Sum (1)	7	N/A	2017/11/24	N/A	Auto Calc.
Anion and Cation Sum (1)	1	N/A	2017/11/27	N/A	Auto Calc.
Nitrogen Ammonia - water (1)	8	N/A	2017/11/23	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite (1)	8	N/A	2017/11/28	ATL SOP 00016	USGS SOPINCF0452.2 m
Nitrogen - Nitrite (1)	8	N/A	2017/11/27	ATL SOP 00017	SM 22 4500-NO2- B m
Nitrogen - Nitrate (as N) (1)	8	N/A	2017/11/28	ATL SOP 00018	ASTM D3867-16
pH (1, 6)	8	N/A	2017/11/22	ATL SOP 00003	SM 22 4500-H+ B m
Phosphorus - ortho (1)	8	N/A	2017/11/27	ATL SOP 00021	SM 22 4500-P E m
Radium Isotopes by Alpha Spectrometry (3, 7)	1	N/A	2017/12/01	BQL SOP-00006 BQL SOP-00017 BQL SOP-00032	Alpha Spectrometry
Radium Isotopes by Alpha Spectrometry (3, 7)	5	N/A	2017/12/03	BQL SOP-00006 BQL SOP-00017 BQL SOP-00032	Alpha Spectrometry

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Maxxam
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Your Project #: 121414740
Site Location: MARATHON
Your C.O.C. #: 637611-01-01

Attention:Aaron Power

Stantec Consulting Ltd
141 Kelsey Drive
St. John's, NL
A1B 0L2

Report Date: 2017/12/06
Report #: R4896047
Version: 2 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7Q1410
Received: 2017/11/20, 09:16

Sample Matrix: Water
Samples Received: 11

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Radium Isotopes by Alpha Spectrometry (3, 7)	1	N/A	2017/12/04	BQL SOP-00006 BQL SOP-00017 BQL SOP-00032	Alpha Spectrometry
Sat. pH and Langelier Index (@ 20C) (1)	8	N/A	2017/11/29	ATL SOP 00049	Auto Calc.
Sat. pH and Langelier Index (@ 4C) (1)	8	N/A	2017/11/29	ATL SOP 00049	Auto Calc.
Reactive Silica (1)	4	N/A	2017/11/27	ATL SOP 00022	EPA 366.0 m
Reactive Silica (1)	4	N/A	2017/11/28	ATL SOP 00022	EPA 366.0 m
Sulphate (1)	8	N/A	2017/11/27	ATL SOP 00023	ASTM D516-16 m
Total Dissolved Solids (TDS calc) (1)	8	N/A	2017/11/29	N/A	Auto Calc.
Organic carbon - Total (TOC) (1, 8)	8	N/A	2017/11/28	ATL SOP 00037	SM 22 5310C m
Turbidity (1)	8	N/A	2017/11/23	ATL SOP 00011	EPA 180.1 R2 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

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Your Project #: 121414740
Site Location: MARATHON
Your C.O.C. #: 637611-01-01

Attention:Aaron Power

Stantec Consulting Ltd
141 Kelsey Drive
St. John's, NL
A1B 0L2

Report Date: 2017/12/06
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CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7Q1410

Received: 2017/11/20, 09:16

(1) This test was performed by Maxxam Bedford
(2) This test was performed by Bedford to Montreal Subcontrac
(3) This test was performed by Maxxam Analytics Kitimat
(4) Strong acid dissociable cyanide value may include contribution from thiocyanate.
(5) Sample filtered in laboratory prior to analysis for dissolved metals.
(6) The APHA Standard Method require pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the APHA Standard Method holding time.
(7) Radium-226 results have not been corrected for blanks.
(8) TOC / DOC present in the sample should be considered as non-purgeable TOC / DOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Heather Macumber, Senior Project Manager
Email: HMacumber@maxxam.ca
Phone# (902)420-0203 Ext:226
==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

ATL. RCAP-MS DISSOLVED (LABFILT) IN W

Maxxam ID		FPB611			FPB614			
Sampling Date		2017/11/15			2017/11/16			
COC Number		637611-01-01			637611-01-01			
	UNITS	**MA-17-250-2017**	**RDL**	**QC Batch**	**VL-09-134-2017**	**RDL**	**QC Batch**	**MDL**
Calculated Parameters								
Anion Sum	me/L	13.6	N/A	5275722	1.95	N/A	5275722	N/A
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	72	1.0	5275719	80	1.0	5275719	0.20
Calculated TDS	mg/L	880	1.0	5275727	110	1.0	5275727	0.20
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	1.0	5275719	<1.0	1.0	5275719	0.20
Cation Sum	me/L	13.8	N/A	5275722	1.93	N/A	5275722	N/A
Hardness (CaCO3)	mg/L	450	1.0	5275720	89	1.0	5275720	1.0
Ion Balance (% Difference)	%	0.880	N/A	5275721	0.520	N/A	5275721	N/A
Langelier Index (@ 20C)	N/A	0.187		5275725	-0.462		5275725	
Langelier Index (@ 4C)	N/A	-0.0590		5275726	-0.713		5275726	
Nitrate (N)	mg/L	<0.050	0.050	5275723	<0.050	0.050	5275723	N/A
Saturation pH (@ 20C)	N/A	7.49		5275725	7.94		5275725	
Saturation pH (@ 4C)	N/A	7.74		5275726	8.19		5275726	
Inorganics								
Total Alkalinity (Total as CaCO3)	mg/L	72	5.0	5283121	81	5.0	5283142	N/A
Dissolved Chloride (Cl)	mg/L	92	1.0	5283123	3.6	1.0	5283147	N/A
Colour	TCU	6.4	5.0	5283132	7.7	5.0	5283163	N/A
Nitrate + Nitrite (N)	mg/L	<0.050	0.050	5283136	<0.050	0.050	5283169	N/A
Nitrite (N)	mg/L	<0.010	0.010	5283138	<0.010	0.010	5283171	N/A
Nitrogen (Ammonia Nitrogen)	mg/L	0.82	0.050	5282490	<0.050	0.050	5282490	N/A
Total Organic Carbon (C)	mg/L	11 (1)	5.0	5288033	2.6	0.50	5288033	N/A
Orthophosphate (P)	mg/L	0.011	0.010	5283134	0.011	0.010	5283166	N/A
pH	pH	7.68	N/A	5278361	7.48	N/A	5278356	N/A
Reactive Silica (SiO2)	mg/L	8.2	0.50	5283126	7.2	0.50	5283151	N/A
Dissolved Sulphate (SO4)	mg/L	460	40	5283125	12	2.0	5283150	N/A
Turbidity	NTU	12	0.10	5280326	210	1.0	5280327	0.10
Conductivity	uS/cm	1300	1.0	5278364	190	1.0	5278359	N/A
Metals								
Dissolved Aluminum (Al)	ug/L	42	5.0	5280296	15	5.0	5280296	N/A
Dissolved Antimony (Sb)	ug/L	<1.0	1.0	5280296	<1.0	1.0	5280296	N/A
Dissolved Arsenic (As)	ug/L	2.9	1.0	5280296	<1.0	1.0	5280296	N/A
Dissolved Barium (Ba)	ug/L	11	1.0	5280296	62	1.0	5280296	N/A
Dissolved Beryllium (Be)	ug/L	<1.0	1.0	5280296	<1.0	1.0	5280296	N/A
Dissolved Bismuth (Bi)	ug/L	<2.0	2.0	5280296	<2.0	2.0	5280296	N/A

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Elevated reporting limit due to sample matrix.

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

ATL. RCAP-MS DISSOLVED (LABFILT) IN W

Maxxam ID		FPB611			FPB614			
Sampling Date		2017/11/15			2017/11/16			
COC Number		637611-01-01			637611-01-01			
	UNITS	**MA-17-250-2017**	**RDL**	**QC Batch**	**VL-09-134-2017**	**RDL**	**QC Batch**	**MDL**
Dissolved Boron (B)	ug/L	<50	50	5280296	<50	50	5280296	N/A
Dissolved Cadmium (Cd)	ug/L	0.022	0.010	5280296	0.037	0.010	5280296	N/A
Dissolved Calcium (Ca)	ug/L	150000	100	5280296	32000	100	5280296	N/A
Dissolved Chromium (Cr)	ug/L	<1.0	1.0	5280296	<1.0	1.0	5280296	N/A
Dissolved Cobalt (Co)	ug/L	<0.40	0.40	5280296	1.0	0.40	5280296	N/A
Dissolved Copper (Cu)	ug/L	2.0	2.0	5280296	<2.0	2.0	5280296	N/A
Dissolved Iron (Fe)	ug/L	120	50	5280296	130	50	5280296	N/A
Dissolved Lead (Pb)	ug/L	<0.50	0.50	5280296	<0.50	0.50	5280296	N/A
Dissolved Magnesium (Mg)	ug/L	15000	100	5280296	2300	100	5280296	N/A
Dissolved Manganese (Mn)	ug/L	250	2.0	5280296	1400	2.0	5280296	N/A
Dissolved Molybdenum (Mo)	ug/L	12	2.0	5280296	2.5	2.0	5280296	N/A
Dissolved Nickel (Ni)	ug/L	<2.0	2.0	5280296	<2.0	2.0	5280296	N/A
Dissolved Phosphorus (P)	ug/L	<100	100	5280296	<100	100	5280296	N/A
Dissolved Potassium (K)	ug/L	1300	100	5280296	480	100	5280296	N/A
Dissolved Selenium (Se)	ug/L	<1.0	1.0	5280296	<1.0	1.0	5280296	N/A
Dissolved Silver (Ag)	ug/L	<0.10	0.10	5280296	<0.10	0.10	5280296	N/A
Dissolved Sodium (Na)	ug/L	110000	100	5280296	3100	100	5280296	N/A
Dissolved Strontium (Sr)	ug/L	2000	2.0	5280296	260	2.0	5280296	N/A
Dissolved Thallium (Tl)	ug/L	<0.10	0.10	5280296	<0.10	0.10	5280296	N/A
Dissolved Tin (Sn)	ug/L	<2.0	2.0	5280296	<2.0	2.0	5280296	N/A
Dissolved Titanium (Ti)	ug/L	<2.0	2.0	5280296	<2.0	2.0	5280296	N/A
Dissolved Uranium (U)	ug/L	1.3	0.10	5280296	0.27	0.10	5280296	N/A
Dissolved Vanadium (V)	ug/L	<2.0	2.0	5280296	<2.0	2.0	5280296	N/A
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	5280296	<5.0	5.0	5280296	N/A

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

ATL. RCAP-MS DISSOLVED (LABFILT) IN W

Maxxam ID		FPB618				FPB618			
Sampling Date		2017/11/16				2017/11/16			
COC Number		637611-01-01				637611-01-01			
	UNITS	**FLD-DUP-5-2017**	**RDL**	**QC Batch**	**MDL**	**FLD-DUP-5-2017 Lab-Dup**	**RDL**	**QC Batch**	**MDL**
Calculated Parameters									
Anion Sum	me/L	2.86	N/A	5275722	N/A				
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	140	1.0	5275719	0.20				
Calculated TDS	mg/L	150	1.0	5275727	0.20				
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	1.0	5275719	0.20				
Cation Sum	me/L	2.92	N/A	5275722	N/A				
Hardness (CaCO3)	mg/L	140	1.0	5275720	1.0				
Ion Balance (% Difference)	%	1.04	N/A	5275721	N/A				
Langelier Index (@ 20C)	N/A	0.0540		5275725					
Langelier Index (@ 4C)	N/A	-0.196		5275726					
Nitrate (N)	mg/L	0.066	0.050	5275723	N/A				
Saturation pH (@ 20C)	N/A	7.57		5275725					
Saturation pH (@ 4C)	N/A	7.82		5275726					
Inorganics									
Total Alkalinity (Total as CaCO3)	mg/L	140 (1)	25	5283142	N/A	130 (1)	25	5283142	N/A
Dissolved Chloride (Cl)	mg/L	3.2	1.0	5283147	N/A	3.0	1.0	5283147	N/A
Colour	TCU	7.5	5.0	5283163	N/A	5.9	5.0	5283163	N/A
Nitrate + Nitrite (N)	mg/L	0.066	0.050	5283169	N/A	<0.050	0.050	5283169	N/A
Nitrite (N)	mg/L	<0.010	0.010	5283171	N/A	<0.010	0.010	5283171	N/A
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050	0.050	5282490	N/A				
Total Organic Carbon (C)	mg/L	7.6 (2)	5.0	5288033	N/A				
Orthophosphate (P)	mg/L	0.011	0.010	5283166	N/A	0.010	0.010	5283166	N/A
pH	pH	7.62	N/A	5278361	N/A				
Reactive Silica (SiO2)	mg/L	10	0.50	5283151	N/A	10	0.50	5283151	N/A
Dissolved Sulphate (SO4)	mg/L	2.5	2.0	5283150	N/A	2.4	2.0	5283150	N/A
Turbidity	NTU	160	1.0	5280327	0.10	160	1.0	5280327	0.10
Conductivity	uS/cm	270	1.0	5278364	N/A				
Metals									
Dissolved Aluminum (Al)	ug/L	33	5.0	5282445	N/A	23	5.0	5282445	N/A
Dissolved Antimony (Sb)	ug/L	<1.0	1.0	5282445	N/A	<1.0	1.0	5282445	N/A
Dissolved Arsenic (As)	ug/L	2.3	1.0	5282445	N/A	2.4	1.0	5282445	N/A
Dissolved Barium (Ba)	ug/L	62	1.0	5282445	N/A	61	1.0	5282445	N/A

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Elevated reporting limit due to sample martix.
(2) Elevated reporting limit due to sample matrix.

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

ATL. RCAP-MS DISSOLVED (LABFILT) IN W

Maxxam ID		FPB618				FPB618			
Sampling Date		2017/11/16				2017/11/16			
COC Number		637611-01-01				637611-01-01			
	UNITS	**FLD-DUP-5-2017**	**RDL**	**QC Batch**	**MDL**	**FLD-DUP-5-2017 Lab-Dup**	**RDL**	**QC Batch**	**MDL**
Dissolved Beryllium (Be)	ug/L	<1.0	1.0	5282445	N/A	<1.0	1.0	5282445	N/A
Dissolved Bismuth (Bi)	ug/L	<2.0	2.0	5282445	N/A	<2.0	2.0	5282445	N/A
Dissolved Boron (B)	ug/L	<50	50	5282445	N/A	<50	50	5282445	N/A
Dissolved Cadmium (Cd)	ug/L	0.026	0.010	5282445	N/A	0.025	0.010	5282445	N/A
Dissolved Calcium (Ca)	ug/L	47000	100	5282445	N/A	46000	100	5282445	N/A
Dissolved Chromium (Cr)	ug/L	<1.0	1.0	5282445	N/A	<1.0	1.0	5282445	N/A
Dissolved Cobalt (Co)	ug/L	0.54	0.40	5282445	N/A	0.61	0.40	5282445	N/A
Dissolved Copper (Cu)	ug/L	<2.0	2.0	5282445	N/A	<2.0	2.0	5282445	N/A
Dissolved Iron (Fe)	ug/L	<50	50	5282445	N/A	<50	50	5282445	N/A
Dissolved Lead (Pb)	ug/L	<0.50	0.50	5282445	N/A	<0.50	0.50	5282445	N/A
Dissolved Magnesium (Mg)	ug/L	4900	100	5282445	N/A	4800	100	5282445	N/A
Dissolved Manganese (Mn)	ug/L	580	2.0	5282445	N/A	570	2.0	5282445	N/A
Dissolved Molybdenum (Mo)	ug/L	<2.0	2.0	5282445	N/A	<2.0	2.0	5282445	N/A
Dissolved Nickel (Ni)	ug/L	<2.0	2.0	5282445	N/A	<2.0	2.0	5282445	N/A
Dissolved Phosphorus (P)	ug/L	<100	100	5282445	N/A	<100	100	5282445	N/A
Dissolved Potassium (K)	ug/L	430	100	5282445	N/A	420	100	5282445	N/A
Dissolved Selenium (Se)	ug/L	<1.0	1.0	5282445	N/A	<1.0	1.0	5282445	N/A
Dissolved Silver (Ag)	ug/L	<0.10	0.10	5282445	N/A	<0.10	0.10	5282445	N/A
Dissolved Sodium (Na)	ug/L	4000	100	5282445	N/A	4000	100	5282445	N/A
Dissolved Strontium (Sr)	ug/L	100	2.0	5282445	N/A	99	2.0	5282445	N/A
Dissolved Thallium (Tl)	ug/L	<0.10	0.10	5282445	N/A	<0.10	0.10	5282445	N/A
Dissolved Tin (Sn)	ug/L	<2.0	2.0	5282445	N/A	<2.0	2.0	5282445	N/A
Dissolved Titanium (Ti)	ug/L	<2.0	2.0	5282445	N/A	<2.0	2.0	5282445	N/A
Dissolved Uranium (U)	ug/L	1.0	0.10	5282445	N/A	0.96	0.10	5282445	N/A
Dissolved Vanadium (V)	ug/L	<2.0	2.0	5282445	N/A	<2.0	2.0	5282445	N/A
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	5282445	N/A	<5.0	5.0	5282445	N/A

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Maxxam ID		FPB609				FPB609			
Sampling Date		2017/11/14				2017/11/14			
COC Number		637611-01-01				637611-01-01			
	UNITS	**MA-17-158-2017**	**RDL**	**QC Batch**	**MDL**	**MA-17-158-2017 Lab-Dup**	**RDL**	**QC Batch**	**MDL**
Calculated Parameters									
Anion Sum	me/L	2.27	N/A	5275722	N/A				
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	100	1.0	5275719	0.20				
Calculated TDS	mg/L	130	1.0	5275727	0.20				
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	1.0	5275719	0.20				
Cation Sum	me/L	2.20	N/A	5275722	N/A				
Hardness (CaCO3)	mg/L	100	1.0	5275720	1.0				
Ion Balance (% Difference)	%	1.57	N/A	5275721	N/A				
Langelier Index (@ 20C)	N/A	-0.127		5275725					
Langelier Index (@ 4C)	N/A	-0.378		5275726					
Nitrate (N)	mg/L	<0.050	0.050	5275723	N/A				
Saturation pH (@ 20C)	N/A	7.78		5275725					
Saturation pH (@ 4C)	N/A	8.03		5275726					
Inorganics									
Total Alkalinity (Total as CaCO3)	mg/L	100 (1)	25	5283121	N/A	100 (1)	25	5283121	N/A
Dissolved Chloride (Cl)	mg/L	4.5	1.0	5283123	N/A	4.6	1.0	5283123	N/A
Colour	TCU	<5.0	5.0	5283132	N/A	<5.0	5.0	5283132	N/A
Nitrate + Nitrite (N)	mg/L	<0.050	0.050	5283136	N/A	<0.050	0.050	5283136	N/A
Nitrite (N)	mg/L	<0.010	0.010	5283138	N/A	<0.010	0.010	5283138	N/A
Nitrogen (Ammonia Nitrogen)	mg/L	<0.050	0.050	5282490	N/A				
Total Organic Carbon (C)	mg/L	1.4	0.50	5288033	N/A				
Orthophosphate (P)	mg/L	0.012	0.010	5283134	N/A	0.012	0.010	5283134	N/A
pH	pH	7.65	N/A	5278361	N/A	7.71	N/A	5278361	N/A
Reactive Silica (SiO2)	mg/L	12	0.50	5283126	N/A	12	0.50	5283126	N/A
Dissolved Sulphate (SO4)	mg/L	3.3	2.0	5283125	N/A	3.6	2.0	5283125	N/A
Turbidity	NTU	99	0.10	5280326	0.10				
Conductivity	uS/cm	220	1.0	5278364	N/A	220	1.0	5278364	N/A
Metals									
Dissolved Aluminum (Al)	ug/L	12	5.0	5280304	N/A				
Dissolved Antimony (Sb)	ug/L	<1.0	1.0	5280304	N/A				
Dissolved Arsenic (As)	ug/L	<1.0	1.0	5280304	N/A				
Dissolved Barium (Ba)	ug/L	1.6	1.0	5280304	N/A				
Dissolved Beryllium (Be)	ug/L	<1.0	1.0	5280304	N/A				

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Elevated reporting limit due to sample martix.

AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Maxxam ID		FPB609				FPB609			
Sampling Date		2017/11/14				2017/11/14			
COC Number		637611-01-01				637611-01-01			
	UNITS	**MA-17-158-2017**	**RDL**	**QC Batch**	**MDL**	**MA-17-158-2017 Lab-Dup**	**RDL**	**QC Batch**	**MDL**
Dissolved Bismuth (Bi)	ug/L	<2.0	2.0	5280304	N/A				
Dissolved Boron (B)	ug/L	<50	50	5280304	N/A				
Dissolved Cadmium (Cd)	ug/L	<0.010	0.010	5280304	N/A				
Dissolved Calcium (Ca)	ug/L	37000	100	5280304	N/A				
Dissolved Chromium (Cr)	ug/L	<1.0	1.0	5280304	N/A				
Dissolved Cobalt (Co)	ug/L	<0.40	0.40	5280304	N/A				
Dissolved Copper (Cu)	ug/L	<2.0	2.0	5280304	N/A				
Dissolved Iron (Fe)	ug/L	190	50	5280304	N/A				
Dissolved Lead (Pb)	ug/L	<0.50	0.50	5280304	N/A				
Dissolved Magnesium (Mg)	ug/L	2200	100	5280304	N/A				
Dissolved Manganese (Mn)	ug/L	1700	2.0	5280304	N/A				
Dissolved Molybdenum (Mo)	ug/L	2.7	2.0	5280304	N/A				
Dissolved Nickel (Ni)	ug/L	<2.0	2.0	5280304	N/A				
Dissolved Phosphorus (P)	ug/L	<100	100	5280304	N/A				
Dissolved Potassium (K)	ug/L	340	100	5280304	N/A				
Dissolved Selenium (Se)	ug/L	<1.0	1.0	5280304	N/A				
Dissolved Silver (Ag)	ug/L	<0.10	0.10	5280304	N/A				
Dissolved Sodium (Na)	ug/L	3800	100	5280304	N/A				
Dissolved Strontium (Sr)	ug/L	64	2.0	5280304	N/A				
Dissolved Thallium (Tl)	ug/L	<0.10	0.10	5280304	N/A				
Dissolved Tin (Sn)	ug/L	<2.0	2.0	5280304	N/A				
Dissolved Titanium (Ti)	ug/L	<2.0	2.0	5280304	N/A				
Dissolved Uranium (U)	ug/L	0.86	0.10	5280304	N/A				
Dissolved Vanadium (V)	ug/L	<2.0	2.0	5280304	N/A				
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	5280304	N/A				

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Maxxam ID		FPB610			FPB612			
Sampling Date		2017/11/15			2017/11/15			
COC Number		637611-01-01			637611-01-01			
	UNITS	**MA-17-218-2017**	**RDL**	**QC Batch**	**VL-11-248-2017**	**RDL**	**QC Batch**	**MDL**
Calculated Parameters								
Anion Sum	me/L	7.97	N/A	5275722	2.95	N/A	5275722	N/A
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	100	1.0	5275719	140	1.0	5275719	0.20
Calculated TDS	mg/L	490	1.0	5275727	160	1.0	5275727	0.20
Carb. Alkalinity (calc. as CaCO3)	mg/L	<1.0	1.0	5275719	<1.0	1.0	5275719	0.20
Cation Sum	me/L	7.19	N/A	5275722	2.88	N/A	5275722	N/A
Hardness (CaCO3)	mg/L	240	1.0	5275720	140	1.0	5275720	1.0
Ion Balance (% Difference)	%	5.15	N/A	5275721	1.20	N/A	5275721	N/A
Langelier Index (@ 20C)	N/A	0.206		5275725	0.165		5275725	
Langelier Index (@ 4C)	N/A	-0.0420		5275726	-0.0860		5275726	
Nitrate (N)	mg/L	<0.050	0.050	5275723	<0.050	0.050	5275723	N/A
Saturation pH (@ 20C)	N/A	7.55		5275725	7.51		5275725	
Saturation pH (@ 4C)	N/A	7.80		5275726	7.76		5275726	
Inorganics								
Total Alkalinity (Total as CaCO3)	mg/L	100 (1)	25	5283121	140 (1)	25	5282880	N/A
Dissolved Chloride (Cl)	mg/L	48	1.0	5283123	3.0	1.0	5282882	N/A
Colour	TCU	25	5.0	5283132	<5.0	5.0	5282885	N/A
Nitrate + Nitrite (N)	mg/L	<0.050	0.050	5283136	<0.050	0.050	5282891	N/A
Nitrite (N)	mg/L	<0.010	0.010	5283138	<0.010	0.010	5282892	N/A
Nitrogen (Ammonia Nitrogen)	mg/L	0.33	0.050	5282490	<0.050	0.050	5282490	N/A
Total Organic Carbon (C)	mg/L	4.6	0.50	5288033	<5.0 (2)	5.0	5288033	N/A
Orthophosphate (P)	mg/L	0.018	0.010	5283134	0.012	0.010	5282887	N/A
pH	pH	7.76	N/A	5278361	7.67	N/A	5278361	N/A
Reactive Silica (SiO2)	mg/L	9.9	0.50	5283126	11	0.50	5282884	N/A
Dissolved Sulphate (SO4)	mg/L	220 (3)	40	5283125	<2.0	2.0	5282883	N/A
Turbidity	NTU	53	0.10	5280326	60	0.10	5280326	0.10
Conductivity	uS/cm	830	1.0	5278364	280	1.0	5278364	N/A
Metals								
Dissolved Aluminum (Al)	ug/L	12	5.0	5280304	<5.0	5.0	5280304	N/A
Dissolved Antimony (Sb)	ug/L	<1.0	1.0	5280304	<1.0	1.0	5280304	N/A
Dissolved Arsenic (As)	ug/L	1.5	1.0	5280304	<1.0	1.0	5280304	N/A
Dissolved Barium (Ba)	ug/L	6.7	1.0	5280304	3.4	1.0	5280304	N/A

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Elevated reporting limit due to sample martix.
(2) Reporting limit was increased due to turbidity.
(3) Elevated reporting limit due to sample matrix.

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Maxxam ID		FPB610			FPB612			
Sampling Date		2017/11/15			2017/11/15			
COC Number		637611-01-01			637611-01-01			
	UNITS	**MA-17-218-2017**	**RDL**	**QC Batch**	**VL-11-248-2017**	**RDL**	**QC Batch**	**MDL**
Dissolved Beryllium (Be)	ug/L	<1.0	1.0	5280304	<1.0	1.0	5280304	N/A
Dissolved Bismuth (Bi)	ug/L	<2.0	2.0	5280304	<2.0	2.0	5280304	N/A
Dissolved Boron (B)	ug/L	<50	50	5280304	<50	50	5280304	N/A
Dissolved Cadmium (Cd)	ug/L	<0.010	0.010	5280304	<0.010	0.010	5280304	N/A
Dissolved Calcium (Ca)	ug/L	82000	100	5280304	51000	100	5280304	N/A
Dissolved Chromium (Cr)	ug/L	<1.0	1.0	5280304	<1.0	1.0	5280304	N/A
Dissolved Cobalt (Co)	ug/L	<0.40	0.40	5280304	<0.40	0.40	5280304	N/A
Dissolved Copper (Cu)	ug/L	<2.0	2.0	5280304	<2.0	2.0	5280304	N/A
Dissolved Iron (Fe)	ug/L	1400	50	5280304	<50	50	5280304	N/A
Dissolved Lead (Pb)	ug/L	<0.50	0.50	5280304	<0.50	0.50	5280304	N/A
Dissolved Magnesium (Mg)	ug/L	8500	100	5280304	2600	100	5280304	N/A
Dissolved Manganese (Mn)	ug/L	500	2.0	5280304	11	2.0	5280304	N/A
Dissolved Molybdenum (Mo)	ug/L	7.4	2.0	5280304	<2.0	2.0	5280304	N/A
Dissolved Nickel (Ni)	ug/L	<2.0	2.0	5280304	<2.0	2.0	5280304	N/A
Dissolved Phosphorus (P)	ug/L	<100	100	5280304	<100	100	5280304	N/A
Dissolved Potassium (K)	ug/L	720	100	5280304	310	100	5280304	N/A
Dissolved Selenium (Se)	ug/L	<1.0	1.0	5280304	<1.0	1.0	5280304	N/A
Dissolved Silver (Ag)	ug/L	<0.10	0.10	5280304	<0.10	0.10	5280304	N/A
Dissolved Sodium (Na)	ug/L	54000	100	5280304	2500	100	5280304	N/A
Dissolved Strontium (Sr)	ug/L	1000	2.0	5280304	100	2.0	5280304	N/A
Dissolved Thallium (Tl)	ug/L	<0.10	0.10	5280304	<0.10	0.10	5280304	N/A
Dissolved Tin (Sn)	ug/L	<2.0	2.0	5280304	<2.0	2.0	5280304	N/A
Dissolved Titanium (Ti)	ug/L	<2.0	2.0	5280304	<2.0	2.0	5280304	N/A
Dissolved Uranium (U)	ug/L	0.92	0.10	5280304	1.6	0.10	5280304	N/A
Dissolved Vanadium (V)	ug/L	<2.0	2.0	5280304	<2.0	2.0	5280304	N/A
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	5280304	<5.0	5.0	5280304	N/A

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Maxxam ID		FPB612				FPB613		FPB620			
Sampling Date		2017/11/15				2017/11/16		2017/11/14			
COC Number		637611-01-01				637611-01-01		637611-01-01			
	UNITS	**VL-11-248-2017 Lab-Dup**	**RDL**	**QC Batch**	**MDL**	**VL-17-650-2017**	**RDL**	**INJECTION WATER**	**RDL**	**QC Batch**	**MDL**
Calculated Parameters											
Anion Sum	me/L					2.84	N/A	0.650	N/A	5275722	N/A
Bicarb. Alkalinity (calc. as CaCO3)	mg/L					130	1.0	21	1.0	5275719	0.20
Calculated TDS	mg/L					150	1.0	40	1.0	5275727	0.20
Carb. Alkalinity (calc. as CaCO3)	mg/L					<1.0	1.0	<1.0	1.0	5275719	0.20
Cation Sum	me/L					2.69	N/A	0.680	N/A	5275722	N/A
Hardness (CaCO3)	mg/L					130	1.0	23	1.0	5275720	1.0
Ion Balance (% Difference)	%					2.71	N/A	2.26	N/A	5275721	N/A
Langelier Index (@ 20C)	N/A					-0.144		-2.05		5275725	
Langelier Index (@ 4C)	N/A					-0.395		-2.30		5275726	
Nitrate (N)	mg/L					0.053	0.050	0.099	0.050	5275723	N/A
Saturation pH (@ 20C)	N/A					7.60		9.18		5275725	
Saturation pH (@ 4C)	N/A					7.86		9.43		5275726	
Inorganics											
Total Alkalinity (Total as CaCO3)	mg/L					130 (1)	25	21	5.0	5283142	N/A
Dissolved Chloride (Cl)	mg/L					3.3	1.0	6.3	1.0	5283147	N/A
Colour	TCU					5.1	5.0	17	5.0	5283163	N/A
Nitrate + Nitrite (N)	mg/L					0.053	0.050	0.099	0.050	5283169	N/A
Nitrite (N)	mg/L					<0.010	0.010	<0.010	0.010	5283171	N/A
Nitrogen (Ammonia Nitrogen)	mg/L					<0.050	0.050	<0.050	0.050	5282490	N/A
Total Organic Carbon (C)	mg/L					3.9	0.50	5.4	0.50	5288033	N/A
Orthophosphate (P)	mg/L					0.011	0.010	<0.010	0.010	5283166	N/A
pH	pH					7.46	N/A	7.13	N/A	5278361	N/A
Reactive Silica (SiO2)	mg/L					10	0.50	5.3	0.50	5283151	N/A
Dissolved Sulphate (SO4)	mg/L					2.4	2.0	2.5	2.0	5283150	N/A
Turbidity	NTU					170	1.0	0.30	0.10	5280327	0.10
Conductivity	uS/cm					270	1.0	71	1.0	5278364	N/A
Metals											
Dissolved Aluminum (Al)	ug/L	<5.0	5.0	5280304	N/A	15	5.0	19	5.0	5280304	N/A
Dissolved Antimony (Sb)	ug/L	<1.0	1.0	5280304	N/A	<1.0	1.0	<1.0	1.0	5280304	N/A
Dissolved Arsenic (As)	ug/L	<1.0	1.0	5280304	N/A	4.4	1.0	1.4	1.0	5280304	N/A
Dissolved Barium (Ba)	ug/L	3.2	1.0	5280304	N/A	58	1.0	<1.0	1.0	5280304	N/A
Dissolved Beryllium (Be)	ug/L	<1.0	1.0	5280304	N/A	<1.0	1.0	<1.0	1.0	5280304	N/A

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Elevated reporting limit due to sample martix.

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

AT. RCAP-MS DISSOLVED (FIELDFILT) IN W

Maxxam ID		FPB612				FPB613		FPB620			
Sampling Date		2017/11/15				2017/11/16		2017/11/14			
COC Number		637611-01-01				637611-01-01		637611-01-01			
	UNITS	**VL-11-248-2017 Lab-Dup**	**RDL**	**QC Batch**	**MDL**	**VL-17-650-2017**	**RDL**	**INJECTION WATER**	**RDL**	**QC Batch**	**MDL**
Dissolved Bismuth (Bi)	ug/L	<2.0	2.0	5280304	N/A	<2.0	2.0	<2.0	2.0	5280304	N/A
Dissolved Boron (B)	ug/L	<50	50	5280304	N/A	<50	50	<50	50	5280304	N/A
Dissolved Cadmium (Cd)	ug/L	<0.010	0.010	5280304	N/A	<0.010	0.010	<0.010	0.010	5280304	N/A
Dissolved Calcium (Ca)	ug/L	51000	100	5280304	N/A	43000	100	6500	100	5280304	N/A
Dissolved Chromium (Cr)	ug/L	<1.0	1.0	5280304	N/A	<1.0	1.0	<1.0	1.0	5280304	N/A
Dissolved Cobalt (Co)	ug/L	<0.40	0.40	5280304	N/A	0.81	0.40	<0.40	0.40	5280304	N/A
Dissolved Copper (Cu)	ug/L	<2.0	2.0	5280304	N/A	<2.0	2.0	<2.0	2.0	5280304	N/A
Dissolved Iron (Fe)	ug/L	<50	50	5280304	N/A	520	50	51	50	5280304	N/A
Dissolved Lead (Pb)	ug/L	<0.50	0.50	5280304	N/A	<0.50	0.50	<0.50	0.50	5280304	N/A
Dissolved Magnesium (Mg)	ug/L	2600	100	5280304	N/A	4300	100	1800	100	5280304	N/A
Dissolved Manganese (Mn)	ug/L	11	2.0	5280304	N/A	550	2.0	100	2.0	5280304	N/A
Dissolved Molybdenum (Mo)	ug/L	<2.0	2.0	5280304	N/A	<2.0	2.0	<2.0	2.0	5280304	N/A
Dissolved Nickel (Ni)	ug/L	<2.0	2.0	5280304	N/A	<2.0	2.0	<2.0	2.0	5280304	N/A
Dissolved Phosphorus (P)	ug/L	<100	100	5280304	N/A	<100	100	<100	100	5280304	N/A
Dissolved Potassium (K)	ug/L	310	100	5280304	N/A	400	100	550	100	5280304	N/A
Dissolved Selenium (Se)	ug/L	<1.0	1.0	5280304	N/A	<1.0	1.0	<1.0	1.0	5280304	N/A
Dissolved Silver (Ag)	ug/L	<0.10	0.10	5280304	N/A	<0.10	0.10	<0.10	0.10	5280304	N/A
Dissolved Sodium (Na)	ug/L	2500	100	5280304	N/A	3700	100	4500	100	5280304	N/A
Dissolved Strontium (Sr)	ug/L	100	2.0	5280304	N/A	94	2.0	14	2.0	5280304	N/A
Dissolved Thallium (Tl)	ug/L	<0.10	0.10	5280304	N/A	<0.10	0.10	<0.10	0.10	5280304	N/A
Dissolved Tin (Sn)	ug/L	<2.0	2.0	5280304	N/A	<2.0	2.0	<2.0	2.0	5280304	N/A
Dissolved Titanium (Ti)	ug/L	<2.0	2.0	5280304	N/A	<2.0	2.0	<2.0	2.0	5280304	N/A
Dissolved Uranium (U)	ug/L	1.6	0.10	5280304	N/A	1.3	0.10	<0.10	0.10	5280304	N/A
Dissolved Vanadium (V)	ug/L	<2.0	2.0	5280304	N/A	<2.0	2.0	<2.0	2.0	5280304	N/A
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	5280304	N/A	<5.0	5.0	<5.0	5.0	5280304	N/A

RDL = Reportable Detection Limit
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Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

RESULTS OF ANALYSES OF WATER

Maxxam ID		FPB609				FPB609			
Sampling Date		2017/11/14				2017/11/14			
COC Number		637611-01-01				637611-01-01			
	UNITS	**MA-17-158-2017**	**RDL**	**QC Batch**	**MDL**	**MA-17-158-2017 Lab-Dup**	**RDL**	**QC Batch**	**MDL**
Inorganics									
Strong Acid Dissoc. Cyanide (CN)	mg/L	<0.0010	0.0010	5278495	N/A	<0.0010	0.0010	5278495	N/A
RADIONUCLIDE									
Radium-226	Bq/L	<0.010	0.010	5279434	N/A				
Subcontracted Analysis									
Subcontract Parameter	N/A	ATTACHED	N/A	5281654	N/A				

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

Maxxam ID		FPB610	FPB611	FPB612	FPB613			
Sampling Date		2017/11/15	2017/11/15	2017/11/15	2017/11/16			
COC Number		637611-01-01	637611-01-01	637611-01-01	637611-01-01			
	UNITS	**MA-17-218-2017**	**MA-17-250-2017**	**VL-11-248-2017**	**VL-17-650-2017**	**RDL**	**QC Batch**	**MDL**
Inorganics								
Strong Acid Dissoc. Cyanide (CN)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	5278495	N/A
RADIONUCLIDE								
Radium-226	Bq/L	<0.010	<0.010	<0.010	<0.010	0.010	5279434	N/A
Subcontracted Analysis								
Subcontract Parameter	N/A	ATTACHED	ATTACHED	ATTACHED	ATTACHED	N/A	5281654	N/A

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Maxxam ID		FPB614				FPB615			
Sampling Date		2017/11/16				2017/11/14			
COC Number		637611-01-01				637611-01-01			
	UNITS	**VL-09-134-2017**	**RDL**	**QC Batch**	**MDL**	**FLD-DUP-1-2017**	**RDL**	**QC Batch**	**MDL**
Inorganics									
Strong Acid Dissoc. Cyanide (CN)	mg/L	<0.0010	0.0010	5278495	N/A	<0.0010	0.0010	5278495	N/A
RADIONUCLIDE									
Radium-226	Bq/L	<0.010	0.010	5279434	N/A				
Subcontracted Analysis									
Subcontract Parameter	N/A	ATTACHED	N/A	5281654	N/A	ATTACHED	N/A	5281654	N/A

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
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Sampler Initials: AP

RESULTS OF ANALYSES OF WATER

Maxxam ID		FPB617			
Sampling Date		2017/11/15			
COC Number		637611-01-01			
	UNITS	**FLD-DUP-4-2017**	**RDL**	**QC Batch**	**MDL**
RADIONUCLIDE					
Radium-226	Bq/L	<0.010	0.010	5279434	N/A

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

MERCURY BY COLD VAPOUR AA (WATER)

Maxxam ID		FPB609	FPB610	FPB611	FPB612	FPB613			
Sampling Date		2017/11/14	2017/11/15	2017/11/15	2017/11/15	2017/11/16			
COC Number		637611-01-01	637611-01-01	637611-01-01	637611-01-01	637611-01-01			
	UNITS	**MA-17-158-2017**	**MA-17-218-2017**	**MA-17-250-2017**	**VL-11-248-2017**	**VL-17-650-2017**	**RDL**	**QC Batch**	**MDL**
Metals									
Dissolved Mercury (Hg)	ug/L	<0.013	<0.013	<0.013	<0.013	<0.013	0.013	5278161	N/A

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Maxxam ID		FPB614	FPB616			
Sampling Date		2017/11/16	2017/11/15			
COC Number		637611-01-01	637611-01-01			
	UNITS	**VL-09-134-2017**	**FLD-DUP-2-2017**	**RDL**	**QC Batch**	**MDL**
Metals						
Dissolved Mercury (Hg)	ug/L	<0.013	<0.013	0.013	5278161	N/A

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

TEST SUMMARY

Maxxam ID: FPB609
Sample ID: MA-17-158-2017
Matrix: Water

Collected: 2017/11/14
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	5275719	N/A	2017/11/23	Automated Statchk
Alkalinity	KONE	5283121	N/A	2017/11/27	Nancy Rogers
Chloride	KONE	5283123	N/A	2017/11/28	Nancy Rogers
Cyanide free in Water		5281654	2017/11/27	2017/11/28	Eric Dearman
Str. Acid Diss. Cyanide water	TECH	5278495	N/A	2017/11/22	Cliff Raymond
Colour	KONE	5283132	N/A	2017/11/27	Nancy Rogers
Conductance - water	AT	5278364	N/A	2017/11/22	Julia McGovern
Hardness (calculated as CaCO3)		5275720	N/A	2017/11/24	Automated Statchk
Mercury - Dissolved (CVAA,LL)	CV/AA	5278161	2017/11/22	2017/11/23	Arlene Rossiter
Metals Water Diss. MS (as rec'd)	CICP/MS	5280304	N/A	2017/11/23	Mike Leblanc
Ion Balance (% Difference)	CALC	5275721	N/A	2017/11/29	Automated Statchk
Anion and Cation Sum	CALC	5275722	N/A	2017/11/24	Automated Statchk
Nitrogen Ammonia - water	KONE	5282490	N/A	2017/11/23	Nancy Rogers
Nitrogen - Nitrate + Nitrite	KONE	5283136	N/A	2017/11/28	Nancy Rogers
Nitrogen - Nitrite	KONE	5283138	N/A	2017/11/27	Nancy Rogers
Nitrogen - Nitrate (as N)	CALC	5275723	N/A	2017/11/28	Automated Statchk
pH	AT	5278361	N/A	2017/11/22	Julia McGovern
Phosphorus - ortho	KONE	5283134	N/A	2017/11/27	Nancy Rogers
Radium Isotopes by Alpha Spectrometry	AS	5279434	N/A	2017/12/01	Rajmeet Kaur
Sat. pH and Langelier Index (@ 20C)	CALC	5275725	N/A	2017/11/29	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5275726	N/A	2017/11/29	Automated Statchk
Reactive Silica	KONE	5283126	N/A	2017/11/27	Nancy Rogers
Sulphate	KONE	5283125	N/A	2017/11/27	Nancy Rogers
Total Dissolved Solids (TDS calc)	CALC	5275727	N/A	2017/11/29	Automated Statchk
Organic carbon - Total (TOC)	TECH	5288033	N/A	2017/11/28	Luke MacPherson
Turbidity	TURB	5280326	N/A	2017/11/23	Julia McGovern

Maxxam ID: FPB609 Dup
Sample ID: MA-17-158-2017
Matrix: Water

Collected: 2017/11/14
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	KONE	5283121	N/A	2017/11/27	Nancy Rogers
Chloride	KONE	5283123	N/A	2017/11/28	Nancy Rogers
Str. Acid Diss. Cyanide water	TECH	5278495	N/A	2017/11/22	Cliff Raymond
Colour	KONE	5283132	N/A	2017/11/27	Nancy Rogers
Conductance - water	AT	5278364	N/A	2017/11/22	Julia McGovern
Nitrogen - Nitrate + Nitrite	KONE	5283136	N/A	2017/11/28	Nancy Rogers
Nitrogen - Nitrite	KONE	5283138	N/A	2017/11/27	Nancy Rogers
pH	AT	5278361	N/A	2017/11/22	Julia McGovern
Phosphorus - ortho	KONE	5283134	N/A	2017/11/27	Nancy Rogers
Reactive Silica	KONE	5283126	N/A	2017/11/27	Nancy Rogers
Sulphate	KONE	5283125	N/A	2017/11/27	Nancy Rogers

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

TEST SUMMARY

Maxxam ID: FPB610
Sample ID: MA-17-218-2017
Matrix: Water

Collected: 2017/11/15
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	5275719	N/A	2017/11/23	Automated Statchk
Alkalinity	KONE	5283121	N/A	2017/11/27	Nancy Rogers
Chloride	KONE	5283123	N/A	2017/11/28	Nancy Rogers
Cyanide free in Water		5281654	2017/11/27	2017/11/28	Eric Dearman
Str. Acid Diss. Cyanide water	TECH	5278495	N/A	2017/11/22	Cliff Raymond
Colour	KONE	5283132	N/A	2017/11/27	Nancy Rogers
Conductance - water	AT	5278364	N/A	2017/11/22	Julia McGovern
Hardness (calculated as CaCO3)		5275720	N/A	2017/11/24	Automated Statchk
Mercury - Dissolved (CVAA,LL)	CV/AA	5278161	2017/11/22	2017/11/23	Arlene Rossiter
Metals Water Diss. MS (as rec'd)	CICP/MS	5280304	N/A	2017/11/23	Mike Leblanc
Ion Balance (% Difference)	CALC	5275721	N/A	2017/11/29	Automated Statchk
Anion and Cation Sum	CALC	5275722	N/A	2017/11/24	Automated Statchk
Nitrogen Ammonia - water	KONE	5282490	N/A	2017/11/23	Nancy Rogers
Nitrogen - Nitrate + Nitrite	KONE	5283136	N/A	2017/11/28	Nancy Rogers
Nitrogen - Nitrite	KONE	5283138	N/A	2017/11/27	Nancy Rogers
Nitrogen - Nitrate (as N)	CALC	5275723	N/A	2017/11/28	Automated Statchk
pH	AT	5278361	N/A	2017/11/22	Julia McGovern
Phosphorus - ortho	KONE	5283134	N/A	2017/11/27	Nancy Rogers
Radium Isotopes by Alpha Spectrometry	AS	5279434	N/A	2017/12/04	Rajmeet Kaur
Sat. pH and Langelier Index (@ 20C)	CALC	5275725	N/A	2017/11/29	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5275726	N/A	2017/11/29	Automated Statchk
Reactive Silica	KONE	5283126	N/A	2017/11/27	Nancy Rogers
Sulphate	KONE	5283125	N/A	2017/11/27	Nancy Rogers
Total Dissolved Solids (TDS calc)	CALC	5275727	N/A	2017/11/29	Automated Statchk
Organic carbon - Total (TOC)	TECH	5288033	N/A	2017/11/28	Luke MacPherson
Turbidity	TURB	5280326	N/A	2017/11/23	Julia McGovern

Maxxam ID: FPB611
Sample ID: MA-17-250-2017
Matrix: Water

Collected: 2017/11/15
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	5275719	N/A	2017/11/23	Automated Statchk
Alkalinity	KONE	5283121	N/A	2017/11/27	Nancy Rogers
Chloride	KONE	5283123	N/A	2017/11/28	Nancy Rogers
Cyanide free in Water		5281654	2017/11/27	2017/11/28	Eric Dearman
Str. Acid Diss. Cyanide water	TECH	5278495	N/A	2017/11/22	Cliff Raymond
Colour	KONE	5283132	N/A	2017/11/27	Nancy Rogers
Conductance - water	AT	5278364	N/A	2017/11/22	Julia McGovern
Hardness (calculated as CaCO3)		5275720	N/A	2017/11/24	Automated Statchk
Mercury - Dissolved (CVAA,LL)	CV/AA	5278161	2017/11/22	2017/11/23	Arlene Rossiter
Metals Water Diss. MS	CICP/MS	5280296	N/A	2017/11/23	Mike Leblanc
Ion Balance (% Difference)	CALC	5275721	N/A	2017/11/29	Automated Statchk
Anion and Cation Sum	CALC	5275722	N/A	2017/11/24	Automated Statchk

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

TEST SUMMARY

Maxxam ID: FPB611
Sample ID: MA-17-250-2017
Matrix: Water

Collected: 2017/11/15
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrogen Ammonia - water	KONE	5282490	N/A	2017/11/23	Nancy Rogers
Nitrogen - Nitrate + Nitrite	KONE	5283136	N/A	2017/11/28	Nancy Rogers
Nitrogen - Nitrite	KONE	5283138	N/A	2017/11/27	Nancy Rogers
Nitrogen - Nitrate (as N)	CALC	5275723	N/A	2017/11/28	Automated Statchk
pH	AT	5278361	N/A	2017/11/22	Julia McGovern
Phosphorus - ortho	KONE	5283134	N/A	2017/11/27	Nancy Rogers
Radium Isotopes by Alpha Spectrometry	AS	5279434	N/A	2017/12/03	Rajmeet Kaur
Sat. pH and Langelier Index (@ 20C)	CALC	5275725	N/A	2017/11/29	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5275726	N/A	2017/11/29	Automated Statchk
Reactive Silica	KONE	5283126	N/A	2017/11/27	Nancy Rogers
Sulphate	KONE	5283125	N/A	2017/11/27	Nancy Rogers
Total Dissolved Solids (TDS calc)	CALC	5275727	N/A	2017/11/29	Automated Statchk
Organic carbon - Total (TOC)	TECH	5288033	N/A	2017/11/28	Luke MacPherson
Turbidity	TURB	5280326	N/A	2017/11/23	Julia McGovern

Maxxam ID: FPB612
Sample ID: VL-11-248-2017
Matrix: Water

Collected: 2017/11/15
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	5275719	N/A	2017/11/23	Automated Statchk
Alkalinity	KONE	5282880	N/A	2017/11/27	Nancy Rogers
Chloride	KONE	5282882	N/A	2017/11/28	Nancy Rogers
Cyanide free in Water		5281654	2017/11/27	2017/11/28	Eric Dearman
Str. Acid Diss. Cyanide water	TECH	5278495	N/A	2017/11/22	Cliff Raymond
Colour	KONE	5282885	N/A	2017/11/27	Nancy Rogers
Conductance - water	AT	5278364	N/A	2017/11/22	Julia McGovern
Hardness (calculated as CaCO3)		5275720	N/A	2017/11/24	Automated Statchk
Mercury - Dissolved (CVAA,LL)	CV/AA	5278161	2017/11/22	2017/11/23	Arlene Rossiter
Metals Water Diss. MS (as rec'd)	CICP/MS	5280304	N/A	2017/11/23	Mike Leblanc
Ion Balance (% Difference)	CALC	5275721	N/A	2017/11/29	Automated Statchk
Anion and Cation Sum	CALC	5275722	N/A	2017/11/24	Automated Statchk
Nitrogen Ammonia - water	KONE	5282490	N/A	2017/11/23	Nancy Rogers
Nitrogen - Nitrate + Nitrite	KONE	5282891	N/A	2017/11/28	Nancy Rogers
Nitrogen - Nitrite	KONE	5282892	N/A	2017/11/27	Nancy Rogers
Nitrogen - Nitrate (as N)	CALC	5275723	N/A	2017/11/28	Automated Statchk
pH	AT	5278361	N/A	2017/11/22	Julia McGovern
Phosphorus - ortho	KONE	5282887	N/A	2017/11/27	Nancy Rogers
Radium Isotopes by Alpha Spectrometry	AS	5279434	N/A	2017/12/03	Rajmeet Kaur
Sat. pH and Langelier Index (@ 20C)	CALC	5275725	N/A	2017/11/29	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5275726	N/A	2017/11/29	Automated Statchk
Reactive Silica	KONE	5282884	N/A	2017/11/27	Nancy Rogers
Sulphate	KONE	5282883	N/A	2017/11/27	Nancy Rogers
Total Dissolved Solids (TDS calc)	CALC	5275727	N/A	2017/11/29	Automated Statchk

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

TEST SUMMARY

Maxxam ID: FPB612
Sample ID: VL-11-248-2017
Matrix: Water

Collected: 2017/11/15
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Organic carbon - Total (TOC)	TECH	5288033	N/A	2017/11/28	Luke MacPherson
Turbidity	TURB	5280326	N/A	2017/11/23	Julia McGovern

Maxxam ID: FPB612 Dup
Sample ID: VL-11-248-2017
Matrix: Water

Collected: 2017/11/15
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals Water Diss. MS (as rec'd)	CICP/MS	5280304	N/A	2017/11/23	Mike Leblanc

Maxxam ID: FPB613
Sample ID: VL-17-650-2017
Matrix: Water

Collected: 2017/11/16
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	5275719	N/A	2017/11/23	Automated Statchk
Alkalinity	KONE	5283142	N/A	2017/11/28	Nancy Rogers
Chloride	KONE	5283147	N/A	2017/11/28	Nancy Rogers
Cyanide free in Water		5281654	2017/11/27	2017/11/28	Eric Dearman
Str. Acid Diss. Cyanide water	TECH	5278495	N/A	2017/11/22	Cliff Raymond
Colour	KONE	5283163	N/A	2017/11/27	Nancy Rogers
Conductance - water	AT	5278364	N/A	2017/11/22	Julia McGovern
Hardness (calculated as CaCO3)		5275720	N/A	2017/11/24	Automated Statchk
Mercury - Dissolved (CVAA,LL)	CV/AA	5278161	2017/11/22	2017/11/23	Arlene Rossiter
Metals Water Diss. MS (as rec'd)	CICP/MS	5280304	N/A	2017/11/23	Mike Leblanc
Ion Balance (% Difference)	CALC	5275721	N/A	2017/11/29	Automated Statchk
Anion and Cation Sum	CALC	5275722	N/A	2017/11/24	Automated Statchk
Nitrogen Ammonia - water	KONE	5282490	N/A	2017/11/23	Nancy Rogers
Nitrogen - Nitrate + Nitrite	KONE	5283169	N/A	2017/11/28	Nancy Rogers
Nitrogen - Nitrite	KONE	5283171	N/A	2017/11/27	Nancy Rogers
Nitrogen - Nitrate (as N)	CALC	5275723	N/A	2017/11/28	Automated Statchk
pH	AT	5278361	N/A	2017/11/22	Julia McGovern
Phosphorus - ortho	KONE	5283166	N/A	2017/11/27	Nancy Rogers
Radium Isotopes by Alpha Spectrometry	AS	5279434	N/A	2017/12/03	Rajmeet Kaur
Sat. pH and Langelier Index (@ 20C)	CALC	5275725	N/A	2017/11/29	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5275726	N/A	2017/11/29	Automated Statchk
Reactive Silica	KONE	5283151	N/A	2017/11/28	Nancy Rogers
Sulphate	KONE	5283150	N/A	2017/11/27	Nancy Rogers
Total Dissolved Solids (TDS calc)	CALC	5275727	N/A	2017/11/29	Automated Statchk
Organic carbon - Total (TOC)	TECH	5288033	N/A	2017/11/28	Luke MacPherson
Turbidity	TURB	5280327	N/A	2017/11/23	Julia McGovern

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

TEST SUMMARY

Maxxam ID: FPB614
Sample ID: VL-09-134-2017
Matrix: Water

Collected: 2017/11/16
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	5275719	N/A	2017/11/23	Automated Statchk
Alkalinity	KONE	5283142	N/A	2017/11/28	Nancy Rogers
Chloride	KONE	5283147	N/A	2017/11/28	Nancy Rogers
Cyanide free in Water		5281654	2017/11/27	2017/11/28	Eric Dearman
Str. Acid Diss. Cyanide water	TECH	5278495	N/A	2017/11/22	Cliff Raymond
Colour	KONE	5283163	N/A	2017/11/27	Nancy Rogers
Conductance - water	AT	5278359	N/A	2017/11/22	Julia McGovern
Hardness (calculated as CaCO3)		5275720	N/A	2017/11/24	Automated Statchk
Mercury - Dissolved (CVAA,LL)	CV/AA	5278161	2017/11/22	2017/11/23	Arlene Rossiter
Metals Water Diss. MS	CICP/MS	5280296	N/A	2017/11/23	Mike Leblanc
Ion Balance (% Difference)	CALC	5275721	N/A	2017/11/29	Automated Statchk
Anion and Cation Sum	CALC	5275722	N/A	2017/11/24	Automated Statchk
Nitrogen Ammonia - water	KONE	5282490	N/A	2017/11/23	Nancy Rogers
Nitrogen - Nitrate + Nitrite	KONE	5283169	N/A	2017/11/28	Nancy Rogers
Nitrogen - Nitrite	KONE	5283171	N/A	2017/11/27	Nancy Rogers
Nitrogen - Nitrate (as N)	CALC	5275723	N/A	2017/11/28	Automated Statchk
pH	AT	5278356	N/A	2017/11/22	Julia McGovern
Phosphorus - ortho	KONE	5283166	N/A	2017/11/27	Nancy Rogers
Radium Isotopes by Alpha Spectrometry	AS	5279434	N/A	2017/12/03	Rajmeet Kaur
Sat. pH and Langelier Index (@ 20C)	CALC	5275725	N/A	2017/11/29	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5275726	N/A	2017/11/29	Automated Statchk
Reactive Silica	KONE	5283151	N/A	2017/11/28	Nancy Rogers
Sulphate	KONE	5283150	N/A	2017/11/27	Nancy Rogers
Total Dissolved Solids (TDS calc)	CALC	5275727	N/A	2017/11/29	Automated Statchk
Organic carbon - Total (TOC)	TECH	5288033	N/A	2017/11/28	Luke MacPherson
Turbidity	TURB	5280327	N/A	2017/11/23	Julia McGovern

Maxxam ID: FPB615
Sample ID: FLD-DUP-1-2017
Matrix: Water

Collected: 2017/11/14
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Cyanide free in Water		5281654	2017/11/27	2017/11/28	Eric Dearman
Str. Acid Diss. Cyanide water	TECH	5278495	N/A	2017/11/22	Cliff Raymond

Maxxam ID: FPB616
Sample ID: FLD-DUP-2-2017
Matrix: Water

Collected: 2017/11/15
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury - Dissolved (CVAA,LL)	CV/AA	5278161	2017/11/22	2017/11/23	Arlene Rossiter

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

TEST SUMMARY

Maxxam ID: FPB617
Sample ID: FLD-DUP-4-2017
Matrix: Water

Collected: 2017/11/15
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Radium Isotopes by Alpha Spectrometry	AS	5279434	N/A	2017/12/03	Rajmeet Kaur

Maxxam ID: FPB618
Sample ID: FLD-DUP-5-2017
Matrix: Water

Collected: 2017/11/16
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	5275719	N/A	2017/11/23	Automated Statchk
Alkalinity	KONE	5283142	N/A	2017/11/28	Nancy Rogers
Chloride	KONE	5283147	N/A	2017/11/28	Nancy Rogers
Colour	KONE	5283163	N/A	2017/11/27	Nancy Rogers
Conductance - water	AT	5278364	N/A	2017/11/22	Julia McGovern
Hardness (calculated as CaCO3)		5275720	N/A	2017/11/27	Automated Statchk
Metals Water Diss. MS	CICP/MS	5282445	N/A	2017/11/24	Bryon Angevine
Ion Balance (% Difference)	CALC	5275721	N/A	2017/11/29	Automated Statchk
Anion and Cation Sum	CALC	5275722	N/A	2017/11/27	Automated Statchk
Nitrogen Ammonia - water	KONE	5282490	N/A	2017/11/23	Nancy Rogers
Nitrogen - Nitrate + Nitrite	KONE	5283169	N/A	2017/11/28	Nancy Rogers
Nitrogen - Nitrite	KONE	5283171	N/A	2017/11/27	Nancy Rogers
Nitrogen - Nitrate (as N)	CALC	5275723	N/A	2017/11/28	Automated Statchk
pH	AT	5278361	N/A	2017/11/22	Julia McGovern
Phosphorus - ortho	KONE	5283166	N/A	2017/11/27	Nancy Rogers
Sat. pH and Langelier Index (@ 20C)	CALC	5275725	N/A	2017/11/29	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5275726	N/A	2017/11/29	Automated Statchk
Reactive Silica	KONE	5283151	N/A	2017/11/28	Nancy Rogers
Sulphate	KONE	5283150	N/A	2017/11/27	Nancy Rogers
Total Dissolved Solids (TDS calc)	CALC	5275727	N/A	2017/11/29	Automated Statchk
Organic carbon - Total (TOC)	TECH	5288033	N/A	2017/11/28	Luke MacPherson
Turbidity	TURB	5280327	N/A	2017/11/23	Julia McGovern

Maxxam ID: FPB618 Dup
Sample ID: FLD-DUP-5-2017
Matrix: Water

Collected: 2017/11/16
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	KONE	5283142	N/A	2017/11/28	Nancy Rogers
Chloride	KONE	5283147	N/A	2017/11/28	Nancy Rogers
Colour	KONE	5283163	N/A	2017/11/27	Nancy Rogers
Metals Water Diss. MS	CICP/MS	5282445	N/A	2017/11/24	Bryon Angevine
Nitrogen - Nitrate + Nitrite	KONE	5283169	N/A	2017/11/28	Nancy Rogers
Nitrogen - Nitrite	KONE	5283171	N/A	2017/11/27	Nancy Rogers
Phosphorus - ortho	KONE	5283166	N/A	2017/11/27	Nancy Rogers
Reactive Silica	KONE	5283151	N/A	2017/11/28	Nancy Rogers
Sulphate	KONE	5283150	N/A	2017/11/27	Nancy Rogers

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

TEST SUMMARY

Maxxam ID: FPB618 Dup
Sample ID: FLD-DUP-5-2017
Matrix: Water

Collected: 2017/11/16
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Turbidity	TURB	5280327	N/A	2017/11/23	Julia McGovern

Maxxam ID: FPB620
Sample ID: INJECTION WATER
Matrix: Water

Collected: 2017/11/14
Shipped:
Received: 2017/11/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	5275719	N/A	2017/11/23	Automated Statchk
Alkalinity	KONE	5283142	N/A	2017/11/28	Nancy Rogers
Chloride	KONE	5283147	N/A	2017/11/28	Nancy Rogers
Colour	KONE	5283163	N/A	2017/11/27	Nancy Rogers
Conductance - water	AT	5278364	N/A	2017/11/22	Julia McGovern
Hardness (calculated as CaCO3)		5275720	N/A	2017/11/24	Automated Statchk
Metals Water Diss. MS (as rec'd)	CICP/MS	5280304	N/A	2017/11/23	Mike Leblanc
Ion Balance (% Difference)	CALC	5275721	N/A	2017/11/29	Automated Statchk
Anion and Cation Sum	CALC	5275722	N/A	2017/11/24	Automated Statchk
Nitrogen Ammonia - water	KONE	5282490	N/A	2017/11/23	Nancy Rogers
Nitrogen - Nitrate + Nitrite	KONE	5283169	N/A	2017/11/28	Nancy Rogers
Nitrogen - Nitrite	KONE	5283171	N/A	2017/11/27	Nancy Rogers
Nitrogen - Nitrate (as N)	CALC	5275723	N/A	2017/11/28	Automated Statchk
pH	AT	5278361	N/A	2017/11/22	Julia McGovern
Phosphorus - ortho	KONE	5283166	N/A	2017/11/27	Nancy Rogers
Sat. pH and Langelier Index (@ 20C)	CALC	5275725	N/A	2017/11/29	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5275726	N/A	2017/11/29	Automated Statchk
Reactive Silica	KONE	5283151	N/A	2017/11/28	Nancy Rogers
Sulphate	KONE	5283150	N/A	2017/11/27	Nancy Rogers
Total Dissolved Solids (TDS calc)	CALC	5275727	N/A	2017/11/29	Automated Statchk
Organic carbon - Total (TOC)	TECH	5288033	N/A	2017/11/28	Luke MacPherson
Turbidity	TURB	5280327	N/A	2017/11/23	Julia McGovern

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	6.7°C

Sample FPB610 [MA-17-218-2017] : Poor RCAp Ion Balance due to sample matrix.

Results relate only to the items tested.

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

QUALITY ASSURANCE REPORT

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5278161	Dissolved Mercury (Hg)	2017/11/23	103	80 - 120	102	80 - 120	<0.013	ug/L	NC	20		
5278356	pH	2017/11/22							5.2 (1)	N/A	100	97 - 103
5278359	Conductivity	2017/11/22			103	80 - 120	1.6, RDL=1.0	uS/cm	0.00097	25		
5278361	pH	2017/11/22							0.80	N/A	100	97 - 103
5278364	Conductivity	2017/11/22			103	80 - 120	1.5, RDL=1.0	uS/cm	0.93	25		
5278495	Strong Acid Dissoc. Cyanide (CN)	2017/11/22	102	80 - 120	103	80 - 120	<0.0010	mg/L	NC	25		
5279434	Radium-226	2017/11/30			86	85 - 115	<0.010	Bq/L	NC	N/A		
5280296	Dissolved Aluminum (Al)	2017/11/23	101	80 - 120	99	80 - 120	<5.0	ug/L	NC	20		
5280296	Dissolved Antimony (Sb)	2017/11/23	101	80 - 120	99	80 - 120	<1.0	ug/L	NC	20		
5280296	Dissolved Arsenic (As)	2017/11/23	99	80 - 120	97	80 - 120	<1.0	ug/L	4.3	20		
5280296	Dissolved Barium (Ba)	2017/11/23	91	80 - 120	96	80 - 120	<1.0	ug/L	1.6	20		
5280296	Dissolved Beryllium (Be)	2017/11/23	98	80 - 120	98	80 - 120	<1.0	ug/L	NC	20		
5280296	Dissolved Bismuth (Bi)	2017/11/23	102	80 - 120	105	80 - 120	<2.0	ug/L	NC	20		
5280296	Dissolved Boron (B)	2017/11/23	103	80 - 120	103	80 - 120	<50	ug/L	NC	20		
5280296	Dissolved Cadmium (Cd)	2017/11/23	99	80 - 120	99	80 - 120	<0.010	ug/L	NC	20		
5280296	Dissolved Calcium (Ca)	2017/11/23	NC	80 - 120	101	80 - 120	<100	ug/L	0.42	20		
5280296	Dissolved Chromium (Cr)	2017/11/23	97	80 - 120	96	80 - 120	<1.0	ug/L	NC	20		
5280296	Dissolved Cobalt (Co)	2017/11/23	97	80 - 120	97	80 - 120	<0.40	ug/L	NC	20		
5280296	Dissolved Copper (Cu)	2017/11/23	96	80 - 120	96	80 - 120	<2.0	ug/L	NC	20		
5280296	Dissolved Iron (Fe)	2017/11/23	100	80 - 120	99	80 - 120	<50	ug/L	NC	20		
5280296	Dissolved Lead (Pb)	2017/11/23	95	80 - 120	96	80 - 120	<0.50	ug/L	NC	20		
5280296	Dissolved Magnesium (Mg)	2017/11/23	100	80 - 120	101	80 - 120	<100	ug/L	0.24	20		
5280296	Dissolved Manganese (Mn)	2017/11/23	NC	80 - 120	99	80 - 120	<2.0	ug/L	0.49	20		
5280296	Dissolved Molybdenum (Mo)	2017/11/23	104	80 - 120	103	80 - 120	<2.0	ug/L	NC	20		
5280296	Dissolved Nickel (Ni)	2017/11/23	98	80 - 120	98	80 - 120	<2.0	ug/L	NC	20		
5280296	Dissolved Phosphorus (P)	2017/11/23	104	80 - 120	103	80 - 120	<100	ug/L	NC	20		
5280296	Dissolved Potassium (K)	2017/11/23	98	80 - 120	99	80 - 120	<100	ug/L	0.023	20		
5280296	Dissolved Selenium (Se)	2017/11/23	100	80 - 120	98	80 - 120	<1.0	ug/L	NC	20		
5280296	Dissolved Silver (Ag)	2017/11/23	97	80 - 120	98	80 - 120	<0.10	ug/L	NC	20		
5280296	Dissolved Sodium (Na)	2017/11/23	94	80 - 120	99	80 - 120	<100	ug/L	0.83	20		
5280296	Dissolved Strontium (Sr)	2017/11/23	NC	80 - 120	96	80 - 120	<2.0	ug/L	0.12	20		

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

QUALITY ASSURANCE REPORT(CONT'D)

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5280296	Dissolved Thallium (Tl)	2017/11/23	103	80 - 120	105	80 - 120	<0.10	ug/L	NC	20		
5280296	Dissolved Tin (Sn)	2017/11/23	104	80 - 120	104	80 - 120	<2.0	ug/L	NC	20		
5280296	Dissolved Titanium (Ti)	2017/11/23	96	80 - 120	100	80 - 120	<2.0	ug/L	NC	20		
5280296	Dissolved Uranium (U)	2017/11/23	103	80 - 120	103	80 - 120	<0.10	ug/L	NC	20		
5280296	Dissolved Vanadium (V)	2017/11/23	97	80 - 120	96	80 - 120	<2.0	ug/L	NC	20		
5280296	Dissolved Zinc (Zn)	2017/11/23	103	80 - 120	105	80 - 120	<5.0	ug/L	NC	20		
5280304	Dissolved Aluminum (Al)	2017/11/23	99	80 - 120	100	80 - 120	<5.0	ug/L	NC	20		
5280304	Dissolved Antimony (Sb)	2017/11/23	102	80 - 120	99	80 - 120	<1.0	ug/L	NC	20		
5280304	Dissolved Arsenic (As)	2017/11/23	98	80 - 120	97	80 - 120	<1.0	ug/L	NC	20		
5280304	Dissolved Barium (Ba)	2017/11/23	95	80 - 120	94	80 - 120	<1.0	ug/L	7.3	20		
5280304	Dissolved Beryllium (Be)	2017/11/23	96	80 - 120	96	80 - 120	<1.0	ug/L	NC	20		
5280304	Dissolved Bismuth (Bi)	2017/11/23	103	80 - 120	103	80 - 120	<2.0	ug/L	NC	20		
5280304	Dissolved Boron (B)	2017/11/23	95	80 - 120	101	80 - 120	<50	ug/L	NC	20		
5280304	Dissolved Cadmium (Cd)	2017/11/23	100	80 - 120	98	80 - 120	<0.010	ug/L	NC	20		
5280304	Dissolved Calcium (Ca)	2017/11/23	NC	80 - 120	101	80 - 120	<100	ug/L	0.13	20		
5280304	Dissolved Chromium (Cr)	2017/11/23	95	80 - 120	95	80 - 120	<1.0	ug/L	NC	20		
5280304	Dissolved Cobalt (Co)	2017/11/23	95	80 - 120	96	80 - 120	<0.40	ug/L	NC	20		
5280304	Dissolved Copper (Cu)	2017/11/23	93	80 - 120	95	80 - 120	<2.0	ug/L	NC	20		
5280304	Dissolved Iron (Fe)	2017/11/23	97	80 - 120	100	80 - 120	<50	ug/L	NC	20		
5280304	Dissolved Lead (Pb)	2017/11/23	96	80 - 120	97	80 - 120	<0.50	ug/L	NC	20		
5280304	Dissolved Magnesium (Mg)	2017/11/23	97	80 - 120	102	80 - 120	<100	ug/L	0.82	20		
5280304	Dissolved Manganese (Mn)	2017/11/23	96	80 - 120	97	80 - 120	<2.0	ug/L	3.5	20		
5280304	Dissolved Molybdenum (Mo)	2017/11/23	103	80 - 120	103	80 - 120	<2.0	ug/L	NC	20		
5280304	Dissolved Nickel (Ni)	2017/11/23	95	80 - 120	97	80 - 120	<2.0	ug/L	NC	20		
5280304	Dissolved Phosphorus (P)	2017/11/23	102	80 - 120	102	80 - 120	<100	ug/L	NC	20		
5280304	Dissolved Potassium (K)	2017/11/23	98	80 - 120	98	80 - 120	<100	ug/L	0.47	20		
5280304	Dissolved Selenium (Se)	2017/11/23	99	80 - 120	98	80 - 120	<1.0	ug/L	NC	20		
5280304	Dissolved Silver (Ag)	2017/11/23	98	80 - 120	96	80 - 120	<0.10	ug/L	NC	20		
5280304	Dissolved Sodium (Na)	2017/11/23	96	80 - 120	100	80 - 120	<100	ug/L	0.38	20		
5280304	Dissolved Strontium (Sr)	2017/11/23	NC	80 - 120	96	80 - 120	<2.0	ug/L	0.91	20		
5280304	Dissolved Thallium (Tl)	2017/11/23	103	80 - 120	104	80 - 120	<0.10	ug/L	NC	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5280304	Dissolved Tin (Sn)	2017/11/23	107	80 - 120	104	80 - 120	<2.0	ug/L	NC	20		
5280304	Dissolved Titanium (Ti)	2017/11/23	97	80 - 120	99	80 - 120	<2.0	ug/L	NC	20		
5280304	Dissolved Uranium (U)	2017/11/23	103	80 - 120	103	80 - 120	<0.10	ug/L	0.32	20		
5280304	Dissolved Vanadium (V)	2017/11/23	95	80 - 120	96	80 - 120	<2.0	ug/L	NC	20		
5280304	Dissolved Zinc (Zn)	2017/11/23	99	80 - 120	100	80 - 120	<5.0	ug/L	NC	20		
5280326	Turbidity	2017/11/23			92	80 - 120	<0.10	NTU	2.3	20	97	80 - 120
5280327	Turbidity	2017/11/23			93	80 - 120	<0.10	NTU	0.13	20	97	80 - 120
5282445	Dissolved Aluminum (Al)	2017/11/24	99	80 - 120	103	80 - 120	<5.0	ug/L	NC	20		
5282445	Dissolved Antimony (Sb)	2017/11/24	98	80 - 120	97	80 - 120	<1.0	ug/L	NC	20		
5282445	Dissolved Arsenic (As)	2017/11/24	99	80 - 120	98	80 - 120	<1.0	ug/L	2.7	20		
5282445	Dissolved Barium (Ba)	2017/11/24	94	80 - 120	99	80 - 120	<1.0	ug/L	2.3	20		
5282445	Dissolved Beryllium (Be)	2017/11/24	106	80 - 120	104	80 - 120	<1.0	ug/L	NC	20		
5282445	Dissolved Bismuth (Bi)	2017/11/24	102	80 - 120	103	80 - 120	<2.0	ug/L	NC	20		
5282445	Dissolved Boron (B)	2017/11/24	108	80 - 120	108	80 - 120	<50	ug/L	NC	20		
5282445	Dissolved Cadmium (Cd)	2017/11/24	99	80 - 120	98	80 - 120	<0.010	ug/L	4.3	20		
5282445	Dissolved Calcium (Ca)	2017/11/24	NC	80 - 120	103	80 - 120	<100	ug/L	1.1	20		
5282445	Dissolved Chromium (Cr)	2017/11/24	100	80 - 120	100	80 - 120	<1.0	ug/L	NC	20		
5282445	Dissolved Cobalt (Co)	2017/11/24	99	80 - 120	100	80 - 120	<0.40	ug/L	13	20		
5282445	Dissolved Copper (Cu)	2017/11/24	94	80 - 120	96	80 - 120	<2.0	ug/L	NC	20		
5282445	Dissolved Iron (Fe)	2017/11/24	97	80 - 120	101	80 - 120	<50	ug/L	NC	20		
5282445	Dissolved Lead (Pb)	2017/11/24	97	80 - 120	98	80 - 120	<0.50	ug/L	NC	20		
5282445	Dissolved Magnesium (Mg)	2017/11/24	97	80 - 120	102	80 - 120	<100	ug/L	1.5	20		
5282445	Dissolved Manganese (Mn)	2017/11/24	NC	80 - 120	99	80 - 120	<2.0	ug/L	1.5	20		
5282445	Dissolved Molybdenum (Mo)	2017/11/24	105	80 - 120	99	80 - 120	<2.0	ug/L	NC	20		
5282445	Dissolved Nickel (Ni)	2017/11/24	98	80 - 120	99	80 - 120	<2.0	ug/L	NC	20		
5282445	Dissolved Phosphorus (P)	2017/11/24	105	80 - 120	105	80 - 120	<100	ug/L	NC	20		
5282445	Dissolved Potassium (K)	2017/11/24	104	80 - 120	104	80 - 120	<100	ug/L	3.1	20		
5282445	Dissolved Selenium (Se)	2017/11/24	101	80 - 120	99	80 - 120	<1.0	ug/L	NC	20		
5282445	Dissolved Silver (Ag)	2017/11/24	98	80 - 120	97	80 - 120	<0.10	ug/L	NC	20		
5282445	Dissolved Sodium (Na)	2017/11/24	98	80 - 120	101	80 - 120	<100	ug/L	1.3	20		
5282445	Dissolved Strontium (Sr)	2017/11/24	NC	80 - 120	97	80 - 120	<2.0	ug/L	1.8	20		

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

QUALITY ASSURANCE REPORT(CONT'D)

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5282445	Dissolved Thallium (Tl)	2017/11/24	102	80 - 120	103	80 - 120	<0.10	ug/L	NC	20		
5282445	Dissolved Tin (Sn)	2017/11/24	104	80 - 120	101	80 - 120	<2.0	ug/L	NC	20		
5282445	Dissolved Titanium (Ti)	2017/11/24	102	80 - 120	99	80 - 120	<2.0	ug/L	NC	20		
5282445	Dissolved Uranium (U)	2017/11/24	101	80 - 120	101	80 - 120	<0.10	ug/L	3.4	20		
5282445	Dissolved Vanadium (V)	2017/11/24	101	80 - 120	101	80 - 120	<2.0	ug/L	NC	20		
5282445	Dissolved Zinc (Zn)	2017/11/24	100	80 - 120	102	80 - 120	<5.0	ug/L	NC	20		
5282490	Nitrogen (Ammonia Nitrogen)	2017/11/24	NC	80 - 120	105	80 - 120	<0.050	mg/L	0.50	20		
5282880	Total Alkalinity (Total as CaCO3)	2017/11/27	NC	80 - 120	108	80 - 120	<5.0	mg/L	3.8	25		
5282882	Dissolved Chloride (Cl)	2017/11/28	105	80 - 120	107	80 - 120	<1.0	mg/L	1.5	25	113	80 - 120
5282883	Dissolved Sulphate (SO4)	2017/11/27	98	80 - 120	98	80 - 120	<2.0	mg/L	6.8	25		
5282884	Reactive Silica (SiO2)	2017/11/27	NC	80 - 120	99	80 - 120	<0.50	mg/L	0.54	25		
5282885	Colour	2017/11/27			101	80 - 120	<5.0	TCU	NC	20		
5282887	Orthophosphate (P)	2017/11/27	97	80 - 120	105	80 - 120	<0.010	mg/L	9.5	25		
5282891	Nitrate + Nitrite (N)	2017/11/28	92	80 - 120	95	80 - 120	<0.050	mg/L	NC	25		
5282892	Nitrite (N)	2017/11/27	102	80 - 120	106	80 - 120	<0.010	mg/L	NC	25		
5283121	Total Alkalinity (Total as CaCO3)	2017/11/27	NC	80 - 120	108	80 - 120	<5.0	mg/L	0.36 (2)	25		
5283123	Dissolved Chloride (Cl)	2017/11/28	100	80 - 120	105	80 - 120	<1.0	mg/L	1.3	25	113	80 - 120
5283125	Dissolved Sulphate (SO4)	2017/11/27	102	80 - 120	96	80 - 120	<2.0	mg/L	8.5	25		
5283126	Reactive Silica (SiO2)	2017/11/27	NC	80 - 120	99	80 - 120	<0.50	mg/L	0.35	25		
5283132	Colour	2017/11/27			102	80 - 120	<5.0	TCU	NC	20		
5283134	Orthophosphate (P)	2017/11/27	99	80 - 120	105	80 - 120	<0.010	mg/L	0.86	25		
5283136	Nitrate + Nitrite (N)	2017/11/28	96	80 - 120	96	80 - 120	<0.050	mg/L	NC	25		
5283138	Nitrite (N)	2017/11/27	103	80 - 120	107	80 - 120	<0.010	mg/L	NC	25		
5283142	Total Alkalinity (Total as CaCO3)	2017/11/28	NC	80 - 120	107	80 - 120	<5.0	mg/L	3.5 (2)	25		
5283147	Dissolved Chloride (Cl)	2017/11/28	108	80 - 120	106	80 - 120	<1.0	mg/L	5.1	25	111	80 - 120
5283150	Dissolved Sulphate (SO4)	2017/11/27	99	80 - 120	99	80 - 120	<2.0	mg/L	2.3	25		
5283151	Reactive Silica (SiO2)	2017/11/28	NC	80 - 120	100	80 - 120	<0.50	mg/L	0.56	25		
5283163	Colour	2017/11/27			100	80 - 120	<5.0	TCU	NC	20		
5283166	Orthophosphate (P)	2017/11/27	96	80 - 120	106	80 - 120	<0.010	mg/L	11	25		
5283169	Nitrate + Nitrite (N)	2017/11/28	93	80 - 120	89	80 - 120	<0.050	mg/L	NC	25		
5283171	Nitrite (N)	2017/11/27	93	80 - 120	106	80 - 120	<0.010	mg/L	NC	25		

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Maxxam Job #: B7Q1410
Report Date: 2017/12/06

QUALITY ASSURANCE REPORT(CONT'D)

Stantec Consulting Ltd
Client Project #: 121414740
Site Location: MARATHON
Sampler Initials: AP

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5288033	Total Organic Carbon (C)	2017/11/28	91	80 - 120	96	80 - 120	<0.50	mg/L	3.1	20		

N/A = Not Applicable

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Poor duplicate results due to sample matrix, results confirmed by repeat analysis.

(2) Elevated reporting limit due to sample martix.

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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

<Original signed by>

Eric Dearman, Scientific Specialist

<Original signed by>

Kevin MacDonald, Inorganics Supervisor

<Original signed by>

Steven Simpson, Lab Director

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Your Project #: B7Q1410
Your C.O.C. #: N-A

Attention:Heather Macumber

Maxxam Analytics
200 Bluewater road
Bedford, NS
CANADA B4B 1G9

Report Date: 2017/11/28
Report #: R2339572
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B770222
Received: 2017/11/23, 09:00

Sample Matrix: WATER
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Primary Reference
Weak Acid Dissociable Cyanides*	7	2017/11/27	2017/11/28	STL SOP-00035	MA300-CN 1.2 R3 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
Note: RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

* Maxxam is accredited as per the MDDELCC program.

Your Project #: B7Q1410
Your C.O.C. #: N-A

Attention:Heather Macumber

Maxxam Analytics
200 Bluewater road
Bedford, NS
CANADA B4B 1G9

Report Date: 2017/11/28
Report #: R2339572
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B770222
Received: 2017/11/23, 09:00

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Sophie Retailleau, Project Manager
Email: SRetailleau@maxxam.ca
Phone# (514) 448-9001
==
This report has been generated and distributed using a secure automated process.
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Maxxam Job #: B770222
Report Date: 2017/11/28

Maxxam Analytics
Client Project #: B7Q1410

CONVENTIONAL PARAMETERS (WATER)

Maxxam ID		EW7292	EW7293	EW7294		
Sampling Date		2017/11/14	2017/11/14	2017/11/14		
COC Number		N-A	N-A	N-A		
	Units	**FPB609-07R/MA-17-158-2017**	**FPB610-07R/MA-17-218-2017**	**FPB611-06R/MA-17-250-2017**	**RDL**	**QC Batch**
CONVENTIONALS						
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.0030	<0.0030	<0.0030	0.0030	1862022

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		EW7295	EW7296	EW7297		
Sampling Date		2017/11/14	2017/11/14	2017/11/14		
COC Number		N-A	N-A	N-A		
	Units	**FPB612-07R/VL-11-248-2017**	**FPB613-07R/VL-17-650-2017**	**FPB614-06R/VL-09-134-2017**	**RDL**	**QC Batch**
CONVENTIONALS						
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.0030	<0.0030	<0.0030	0.0030	1862022

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		EW7298		
Sampling Date		2017/11/14		
COC Number		N-A		
	Units	**FPB615-02R/FLD-DUP-1-2017**	**RDL**	**QC Batch**
CONVENTIONALS				
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.0030	0.0030	1862022

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-4MAXXAM (462-9926)

GENERAL COMMENTS

CONVENTIONAL PARAMETERS (WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

Results relate only to the items tested.

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Maxxam Job #: B770222
Report Date: 2017/11/28

Maxxam Analytics
Client Project #: B7Q1410

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
1862022	ST1	Spiked Blank	Weak Acid Dissociable Cyanide (CN-)	2017/11/28		95	%	75 - 125
1862022	ST1	Method Blank	Weak Acid Dissociable Cyanide (CN-)	2017/11/28	<0.0030		mg/L	

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

<Original signed by>

Dochka Koleva Hristova, B.Sc., Chemist

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ATTACHMENT 3-B

Valentine Lake Project: Preliminary Hydrogeology Assessment, Water Level Data (2019)

Stantec Consulting Ltd.
141 Kelsey Drive, St. John's NL A1B 0L2

January 18, 2019
File: 121415923

Attention: Mr. James Powell
36 Birchview Drive
Pasadena, NL A0L 1K0

Dear Mr. Powell,

Reference: Valentine Lake Project: Preliminary Baseline Hydrogeology Assessment, Water Level Data

Stantec Consulting Ltd. (Stantec) was retained by Marathon Gold Corporation (Marathon) to conduct a number of environmental surveys at the Valentine Lake Project site (the site), including characterization of site hydrogeology. The preliminary baseline hydrogeology assessment was conducted to begin characterization of groundwater conditions at the site in November 2017 in support of mine development (the Project). A draft report summarizing the results of the initial hydrogeological assessment was submitted to Marathon on December 15, 2017 entitled *Valentine Lake Project: Preliminary Baseline Hydrogeology Assessment* (Stantec 2017). This letter report provides an update on hydrogeological data that has been collected since November 2017.

BACKGROUND

The overall baseline hydrogeology program was designed to support the assessment of environmental effects of the Project on water quantity and water quality; to support other technical evaluations such as mine water balance assessment; assimilative capacity assessment; to support the design of mine infrastructure; and to support the mine planning activities related to water management and discharge. The overall baseline hydrogeology program will form part of the supporting documentation for the EA completed for the Project.

The preliminary baseline hydrogeology assessment completed in December 2017 included a desktop review of available geological maps, hydrogeological reports, and air photos to develop a conceptual model of the Project area. A field program was also carried out which consisted of hydraulic testing, water sampling, and groundwater monitoring in six select exploration boreholes within the Leprechaun and Marathon deposits. These boreholes are listed in Table 1. Note that in the report *Valentine Lake Project: Preliminary Baseline Hydrogeology Assessment* (Stantec 2017), borehole VL-11-319 was incorrectly reported as VL-11-248.

Reference: **Valentine Lake Project: Preliminary Baseline Hydrogeology Assessment, Water Level Data**

Table 1 Water Loggers in Existing Exploration Boreholes

Borehole ID	Length (m)	Dip (degrees below horizontal)	Location
VL-09-134	25	90.0	Leprechaun Pond Pit
VL-11-319 [1]	112	72.0	Leprechaun Pond Pit
VL-17-650	488	80.0	Leprechaun Pond Pit
MA-17-158	317	86.3	Marathon Pit
MA-17-218 [2]	974	82.0	Marathon Pit
MA-17-250	600	80.0	Marathon Pit

Notes:
[1] Previously reported as VL-11-248
[2] Barometric logger installed

Water level data loggers were installed in the six boreholes in November 2017 to record water levels at 1-hour intervals to allow for better understanding of temporal variability of ground water levels in the area. The current investigation involved the retrieval of water level loggers, as well as manual water level measurements in 191 exploration boreholes throughout the Leprechaun, Sprite, and Marathon deposits. The locations of these boreholes are shown on Figure 1, attached.

METHOD

The field component of water logger retrieval and the water level survey at the Valentine Lake Project was completed between November 23, 2018 and November 26, 2018. Manual water level measurements were collected by Stantec and Marathon personnel with Solinst 101 Water Level Meters in accordance with Stantec's Standard Operating Procedures. Manual water level measurements were adjusted for the dip angle of each borehole and were referenced to measured collar elevations based on data provided by Marathon. Boreholes were selected for measurement primarily based on their accessibility and their spatial distribution (*i.e.*, coverage of Leprechaun, Sprite, and Marathon deposits within the timeframe of the field program). Snowmobiles were provided by Marathon for site access.

The water level loggers were retrieved, where possible, from each borehole and the data was downloaded. The water level logger and barometric logger in borehole MA-17-218 were lost in the borehole during the monitoring period. Neither logger was retrieved during the current investigation. In-lieu of a barometric reference from the installed logger, hourly atmospheric pressure data reported at the nearby weather station *Millertown RCS* (Environment and Climate Change Canada 2018), located approximately 65 kilometres northeast of the site were used to correct the water level data for barometric pressure fluctuations.

RESULTS

WATER LEVEL LOGGER DATA

The water level data recorded by water level loggers from November 14, 2017 to November 24, 2018 are presented in Figure 2 to Figure 6, attached, and are summarized in Table 2. Each figure also contains the daily precipitation data from the *Millertown RCS* station to identify possible correlation between groundwater levels and precipitation. It should be noted that this meteorological station does not separate snow and rain data, so values are presented as millimeter equivalent of rain. In general, there does not appear to be a strong correlation between precipitation and groundwater levels. Annual fluctuation of water levels in the five measured wells is less than 0.8 m.

Based on the water level response to precipitation events, borehole VL-09-134 appears to be influenced by surface runoff. Minimal fluctuation was observed in borehole VL-11-319 due to continuous flowing conditions.

Table 2 **Summary of Water Level Data**

Borehole ID	Water Level (m below ground surface)		Range in Water Level (m)
	Minimum	Maximum	
VL-09-134	1.31	2.08	0.77
VL-11-319 [1]	-0.91	-0.74	0.17
VL-17-650	0.99	1.75	0.76
MA-17-158	0.41	1.18	0.77
MA-17-218 [2]	-	-	-
MA-17-250	-0.23	0.13	0.35

Notes:
- Negative numbers indicate water level above ground surface (in casing)
[1] Flowing artesian conditions
[2] Logger not retrieved

WATER LEVEL SURVEY

Results of the manual water level survey carried out between November 24, 2018 to November 26, 2018 are presented in Table 3, attached. Depth to groundwater ranged from -0.837 metres below ground surface (mbgs) (flowing artesian well) to 8.928 mbgs. A groundwater elevation change of 100 m was observed between the topographic highs of the Sprite Deposit down to Valentine Lake and Victoria Lake. Based on elevations of surrounding water bodies and measured groundwater levels, groundwater elevation contours (metres above sea level) were interpolated for the site as shown on Figure 1, attached.

LIMITATIONS

This document was prepared by Stantec Consulting Ltd. (“Stantec”) for the account of Marathon Gold Corporation (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.

Reference: Valentine Lake Project: Preliminary Baseline Hydrogeology Assessment, Water Level Data

This report was prepared by Aaron Power, EIT., and reviewed by Robert MacLeod, M.Sc., P.Geo.

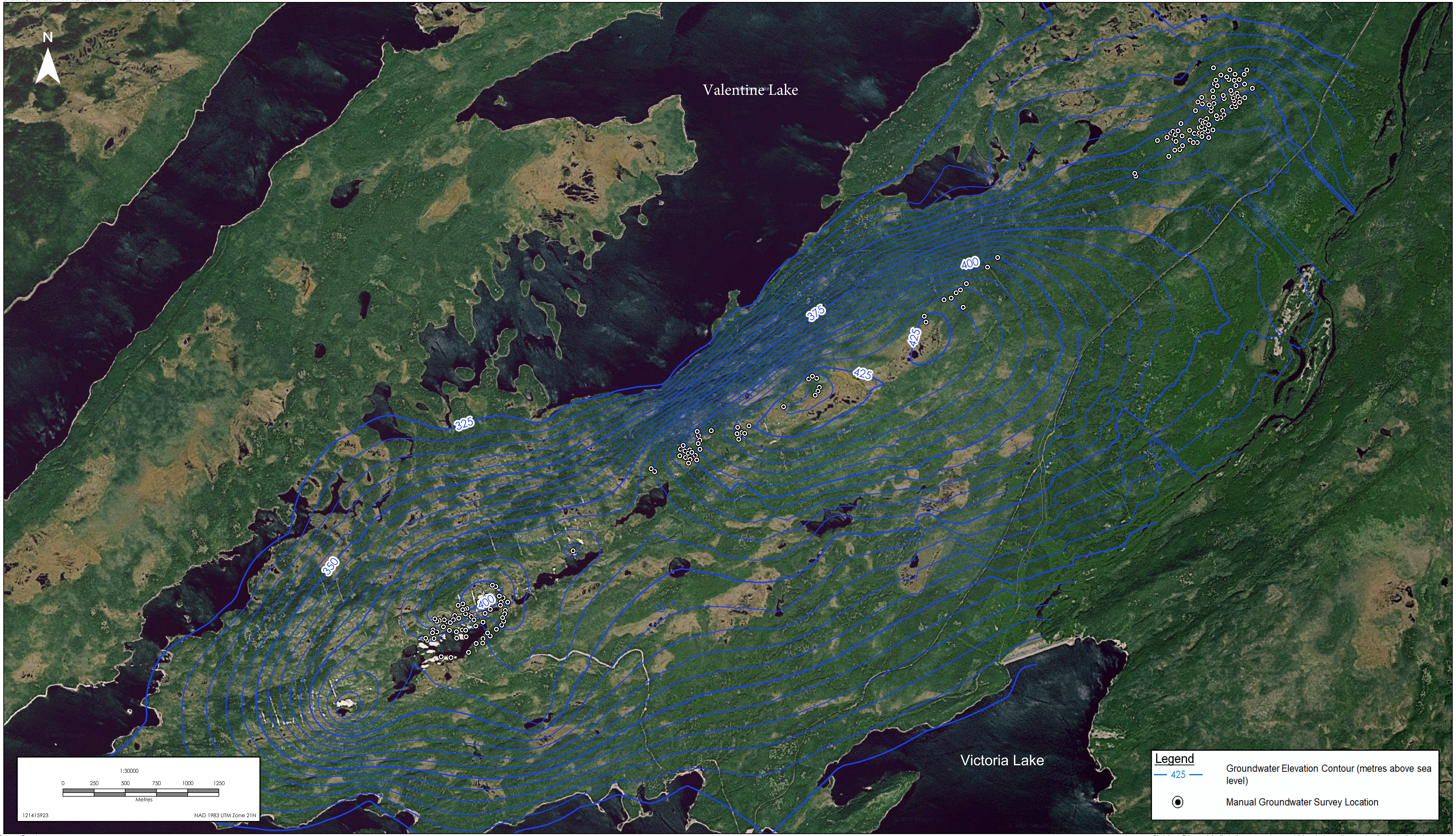
Regards,

Stantec Consulting Ltd.

Robert MacLeod, M.Sc., P.Geo.
Senior Principal, Senior Hydrogeologist

Attachment: Figure 1 – Survey Locations and Interpreted Groundwater Contours
Figure 2 to 6 – Water Level Logger and Precipitation Data
Table 3 – Manual Water Level Survey

C:\Users\jkeizer\Downloads\projects\marathon_gold\marathon_gw.qgz



Sources: Google

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

Stantec

Survey Locations and Interpreted Groundwater Contours

Marathon Gold

Figure 1

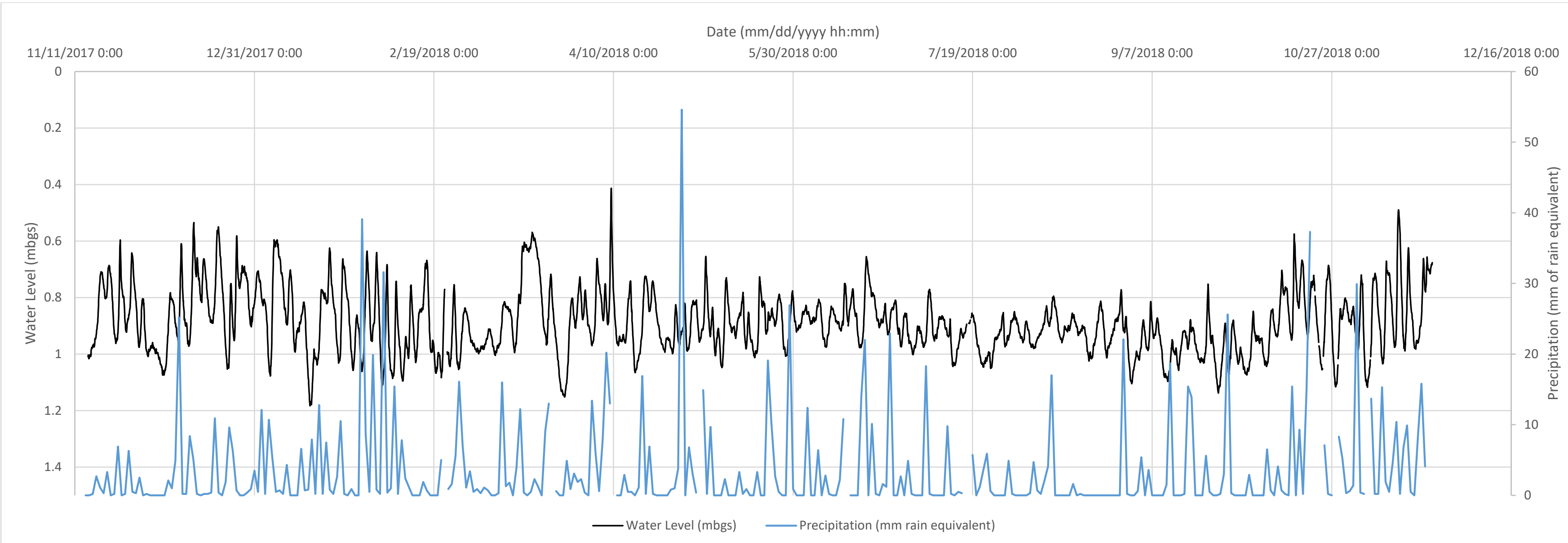


Figure 2 - Water Level Logger and Precipitation Data for MA-17-158

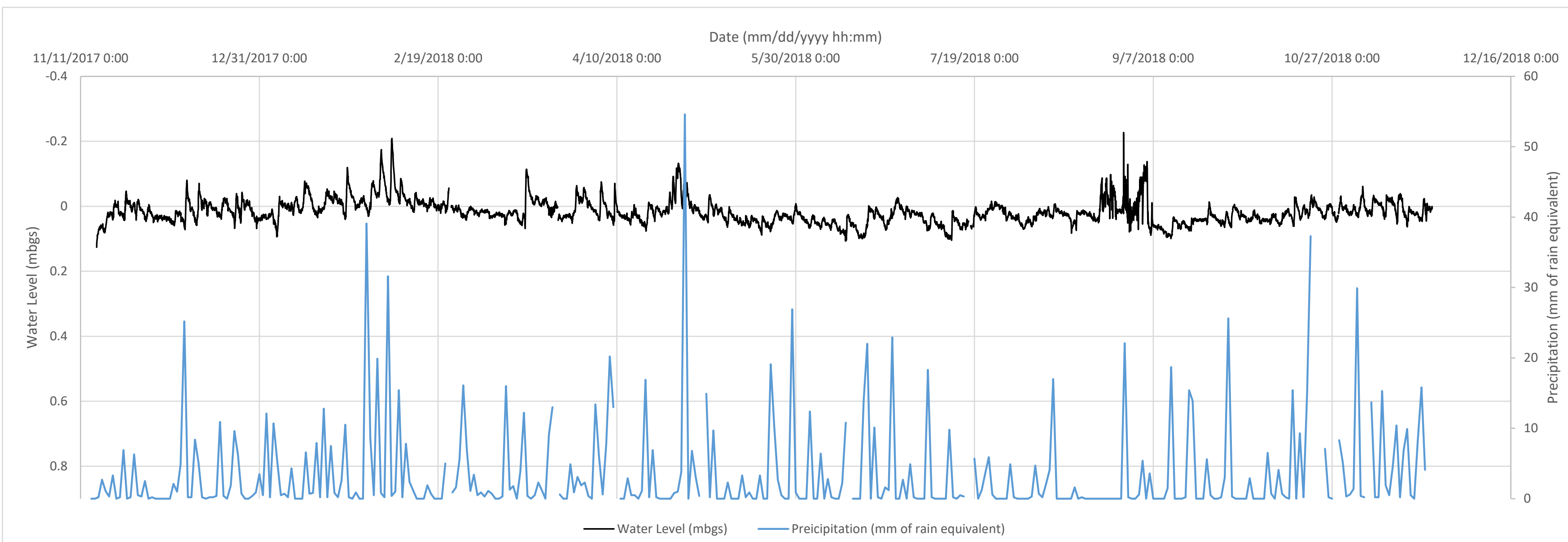


Figure 3 - Water Level Logger and Precipitation Data for MA-17-250

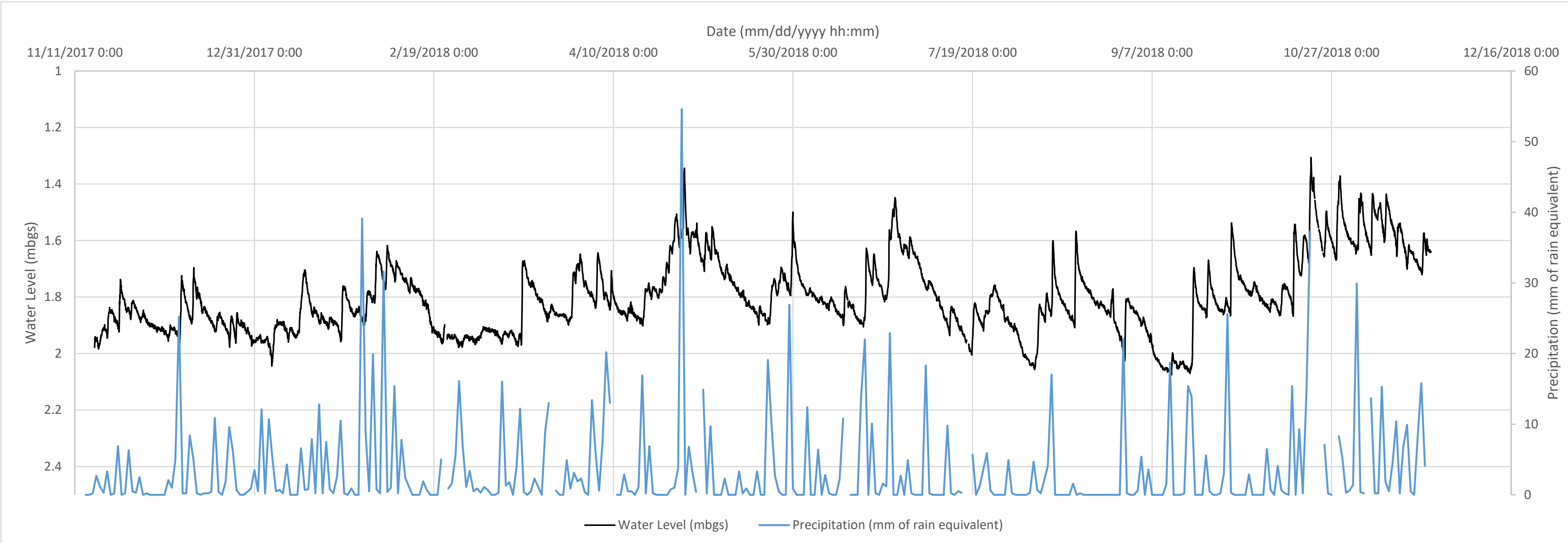


Figure 4 - Water Level Logger and Precipitation Data for VL-09-134

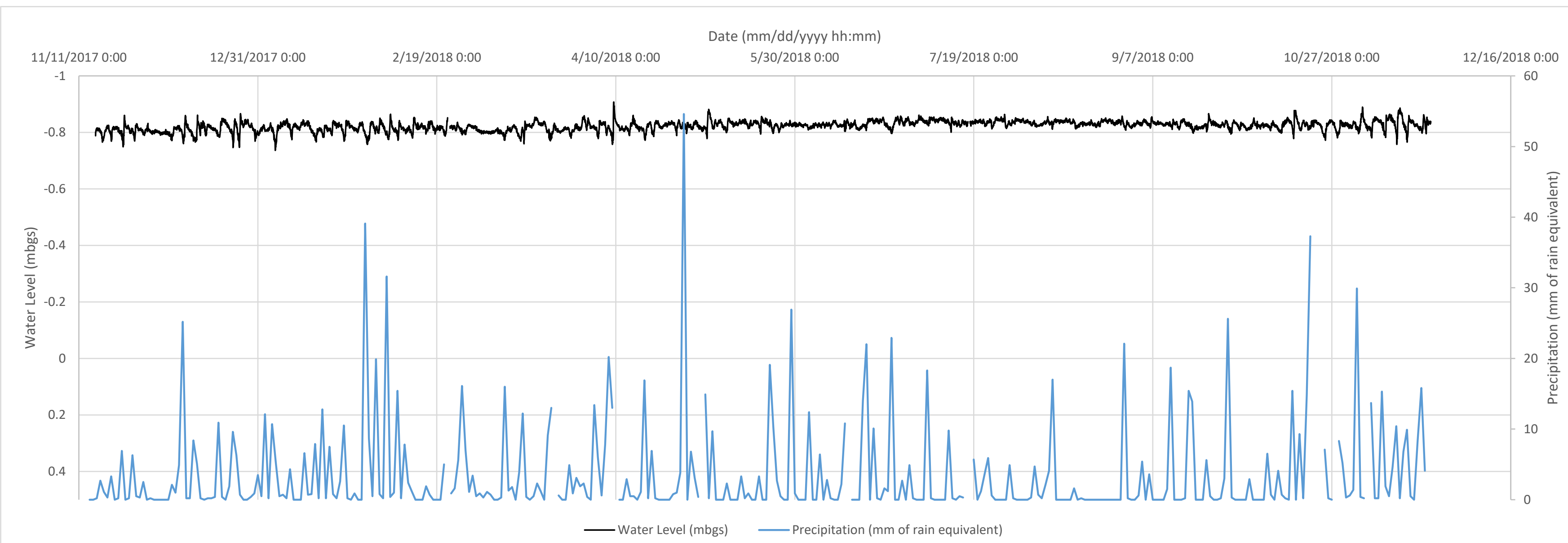


Figure 5 - Water Level Logger and Precipitation Data for VL-11-319

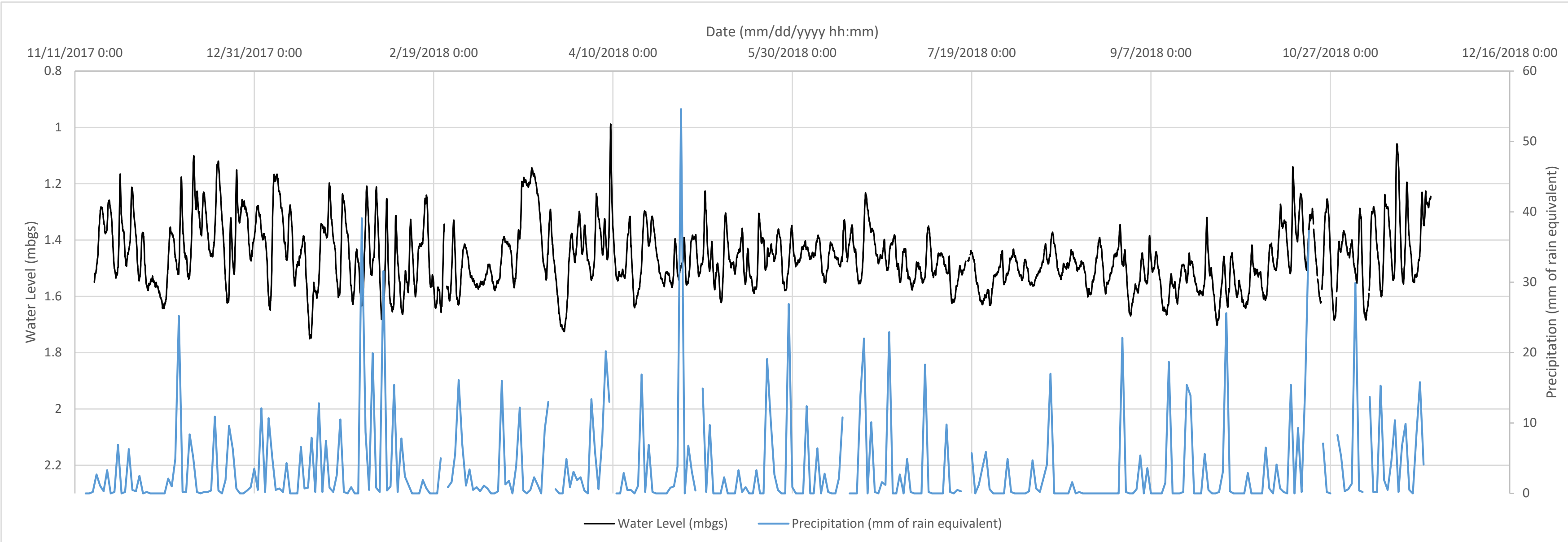


Figure 6 - Water Level Logger and Precipitation Data for VL-17-650

Table 3 Manual Water Level Survey
Valentine Lake Project: Preliminary Baseline Hydrogeology Assessment - Water Level Data
Stantec Project No. 121415923

Borehole ID	Easting (m)	Northing (m)	Ground Surface Elevation (masl)	Elevation of Groundwater (masl)	Depth to Groundwater (mbgs)
VL-10-168	486768.810	5356030.700	388.305	385.792	2.513
VL-11-319*	486747.825	5356055.339	384.721	385.558	-0.837
VL-11-237	486818.437	5356085.621	390.126	389.287	0.839
VL-11-275	486860.968	5356117.896	392.469	390.924	1.545
VL-11-234	486876.996	5356149.799	394.268	392.594	1.674
VL-11-286	486908.854	5356302.628	397.693	397.730	-0.037
VL-12-409	486872.089	5356337.214	398.225	398.088	0.137
VL-11-289	486856.731	5356303.827	395.825	394.407	1.418
VL-11-291	486850.885	5356278.030	393.679	393.667	0.012
VL-10-200	486889.600	5356236.210	393.556	393.065	0.491
VL-11-249	486884.804	5356209.498	391.906	392.364	-0.458
VL-11-241	486868.285	5356178.563	391.888	392.263	-0.375
VL-11-318	486710.458	5356010.497	385.196	384.338	0.858
VL-17-656	486708.486	5355974.341	387.950	384.008	3.942
VL-10-153	486655.840	5355971.560	384.084	384.075	0.009
VL-17-655	486595.190	5355900.172	384.061	383.975	0.086
VL-10-140	486454.100	5355858.390	385.863	384.215	1.648
VL-12-439	486841.621	5356351.234	401.925	400.690	1.235
VL-16-617	486813.624	5356427.470	408.260	400.918	7.342
VL-13-538	486786.469	5356438.678	409.909	400.981	8.928
VL-17-618	486740.470	5356348.447	407.361	403.652	3.709
VL-12-502	486707.549	5356285.185	402.203	400.786	1.417
VL-17-619	486681.571	5356302.690	405.290	403.271	2.019
VL-12-447	486600.595	5356199.451	398.888	395.401	3.487
VL-12-384	486617.398	5356187.357	393.326	391.858	1.468
VL-11-360	486638.453	5356160.198	392.969	386.832	6.137
VL-11-339	486653.391	5356111.747	386.676	385.223	1.453
VL-11-326	486711.312	5356142.602	387.260	386.149	1.111
VL-12-406	486728.114	5356212.362	393.157	392.837	0.320
VL-12-395	486769.571	5356245.361	392.952	392.818	0.134
VL-11-290	486375.896	5355864.598	385.009	383.879	1.130
VL-11-336	486545.414	5356079.748	386.404	384.056	2.348
VL-11-342	486572.000	5356078.118	384.708	384.551	0.157
VL-11-332	486575.568	5356025.489	385.660	383.825	1.835
VL-11-327	486500.338	5356014.322	384.624	383.932	0.692
VL-11-344	486497.546	5356065.036	384.823	384.547	0.276
VL-11-320	486441.891	5356076.554	384.294	384.316	-0.022
VL-12-468	486393.916	5356104.957	389.453	388.483	0.970
VL-12-398	486341.048	5356064.349	386.854	386.868	-0.014
VL-17-643	486310.440	5356079.830	388.885	387.449	1.436
VL-17-651	486306.538	5356057.817	388.165	387.331	0.834
VL-11-293	486318.500	5356010.454	386.854	385.708	1.146
VL-17-624	486262.761	5355997.321	388.326	385.070	3.256

masl = metres above sea level
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* = flowing artesian conditions, hydrostatic groundwater elevation is likely higher than recorded

Table 3 Manual Water Level Survey
Valentine Lake Project: Preliminary Baseline Hydrogeology Assessment - Water Level Data
Stantec Project No. 121415923

Borehole ID	Easting (m)	Northing (m)	Ground Surface Elevation (masl)	Elevation of Groundwater (masl)	Depth to Groundwater (mbgs)
VL-12-438	486252.145	5356013.153	389.510	385.764	3.746
VL-12-462	486571.088	5356208.859	400.804	399.069	1.735
VL-13-521	486582.461	5356251.269	402.683	401.996	0.687
VL-17-650	486562.614	5356246.450	402.889	401.644	1.245
VL-13-524	486549.225	5356288.889	403.930	399.891	4.039
VL-13-527*	486511.432	5356277.522	398.821	399.490	-0.669
VL-12-444	486548.279	5356241.936	402.323	398.662	3.661
VL-12-465	486484.431	5356194.634	399.252	398.972	0.280
VL-12-410	486492.849	5356166.563	397.729	396.630	1.099
VL-12-407	486516.756	5356174.202	397.518	396.496	1.022
VL-13-537	486473.663	5356161.877	397.000	395.544	1.456
VL-17-645	486426.020	5356146.090	397.974	394.018	3.956
VL-17-652	486449.039	5356139.027	395.310	387.926	7.384
VL-12-504	486400.534	5356160.969	397.609	397.064	0.545
VL-13-533	486360.433	5356154.934	401.765	396.228	5.537
VL-13-532	486341.191	5356150.193	401.108	398.268	2.840
VL-17-649	486324.985	5356168.976	405.240	398.736	6.504
VL-11-267	487432.847	5356714.113	395.144	392.662	2.482
VL-14-599	488288.568	5357475.710	401.086	400.569	0.517
VL-14-600	488334.367	5357462.515	400.457	399.950	0.507
VL-14-545	488450.340	5357528.202	407.736	406.997	0.739
VL-14-555	488413.013	5357478.892	404.473	400.392	4.081
VL-14-556	488424.248	5357442.736	400.783	401.064	-0.281
VL-14-595	488438.107	5357636.974	411.706	409.893	1.813
VL-14-597	488427.768	5357670.854	403.359	403.216	0.143
VL-14-572	488540.739	5357677.120	410.897	410.404	0.493
VL-14-576	488842.882	5357715.744	426.195	424.827	1.368
VL-15-610	489120.457	5357869.236	430.635	430.392	0.243
VL-15-611	489321.287	5358091.461	430.641	428.735	1.906
VL-18-663	489385.581	5358097.416	436.436	433.412	3.024
VL-15-612	489351.817	5358113.297	431.539	430.865	0.674
VL-18-660	490248.054	5358594.669	425.526	425.768	-0.242
VL-18-659	490261.623	5358547.409	426.786	426.715	0.071
VL-18-672*	490585.625	5358855.605	412.179	412.366	-0.187
VL-14-562	488086.840	5357349.218	386.242	383.927	2.315
VL-14-560	488059.090	5357372.277	385.753	384.966	0.787
VL-14-556	488424.248	5357442.736	400.783	398.749	2.034
VL-14-569	488293.766	5357527.965	404.204	399.657	4.547
VL-14-553	488329.257	5357513.885	404.904	403.278	1.626
VL-14-554	488368.574	5357522.877	407.813	406.164	1.649
VL-14-542	488355.702	5357496.058	404.302	402.990	1.312
VL-14-544	488370.930	5357446.040	399.584	399.671	-0.087
VL-14-558	488358.744	5357417.116	398.952	396.834	2.118

masl = metres above sea level
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Table 3 Manual Water Level Survey
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Stantec Project No. 121415923

Borehole ID	Easting (m)	Northing (m)	Ground Surface Elevation (masl)	Elevation of Groundwater (masl)	Depth to Groundwater (mbgs)
VL-14-589	488384.717	5357503.141	406.332	403.939	2.393
VL-14-590	488315.714	5357558.273	406.805	403.448	3.357
VL-14-596	488448.922	5357601.012	416.124	414.141	1.983
VL-14-598	488435.971	5357574.021	415.165	412.803	2.362
VL-14-577	488752.331	5357703.992	424.092	423.103	0.989
VL-14-575	488769.105	5357648.330	421.330	421.114	0.216
VL-14-604	488760.588	5357608.550	417.504	415.994	1.510
VL-14-602	488786.272	5357660.651	422.304	421.757	0.547
VL-14-605	488808.819	5357655.412	422.930	422.904	0.026
VL-14-601	488746.937	5357652.349	421.256	420.512	0.744
VL-18-661	489407.063	5358025.146	433.220	430.706	2.514
VL-18-676	489395.187	5357994.412	432.479	430.625	1.854
VL-18-678	489373.866	5357961.789	431.314	430.141	1.173
VL-18-669*	490406.290	5358725.980	421.892	422.476	-0.584
VL-18-674*	490463.880	5358740.085	418.435	418.552	-0.117
VL-18-671*	490503.482	5358782.604	416.514	416.680	-0.166
VL-18-667*	490538.552	5358805.200	417.796	418.173	-0.377
VL-18-673	490559.937	5358666.076	422.459	418.567	3.892
MA-18-293	490835.929	5359065.206	400.104	400.153	-0.049
MA-18-292*	490754.994	5358987.956	405.549	405.809	-0.260
MA-17-158	492652.133	5360339.248	352.272	351.596	0.676
MA-17-218	492644.386	5360364.261	351.595	349.829	1.766
MA-17-250	492573.888	5360458.082	344.550	344.543	0.007
MA-18-282	492713.157	5360272.501	357.029	355.055	1.974
MA-18-288	491943.084	5359717.911	367.527	365.141	2.386
MA-18-287	491935.236	5359739.082	361.045	355.093	5.952
MA-16-129	492745.307	5360274.367	359.561	357.171	2.390
MA-16-111	492737.745	5360297.984	356.431	354.284	2.147
MA-18-307	492730.089	5360322.749	355.703	354.721	0.982
MA-16-141	492724.054	5360343.887	354.612	353.416	1.196
MA-14-012	492712.589	5360380.468	354.852	353.012	1.840
MA-14-009	492705.358	5360404.066	352.204	350.529	1.675
MA-14-019	492732.804	5360485.455	349.788	348.845	0.943
MA-17-186	492745.866	5360442.572	351.406	350.216	1.190
MA-18-306	492753.880	5360382.028	354.645	353.523	1.122
MA-17-235	492762.036	5360355.483	356.217	354.614	1.603
MA-16-128	492778.384	5360336.191	357.702	356.175	1.527
MA-18-291	492775.975	5360309.623	358.262	355.817	2.445
MA-16-130	492817.093	5360346.322	358.706	357.340	1.366
MA-17-225*	492688.900	5360492.415	345.352	345.648	-0.296
MA-17-251*	492672.215	5360512.716	343.984	344.333	-0.349
MA-17-201*	492696.831	5360569.282	341.996	342.369	-0.373
MA-16-095	492772.707	5360491.273	351.448	349.049	2.399

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Table 3 Manual Water Level Survey
Valentine Lake Project: Preliminary Baseline Hydrogeology Assessment - Water Level Data
Stantec Project No. 121415923

Borehole ID	Easting (m)	Northing (m)	Ground Surface Elevation (masl)	Elevation of Groundwater (masl)	Depth to Groundwater (mbgs)
MA-18-276	492877.815	5360421.413	354.732	354.582	0.150
MA-18-278	492833.435	5360567.921	349.755	345.500	4.255
MA-18-266	492812.315	5360532.719	351.097	347.476	3.621
MA-17-254*	492625.542	5360527.858	343.012	343.303	-0.291
MA-18-289	492566.331	5360585.597	339.345	339.383	-0.038
MA-18-314	492585.979	5360486.821	344.325	344.413	-0.088
MA-18-310	492596.376	5360437.927	345.509	345.468	0.041
MA-18-312*	492595.508	5360441.321	345.326	345.690	-0.364
MA-17-199*	492559.644	5360401.927	346.482	346.674	-0.192
MA-17-169	492564.856	5360350.316	348.033	347.923	0.110
MA-17-173*	492570.070	5360299.430	349.644	349.882	-0.238
MA-18-297	492639.562	5360243.546	355.071	353.941	1.130
MA-15-028	492649.885	5360209.369	357.498	353.963	3.535
MA-17-246	492625.529	5360185.990	357.808	353.501	4.307
MA-15-031	492596.866	5360177.545	356.890	354.396	2.494
MA-18-295	492589.285	5360201.839	354.793	354.014	0.779
MA-17-241*	492546.570	5360239.084	350.828	351.002	-0.174
MA-15-045	492548.566	5360267.022	350.206	350.426	-0.220
MA-17-248	492531.844	5360288.619	349.522	348.986	0.536
MA-18-311*	492477.077	5360295.846	349.041	349.297	-0.256
MA-17-253*	492471.711	5360348.022	347.059	347.309	-0.250
MA-17-260	492440.911	5360311.893	347.928	347.737	0.191
MA-17-231	492512.788	5360178.688	353.592	352.667	0.925
MA-16-100	492738.470	5360534.703	346.147	344.736	1.411
MA-18-263	492815.261	5360455.271	353.322	349.766	3.556
MA-15-064	492296.055	5359930.402	360.943	359.735	1.208
MA-18-336	492255.713	5359926.003	360.084	356.149	3.935
MA-18-340	492193.074	5360027.851	352.458	352.473	-0.015
MA-16-120	492494.352	5360068.432	359.836	357.537	2.299
MA-18-329	492249.312	5360014.736	354.631	353.212	1.419
MA-18-337*	492224.236	5360062.772	351.001	351.280	-0.279
MA-18-334*	492240.584	5360077.250	349.777	350.237	-0.460
MA-18-332*	492250.572	5360044.778	352.654	352.941	-0.287
MA-16-126	492259.424	5360049.297	352.933	352.276	0.657
MA-18-342*	492281.475	5360080.655	351.209	351.493	-0.284
MA-18-330	492265.520	5359996.068	355.247	355.222	0.025
MA-18-343	492317.917	5359961.529	359.891	355.512	4.379
MA-18-345*	492305.437	5360139.424	348.803	349.056	-0.253
MA-16-106	492314.791	5360039.909	354.204	352.988	1.216
MA-18-347	492377.076	5360006.726	357.933	355.145	2.788
MA-17-191	492374.610	5360084.837	354.170	352.391	1.779
MA-16-103	492413.331	5360059.513	356.580	354.635	1.945
MA-16-118	492436.085	5359986.820	361.423	358.472	2.951

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Borehole ID	Easting (m)	Northing (m)	Ground Surface Elevation (masl)	Elevation of Groundwater (masl)	Depth to Groundwater (mbgs)
MA-17-258	492446.804	5360053.602	358.396	354.583	3.813
MA-18-316*	492422.141	5360242.666	349.955	350.347	-0.392
MA-16-110	492451.496	5360106.186	355.865	352.785	3.080
MA-18-323	492453.720	5360064.424	358.035	354.814	3.221
MA-17-255	492475.846	5360060.456	359.104	354.493	4.611
MA-16-143	492473.214	5360035.199	360.358	358.351	2.007
MA-15-071	492528.184	5360026.464	364.514	360.765	3.749
MA-17-259	492522.962	5360077.510	360.116	354.697	5.419
MA-17-262	492496.728	5360094.864	358.579	354.475	4.104
MA-18-268	492470.105	5360112.923	356.561	354.513	2.048
MA-18-335	492464.864	5360164.012	353.858	352.909	0.949
MA-17-227	492487.682	5360159.058	354.720	352.832	1.888
MA-16-094	492482.247	5360142.667	355.034	352.606	2.428
MA-18-324	492500.950	5360149.384	355.511	353.347	2.164
MA-17-233	492528.023	5360129.401	357.645	353.059	4.586
MA-16-155*	492561.801	5360087.493	361.204	361.535	-0.331
MA-16-117	492404.369	5359986.553	359.909	354.952	4.957
MA-18-328	492208.142	5359875.750	361.787	356.789	4.998
MA-18-333*	492116.893	5360003.462	351.703	352.038	-0.335

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ATTACHMENT 3-C

Valentine Gold Project Hydrology and Water Quality Monitoring Baseline Report (2020)

Valentine Gold Project Hydrology and Surface Water Quality Monitoring Baseline Report

Prepared for:

Marathon Gold Corp.
36 Birchview Drive
Pasadena, NL A0L 1K0

Prepared by:

Stantec Consulting Ltd.
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St. John's, NL A1B 0L2
TeL: (709) 576-1458
Fax: (709) 576-2126

File: 121416288

August 5, 2020

VALENTINE GOLD PROJECT HYDROLOGY AND SURFACE WATER QUALITY MONITORING BASELINE REPORT

Table of Contents

LIST OF APPENDICES

LIST OF TABLES

LIST OF PHOTOS

LIST OF FIGURES

Glossary of Abbreviations

ARD	Acid Rock Drainage
BFI	Base Flow Index
CCME	Canadian Environmental Assessment Agency
CEAA	Canadian Council of Ministers of the Environment
Client	Marathon Gold Corporation
CWQG-FAL	Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life
DA	Drainage Area
EA	Environmental Assessment
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
ET	Evapotranspiration
FDC	Flow Duration Curve
GHG	Greenhouse Gas
GPS	Global Positioning System
HYDAT	Hydrometric Data National Water Data Archive
HS	Hydrometric Station
I	Infiltration
IDF	Intensity Duration Frequency
IPCC	Intergovernmental Panel on Climate Change
Km	Kilometre
L	Litres
LAA	Local Assessment Area
LAF	Lake Attenuation Factor
m	Metre
MAF	Mean Annual Flow
Masl	Metres above sea level
MDMER	Metal and Diamond Mining Effluent Regulations
mg	Miligrams
NL EPA	Newfoundland and Labrador Environmental Protection Act
NL	Newfoundland and Labrador
NTU	Nephelometric Units
P	Precipitation
PDA	Project Development Area
RAA	Regional Assessment Area

RCAp-MS	Rapid Chemical Analysis package – Metals
RCP	Representative Concentration Pathway Scenario
RFFA	Regional Flood Frequency Analysis
SR	Surface Runoff
Stantec	Stantec Consulting Ltd.
TCU	True Colour Units
USGS	United States Geological Service
WRMD	Water Resources Management Division (NFLD)
WSC	Water Survey of Canada
°C	Degrees Celsius
μΣ	Microsiemens
μγ	Micrograms

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Marathon Gold Corporation (Marathon) to conduct a number of environmental surveys at the Valentine Gold Project Site (the Project), including existing conditions for climate, physiography, hydrology, and surface water quality of the area. The results of the baseline surveys will be used to support the environmental assessment (EA) of the Project.

At the time of this study (summer 2019), Marathon’s Valentine Gold Project includes four near-surface, mainly pit-shell constrained, gold deposits: Marathon Deposit, Leprechaun Deposit, Sprite Deposit, and Victory Deposit (Figure 1.1). Additional gold-mineralized zones have been identified immediately to the southwest of the Leprechaun deposit (J. Frank zone) and approximately 1 km northeast of the Victory deposit. The overall site includes a gold system approximately 20 km long, covering an area of 240 km^2. The Project is located in central Newfoundland, approximately 57 km south of Buchans.

The 2019 Hydrology and Surface Water Quality Monitoring Baseline Report builds on previous work conducted in support of the Valentine Gold Project: the 2012 Hydrology Monitoring Program Report (Stantec 2013), a previous Baseline Hydrology and Surface Water Quality Monitoring Program Report completed in 2017 (Stantec 2017), and the 2018 Hydrology Monitoring Program Report (Stantec 2019).

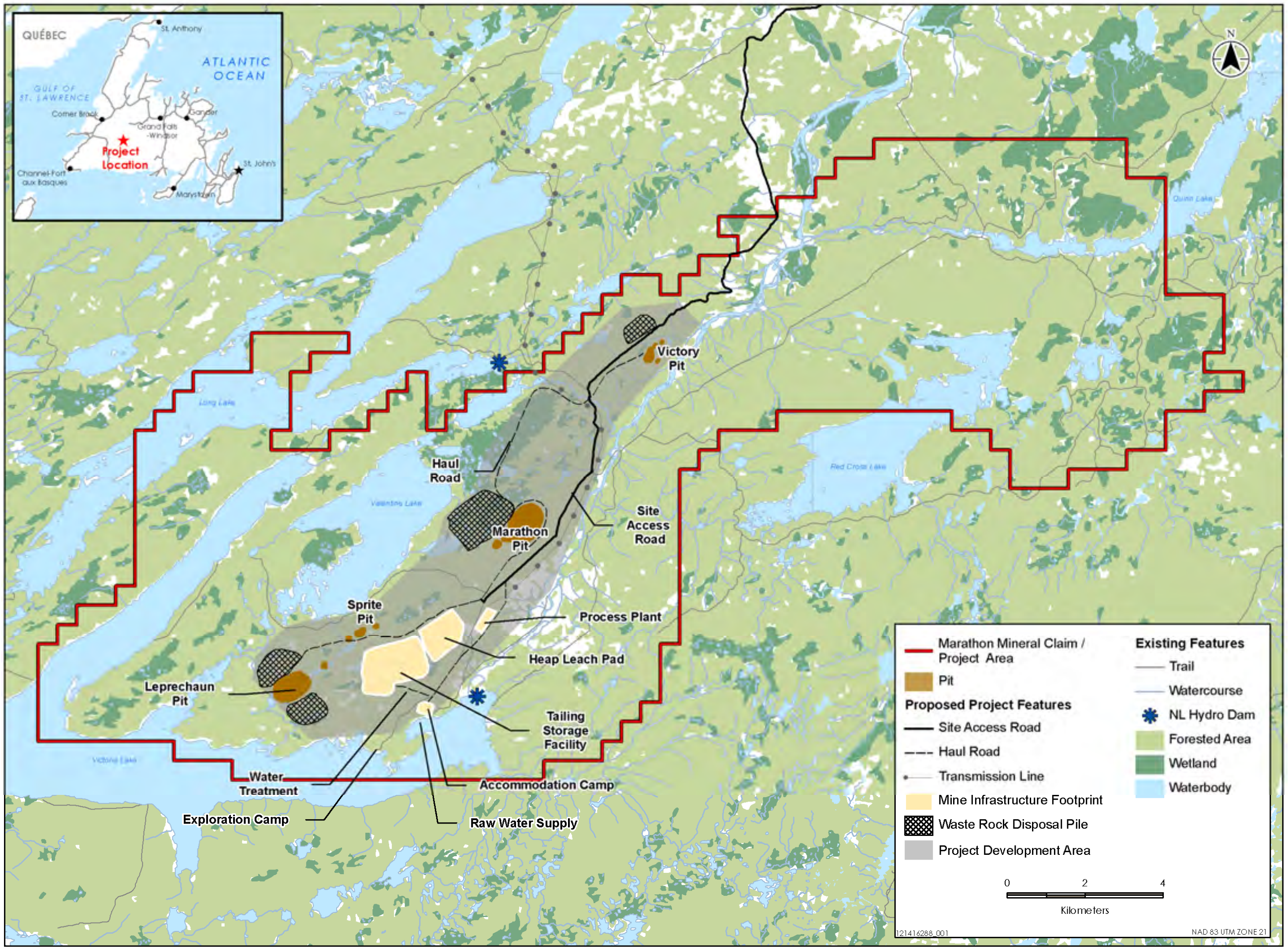


Figure 1.1 Valentine Gold Project Site Plan

2.0 HYDROLOGY AND SURFACE WATER QUALITY BACKGROUND AND REGULATORY CONTEXT

The objective of the hydrology and water quality baseline study was to describe and present the available information and characterize the baseline conditions of climate, hydrology and water quality near the project site. The scope of this hydrology and water quality baseline study includes the following:

- Collect and review available information and data
- Conduct applicable field work
- Analyze baseline hydrologic and water quality conditions
- Prepare a baseline study report

The baseline hydrology and water quality program was designed to support the preparation of environmental effects of the Project on water quantity and water quality section of an EIS; to support other technical evaluations such as mine water balance assessment, assimilative capacity assessment; to support the design of mine infrastructure; and also to support the mine planning activities related to water management and discharge. The baseline hydrology and water quality study will form part of the supporting documentation for the EIS currently being completed for the Project.

To facilitate reference between this baseline study and the corresponding federal and provincial EIS Guidelines, the following concordance table has been prepared (Table 2.1).

Table 2.1 Concordance Table for Topics Listed in Federal and Provincial EIS Guidelines

EIS Guideline Source	Guideline Information Requested	Addressed in Report Section
Newfoundland and Labrador	Delineation of pre-development drainage basins	Section 3.1.1.2 Watershed Delineation (Methods) Section 4.1.5 Watershed Delineation (Results)
Newfoundland and Labrador	Delineation of drainage basins altered by development including flow direction	Not provided in Baseline Report. To be completed in EA and Water Management Plan
Newfoundland and Labrador	Present monitored hydrological data	Section 3.2 Field Program (Methods) Section 4.2 Hydrology (Results)
Newfoundland and Labrador	Ensure monitoring stations are included in the receiving environment and at end of pipe.	Not provided in Baseline Report. To be addressed in EIS and Surface Water Monitoring Plan
Newfoundland and Labrador	Plans for installation of real time water monitoring stations	Not provided in Baseline Report. To be addressed in EIS and Monitoring Plan

Table 2.1 Concordance Table for Topics Listed in Federal and Provincial EIS Guidelines

EIS Guideline Source	Guideline Information Requested	Addressed in Report Section
Newfoundland and Labrador	Describe and assess hydrological regimes, including monthly, seasonal and year-rear variability, normal flows, low flows, environmental flows, flood flows	Section 3.1 Desktop Assessment (Methods) Section 4.2 Hydrology (Results)
Newfoundland and Labrador	Describe design peak flows for selected periods, including estimated runoff to delineated altered drainage basins from diverting flow around the pit	Section 4.2.1.3 Return Period Flows (note that peak flows for altered drainage basins will be presented in the EIS and Water Management Plan)
Newfoundland and Labrador	Describe interactions between surface water and groundwater flow systems during pre-development conditions and potential effects on these interactions during various stages of development	Section 3.1.1.3 Groundwater (Methods) Section 4.1.6 Groundwater (Results) Groundwater Baseline Report (completed by others) Interactions during various stages of development to be discussed in EIS.
Newfoundland and Labrador	Identify local surface water users	Section 3.1.4 Local Water Users (Methods) Section 4.1.6 Local Water Users (Results)
Newfoundland and Labrador	Provide seasonal water quality field and lab analytical results and interpretation	Section 3.2.2 Water Quality (Methods) Section 4.3 Water Quality (Results)
Newfoundland and Labrador	Establish precipitation monitoring at higher elevations above mean annual sea level	Not provided in Baseline Report. To be addressed in EIS and Monitoring Plan
Canadian Environmental Assessment Agency	Delineation and characterization of groundwater – surface water interactions	Section 3.1.1.3 Groundwater (Methods) Section 4.1.6 Groundwater (Results) Groundwater Baseline Report
Canadian Environmental Assessment Agency	Temperature changes in surface water as a result of groundwater discharge	Groundwater Baseline Report
Canadian Environmental Assessment Agency	Delineation of drainage basins overlaid by key project components	Section 3.1.1.2 Watershed Delineation (Methods) Section 4.1.5 Watershed Delineation (Results)
Canadian Environmental Assessment Agency	Hydrological regimes, including monthly, seasonal and annual water flow data	Section 3.1 Desktop Assessment (Methods) Section 4.2 Hydrology (Results)

Table 2.1 Concordance Table for Topics Listed in Federal and Provincial EIS Guidelines

EIS Guideline Source	Guideline Information Requested	Addressed in Report Section
Canadian Environmental Assessment Agency	Surface area, bathymetry, maximum and mean depths, water level fluctuations and sediment of affected water bodies	Section 3.2.3 Bathymetry (Methods) Section 4.2.2.2 Bathymetry (Results) (Sediment discussed in Fish and Fish Habitat Baseline Report (Stantec, 2019))
Canadian Environmental Assessment Agency	Water quality analytical results	Section 3.2.2 Water Quality (Methods) Section 4.3 Water Quality (Results)
Canadian Environmental Assessment Agency	Potable surface water resources	Section 3.1.4 Local Water Users (Methods) Section 4.1.6 Local Water Users (Results)

3.0 METHODS

Environmental studies have been conducted to characterize baseline hydrology and surface water quality conditions. The assessment of baseline hydrology and surface water quality conditions includes both desktop analysis and field program components. Details regarding these components are provided in the following sections.

3.1 STUDY AREA

The Marathon Mineral Claim covers an area of 240 km^2 while the Project Development Area (PDA) covers an area of 40.2 km^2 (Figure 1.1) within the claim area. Hydrology and surface water quality have been evaluated within the Marathon Mineral Claim and PDA. This was done by conducting field work in this area and also by investigation of publicly available regional data. In this report, regional hydrology is considered hydrological and surface water quality information from central Newfoundland, outside the boundaries of the Marathon Mineral Claim.

3.2 DESKTOP ASSESSMENT

The desktop assessment used longer-term regional records as well as shorter duration Project field monitoring results to characterize local climate, hydrology, and water quality conditions. Methods used in the desktop assessment are discussed in the following sub-sections.

3.2.1 Physiographic Assessment

Stantec completed a desktop review of available information pertaining to the physiographic characteristics of the Project area. Information relating to vegetation, ground cover, topography and soil conditions were reviewed and are summarized in Section 4.1. Climate and watershed delineation methods are further discussed below.

3.2.1.1 Climate

Climate factors are important in defining the hydrology of the PDA because they affect the quantity and timing of runoff in each relevant watershed. Methods for the climate factors considered in this study are discussed below.

Temperature and Precipitation

Historical data from three meteorological monitoring stations located northeast of the PDA at Buchans were used for both the temperature and precipitation climate assessment. The stations provide comprehensive year-round long-term records to characterize climate conditions in the PDA. Climate normals for Buchans are provided by Environment and Climate Change Canada (ECCC) (1981-2010) along with maximum and minimum temperature and precipitation data are also presented and discussed.

Dry years are defined as years having annual precipitation less than climate normal and wet years were defined as years having annual precipitation greater than climate normal. Annual precipitation amounts were divided into wet and dry years and analyzed using the Hydrological Statistics tool in the Aquarius Software. Various wet and dry year return periods (5, 10, 25, 50, 100, 200, and 1,000 year) were estimated using the Log Pearson Type III distribution with linear moments (L-moments). The 50-year return period is considered to be the representative wet and dry year conditions and carried forward in the environmental water balance.

Intensity-Duration Frequency Curves

Design return period storm events are characterized by Intensity-Duration-Frequency (IDF) curves. There are limited IDF curve information within the Province from ECCC. No precipitation intensity monitoring and thus no IDF curve information is available for the Buchans climate station (AMEC 2012). Both the Stephenville and the Deer Lake ECCC stations have IDF curve information and were considered in this study.

Additionally, the Province commissioned a study to provide updated IDF curves that incorporate potential precipitation changes associated with climate change. The study completed by Conestoga-Rovers & Associates (CRA) in 2015 followed the same methodology used by ECCC in the development of their IDF curves. IDF curves were developed based on the Intergovernmental Panel on Climate Change (IPCC) Representative Concentration Pathway Scenario 4.5 (RCP4.5) for three separate time horizons (2020s, 2050s, 2080s) (CRA 2015).

Rainfall intensity are generated for various storm events from the IDF curves following Equation 1:

Equation 1 $$I = AT^B$$

Where:

I = Rainfall intensity (mm/hr)
T = Duration (hour)
A & B = constants and are provided by ECCC for various return period events.

Evapotranspiration

Evapotranspiration is the sum of evaporation and transpiration and is dependent on solar radiation, wind, humidity, temperature, type and extent of vegetation and availability of water. Potential evapotranspiration zones were defined in the Newfoundland Water Resources Atlas and referenced in this study (NLDOEC 1992).

Climate Change

Projected climate change precipitation and temperature data for the Red Indian Lake region were generated using the Climate Atlas of Canada (Prairie Climate Center 2019). This online data portal provides downscaled data projections of temperature and precipitation from 24 different climate models. Projected climate changes associated with the IPCC RCP4.5 and 8.5scenarios for a 30-year projection are provided.

The RCP8.5 scenario was selected as it represents the highest greenhouse gas (GHG) emissions, resulting from; high population, slow income growth, and modest rates of change in the technological change resulting from absence of climate change policies (Riahi, et al. 2011). The RCP4.5 scenario was selected as it was used in the development of climate change IDF curves completed by CRA. The Province has established a policy for flood plain management that requires the consideration of a climate change flood zone (Newfoundland and Labrador Department of Municipal Affairs and Environment (NLDMAE) 2014). This is primarily achieved through the incorporation of projected rainfall intensities that will result due to climate change (i.e., updated climate change IDF curves) and projected sea level rise where appropriate.

3.2.1.2 Watershed Delineation

The Project installed hydrometric monitoring stations throughout the PDA. Watershed areas upstream of each hydrometric station were delineated using ArcGIS software (ArcMap 10.6.1). Provincially available data layers for watercourses, waterbodies, roads, and topography were used in conjunction with client supplied LiDAR topographic data to establish each stations watershed.

3.2.1.3 Groundwater

An in-depth overview of the local and regional hydrogeology will be provided in the Groundwater Baseline Report to be completed by Gemtec Consulting Engineers and Scientists.

Baseflow was also considered by calculating the baseflow index (BFI) for the Tributary to Gill's Brook Water Survey of Canada (WSC) station (ID: 02YO014). The BFI is a ratio between stream baseflow and total flow. Calculation of the BFI was completed using the Streamflow Analysis and Assessment Software (Version 4.1) developed by the Ontario Ministry of Natural Resources and Forestry and Trent University (Metcalfe and Schmidt 2016). Daily streamflow records from this station were chosen due to its proximity to the PDA and its relatively small catchment size compared with most other WSC stations. A smaller catchment size was considered to be more representative of conditions in the PDA.

3.2.2 Regional Hydrology Assessment

A regional hydrology analysis was used to assist the characterization of hydrologic conditions in the RAA and PDA. No streamflow monitoring stations with long historical data are available in the PDA, therefore, regional streamflow monitoring stations operated by the WSC in Newfoundland were selected to characterize local hydrologic conditions.

Newfoundland has been subdivided in to four hydrologically homogeneous regions (NE, SE, SW and NW) and regional relationships for flows were developed for each region (AMEC 2014). The PDA is located in the NE hydrologic region (Figure 3.1). Flow relationships developed by AMEC (2014) were used in this study and are discussed below.

For this regional assessment, stations located in the NE hydrologic region were further refined to exclude stations located on regulated watersheds, having watershed areas >1,000 km^2, or having heterogeneous unit flow data. Twelve (12) stations were carried forward in the regional assessment. The selected streamflow stations and station information are listed in Table 3.1.

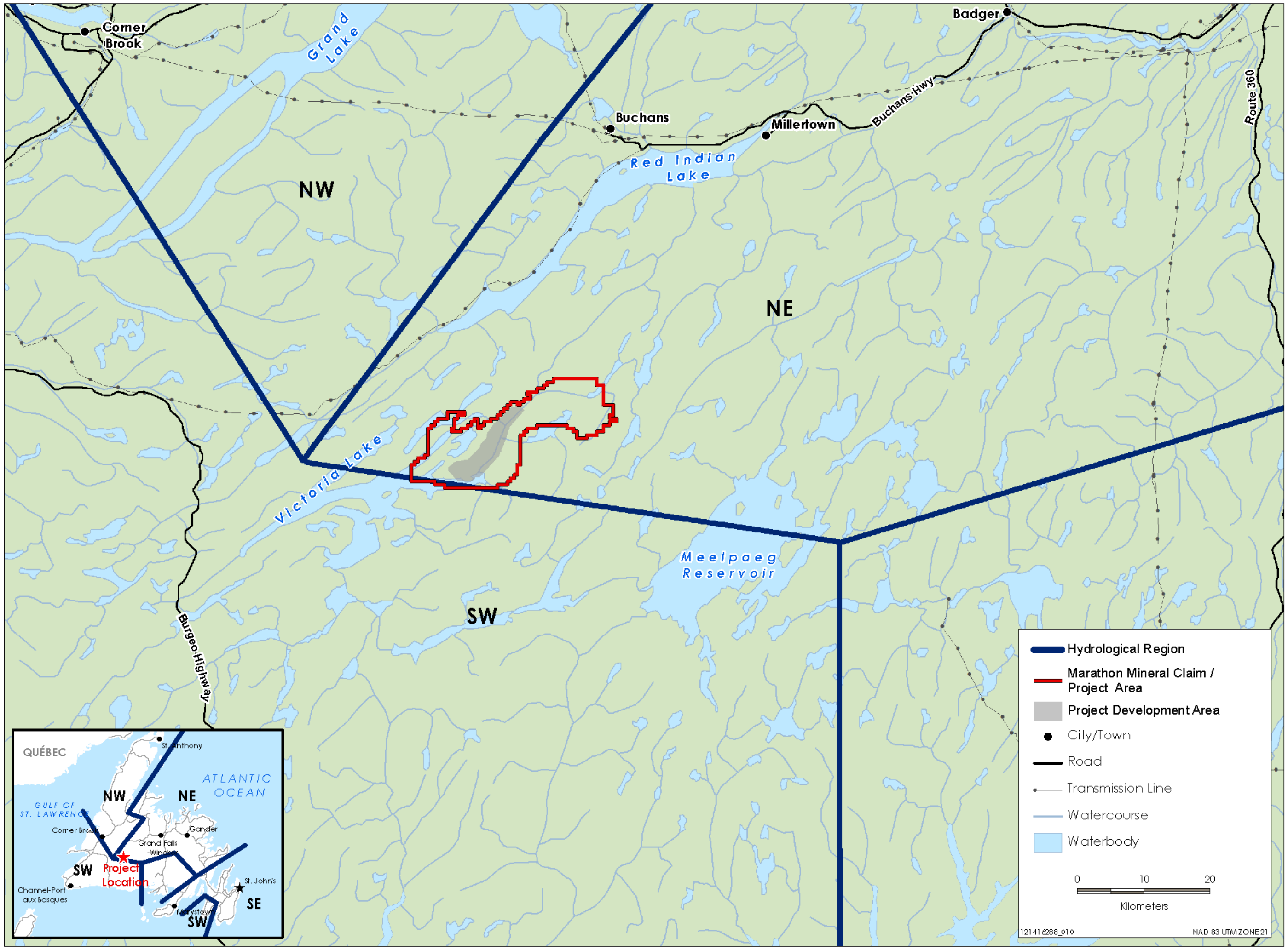


Figure 3.1 Hydrological Regions in Newfoundland (AMEC 2014)

Table 3.1 Water Survey of Canada Streamflow Stations – NE Region

Station ID	Name	Period of Record			Drainage Area (km^2)
		Year From	Year To	Years of Record	
02YO006	Peters River near Botwood	1981	2018	38	177
02YO008	Great Rattiling Brook above Tote River	1984	2018	35	773
02YO010	Junction Brook Near Badger	1985	1997	13	61.6
02YO012	Southwest Brook at Lewisporte	1989	2018	30	58.7
02YP001	Shoal Arm Brook Near Bager Bay	1982	1997	16	63.8
02YQ005	Salmon River near Glenwood	1987	2018	32	80.8
02YR001	Middle Brook near Gambo	1959	2018	60	275
02YR003	Indian Bay Brook near Northwest Arm	1981	2018	38	554
02YS003	Southwest Brook at Terra Nova National Park	1967	2017	51	36.7
02YS006	Northwest River at Terra Nova National Park	1995	2018	23	663
02ZH001	Pipers Hole River at Mothers Brook	1952	2018	66	764
02ZJ003	Shoal Harbour River near Clarenville	1986	2018	32	106

Mean Annual Flows

Mean annual flow and drainage area for selected WSC stations in the NE hydrologic region (Table 3.1) were plotted to establish a relationship. A line of best fit and resulting equation (exponential) were developed for the prediction of mean annual flow based on an input variable of drainage area.

Mean Monthly Flows

Mean monthly flow for each of the stations listed in Table 3.1 were plotted to assess for seasonal trends or characteristics in regional flow. Mean monthly flow was normalized for each stations drainage area prior to plotting to allow for these regional flow trends to be presented more clearly.

Return Period Flows

Return period flows can be estimated using the relationship developed by the regional flood frequency analysis (RFFA) for Newfoundland. The first regional flood frequency analysis for Newfoundland was performed by Poulin (1997) and subsequently updated by the provincial government of Newfoundland and Labrador in 1984, 1990, 1999 and 2014 (Beersing 1990; Paul et al 1984; Rollings 1999; AMEC 2014). The regional relationships developed by AMEC (2014) for the return period flows can be estimated from Equation 2:

Equation 2

$$Q_T = C\ DA^{a1}\ LAF^{a2}$$

Where:

Q_T is estimated flow with a return period of T
DA is drainage area (km^2)
LAF is lake attenuation factor
C, a1 and a2 are constant values

The lake attenuation factor (LAF) represents the influences of lakes within a watershed in the context of the runoff response and is defined in Equation 3:

Equation 3

$$LAF = \sum_{i=1}^{n}\left[\left(100 \times \frac{LAREA_i}{DA}\right) \times \left(100 \times \frac{CAREA_i}{DA}\right)\right]$$

Where:

n is the number of lakes in the watershed with surface area greater than 1% of the watershed's area
LAREAi is the area of a lake
DA is the contributing drainage area of the watershed
CAREAi is the drainage area which is controlled by a lake

The regional equations for the NE hydrologic region were developed based on WSC station watersheds having a range of physiographic parameters listed in Table 3.2. Note that watersheds located in the PDA have areas smaller than the minimum area noted in Table 3.2. The use of the regression equations beyond the range of physiographic parameters is noted to reduce the accuracy of flow estimations. This method is carried forward for flow estimations in this baseline study but it is noted that more detailed assessment of return period flows will be required to inform design of specific water management infrastructure.

Table 3.2 Range of Physiographic Parameters Used for Regression Equation Development

Statistics	DA (km^2)	LAF
Minimum	39	0
2nd Lowest	63	17
2nd Highest	2,034	435
Maximum	4,447	881

Low and Environmental Flows

Low flow indices for the PDA were derived using a regional frequency analysis for Newfoundland and Labrador (Zadeh 2012). Relationships between low flow indices and drainage area were developed by Zadeh for the following low flow indices:

- $7Q_{10}$
- 25% mean annual flow (MAF)
- 30% MAF (winter environmental flow)
- 50% MAF (summer environmental flow)
- Q_{85} flow duration curve (FDC)
- Q_{95} FDC
- Q_{85} annual flow duration curve (AFDC)
- Q_{95} AFDC

The relationships for low flow indices with drainage area are presented in Table 3.3.

Table 3.3 Relationship between Low Flows and Drainage Area in Newfoundland

Method	Equation	R^2
7Q10	Q = 0.0024 DA + 0.0428	0.936
25% MAF	Q = 0.0074 DA + 0.4089	0.954
30% MAF	Q = 0.0089 DA + 0.4907	0.954
50% MAF	Q = 0.0148 DA + 0.8178	0.954
Q85 (FDC)	Q = 0.0084 DA + 0.0639	0.961
Q95 (FDC)	Q = 0.0051 DA + 0.0583	0.948
Q85 (AFDC)	Q = 0.0092 DA – 0.0530	0.955
Q95 (AFDC)	Q = 0.0064 DA – 0.0502	0.951

The NLMAE provides a spreadsheet, developed based on the work of Zedeh, to estimate low flows ($1Q_T$ and $7Q_T$) for return periods ranging from 2 to 100 year (NLDMAE 2017). This spreadsheet was used to establish low flow and drainage area relationships.

Flow Duration Curve (FDC)

FDCs show the percentage of time a given discharge value is exceed in a streamflow monitoring stations period of record. FDCs were developed for each of the WSC stations shown in Table 3.1 by comparing the mean daily flow with the mean annual flow for each respective station.

Environmental Water Balance

An environmental water balance of the PDA was developed based on climate normal, wet year, and dry year conditions. Surplus runoff was calculated in the water balance model based on climate and physiographic characteristics.

The United States Geological Survey (USGS) Thornthwaite monthly water balance model has been refined by the (USGS) (McCabe and Markstrom 2007) was used for the PDA and can be expressed as shown in Equation 2. Surface Runoff (SR) is estimated based on net precipitation (P) less the evapotranspiration (ET) and infiltration (I) losses. The USGS Thornthwaite monthly water balance model is based on the Thornthwaite Method (Thornthwaite 1948). Input parameters are established based on assumptions of local climate and soil conditions and guidance provided by USGS (McCabe and Markstrom 2007).

Equation 4 $$SR = P - ET - I$$

3.2.3 Local Water Users

Newfoundland and Labrador Hydro operate the Bay d'Espoir hydroelectric generating facility which has been in operation since 1967. Victoria Lake forms the headwaters of this system and water from Victoria Lake is directed to the generating facility through an array of man-made dams and canals. One of these dams is located on the northern outlet of Victoria Lake, to the Victoria River (Newfoundland and Labrador Hydro 2020). The WSC operates a water level station (ID 02YN005) at this outlet structure and reports data in real-time and historical water level data back to 2004. This historical data was reviewed to establish the historical (2004 – 2017) mean monthly water levels in Victoria Lake. Minimum and maximum water levels from this timeframe were also assessed. Operational Rule Curve information for Victoria Lake Reservoir was also provided by Newfoundland and Labrador Hydro.

3.2.4 Regional Water Quality

ECCC collects and manages long-term water quality monitoring data through their online data portal. Analytical parameters monitoring in this network include temperature, pH, alkalinity, ions, nutrients, and metals. Stations near the PDA were identified using the Open Map Viewer, showing national long-term water quality monitoring station locations. Two locations were identified to be used as regional water quality references (ID NF02YN0001 Lloyds River at Bridge, RTE 480, Burgeo Road and NF02YO0107 Exploits River Approx. 0.5km Downstream from Dam).

The Water Resources Management Division (WRMD) of NLDMAE initiated a real time water quality monitoring network in 2001. This program was developed to provide real time data from select water bodies throughout the province and was considered necessary by the WRMD to help implement its regulatory mandate (NLDMAE 2019). This monitoring network also relies on industry partners, including Teck Resources Ltd. which reports on data from their Duck Pond operations, located near the PDA. Two monitoring locations established at the Duck Pond Operations (ID NF02YO0190 Tributary to Gill's Pond Brook and NF02YO0192 East Pond Brook Below East Pond) were used as regional water quality references.

3.3 FIELD PROGRAM

3.3.1 Hydrology

The baseline local hydrology assessment included a field hydrometric monitoring program completed by Stantec and Marathon staff. Stantec staff installed the hydrometric stations and monitoring equipment between 2012 and 2019. Stantec and Marathon staff subsequently conducted equipment downloads and undertook hydrometric monitoring. A total of twelve monitoring stations were established at the site (Figure 3.2) and the details of the hydrometric monitoring stations are provided in Table 3.4.

Of these twelve stations, nine were equipped with Solinst Leveloggers to monitor continuous water level, water temperature and allow the development of continuous stream flow records. Two Solinst Barologgers were installed at HS1 and HS7 to collect barometric pressure which was used to barometrically compensate Levelogger water level data. Sites equipped with level logging instruments continued operation throughout the winter, but no spot flow measurements were collected during winter periods. The three remaining stations were established as *in-situ* spot flow measurement stations. Flow measurements were completed using a Sontek Flowtracker. This equipment collects velocity measurements using acoustic doppler technology and computes discharge using the mid-section method (Terzi 1981).

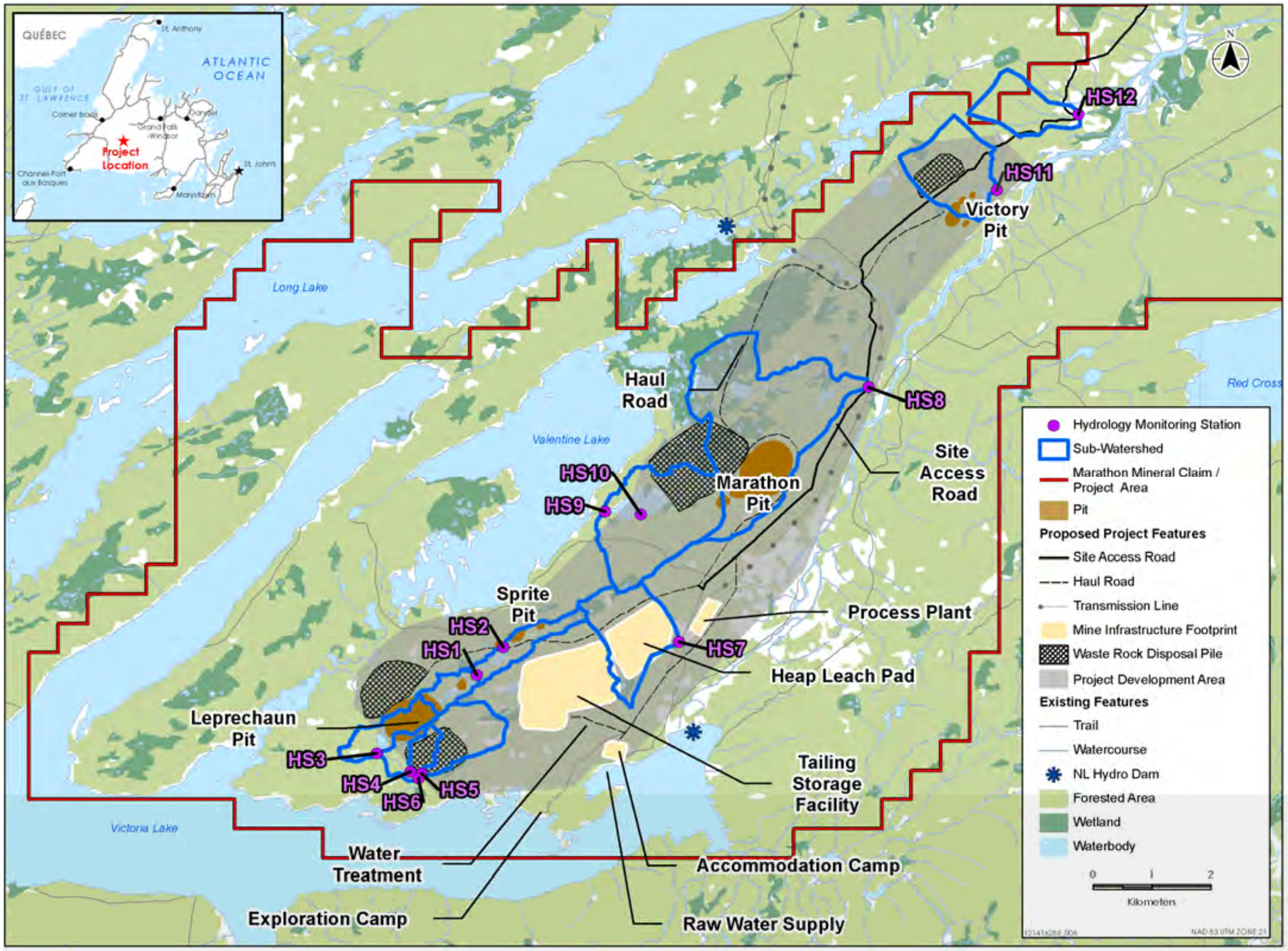


Figure 3.2 Local Hydrometric Monitoring Stations

Table 3.4 Hydrometric and *In-situ* Flow Monitoring Stations

Station ID	Latitude	Longitude	Type of Gauge	Observed Characteristics	Instrumentation	Period of Record
HS1	48° 21' 51.934" N	57° 9' 58.051" W	riverine	Continuous water level, flows, air pressure, and water temperature	Levelogger (SN 2014121) Barologger (SN 2014647)	October 2012 - Present
HS2	48° 22' 7.201" N	57° 9' 36.299" W	riverine	Continuous water level, flows and water temperature	Levelogger (SN 2014183)	October 2012 - Present
HS3	48° 21' 8.759" N	57° 11' 20.641" W	riverine	Continuous water level, flows and water temperature	Levelogger (SN 2014117)	October 2012 - Present
HS4	48° 20' 59.065" N	57° 10' 55.387" W	riverine	spot flow measurement	N/A	N/A
HS5	48° 20' 57.775" N	57° 10' 43.459" W	riverine	spot flow measurement	N/A	N/A
HS6	48° 20' 54.991" N	57° 10' 46.173" W	riverine	spot flow measurement	N/A	N/A
HS7	48° 22' 5.904" N	57° 6' 58.913" W	riverine	Continuous water level, flows, air pressure, and water temperature	Levelogger (SN 22097844) Barologger (SN 12097744)	November 2018 - Present
HS8	48° 24' 30.927" N	57° 4' 36.203" W	riverine	Continuous water level, flows and water temperature	Levelogger (SN 22097867)	November 2018 - Present
HS9	48° 23' 21.920" N	57° 8' 12.291" W	riverine	Continuous water level, flows and water temperature	Levelogger (SN 22097868)	November 2018 - Present
HS10	48° 23' 24.766" N	57° 7' 45.633" W	Lake level	Continuous water level and temperature	Levelogger (SN 2097865)	June 2019 – Present
HS11	48° 26' 20.154" N	57° 2' 50.054" W	riverine	Continuous water level, flows and water temperature	Levelogger (SN 2097853)	June 2019 – Present
HS12	48° 27' 12.653" N	57° 1' 56.824" W	riverine	Continuous water level, flows and water temperature	Levelogger (SN 2107015)	June 2019 – Present

An alternate source of barometric data was required to compensate the Levelogger readings for HS1, HS2, and HS3 between December 2013 and February 2015 during a period when the Barologger at HS1 was inadvertently submerged. The Badger climate station's barometric pressure was compared with Project barometric records and was used to barometrically compensate levelogger water level data between December 2013 and February 2015 after applying an elevation offset between the Badger climate station and the Project site.

Provisional rating curves were developed for each hydrometric station that has a continuous water level logger. The AQUARIUS software, developed by Aquatics Informatics, was used to develop rating curves and to convert the continuous water level data into discharge for each of the local stations. Aquarius is the hydrometric software used by the WSC in data analysis of the national Hydrometric Data National Water Data Archive (HYDAT) stream gauging network. Aquarius is used to develop streamflow statistics, identify potential data anomalies and outliers, repair data gaps and build stage: discharge relationships (rating curves).

Rating curves are developed in Aquarius using the rating curve toolbox which uses field stage and discharge measurements as inputs and determines rating descriptor points. A power equation is interpolated between each of these rating descriptor points to provide a series of equations that result in the locations rating curve. The power equation coefficients are determined using the Levenberg-Marquardt non-linear optimization algorithm, which is a converging algorithm whose solution is dependent on the starting points (rating descriptor points) (Aquatic Informatics 2020).

The equation for a rating curve measures the change in discharge per unit change in stage. The general formula for a rating curve is provided in Equation 5:

Equation 5

$$\boldsymbol{Q = C\,(h + a)^n}$$

Where:

Q = discharge (m^3/s)
C, n = constants
h = gauge height (m)
a = stage at zero flow

3.3.1.1 Bathymetry

Stantec collected bathymetry data from the potential effluent discharge locations in Victoria and Valentine Lakes using a combined GPS/sonic transducer. Vertical and horizontal resolutions achieved were approximately +/- 0.1 m and 4.0 m respectively. The survey was conducted at three locations within each lake with lines spaced approximately 50 m apart. Bathymetric data collected by the echosounder was interpolated using ArcGIS. Additional bathymetry data was provided by Memorial University of Newfoundland (MUN) for both Valentine and Victoria Lakes.

3.3.2 Water Quality

Sampling sites were selected based on a review of the 1:50,000 topographical maps (Victoria Lake 12 A/6 edition 3) in consultation with Marathon. Stantec visited the site and selected station locations during March 2011 and conducted the initial sampling event. Sample collection for subsequent sampling events was completed by both Stantec and Marathon staff. Water samples were collected in clean laboratory-prepared containers specific to each analysis, and were stored and shipped in coolers at 4°C. Water samples were submitted under chain of custody protocols to Bureau Veritas Labs (formerly Maxxam Analytics Inc.) in St. John's, NL for laboratory analysis for RCAp-MS which includes general water quality parameters, as well as metals scan using Inductively Coupled Plasma -Mass Spectrometry (ICP-MS). In addition, water samples were analyzed separately for mercury and TSS.

Sampling conducted in March and April 2011 involved the collection of water samples at 12 locations (LP01 to LP05 and VE01 to VE07). Nine additional water quality sampling locations (VE08, VE09, VE10, VL01 and R01 to R05) were added to the program in May 2011 and subsequent rounds for water quality sampling. Water samples have been collected since 2011 at these locations. Two monitoring locations (FZ01 and FZ02) were added to the baseline monitoring program in 2012 and have been monitored consistently since. Three additional monitoring locations were added to the program in 2019 (VICRV, VIC01, VAL01). The coordinates for each sampling location and the period of monitoring are summarized in Table 3.5. Monitoring locations are shown on Figure 3.3.

Water quality samples taken from Victoria and Valentine Lakes (VIC01 and VAL01) were collected in July, September and November 2019. Three water samples were collected at each of these locations; at the surface, in the thermocline and below the thermocline, using a Niskin water sampler.

Table 3.5 Summary of Sampling Locations (NAD_1983_UTM_Zone_21N – metres)

Station ID	Location		Waterbody Type	Period of Monitoring
	Easting (m)	Northing (m)		
LP01	486,228	5,355,908	Pond outlet stream	March 2011 – October 2019
LP02	485,980	5,355,505	Pond outlet stream	March 2011 – October 2019
LP03	486,225	5,354,638	Stream	March 2011 – October 2019
LP04	487,675	5,356,713	Pond outlet stream	March 2011 – October 2019
LP05	488,180	5,357,259	Pond outlet stream	March 2011 – October 2019
VE01	496,364	5,364,413	Stream	March 2011 – October 2019
VE02	495,531	5,363,937	Stream / Bog	March 2011 – October 2019
VE03	495,502	5,363,922	Stream / Bog	March 2011 – October 2019
VE04	494,970	5,364,554	Stream	March 2011 – October 2019
VE05	496,415	5,365,122	Stream / Bog	March 2011 – October 2019
VE06	496,321	5,365,101	Stream / Bog	March 2011 – October 2019
VE07	496,482	5,365,059	Stream / Bog	March 2011 – October 2019
VE08	495,490	5,364,983	Stream / Bog	March 2011 – October 2019
VE09	496,306	5,365,644	Stream	May 2011 – October 2019
VE10	496,634	5,365,825	Stream	May 2011 – October 2019
R01	491,135	5,357,375	Stream	May 2011 – October 2019

Table 3.5 Summary of Sampling Locations (NAD_1983_UTM_Zone_21N – metres)

Station ID	Location		Waterbody Type	Period of Monitoring
	Easting (m)	Northing (m)		
R02	494,307	5,361,717	Stream	May 2011 – October 2019
R03	494,376	5,362,429	Stream	May 2011 – October 2019
R04	494,358	5,362,890	Stream	May 2011 – October 2019
R05	494,215	5,363,502	River	May 2011 – October 2019
VL01	489,694	5,359,562	Stream	May 2011 – October 2019
FZ01	485,376	5,356,901	Stream / Bog	October 2012 – October 2019
FZ02	485,630	5,355,252	Stream	October 2012 – October 2019
VICRV	497182	5,365,318	River	August – November 2019
VIC01	485,630	5,353,776	Large lake	August – November 2019
VAL01	488,960	5,359,583	Large lake	August – November 2019

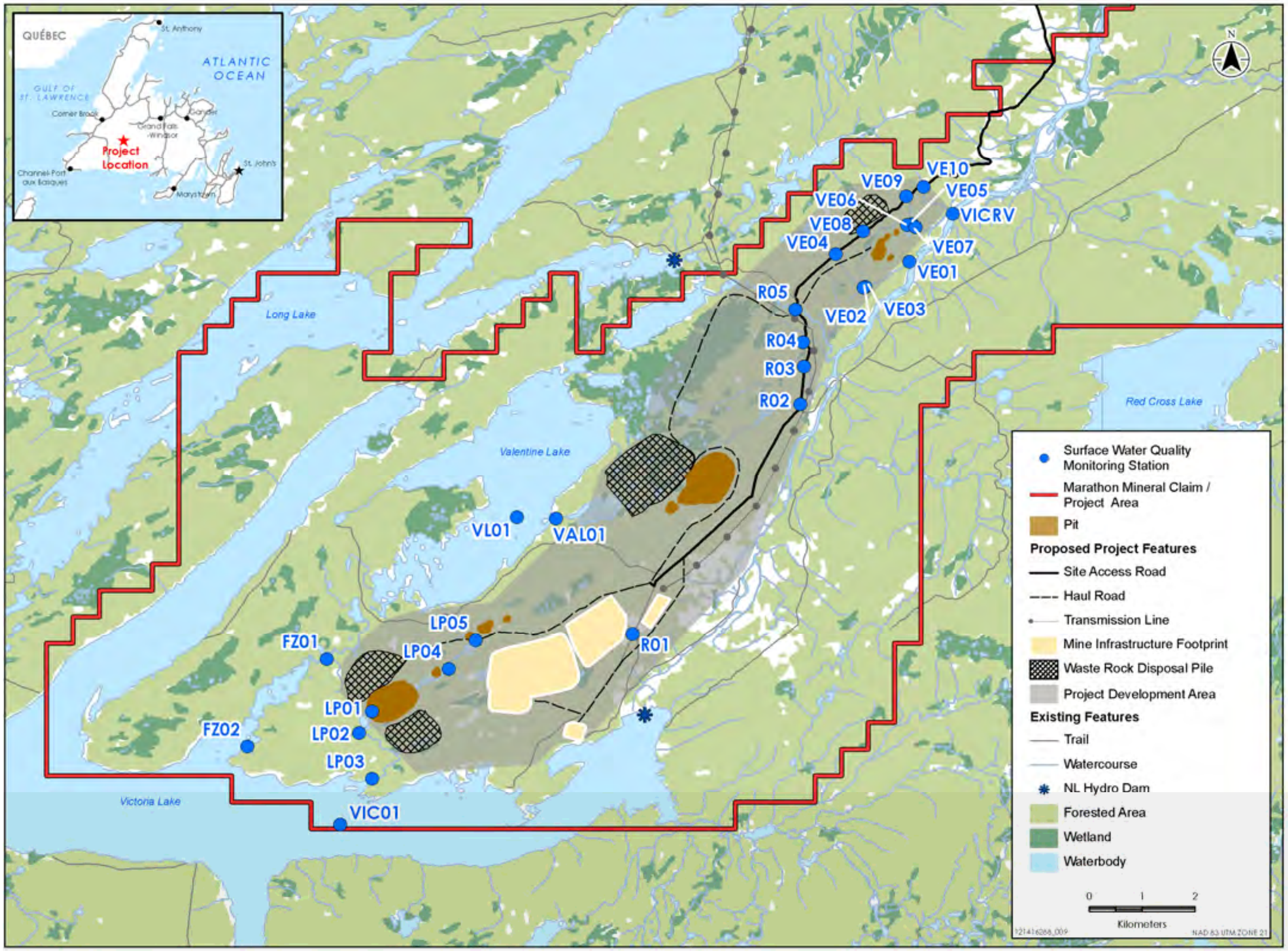


Figure 3.3 Baseline Water Quality Sampling Locations

3.3.2.1 Regulatory Criteria

The primary water quality criteria applicable to this study include the following:

- Canadian Council of Ministers of the Environment's Canadian Water Quality Guidelines for Protection of Freshwater Aquatic Life (CCME CWQG-FAL);
- Schedule 4 of *Metal and Diamond Mining Effluent Regulations* (*MDMER*) SOR/2002-222 under the *Fisheries Act*; and
- Schedule C of Newfoundland and Labrador Regulation 65/03 *Environmental Control Water and Sewage Regulations*, 2003 under the *Water Resources Act* (O.C. 2003-231).

Schedule C of NL Reg. 65/03 states:

"A person primarily in the Metal Mining Industry shall comply with sections 3 and 19.1 and 20 and Schedule 4 of the Metal Mining Effluent Regulations (Canada) SOR/2002-222, including any changes or amendments to those sections of and that schedule to those regulations over time."

Therefore, as the Project is the proposed development of a metal mine the CWQG and MDMER are the primary water quality criteria. The CWQG are those used to assess baseline quality and assimilative capacity and MDMER are those used to establish effluent limits. CWQG and MDMER criteria for parameters assessed in this study are presented in Table 3.6.

Table 3.6 Summary Regulatory Criteria and Reference Water Quality in Project Area

Parameter	Units	Regulatory Criteria		
		CWQG-FAL[1]	MDMER[2]	
			Max Monthly Mean	Max Grab
Alkalinity	mg/L			
Colour	TCU	Narrative		
Conductivity	µS/cm			
DO	mg/L	Variable (6.5 – 9.5 (cold water – life stage))		
pH	pH	6.5 – 9.0		
Turbidity	NTU	Narrative		
TSS	mg/L	Narrative	15	30
Calcium	mg/L			
Chloride	mg/L	120		
Flouride	mg/L	120		
Magnesium	mg/L			
Potassium	mg/L			
Sodium	mg/L			

Table 3.6 Summary Regulatory Criteria and Reference Water Quality in Project Area

Parameter	Units	Regulatory Criteria		
		CWQG-FAL[1]	MDMER[2]	
			Max Monthly Mean	Max Grab
Sulphate	mg/L			
Cyanide	mg/L	0.005 (as free CN)	1	2
DOC	mg/L			
Nitrogen (N)	mg/L			
Un-ionized Ammonia	µg/L	19	0.5 mg/L (expressed as N)	1.0 mg/L (expressed as N)
Nitrite	mg/L	0.06		
Nitrate	mg/L	13		
Phosphorus	µg/L	<4 - >100 (trophic status)		
Silica	mg/L			
Aluminum	µg/L	5 if pH < 6.5, 100 if pH > 6.5		
Arsenic	µg/L	5	500	1000
Barium	µg/L			
Boron	µg/L	29,000 (short-term); 1,500 (long-term)		
Beryllium	µg/L			
Cadmium	µg/L	Hardness adjusted (range of 0.04 to 0.37)		
Cobalt	µg/L			
Chromium	µg/L			
Copper	µg/L	Hardness adjusted (range of 2 to 4)	300	600
Iron	µg/L	300		
Lead	µg/L	Hardness adjusted (range of 1 to 7)	200	400
Lithium	µg/L			
Manganese	µg/L			
Mercury	µg/L	0.026		
Molybdenum	µg/L	73		
Nickel	µg/L	Hardness adjusted (range of 25 to 150)	500	1000
Selenium	µg/L	1		
Strontium	µg/L			
Silver	µg/L	0.25		
Thallium	µg/L	0.8		

Table 3.6 Summary Regulatory Criteria and Reference Water Quality in Project Area

Parameter	Units	Regulatory Criteria		
		CWQG-FAL[1]	MDMER[2]	
			Max Monthly Mean	Max Grab
Uranium	µg/L	33 (short-term), 15 (long-term)		
Vanadium	µg/L			
Zinc	µg/L	Hardness, pH, and DOC adjusted (30)	500	1000
Radium226	Bq/L		0.37	1.11

Notes:
[1] CWQG – Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2019)
[2] MDMER – Metal and Diamond Mining Effluent Regulations, values presented in the table are maximum authorized concentration in grab samples (MDMER 2019). The MDMER provides three effluent water quality limits including the maximum authorized monthly mean concentration, maximum authorized concentration in a composite sample and maximum authorized concentration in a grab sample. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

4.0 RESULTS

4.1 PHYSIOGRAPHIC SETTING

4.1.1 Climate

Climate factors (precipitation and air temperature) affect the runoff characteristics and streamflows that define hydrologic conditions in the PDA. The PDA lies within the Western Mountains and Central Uplands climate zone of Newfoundland and Labrador, generally characterized by cloudy conditions, strong winds and heavy snowfall in winter (Heritage Newfoundland and Labrador 2019). Climate statistics for climate normals obtained from MSC for the period from 1981- 2010 at Buchans station (Station ID 8400698) are presented in Table 4.1 (ECCC 2019).

Table 4.1 Climate Statistics for Buchans Climate Stations

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Climate Normals 1981-2010													
Temperature (°C)	-8.2	-8.4	-4.8	1	7	12.1	16.3	16.2	11.9	6	0.5	-4.5	3.8
Rainfall (mm)	33.7	25.6	39.5	59.5	82.2	87.7	95.3	123	110.3	92.5	81.5	46.3	877
Snowfall (cm)	88.3	72.5	55.5	26.2	4.4	0.1	0	0	0.1	5	30.4	76.9	359.3
Precipitation (mm)	122	98.1	95	85.7	86.6	87.8	95.3	123	110.4	97.5	111.8	123.1	1236.2

Table 4.1 Climate Statistics for Buchans Climate Stations

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wettest Year (2000)													
Temperature (°C)	-6.0	-7.2	-2.4	2.4	5.4	12.5	16.5	17.1	12.1	5.8	1.5	-4.3	4.5
Rainfall (mm)	62	8.4	109.8	48	103	98.6	144.2	128.2	93	158.8	67	45.8	1066.8
Snowfall (cm)	125	81	58	34	20	0	0	0	3	8	12	155	496
Precipitation (mm)	187	89.4	167.8	82	123	98.6	144.2	128.2	96	166.8	79	200.8	1562.8
Driest Year (1950)													
Temperature (°C)	-10.1	-13.6	-8.9	-0.3	7.1	11.8	15.0	14.9	9.3	4.7	1.8	-2.6	2.5
Rainfall (mm)	26.7	0	10.8	13.2	45.4	32.3	79.9	53.8	23.1	41.4	56.2	27.2	410
Snowfall (cm)	50.2	95.3	44.4	49.6	0	0	0	0	0	5.1	2.5	26.1	273.2
Precipitation (mm)	76.9	95.3	55.2	62.8	45.4	32.3	79.9	53.8	23.1	46.5	58.7	53.3	683.2

4.1.1.1 Air Temperature

Climate normal monthly temperature recorded at the Buchans climate station is presented in Table 4.1. The coldest month is February with average temperature -8.4°C. The warmest month is July with average monthly temperature of 16.3°C. Under climate normal conditions, the annual average temperature is 3.8°C. The average daily temperature typically drops below freezing in December and remains below zero until March.

4.1.1.2 Precipitation

Analysis of extreme precipitation events is an important component of climate analysis. All available precipitation records for the Buchans climate station (Station ID 8400698) were used.

Annual precipitation for various wet and dry year return periods is presented in Table 4.2. The wettest year (2000) recorded at Buchans Station, with annual precipitation of 1,562.8 mm, is representative of approximately a 50-year return period wet year. The driest year (1950) recorded at Buchans Station, with annual precipitation of 683.2 mm, is representative of a dry year of approximately a 50-year return period.

Table 4.2 Annual Total Precipitation for Various Return Periods

Climate Normal Precipitation	Annual Precipitation (mm)	
	1,236.2	
Return Period (Year)	**Wet Year**	**Dry Year**
5	1354.9	918.47
10	1428.94	832.388
25	1538.95	735.932
50	1630.69	672.644
100	1729.7	615.975
200	1836.15	564.897
1000	2113.74	463.904

Note:
Based on 54 years of full year records from stations located at Buchans. 39 years reported values below the Climate Normal Annual Precipitation and were used in the Dry Year analysis while 15 years reported values above the Climate Normal Annual Precipitation and were used in the Wet Year analysis.

Snowfall climate normal statistics are presented in Table 4-3 and show that average annual snowfall recorded at Buchans is 359.3 cm with month end snow depths typically highest in February. The largest snow depth recorded was in March of 1982, at 210 cm.

Table 4.3 Snowfall Statistics for Buchans Climate Station (Station ID 8400698)

Month	Snowfall (cm)	Snow Depth (cm)	Snow Depth at Month End (cm)	Extreme Snow Depth (cm)
January	88.3	55	62	162
February	72.5	67	71	207
March	55.5	60	42	210
April	26.2	22	3	127
May	4.4	0	0	38
June	0.1	0	0	0
July	0	0	0	0
August	0	0	0	0
September	0.1	0	0	3
October	5	0	0	25
November	30.4	5	10	70
December	76.9	28	42	140
Annual	359.3			

Intensity-Duration-Frequency Curve

The Stephenville and Deer Lake stations are the two stations relatively close to the Project where IDF data are available. The Deer Lake station is located approximately 90 km northwest of the Project and is an interior station. The Stephenville station located approximately 100 km southwest of the Project and is in a coastal area. Under climate normal conditions, annual precipitation recorded at Stephenville station is 1,340 mm, and annual precipitation recorded at Deer Lake station is 1,096 mm. The Stephenville station IDF was selected to represent the PDA, because the annual precipitation recorded here is closer to that reported at Buchans. Rainfall intensity for the Project are estimated using Equation 1 (Section 3.1.1.1) and the constants shown in Table 4.4. The IDF curves for Stephenville were obtained from Environment and Climate Change Canada (ECCC 2019) and are presented in Table 4.5 and Figure 4.1. The Stephenville IDF was developed based on 48 years of data (1967 – 2017).

Table 4.4 IDF Constants (ECCC 2019)

	2Yr	5Yr	10Yr	25Yr	50Yr	100Yr
A	15.6	21.0	24.6	29.1	32.4	35.7
B	-0.543	-0.554	-0.559	-0.564	-0.567	-0.569
Note: IDF information for Stephenville Station obtained from (ECCC 2019)						

Table 4.5 IDF Curve Statistics for Stephenville Climate Station (1967 – 2017) (ECCC 2019)

Duration	Total Rainfall (mm)					
	2Yr	5Yr	10Yr	25Yr	50Yr	100Yr
5 min	4.5	6.2	7.4	8.8	9.9	10.9
10 min	6.7	9.3	11.0	13.2	14.8	16.4
15 min	8.4	11.5	13.5	16.1	18.0	19.9
30 min	11.9	16.4	19.4	23.2	26.0	28.7
1 hour	16.7	22.3	26.0	30.7	34.2	37.7
2 hour	23.0	30.1	34.8	40.7	45.1	49.5
6 hour	38.5	50.3	58.2	68.1	75.5	82.8
12 hour	47.5	61.5	70.7	82.4	91.1	99.7
24 hour	59.1	78.2	90.8	106.7	118.5	130.3

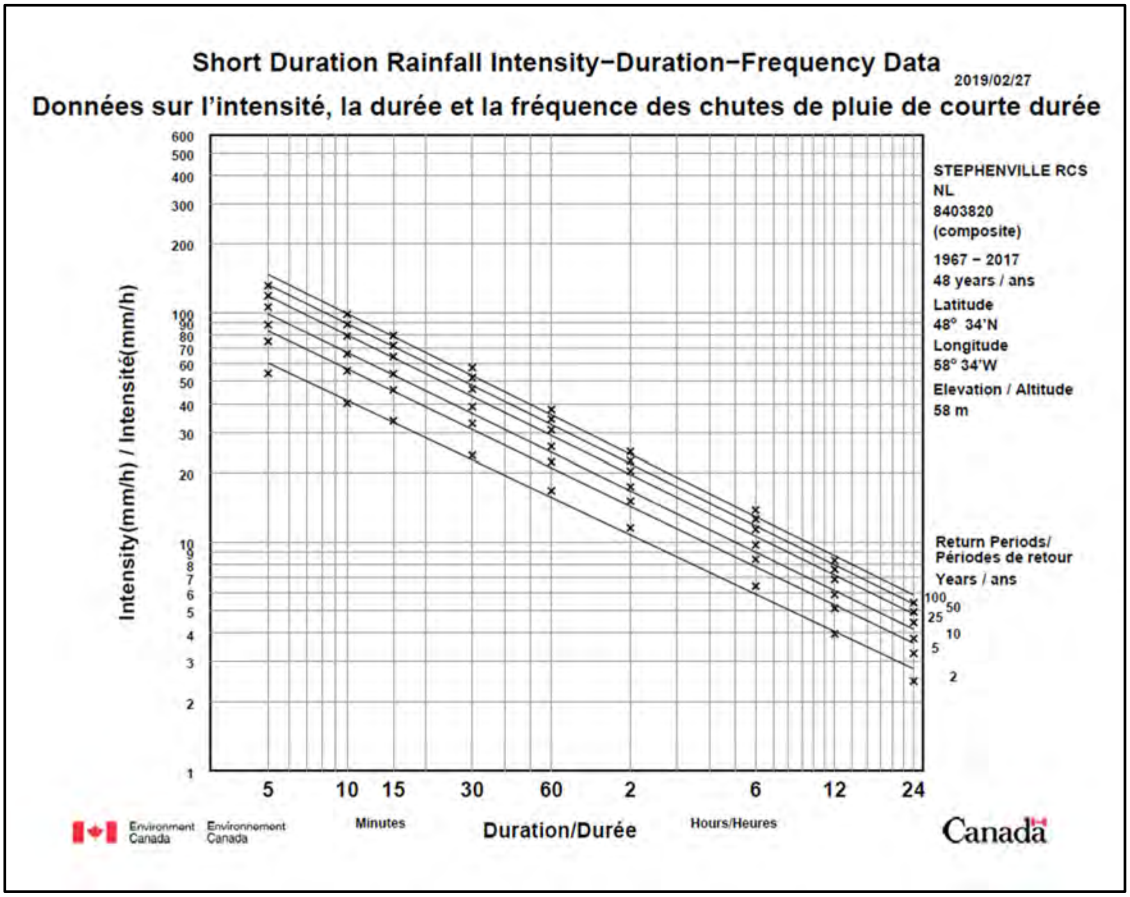


Figure 4.1 IDF Curves for Stephenville Station (ECCC 2019)

The Stephenville IDF curve has also been adjusted to account for the effects of climate change. The IPCC RCP4.5 emissions scenario was used over three separate time horizons (2020s, 2050s, and 2080s) to generate three climate change IDF curves for Stephenville, as shown in Figure 4.2. The average increase of IDF rainfall amounts associated with the various projections are approximately 10% (2020s), 15% (2050s), and 22% (2080s) (CRA 2015).

Future IDF Curve for 2011-2040 Time Horizon Projected Precipitation Amount [mm]						
	Return Interval [years]					
Duration	***2***	***5***	***10***	***25***	***50***	***100***
5-min	5.1	7.0	8.2	9.8	10.9	12.0
10-min	7.2	10.1	12.0	14.4	16.1	17.8
15-min	9.2	12.4	14.6	17.3	19.3	21.2
30-min	13.5	18.3	21.5	25.5	28.4	31.3
1-hr	18.6	24.8	29.0	34.2	38.1	41.9
2-hr	25.0	31.7	36.2	41.8	45.9	50.0
6-hr	42.3	54.1	62.0	71.7	78.9	86.0
12-hr	51.8	67.3	77.7	90.6	100.0	109.4
24-hr	65.1	86.4	100.7	118.6	131.8	144.8
Future IDF Curve for 2041-2070 Time Horizon Projected Precipitation Amount [mm]						
	Return Interval [years]					
Duration	***2***	***5***	***10***	***25***	***50***	***100***
5-min	5.4	7.3	8.6	10.2	11.4	12.7
10-min	7.7	10.7	12.7	15.2	17.1	19.0
15-min	9.7	13.1	15.4	18.3	20.4	22.6
30-min	14.3	19.3	22.6	26.9	30.1	33.2
1-hr	19.6	26.0	30.4	36.0	40.1	44.2
2-hr	26.2	33.2	37.9	43.9	48.4	52.8
6-hr	44.4	56.5	64.8	75.2	82.9	90.7
12-hr	54.4	70.3	81.0	94.7	104.8	114.9
24-hr	68.6	90.6	105.6	124.5	138.5	152.5
Future IDF Curve for 2071-2100 Time Horizon Projected Precipitation Amount [mm]						
	Return Interval [years]					
Duration	***2***	***5***	***10***	***25***	***50***	***100***
5-min	5.7	7.7	9.1	10.9	12.2	13.5
10-min	8.2	11.3	13.6	16.4	18.5	20.7
15-min	10.3	13.8	16.5	19.7	22.2	24.5
30-min	15.2	20.3	24.2	28.9	32.5	35.8
1-hr	20.7	27.4	32.3	38.4	43.0	47.3
2-hr	27.5	34.9	40.3	47.0	51.9	56.6
6-hr	46.5	59.4	68.7	80.3	88.8	96.9
12-hr	57.2	73.8	85.7	100.6	111.8	122.3
24-hr	72.4	95.6	112.0	132.7	148.8	163.6

Figure 4.2 Stephenville Future IDF Curves Under Climate Change

4.1.1.3 Evapotranspiration

Mean annual potential evapotranspiration for Newfoundland is shown in Figure 4.3. The Project site's potential mean annual evapotranspiration ranges from 450 - 474 mm (NLDOEC 1992).

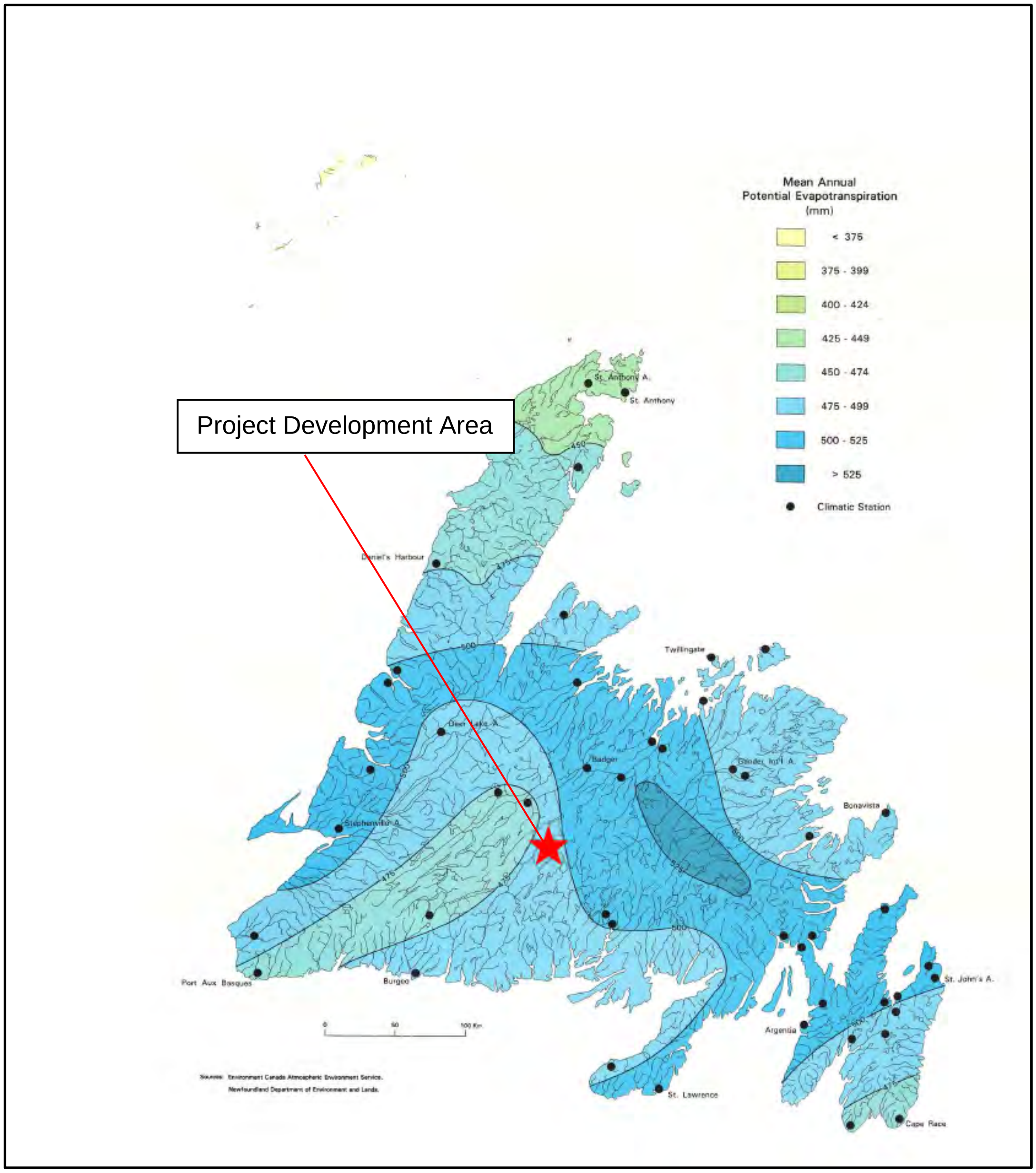


Figure 4.3 Mean Annual Potential Evapotranspiration in Newfoundland (NLDOEC 1992)

4.1.1.4 Climate Change Projections

Projected climate change precipitation and temperature data for the Red Indian Lake region of Newfoundland are shown in Table 4.6. These data represent future conditions as reported in the Climate Atlas of Canada (Prairie Climate Center 2019) and are based on the IPCC RCP4.5 and RCP8.5 emissions scenarios. CRA used the RCP4.5 emissions scenario in the generation of climate change IDF curves, as discussed Section 4.1.1.3. Surface water conditions on site should be considered under climate normal and climate change scenarios to provide an understanding of the range of potential conditions that may be present during operation.

The climate change projected temperatures are seen to increase for each month, with the largest increase coming in the winter months (2.9ºC warmer in January under RCP8.5). The climate change projected precipitation is seen to increase in the winter, spring, and fall months but a decrease is noted in the summer months of August and September. These changes can be summarized as warmer, drier summers accompanied with warmer and wetter conditions in fall, winter and spring.

Table 4.6 Monthly Climate Change Projections Under RCP4.5 and RCP8.5 for Red Indian Lake Region 2021-2050 and Climate Normals from Buchans (Prairie Climate Center 2019)

Month	Temperature (°C)			Precipitation (mm)		
	Climate Normal	Climate Change (RCP4.5)	Climate Change (RCP8.5)	Climate Normal	Climate Change (RCP4.5)	Climate Change (RCP (8.5)
January	-8.2	-5.4	-5.3	122.0	128	126.0
February	-8.4	-6	-5.7	98.1	107	109.0
March	-4.8	-3.2	-2.8	95.0	103	106.0
April	1.0	1.9	1.9	85.7	86	87.0
May	7.0	7.3	7.4	86.6	92	91.0
June	12.1	12.6	12.8	87.8	93	93.0
July	16.3	16.9	17.2	95.3	101	103.0
August	16.2	16.9	17.0	123.0	109	112.0
September	11.9	12.5	12.8	110.4	110	108.0
October	6.0	7	7.4	97.5	121	119.0
November	0.5	2.2	2.5	111.8	129	130.0
December	-4.5	-2.6	-2.4	123.1	136	138.0

4.1.2 Soils and Geology

Based on a review of geological maps and aerial photographs, the overburden material in the vicinity of the Project generally consists of a discontinuous layer of till of variable thickness over exposed bedrock. The Newfoundland Water Resources Atlas classifies the surficial geology as a veneer of glacial till (less than 1.5m) over bedrock (NLDOEC 1992).

The Project site is considered part of the Mountain pedoclimatic zone, which is characterized by stony, shallow, coarse textured soils (Agriculture Canada 1988). These soils are further described as imperfectly drained, commonly very shallow, and associated with large areas of rock outcrops. Coarse textured soils are considered to correspond with sands and loamy sands.

4.1.3 Topography

The topography of the site is considered to be hilly with elevations in the local hydrometric station watersheds ranging from 273 to 437 masl. The elevation range for each of the local hydrometric station watersheds is provided in Table 4.7.

Table 4.7 Elevation Ranges for Local Hydrometric Station Watersheds

Watershed	Minimum Elevation (masl)	Maximum Elevation (masl)	Change in Elevation (m)
HS1	388	421	33
HS2	382	437	55
HS 3	381	429	48
HS 4	341	429	88
HS 5	343	413	70
HS 6	341	429	88
HS 7	361	437	76
HS 8	273	402	129
HS 9	333	435	102

4.1.4 Vegetation

Based on an Ecological Land Classification as prepared for the Project (Stantec Consulting Ltd. 2015), twelve vegetation communities (or land cover classes) are present in the proposed Project Area. Of these, nine are vegetated and three are sparsely vegetated, naturally non-vegetated and/or anthropogenic. These are listed below with the vegetated land cover areas listed first:

- Balsam Fir Forest
- Black Spruce Forest
- Kalmia-Black Spruce Woodland
- Mixedwood Forest

- Regenerating Forest
- Alder Thicket
- Riparian Thicket
- Wet Coniferous Forest
- Open Wetlands
- Open Water
- Exposed Sand / Gravel Shoreline
- Anthropogenic

4.1.5 Watershed Delineation

Watersheds upstream of each of the hydrometric monitoring stations established during baseline monitoring were delineated using ArcGIS software (ArcMap 10.6.1). A site wide depiction of delineated watersheds is shown in Figure 3.2. Watershed delineations are also shown at a more refined scale in the Hydrometric Monitoring Station Summary Forms (Appendix A). A summary of watershed sizes if provided in Table 4.8 below.

Table 4.8 Watershed Area for Hydrometric Monitoring Stations.

Station ID	Watershed Area (km^2)
HS1	0.397
HS2	1.047
HS3	0.702
HS4	1.006
HS5	1.009
HS6	2.332
HS7	1.781
HS8	5.325
HS9	3.031
HS10*	3.031
HS11	1.756
HS12	1.099

Note:
* - Watershed area for HS10 (Lake monitoring station) was assumed to be the same as HS9 (Lake outlet monitoring station).

4.1.6 Groundwater

The depth to groundwater varies across the LAA and groundwater catchment areas are inferred to coincide closely with surface water catchment areas (Gemtec 2020). Groundwater levels in the overburden were lower during winter months due to frozen ground conditions and limited infiltration. The shallow overburden aquifer is noted to be unconfined and direct response to rainfall events is observed.

Vertical hydraulic gradients were used as an indication of groundwater recharge or discharge to local streams. Downward gradients and thus groundwater recharge were observed in areas of high elevation (drainage divides) and upward gradients and groundwater discharge were observed in areas of lower elevations (near water bodies) (Gemtec 2020).

A monthly BFI was calculated using the SAAS (Streamflow Analysis and Assessment Software) (V4.1) based on 13 years of continuous daily flow data from WSC station 02YO014. Baseflow contributions to total flow at this station for its period of record were found to vary from 23% (April) to 43% (March). The BFI calculated for the entire 13-year period of record was 35%. This BFI is considered applicable to the LAA with some potential variations that may include higher BFI in streams located in perched water tables (i.e., HS1 and HS2 which are located in or near bogs) and potentially lower BFI in streams located in areas of highly permeable bedrock (i.e., HS7 which exhibited very low summer flows).

Table 4.9 Monthly Baseflow Index for WSC station 02YO014

Month	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.
BFI	0.3704	0.306	0.4326	0.23	0.4182	0.3819	0.3291	0.3074	0.3863	0.4165	0.4161

4.1.7 Local Water Users

The RAA is an area of substantial hydroelectric development, however, the only hydroelectric facilities within the LAA are the Victoria dam and spillway, which are part of the Bay-d'Espoir Hydroelectric Development. The Bay d'Espoir Hydroelectric Generating Facility is the largest hydroelectric plant on Newfoundland and includes three generating stations, six reservoirs, and associated dykes, dams, canals, and hydraulic structures. The generating stations comprising the Bay d'Espoir Development were built in stages beginning in 1967. There are four remote hydraulic structures associated with the Bay d'Espoir development: Ebbegunbaeg Control Structure, Salmon River Spillway Structure, Victoria Control Structure, and Burnt Dam Spillway (Newfoundland and Labrador Hydro 2012).

The Victoria Control Structure is a dam at the outlet of Victoria Lake to the Victoria River which naturally flowed north to Red Indian Lake. This dam raised the natural lake elevation from 290 to 325m and has a crest elevation of 326m. The low supply level of the lake, set by the Victoria Canal, was set at 319m In the late 1960's Victoria Lake was diverted to the Victoria Canal which flows into the White Bear drainage basin to the south (W.S. Read 1972). The Victoria Canal was designed to convey between 34 m^3/s (at low supply level) and 170 m^3/s (at full supply level) (W.S. Read 1972).

Victoria Lake Reservoir water levels are recorded by a WSC station (ID 02YN005) and reported online. The Victoria Lake reservoir is typically charged to maximum annual operating level following the spring melt (June) and subsequently is drawn down to a minimum operating level in the March and April. Newfoundland and Labrador Hydro also provided the stage storage relationship of the Victoria Reservoir, this relationship and the Victoria Lake Reservoir WSC data are shown on Figure 4.4. Outflows from Victoria Lake are considered to have remained above the low supply level discharge of 34 m^3/s as mean monthly water levels stayed above the low supply water level of 320 masl throughout the period of 2004 – 2017.

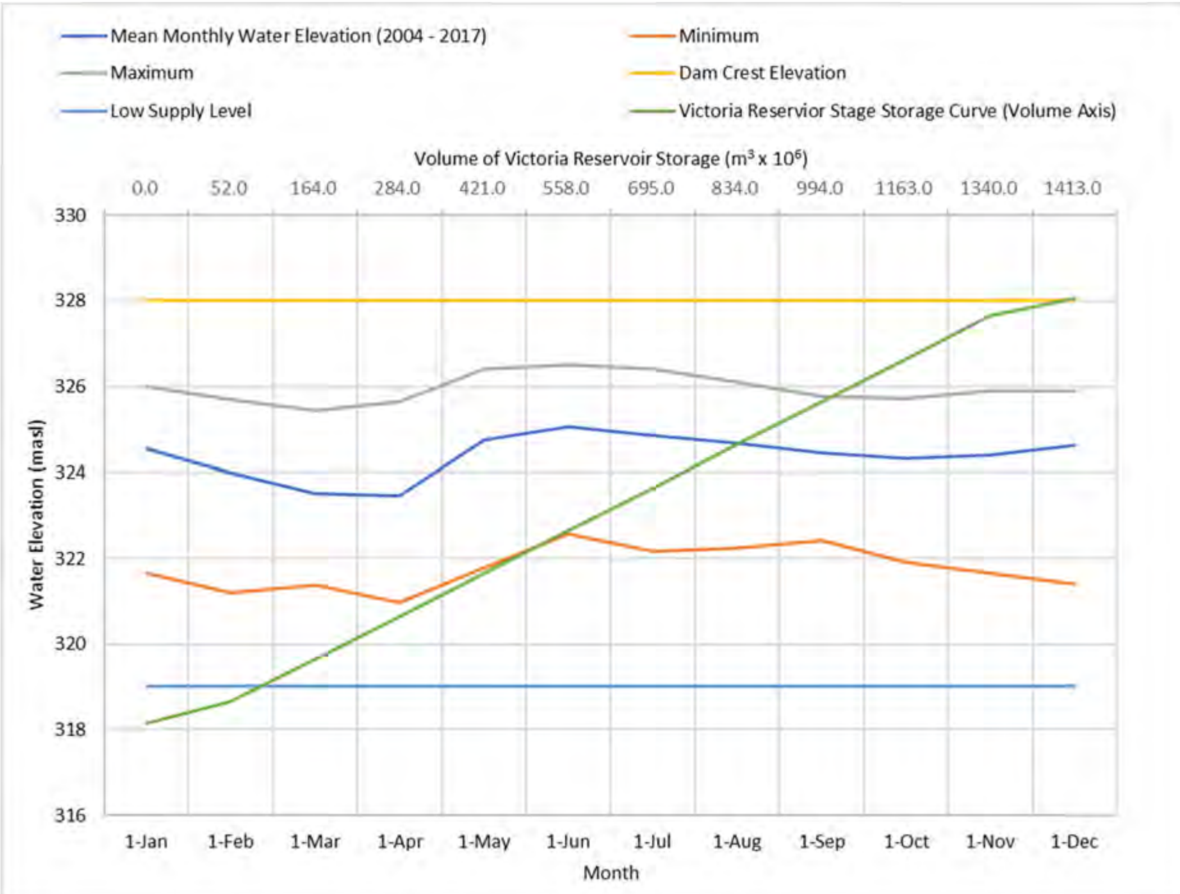


Figure 4.4 Victoria Lake Reservoir Stage Storage Relationship and WSC Reported Water Levels (2004 – 2017)

4.2 HYDROLOGY

4.2.1 Regional Hydrology

The regional hydrology is based on the WSC hydrometric monitoring stations flow data from the selected stations located in the NE hydrologically homogeneous region (AMEC, 2014). A regional assessment is considered appropriate for the Project based on the limited timeframe of available baseline data. Considering hydrology at a regional scale allows for many years of flow data to be considered. This potentially allows for the consideration of higher high flow events and lower low flow events and provides more confidence in other (mean) flow statistics.

The total streamflow coefficient for the PDA was calculated to be 62.5%. This streamflow coefficient was used in the site environmental water balance further discussed in Section 4.2.1.6. The streamflow coefficient was determined using the Climate Normal precipitation from Buchans and the evapotranspiration rate from the Newfoundland Water Resources Atlas as shown in Table 4.10. Streamflow is defined as the cumulative total of groundwater discharge and overland flow.

Table 4.10 Runoff Rate for PDA

Climate Normal Precipitation (mm)	Evapotranspiration (mm)	Streamflow (P – ET) (mm)	Streamflow Coefficient (%)
1,236	463	773	62.5

Additionally, the mean annual streamflow or runoff rate for the selected WSC hydrometric stations was found to range from 58% to 71% with an average of 65%. This was calculated from each stations mean annual flow and the average ET rate for this hydrologic region and was found to correspond with the runoff rate calculated for the PDA. Streamflow coefficients represent the total observed flow in relation to total precipitation over the watershed area and include both overland flow and groundwater contributions.

The unit flows calculated for the NE hydrologic region WSC stations were 0.028 $m^3/s/km^2$ with standard deviation of 0.004 $m^3/s/km^2$ and ranged from 0.020 $m^3/s/km^2$ to 0.036 $m^3/s/km^2$. A summary of these regional WSC station statistics is provided in Appendix B.

4.2.1.1 Mean Annual Flows

The relationship between MAFs and watershed area for selected WSC stations located in the NE hydrologically homogeneous region is presented in Figure 4.5. The correlation coefficient between mean annual flows and drainage areas suggest that 99% of the variability in the MAF can be explained by watershed area.

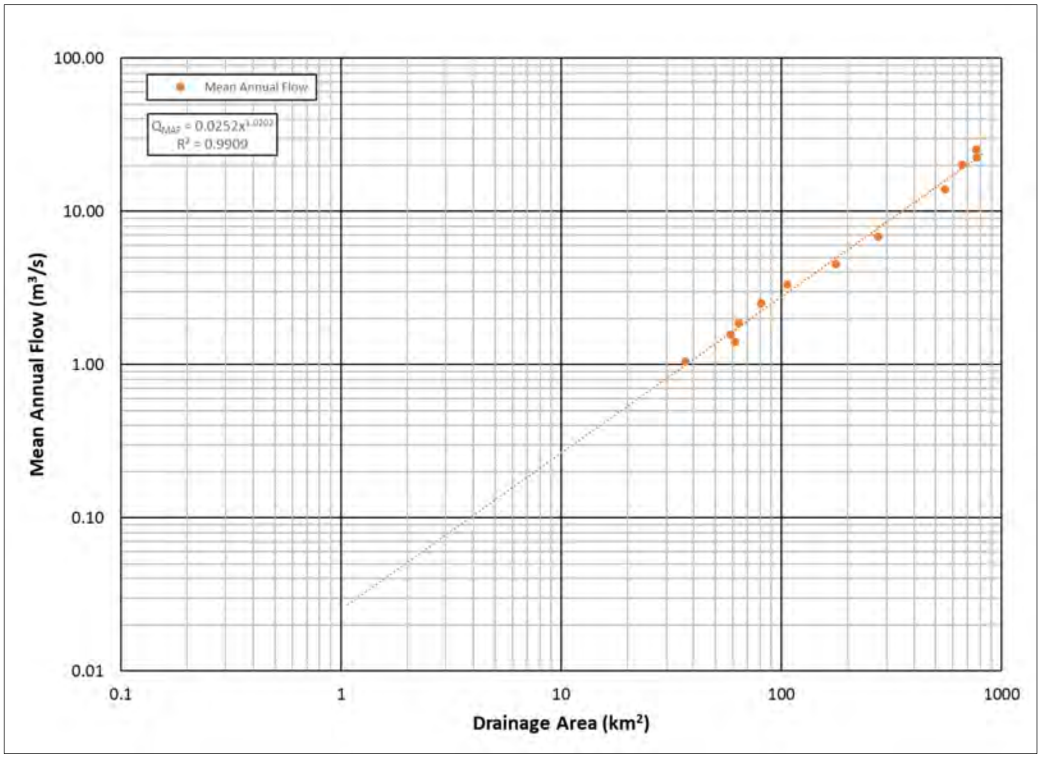


Figure 4.5 Watershed Area and MAF Relationship for Select WSC stations

4.2.1.2 Mean Monthly Flows

The MMFs for unit area for the selected WSC Stations are presented in Figure 4.6. Stream flow tends to peak twice a year in April-May due to spring freshet and in November due to fall rainfall. Minimum flows are observed during winter months from January to February and late summer between July and August.

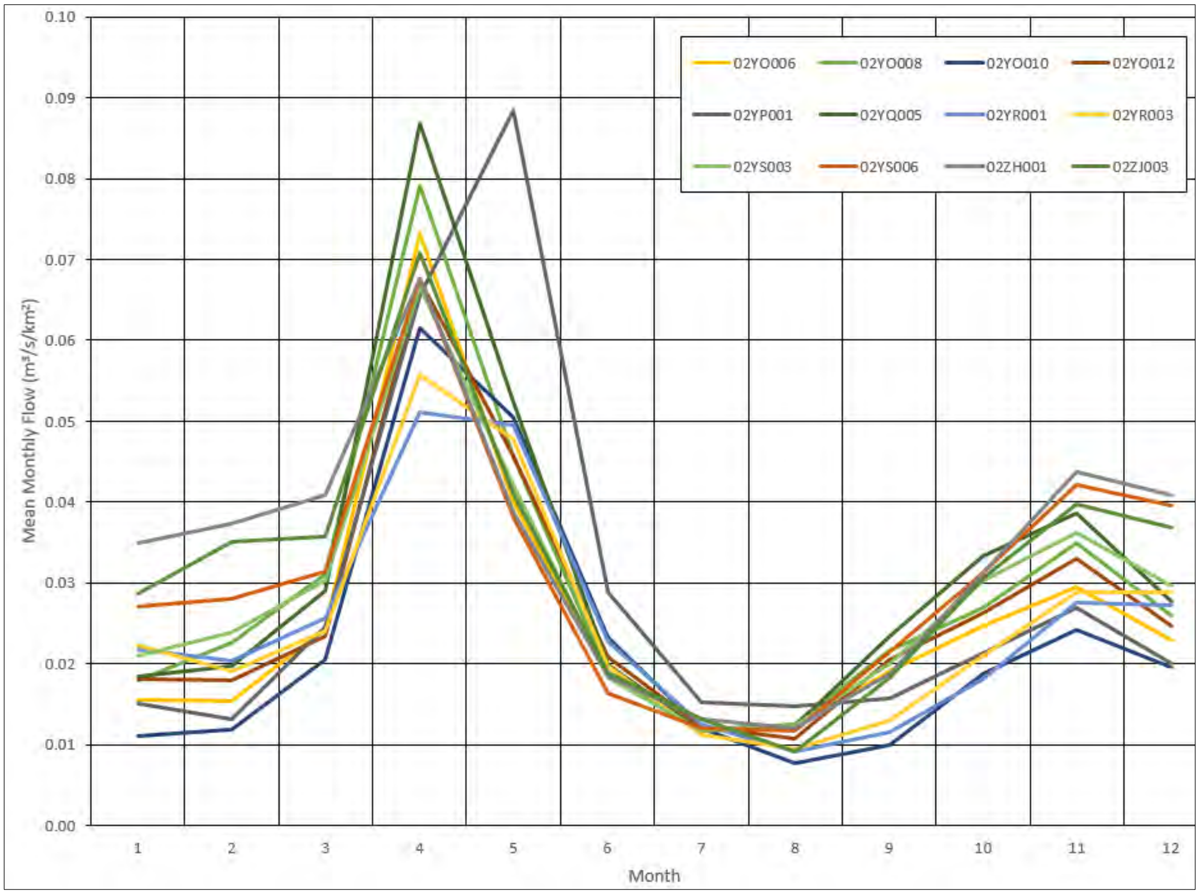


Figure 4.6 Mean Monthly Flows of Select WSC Stations

4.2.1.3 Return Period Flows

Regional relationships for peak flows were developed using the 12 WSC stations selected for the regional assessment. Figure 4.7 presents the relationships between peak flows and watershed areas for various return period events (2, 5, 10, 20, 50, 100, and 200 year).

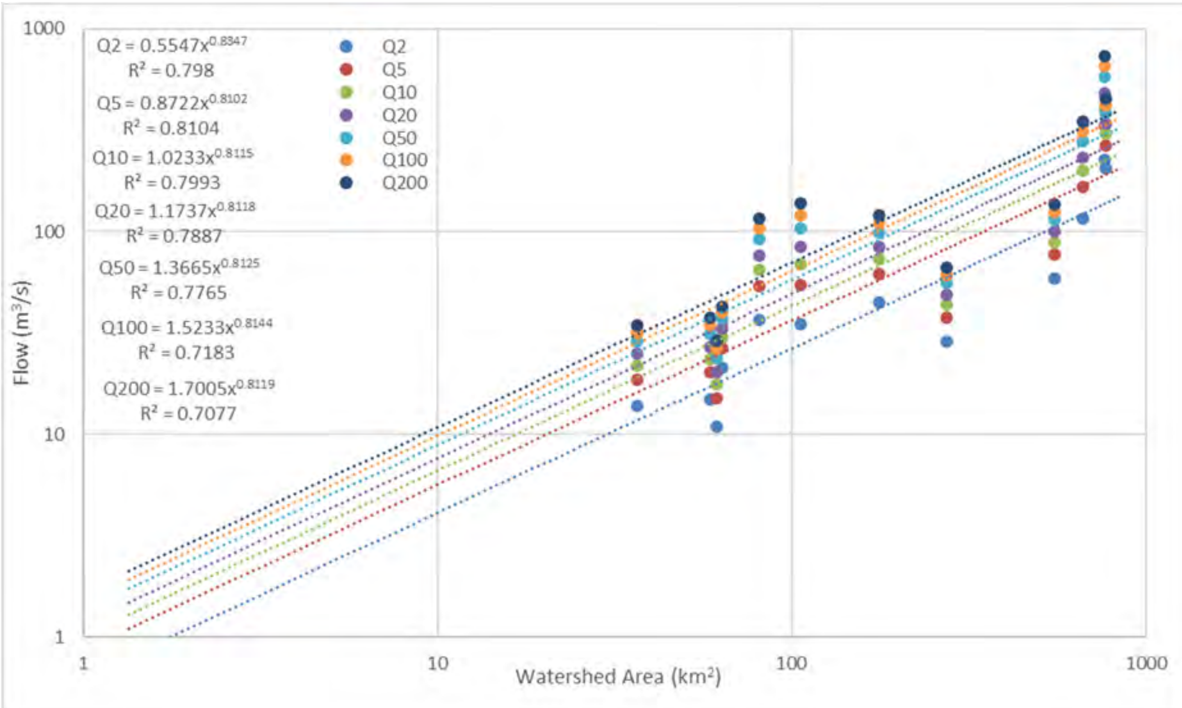


Figure 4-7 Peak Flow and Watershed Area Relationship for Regionally Selected WSC Stations

4.2.1.4 Flow Duration Curves

FDCs for selected WSC stations were developed and the results are shown in Figure 4.8. The FDCs are normalized for watershed area to present a range of flow durations and facilitate station to station comparison. The FDCs demonstrates reasonably good regional homogeneity.

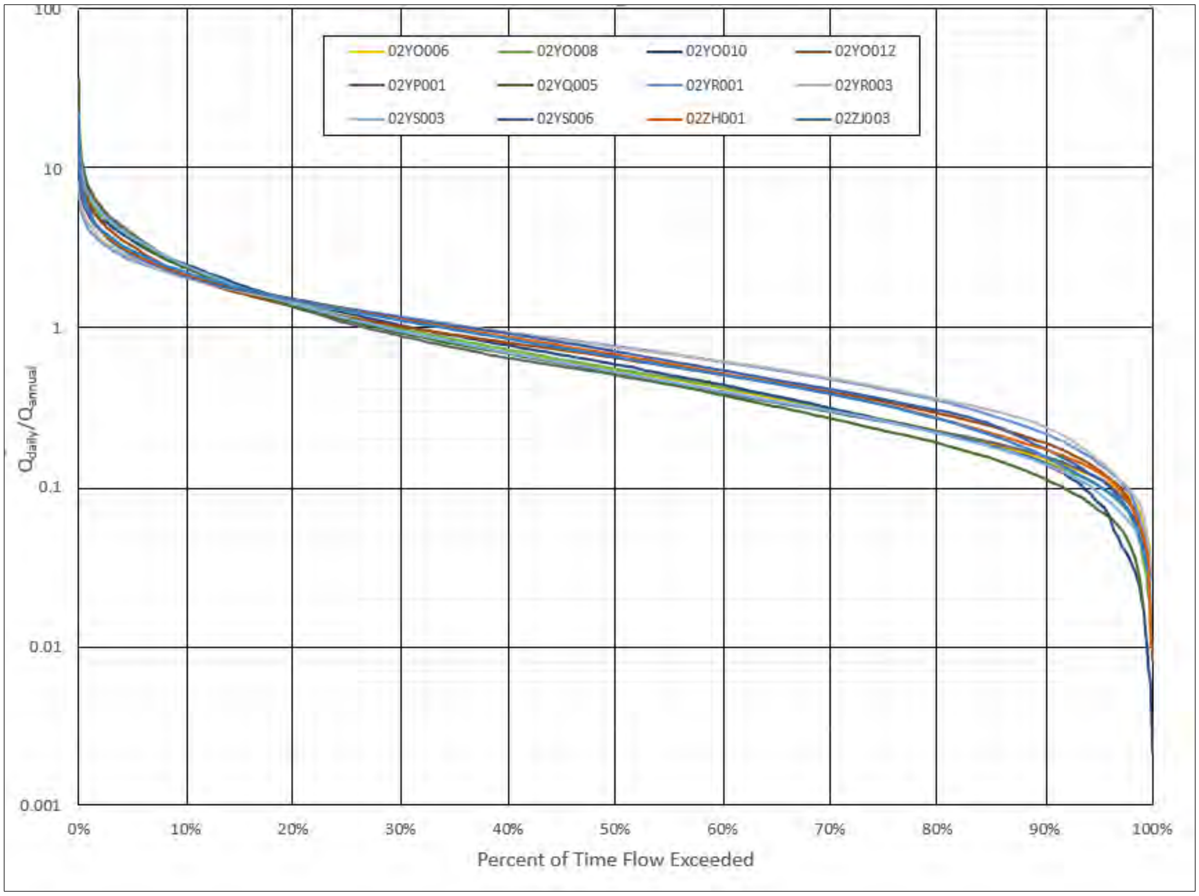


Figure 4.8 FDCs of select NE Hydrologic Region WSC Stations

4.2.1.5 Low and Environmental Flows

Low flow relationships have been derived using the regional frequency analysis developed by Zadeh (2012) and put forward in the provinces low flow spreadsheet. Relationships were developed between low flows and drainage area using the provinces low flow spreadsheet for various return periods and are presented in Figure 4.9.

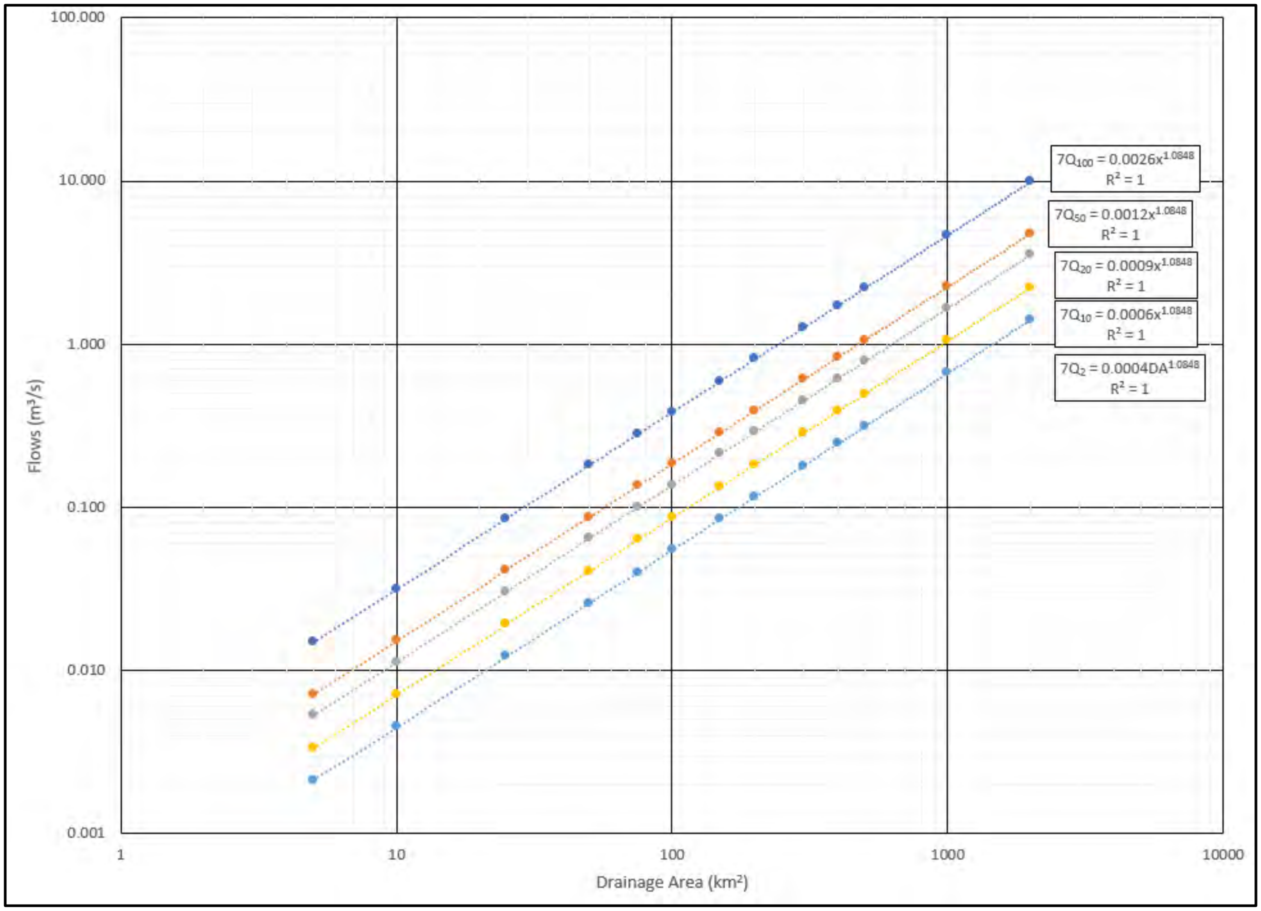


Figure 4.9 Drainage Area Vs Low Flows

4.2.1.6 Environmental Water Balance

The water balance model was run under three climate scenarios, climate normal, wet year and dry year. The input parameters presented in Table 4.11 were established based on assumptions of local climate and soil conditions and guidance provided by USGS (McCabe and Markstrom 2007). Climate normal temperature input values were used for each of the three scenarios. Climate normal precipitation values were used for the climate normal scenario. Precipitation values reported in 1950 were used for the dry-year as this year most closely aligns with the dry year total precipitation calculated in Section 4.1.1.2. Precipitation values reported in 2000 were used for the wet-year as this year most closely aligns with the wet year total precipitation calculated in Section 4.1.1.2.

Table 4.11 Water Balance Input Parameters for the USGS Thornthwaite Water Balance Model

Input Parameter (Units)	Value
Run-off Factor (-)	0.625
Direct Run-off Factor (-)	0.05
Soil Moisture Storage Capacity (mm)	300
Latitude of Location (°)	48
Rain Temperature Threshold (°C)	0.0
Snow Temperature Threshold (°C)	0.0
Maximum Melt Rate (-)	0.5

Notes:
Values are numerical input parameter values.
Soil moisture storage capacity was selected based on a mature forest land cover and fine sandy loam soil type (Ontario Ministry of Environment and Energy 2003)

Results from running the water balance under climate normal, wet year, and dry year conditions are presented in Tables 4.12, 4.13, and 4.14 below.

Table 4.12 Monthly Environmental Water Balance– Climate Normal (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation	122	98.1	95	85.7	86.6	87.8	95.3	123	110.4	97.5	111.8	123.1
Actual Evapotranspiration	3.4	3.9	7.1	27.8	51.5	76	96.9	80	45.3	23.9	11.9	7.6
Snow Storage	122	220.1	315.1	157.6	78.8	39.4	19.7	9.8	0	0	0	123.1
Soil Moisture Storage	146.6	142.7	135.6	300	300	300	300	300	300	300	300	292.4
Total Runoff	15.7	6	2.3	34.2	83.6	63.5	35.5	46.7	64	69.7	88.7	31.6

Table 4.13 Monthly Environmental Water Balance– Wet Year (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation	187	89.4	167.8	82	123	98.6	144.2	128.2	96	166.8	79	200.8
Actual Evapotranspiration	3.4	3.9	7.1	27.8	51.5	76	96.9	80	45.3	23.9	11.9	7.6
Snow Storage	187	276.4	444.2	222.1	111	55.5	27.8	13.9	6.9	0	0	200.8
Soil Moisture Storage	146.6	142.7	135.6	300	300	300	300	300	300	300	300	292.4
Total Runoff	15.7	6	2.3	71.8	141.3	101.7	86	70.8	62	117.8	84.7	30.7

Table 4.14 Monthly Environmental Water Balance– Dry Year (mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation	76.9	95.3	55.2	62.8	45.4	32.3	79.9	53.8	23.1	46.5	58.7	53.3
Actual Evapotranspiration	3.4	3.9	7.1	27.8	51.5	76	96.6	78.3	43	23.9	11.9	7.6
Snow Storage	76.9	172.2	227.4	113.7	56.8	28.4	14.2	7.1	0	0	0	53.3
Soil Moisture Storage	146.6	142.7	135.6	281.2	300	283.1	276.7	256.6	242.6	262.9	300	292.4
Total Runoff	15.7	6	2.3	4	21	8.7	6.7	3.7	1.5	2.5	7.2	1.6

The results of this water balance show that expected annual evapotranspiration ranges from 431mm in the dry year, to 435 mm in the climate normal and wet year. This evapotranspiration rate is near the low end of the Newfoundland Water Resources Atlas range of 450 – 475 mm/year reported for the Project Area (Section 4.1.1.4).

A mean annual BFI was calculated to be 35%, as discussed in Section 4.1.6. Considering this in terms of the environmental water balance indicates that of the total runoff determined for the scenarios listed above, approximately 35% of this flow will be from groundwater influx. Some potential variations may be present across the PDA, including higher BFI in streams located in perched water tables (i.e. HS1 and HS2 which are located in or near bogs) and potentially lower BFI in streams located in areas of highly permeable bedrock (i.e. HS7 which exhibited very low summer flows).

4.2.2 Local Hydrology

4.2.2.1 Hydrometric Monitoring Results

A stage-discharge relationship (rating curve) was developed for each hydrometric monitoring station based on measured water level and discharge measurements. Eight (8) discharge measurements were completed at each of the stations for which a rating curve was developed except HS7 and HS9 which each had seven (7) measurements. Discharge measurements were collected during the ice-free period when each site was accessible, and conditions were considered safe for data collection. Conditions during the summer of 2019 were exceptionally dry and therefor the majority of flow measurements were taken between low flow conditions and bankful. Flows exceeding bankfull were generally not measured due to either safe access during these conditions and the occurrence of such events during site work. Flow records and corresponding rating curves for water levels above bankful are identified as having increased uncertainty in the hydrographs presented below.

The baseline program had twelve (12) hydrometric monitoring stations established between 2011 and 2019. Of these stations, eight collected continuous water level data using a pressure transducer and collected spot flow measurements (HS1, HS2, HS3, HS7, HS8, HS9, HS11, HS12), three were for spot flow measurements only (HS4, HS5, HS6), and one collected continuous water level data but had no corresponding spot flow measurements (HS10). A list of field monitoring stations is presented in Table 3.4 and their locations and watersheds are shown on Figure 3.2.

Hydrometric Station Summary Forms, providing an overview of information relating to each station are provided in Appendix A. Hydrometric monitoring results are further summarized for each station below.

HS1

Hydrometric monitoring station HS1 is located in an Unnamed Creek 1 approximately 115 m downstream of the outflow from the Middle Pond within the north flowing watershed (Figure 4.2). The Unnamed Creek 1 drains to Valentine Lake. The site is characterized as an open grassy meadow dominated by grasses and shrubs (Photo 4.1). Substrate is a mixture of fines with some gravel and cobble, and plentiful vegetation. The Unnamed Creek 1 hydrometric station (HS1) has a drainage area of approximately 0.397 km^2. Eight flow monitoring events were completed at this site during the monitoring period.

Photo 4.1 Hydrometric Monitoring Station HS1

Flow measurements collected throughout the baseline monitoring period and used in the development of a rating curve at HS1 are provided in Table 4.15.

Table 4.15 HS1 Field Flow Measurement Summary Table

Date	16-Oct-2012	26-May-2014	20-Jun-2019	21-Jun-2019	5-Aug-2019	26-Sep-2019	28-Sep-2019	7-Oct-2019
Measured Flow (m^3/s)	0.0226	0.0178	0.0054	0.0047	0.0000	0.0446	0.0199	0.0042

A rating curve was developed in the AQUARIUS platform using the field measured flow rates and corresponding barometrically corrected water stage, as recorded by the HS1 pressure transducer. The rating curve equation is not constant and is adjusted at the stage measurements corresponding to the field discharge measurements as shown in Table 4.16 and Figure 4.10.

Table 4.16 HS1 Rating Curve Equation Table

Stage	Rating Curve Equation
0.1508	-----
0.2147	X = 1852.89285 * Y^8.47959
0.2294	X = 2.76257 * Y^4.24931
0.245	X = 2.67956 * Y^4.22859
0.2617	X = 3.76653 * Y^4.47068
0.2796	X = 3.02831 * Y^4.30795
0.2987	X = 3.33565 * Y^4.38380
0.319	X = 3.39358 * Y^4.39805
0.3408	X = 3.34641 * Y^4.38580
0.364	X = 3.23892 * Y^4.35547
0.3889	X = 3.27605 * Y^4.36675
0.8047	X = 0.27605 * Y^1.74345

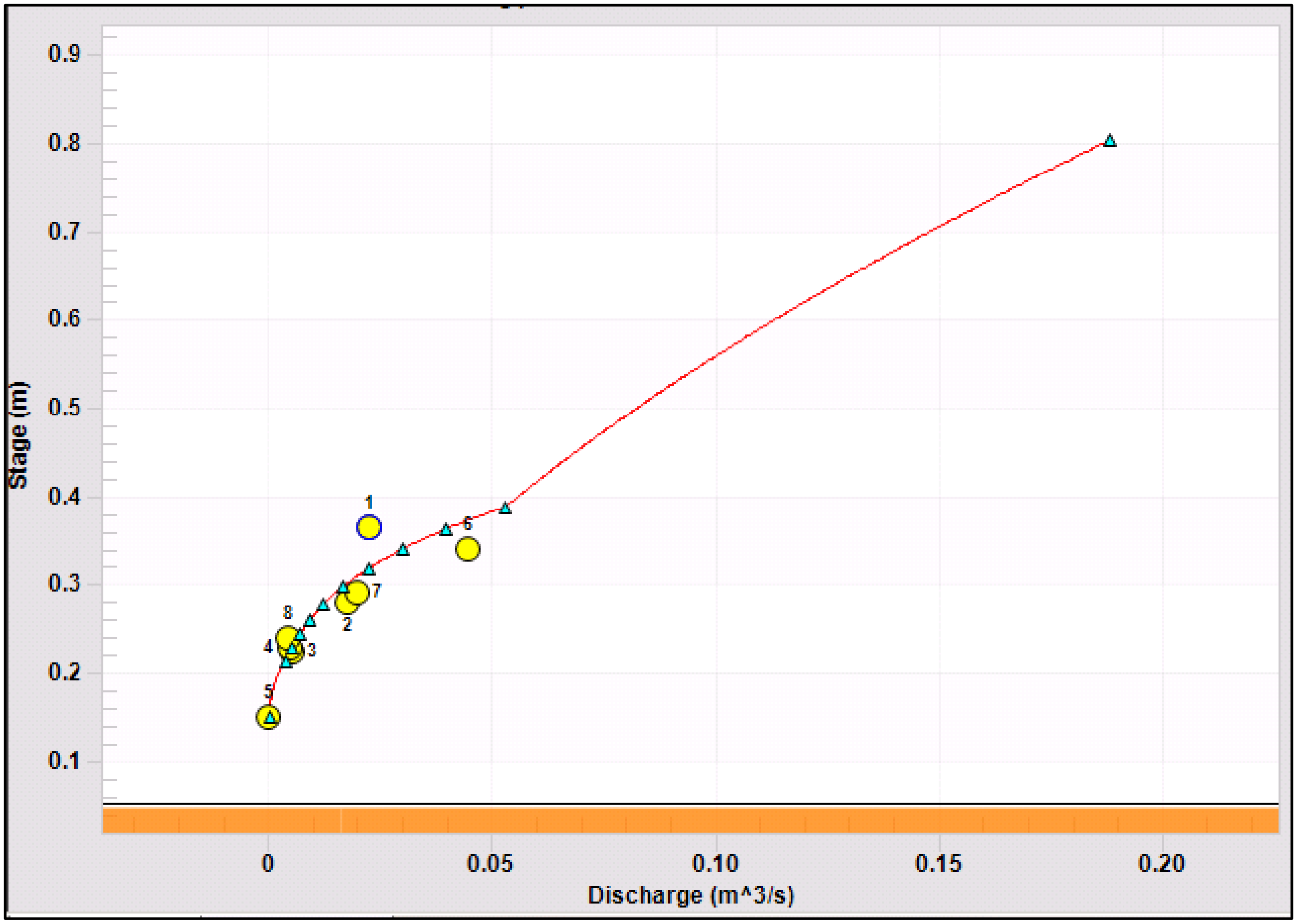


Figure 4.10 HS1 Rating Curve

Figure 4.11 presents the stream flows generated for HS1 for the period of October 2012 to October 2019 based on the rating curve developed. The highest flow of 0.103 m^3/s occurred in April 2014 and the lowest flow of 0 m^3/s occurred during multiple periods of record.

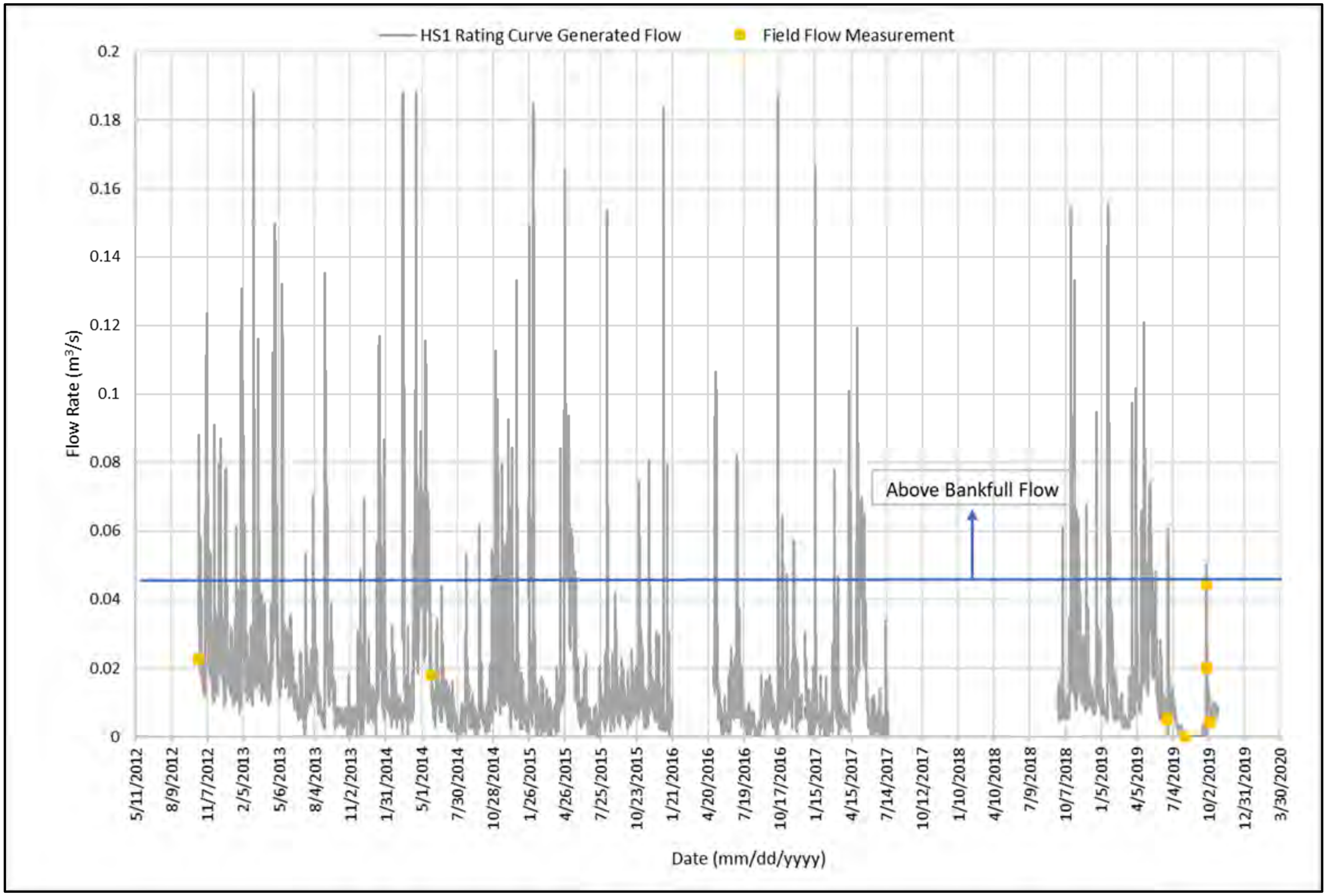


Figure 4.11 Daily Stream Flow at Stream Flow Monitoring Station HS1

HS2

Hydrometric monitoring station HS2 is located on the Unnamed Creek 1 approximately 60 m downstream of the outlet from the East Pond within the north flowing watershed (Figure 4.4). The site is characterized as mainly shrubs with some grasses, fringed by forest (Photo 4.2). Substrate is a mixture of cobble and boulder, with some gravel with minimal instream vegetation was noted at the hydrometric station. The Unnamed Creek 1 hydrometric station (HS2) has a drainage area of approximately 1.05 km^2. Eight flow monitoring events were completed at this site during the monitoring period.

Photo 4.2 Hydrometric Monitoring Station HS2

Flow measurements collected throughout the baseline monitoring period and used in the development of a rating curve at HS2 are provided in Table 4.17.

Table 4.17 HS2 Field Flow Measurement Summary Table

Date	16-Oct-2012	24-Sep-2013	20-Jun-2019	21-Jun-2019	5-Aug-2019	26-Sep-2019	28-Sep-2019	7-Oct-2019
Measured Flow (m^3/s)	0.0059	0.0089	0.0026	0.0025	0.0001	0.110	0.0410	0.0078

A rating curve was developed in the AQUARIUS platform using the field measured flow rates and corresponding barometrically corrected water stage, as recorded by the HS2 pressure transducer. The rating curve equation is not constant and is adjusted at various stage measurements as shown in Table 4.18 and Figure 4.12.

Table 4.18 HS2 Rating Curve Equation Table

Stage	Rating Curve Equation
0.3343	-----
0.3461	X = 1040410019247420 * Y^39.96356
0.3639	X = 2185476776 * Y^27.64221
0.3846	X = 7186.31594 * Y^15.15288
0.4125	X = 68.17251 * Y^10.27832
0.4425	X = 71.63770 * Y^10.33431
0.4788	X = 36.24182 * Y^9.49855
0.518	X = 44.72743 * Y^9.78420
0.5612	X = 9.31964 * Y^7.39972
0.6253	X = 1.78953 * Y^4.54316
0.9792	X = 0.94697 * Y^3.18766

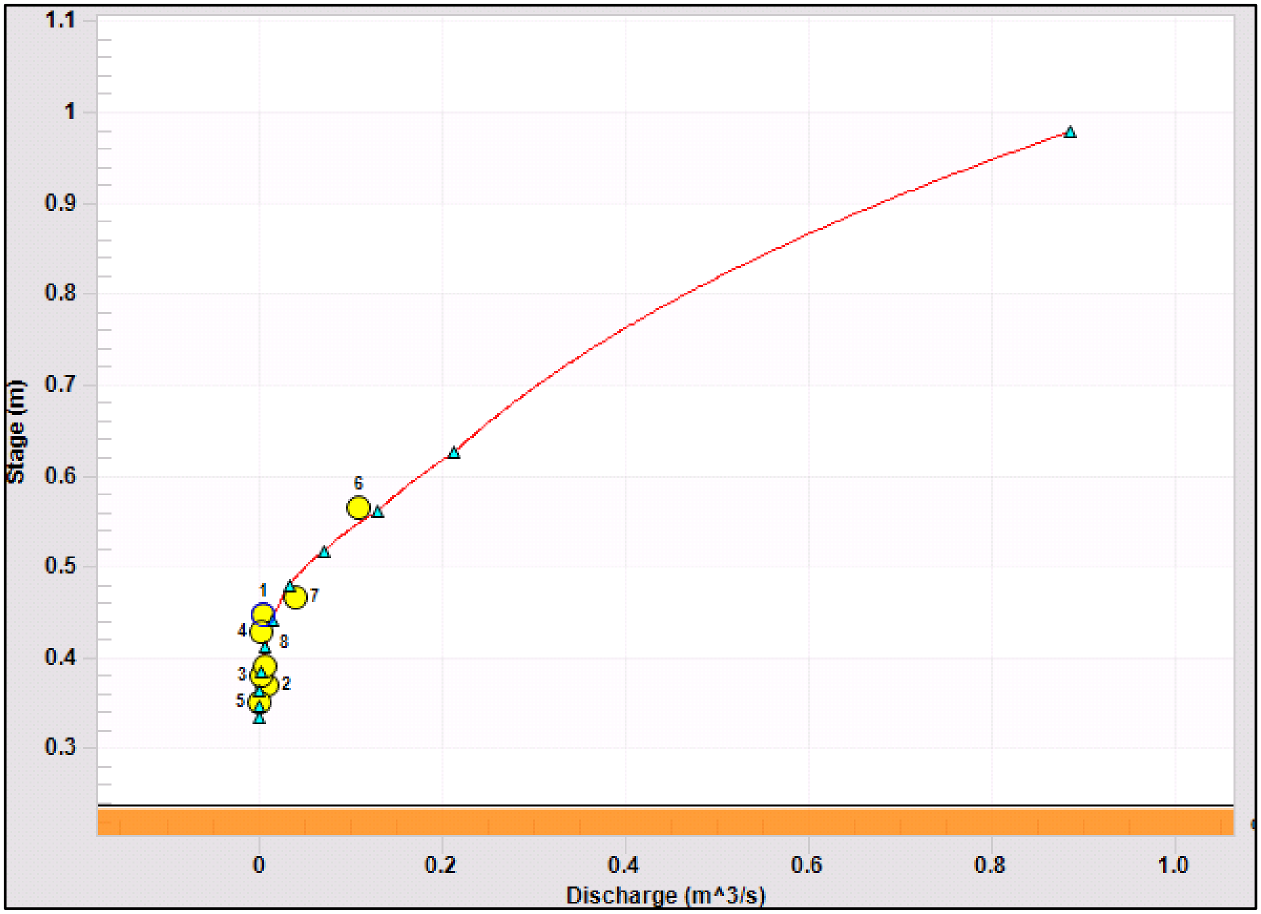


Figure 4.12 HS2 Rating Curve

Figure 4.13 presents the stream flows generated for HS2 for the period of October 2012 to October 2019 based on the rating curve developed. The highest flow of 0.885 m^3/s occurred in March 2014 and the lowest flow of 0 m^3/s occurred during multiple periods of record.

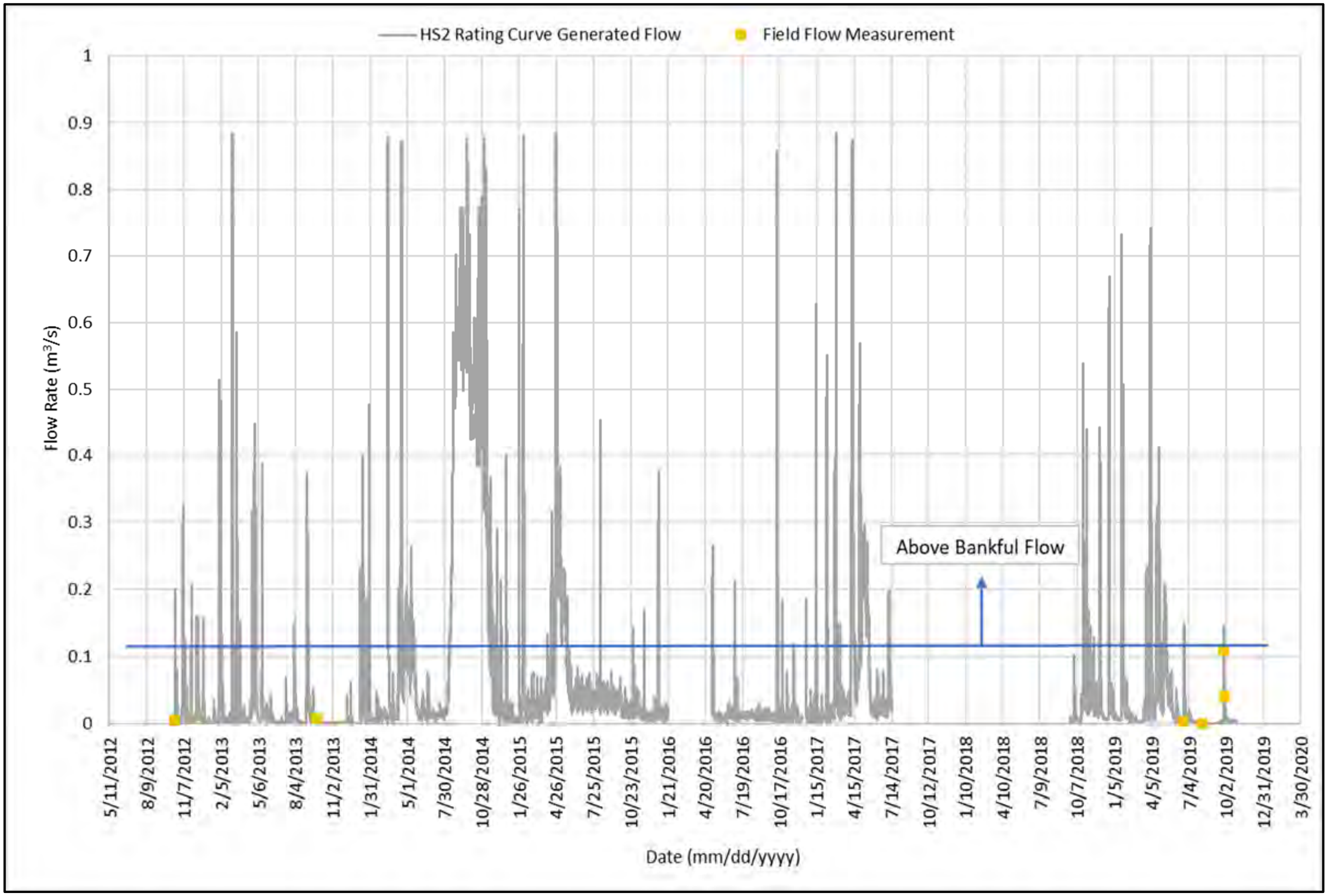


Figure 4.13 Daily Stream Flow at Stream Flow Monitoring Station HS2

HS3

Hydrometric monitoring station HS3 is located in an Unnamed Creek 2 approximately 20 m downstream of the outlet from the West Pond within the south flowing watershed (Figure 4.4). The Unnamed Creek 2 drains to Victoria Lake. The site is characterized as an open grassy meadow dominated by grasses and shrubs, fringed by forest (Photo 4.3). Substrate is a mixture of cobble and gravel with some instream vegetation. The Unnamed Creek 2 hydrometric station (HS3) has a drainage area of approximately 0.702 km^2. Eight flow monitoring events were completed at this site during the monitoring period.

Photo 4.3 Hydrometric Monitoring Station HS3

Flow measurements collected throughout the baseline monitoring period and used in the development of a rating curve at HS3 are provided in Table 4.19.

Table 4.19 HS3 Field Flow Measurement Summary Table

Date	16-Oct-2012	26-May-2014	20-Jun-2019	21-Jun-2019	5-Aug-2019	26-Sep-2019	28-Sep-2019	7-Oct-2019
Measured Flow (m^3/s)	0.0616	0.0123	0.0020	0.0009	0.0000	0.0667	0.0286	0.0037

A rating curve was developed in the AQUARIUS platform using the field measured flow rates and corresponding barometrically corrected water stage, as recorded by the HS3 pressure transducer. The rating curve equation is not constant and is adjusted at various stage measurements as shown in Table 4.20 and Figure 4.14.

Table 4.20 HS3 Rating Curve Equation Table

Stage	Rating Curve Equation
0.0246	-----
0.0739	-----
0.0882	X = 7.32750 * Y^3.37963
0.1053	X = 4.27789 * Y^3.15799
0.1257	X = 5.01810 * Y^3.22889
0.1501	X = 4.53792 * Y^3.18039
0.1792	X = 4.66497 * Y^3.19495
0.2139	X = 4.40472 * Y^3.16156
0.2554	X = 4.63183 * Y^3.19416
0.3049	X = 4.54746 * Y^3.18069
0.7049	X = 4.54730 * Y^3.18066

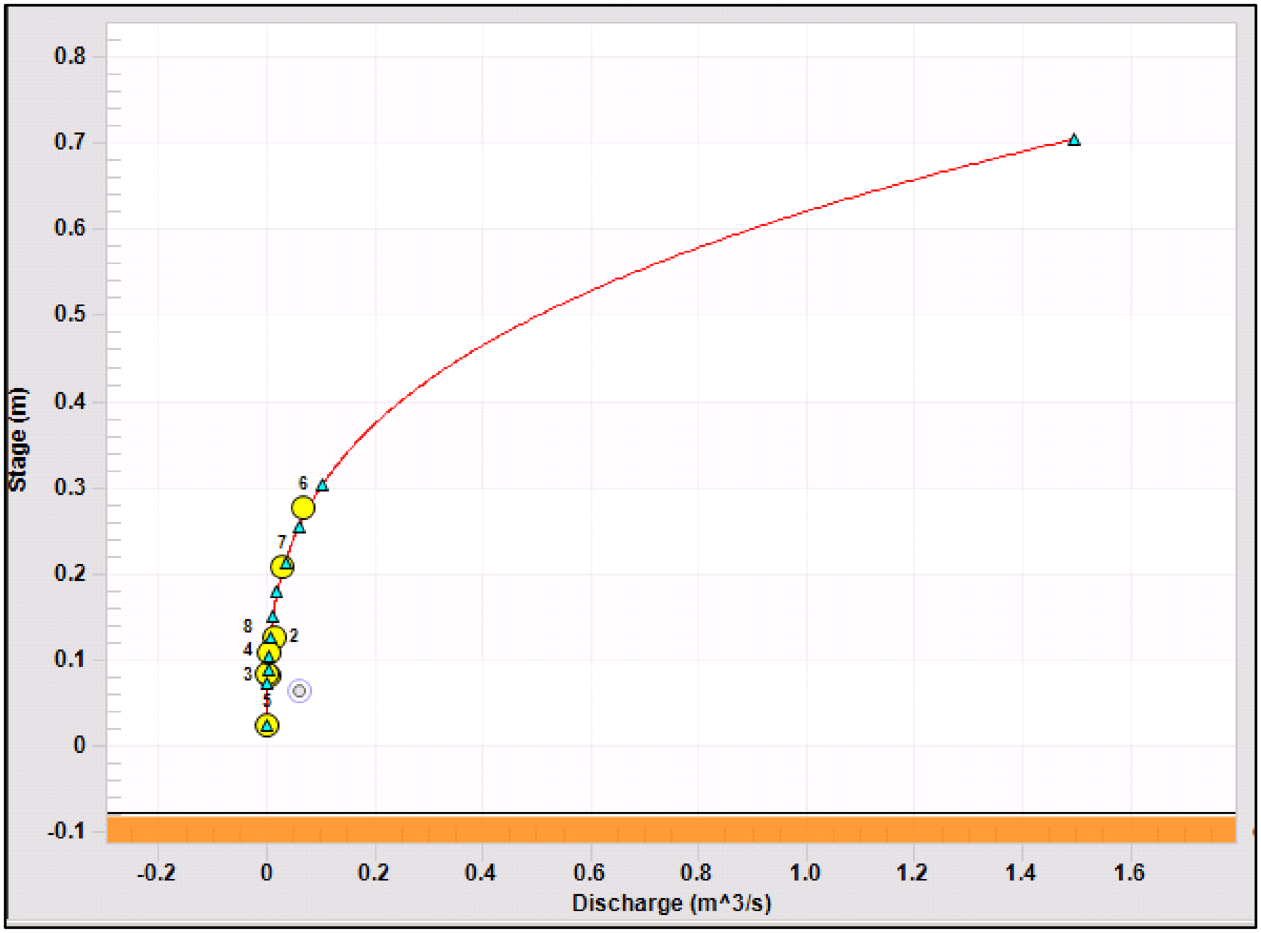


Figure 4.14 HS3 Rating Curve

Figure 4.15 presents the stream flows generated for HS3 for the period of October 2012 to October 2019 based on the rating curve developed. The highest flow of 1.49 m^3/s occurred in March 2014 and the lowest flow of 0 m^3/s occurred during multiple periods of record.

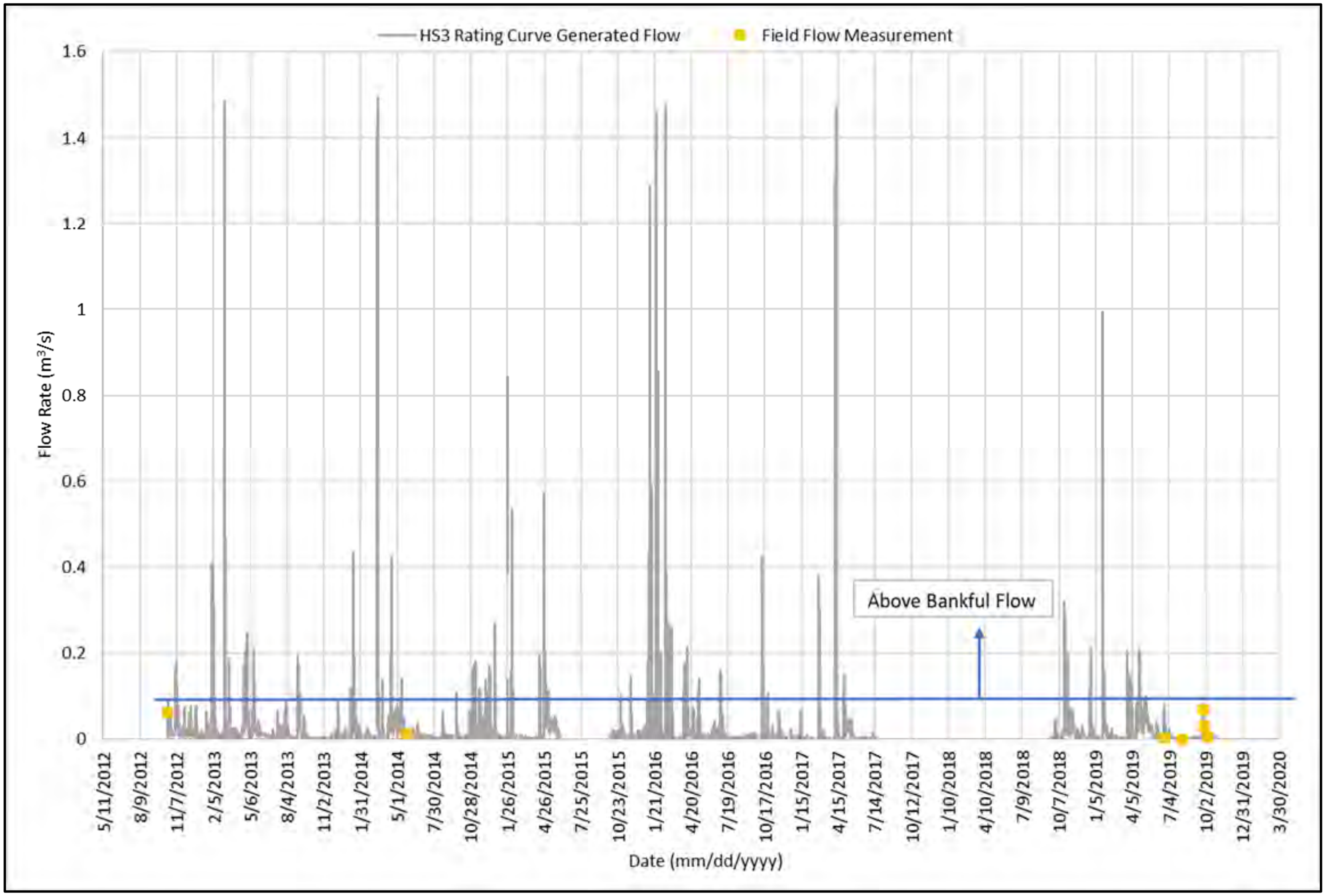


Figure 4.15 Daily Stream Flow at Stream Flow Monitoring Station HS3

HS4

The Unnamed Creek 2 hydrometric station (HS4) has a drainage area of approximately 1.01 km^2. The hydrometric monitoring station is located approximately 600 m downstream of the West Pond Pond and the hydrometric station HS3 (Figure 4.4). The HS4 site is dominated by shrubs and trees, with some grasses and dense overhanging vegetation. The channel substrate is a mixture of cobble and gravel with some areas of fines. A levellogger was not installed at this location. Flow measurements collected throughout the baseline monitoring period at HS4 are provided in Table 4.21. Eight flow monitoring events were completed at this site during the monitoring period.

Table 4.21 HS4 Field Flow Measurement Summary Table

Date	17-Oct-12	24-Sep-13	26-May-14	20-Jun-19	21-Jun-19	6-Aug-19	26-Sep-19	28-Sep-19
Measured Flow (m^3/s)	0.0792	0.014	0.0153	0.0031	0.0041	0.0001	0.0981	0.0377

HS5

The Unnamed Creek 3 hydrometric station (HS5) has a drainage area of approximately 1.01 km^2. The Unnamed Creek 3 is tributary to the Unnamed Creek 2. The hydrometric monitoring station is located approximately 400 m downstream of a small pond (Figure 4.4). The HS5 site is dominated by shrubs and trees with some grasses and overhanging vegetation. The channel substrate is a mixture of cobbles and gravels with some boulders. A levelogger was not installed at this location. Flow measurements collected throughout the baseline monitoring period at HS5 are provided in Table 4.22. Eight flow monitoring events were completed at this site during the monitoring period.

Table 4.22 HS5 Field Flow Measurement Summary Table

Date	17-Oct-12	24-Sep-13	26-May-14	20-Jun-19	6-Aug-19	26-Sep-19	28-Sep-19	6-Aug-19
Measured Flow (m^3/s)	0.0736	0.076	0.017	0.0011	0.0001	0.1153	0.0265	0.0001

HS6

The Unnamed Creek 2 hydrometric station (HS6) has a drainage area of approximately 2.33 km^2. The hydrometric monitoring station is located just downstream of the Unnamed Creek 3 tributary (Figure 4.4). The HS6 site is dominated by grasses and shrubs, fringed by trees. The channel substrate is a mixture of gravel, fines, and woody debris as the area is impacted by beaver activity. A levellogger was not installed at this location. Flow measurements collected throughout the baseline monitoring period at HS6 are provided in Table 4.23. Eight flow monitoring events were completed at this site during the monitoring period.

Table 4.23 HS6 Field Flow Measurement Summary Table

Date	17-Oct-12	24-Sep-13	26-May-14	20-Jun-19	21-Jun-19	6-Aug-19	26-Sep-19	28-Sep-19
Measured Flow (m^3/s)	0.1551	0.082	0.035	0.0056	0.0042	0.0001	0.2899	0.0749

HS7

Hydrometric monitoring station HS7 is located in an unnamed watercourse approximately 20 m upstream of the Site Access Road (Figure 4.4). The watercourse drains to t Victoria River. The site is characterized as an overgrown area dominated by shrubs and trees (Photo 4.4). Substrate is a mixture of cobble and gravel with minimal instream vegetation. The HS7 station has a drainage area of approximately 1.781 km^2. Seven flow monitoring events were completed at this site during the monitoring period.

Photo 4.4 Hydrometric Monitoring Station HS7

Flow measurements collected throughout the baseline monitoring period and used in the development of a rating curve at HS7 are provided in Table 4.24.

Table 4.24 HS7 Field Flow Measurement Summary Table

Date	27-Nov-18	19-Jun-19	22-Jun-19	5-Aug-19	8-Aug-19	26-Sep-19	6-Oct-19
Measured Flow (m^3/s)	0.0137	0.0044	0.3519	0.0008	0.0002	0.1186	0.0090

A rating curve was developed in the AQUARIUS platform using the field measured flow rates and corresponding barometrically corrected water stage, as recorded by the HS7 pressure transducer. The rating curve equation is not constant and is adjusted at various stage measurements as shown in Table 4.25 and Figure 4.16.

Table 4.25 HS7 Rating Curve Equation Table

Stage	Rating Curve Equation
0.067	-----
0.1096	X = 0.20266 * Y^2.81684
0.1282	X = 37.09964 * Y^5.17326
0.1499	X = 202.74925 * Y^6.00005
0.1752	X = 218.84316 * Y^6.04030
0.2048	X = 145.05461 * Y^5.80420
0.2395	X = 161.42680 * Y^5.87164
0.28	X = 163.07563 * Y^5.87875
0.3273	X = 160.48494 * Y^5.86617
0.3827	X = 161.00908 * Y^5.86909
0.5089	X = 16.29254 * Y^3.48414

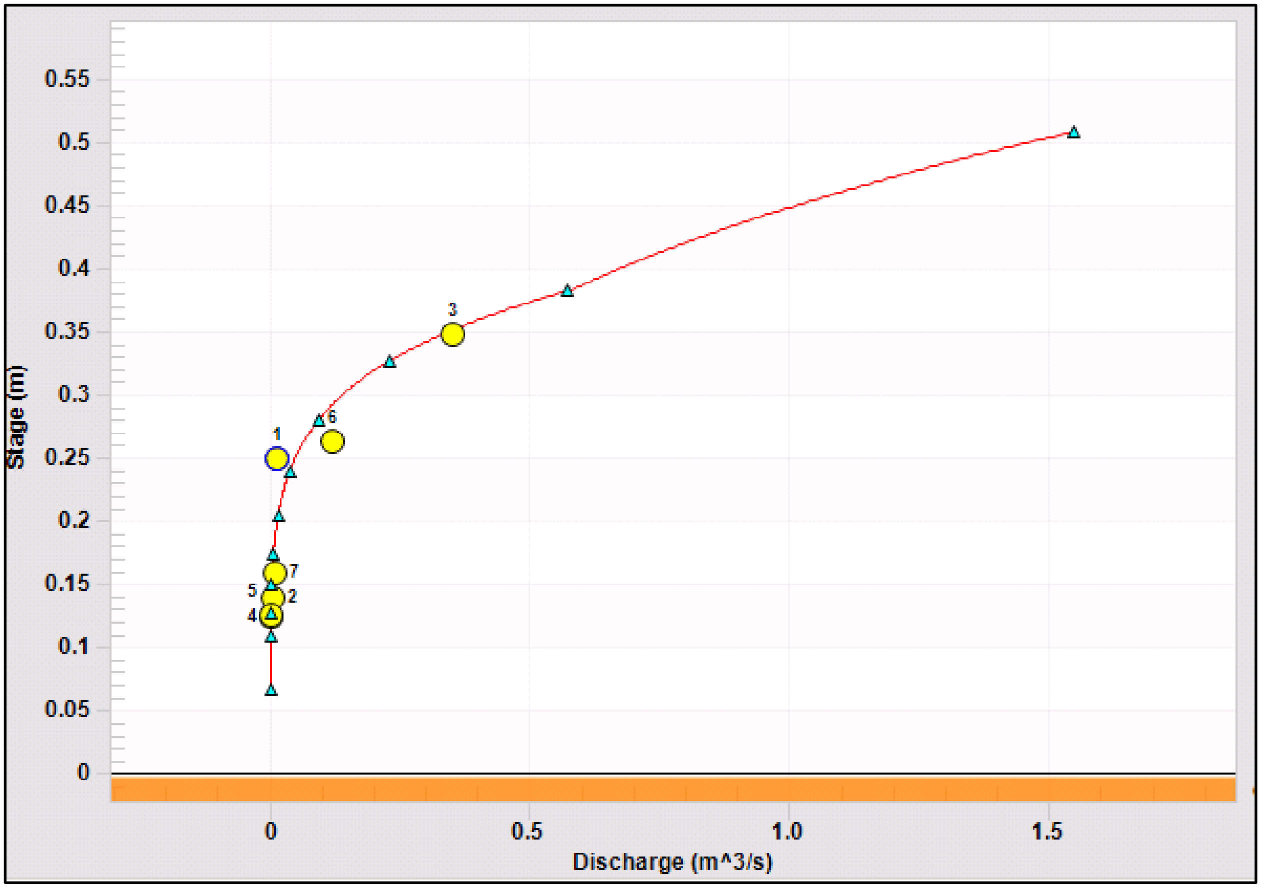


Figure 4.16 HS7 Rating Curve

Figure 4.17 presents the stream flows generated for HS7 for the period of November 2018 to October 2019 based on the rating curve developed. The highest flow of 1.46 m^3/s occurred in April 2019 and the lowest flow of 0.0002 m^3/s occurred during February and March 2019.

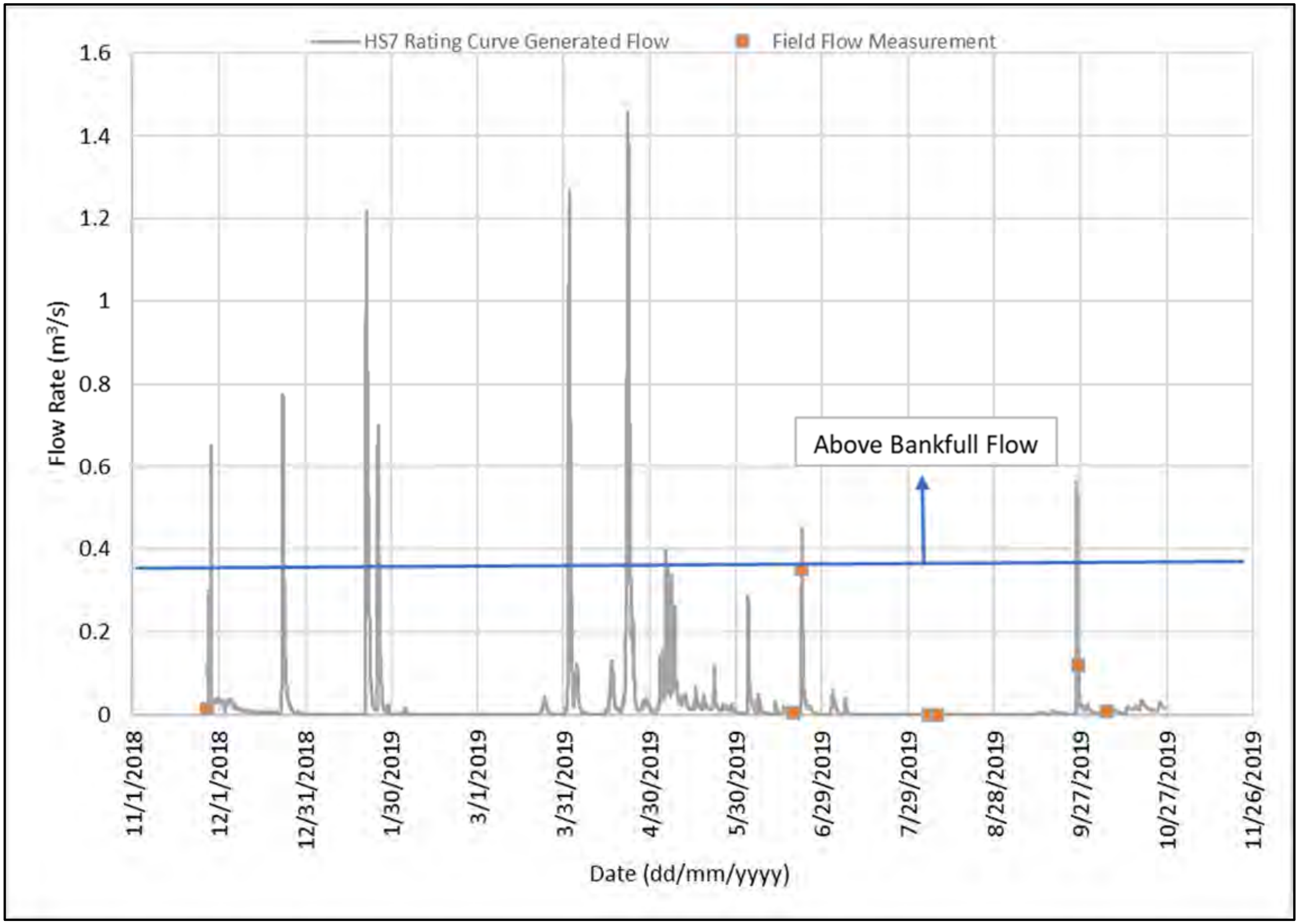


Figure 4.17 Daily Stream Flow at Stream Flow Monitoring Station HS7

HS8

Hydrometric monitoring station HS8 is located in an unnamed watercourse immediately downstream of a bridge on the Site Access Road (Figure 4.4). The watercourse drains to the Victoria River. The site is characterized as an overgrown area dominated by shrubs and trees (Photo 4.5). Substrate is a mixture of cobble, boulders and gravel with minimal instream vegetation. The HS8 station has a drainage area of approximately 5.325 km^2. Eight flow monitoring events were completed at this site during the monitoring period.

Photo 4.5 Hydrometric Monitoring Station HS8

Flow measurements collected throughout the baseline monitoring period and used in the development of a rating curve at HS8 are provided in Table 4.26.

Table 4.26 HS8 Field Flow Measurement Summary Table

Date	27-Nov-18	19-Jun-19	22-Jun-19	4-Aug-19	8-Aug-19	26-Sep-19	28-Sep-19	6-Oct-19
Measured Flow (m^3/s)	0.071	0.0475	0.5159	0.0041	0.0027	0.3139	0.1108	0.0403

A rating curve was developed in the AQUARIUS platform using the field measured flow rates and corresponding barometrically corrected water stage, as recorded by the HS8 pressure transducer. The rating curve equation is not constant and is adjusted at various stage measurements as shown in Table 4.27 and Figure 4.18.

Table 4.27 HS8 Rating Curve Equation Table

Stage	Rating Curve Equation
0.1267	-----
0.1729	X = 31446.09568 * Y^9.47096
0.1977	X = 32.51059 * Y^5.55398
0.2262	X = 30.24165 * Y^5.50935
0.2587	X = 30.25471 * Y^5.50964
0.2959	X = 28.66730 * Y^5.46978
0.3384	X = 29.46969 * Y^5.49245
0.3871	X = 29.59608 * Y^5.49640
0.4428	X = 29.57109 * Y^5.49551
0.5064	X = 29.51356 * Y^5.49312
1.0518	X = 8.50143 * Y^3.66396

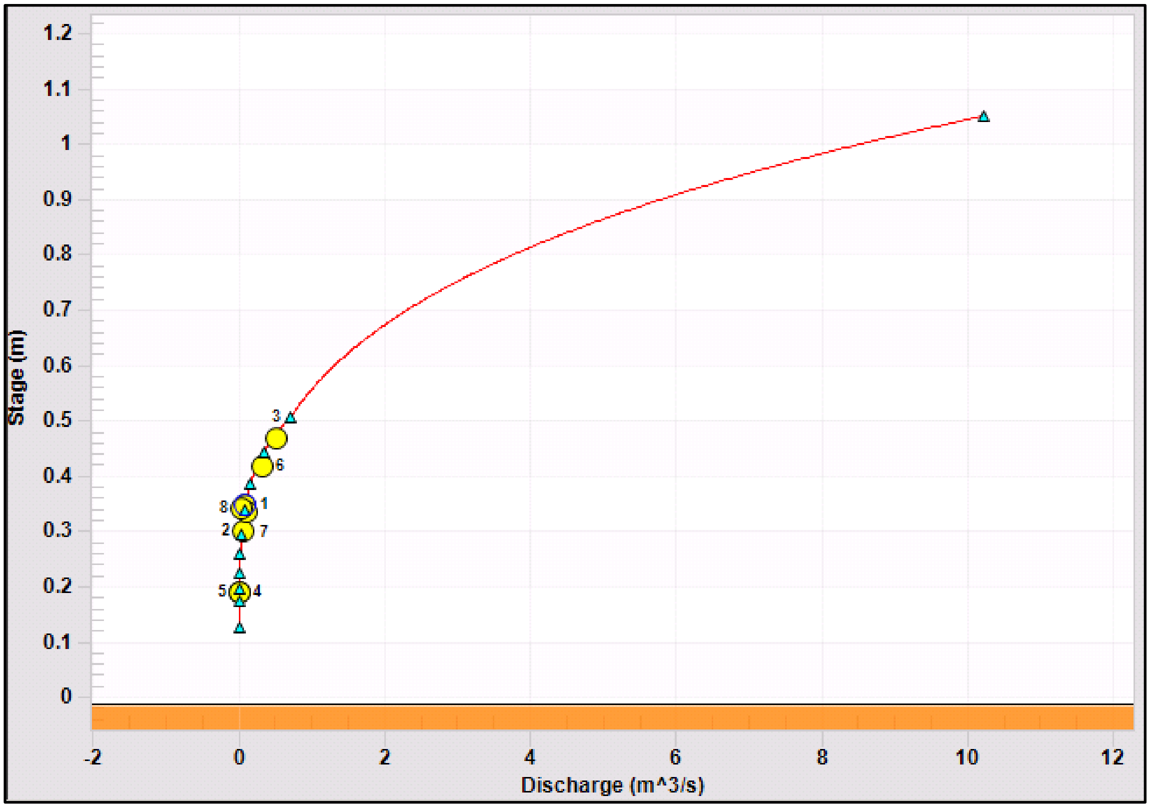


Figure 4.18 HS8 Rating Curve

Figure 4.19 presents the stream flows generated for HS9 for the period of November 2018 to October 2019 based on the rating curve developed. The highest flow of 9.053 m^3/s occurred in January 2019 and the lowest flow of 0.0002 m^3/s occurred during August 2019.

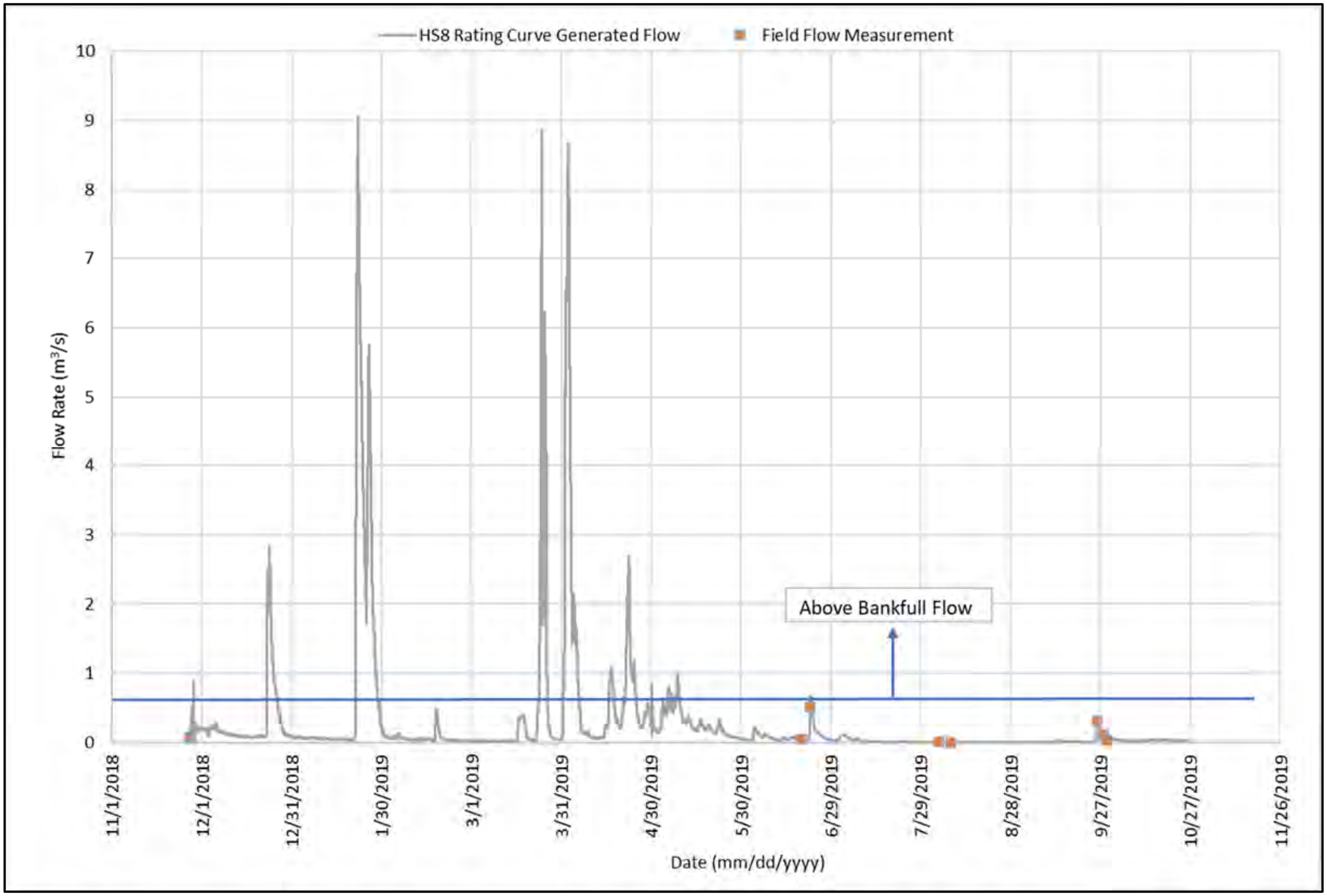


Figure 4.19 Daily Stream Flow at Stream Flow Monitoring Station HS8

HS9

Hydrometric monitoring station HS9 is located in an unnamed watercourse immediately downstream of the outlet of Frozen Ears Lake (Figure 4.4). The watercourse drains to Valentine Lake. The site is characterized as an overgrown area dominated by shrubs and trees (Photo 4.6). Substrate is a mixture of cobble and gravel with minimal instream vegetation. The HS9 station has a drainage area of approximately 3.031 km^2. Seven flow monitoring events were completed at this site during the monitoring period.

Photo 4.6 Hydrometric Monitoring Station HS9

Flow measurements collected throughout the baseline monitoring period and used in the development of a rating curve at HS9 are provided in Table 4.28.

Table 4.28 HS9 Field Flow Measurement Summary Table

Date	27-Nov-18	20-Jun-19	21-Jun-19	5-Aug-19	9-Aug-19	27-Sep-19	28-Sep-19
Measured Flow (m^3/s)	0.0294	0.019	0.0563	0.0004	0.0001	0.1731	0.127

A rating curve was developed in the AQUARIUS platform using the field measured flow rates and corresponding barometrically corrected water stage, as recorded by the HS9 pressure transducer. The rating curve equation is not constant and is adjusted at various stage measurements as shown in Table 4.29 and Figure 4.20.

Table 4.29 HS9 Rating Curve Equation Table

Stage	Rating Curve Equation
0.0757	-----
0.0904	-----
0.1079	X = 1.22644 * Y^3.91696
0.1288	X = 7450.43713 * Y^7.82970
0.1537	X = 272.76046 * Y^6.21592
0.1834	X = 366.48753 * Y^6.37364
0.219	X = 446.09110 * Y^6.48953
0.2614	X = 436.21621 * Y^6.47479
0.312	X = 438.35161 * Y^6.47843
0.3724	X = 437.35737 * Y^6.47648
0.5362	X = 113.23888 * Y^5.10852

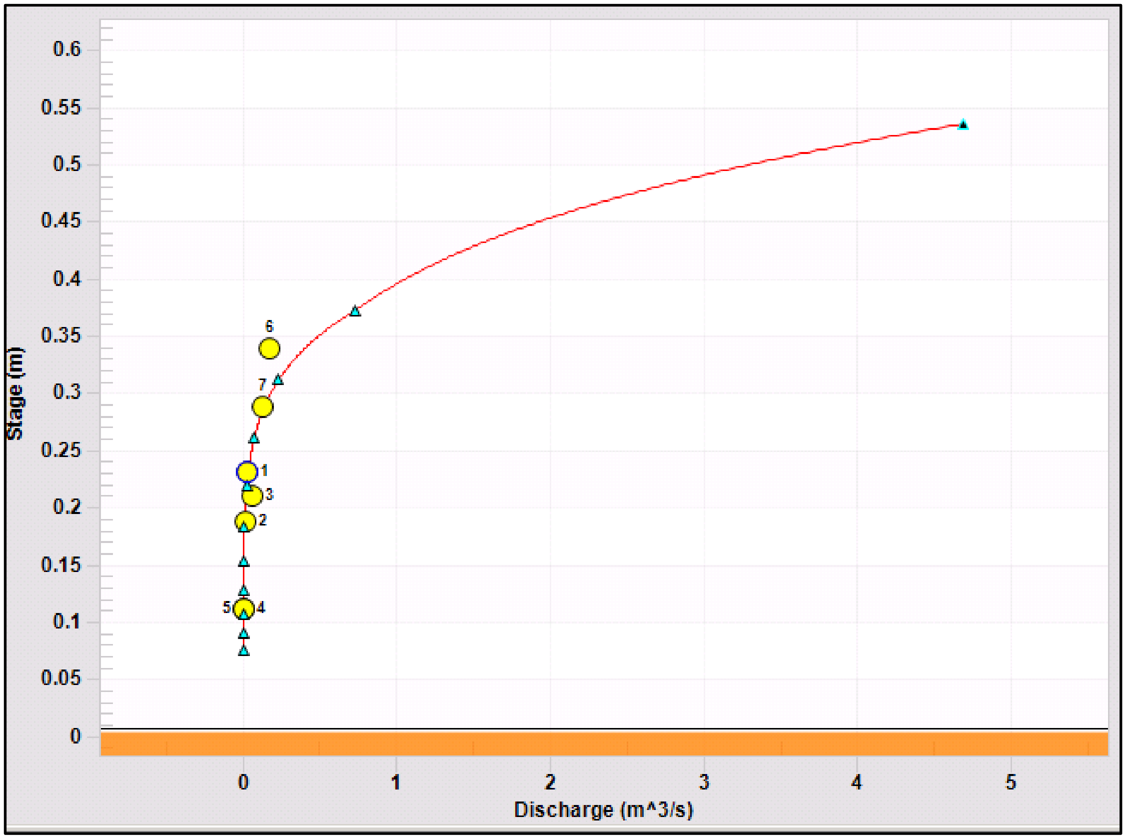


Figure 4.20 HS9 Rating Curve

Figure 4.21 presents the stream flows generated for HS9 for the period of November 2018 to October 2019 based on the rating curve developed. The highest flow of 3.567 m^3/s occurred in April 2019 and the lowest flow of 0.0002 m^3/s occurred during August 2019.

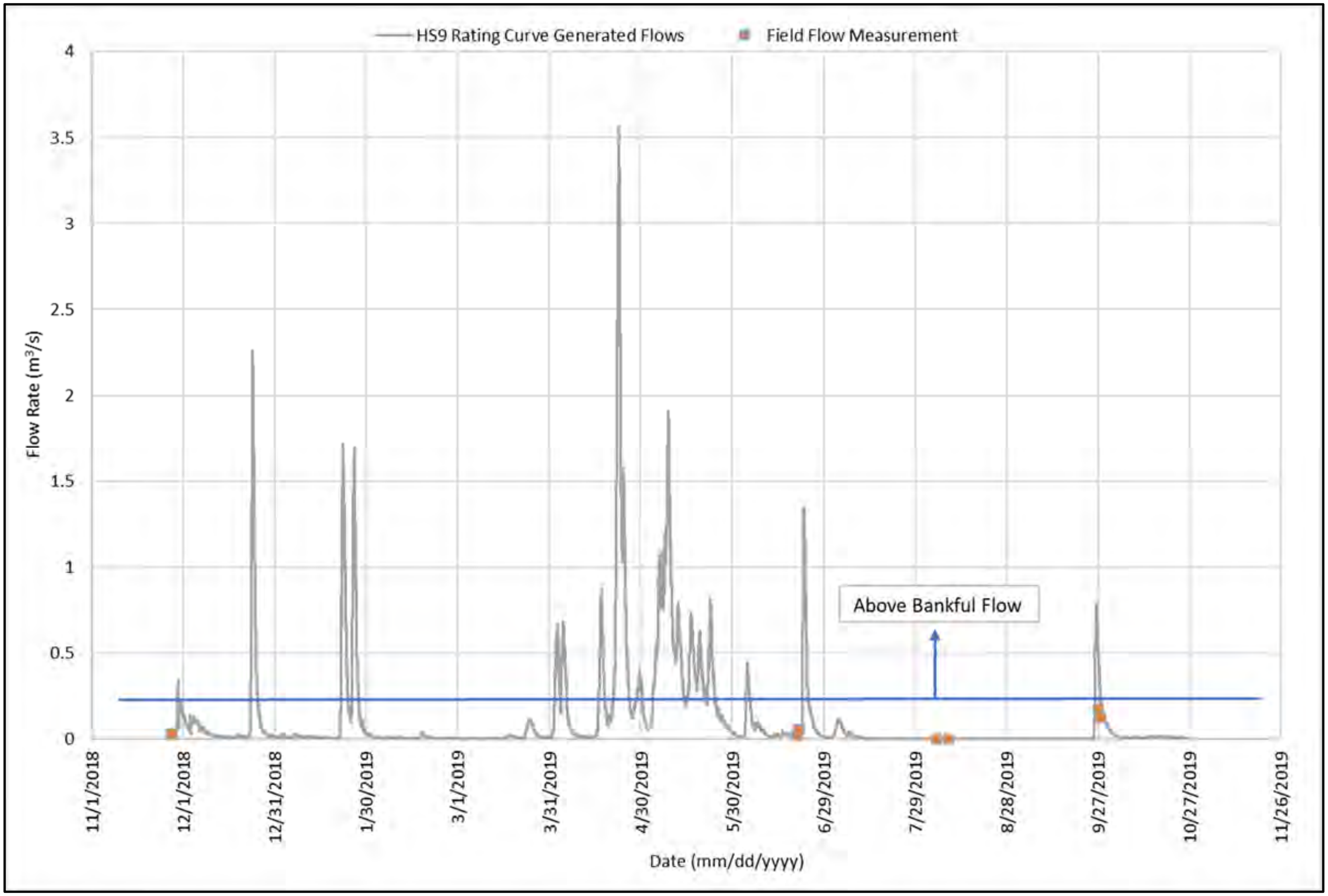


Figure 4.21 Daily Stream Flow at Stream Flow Monitoring Station HS9

HS10

Hydrometric monitoring station HS10 is located in Frozen Ear Lake, approximately 20 m from the southern shoreline (Figure 4.4). Frozen Ear Lake drains to Valentine Lake. The site is characterized as a large lake surrounded by shrubs and forest (Photo 4.7). Substrate is a mixture of cobble and gravel with some fines and organics filling the interstitial space. HS11 has a drainage area of approximately 3.031 km^2. Figure 4.22 presents the water levels at HS10 for the period of June to October 2019. The highest recorded water level was 0.4715 m above the transducer and occurred in June 2019 and the lowest water level was 0.2351 m above transducer and occurred in September 2019. The mean water level at HS11 was 0.3277 m above the transducer.

Photo 4.7 Hydrometric Monitoring Station HS10

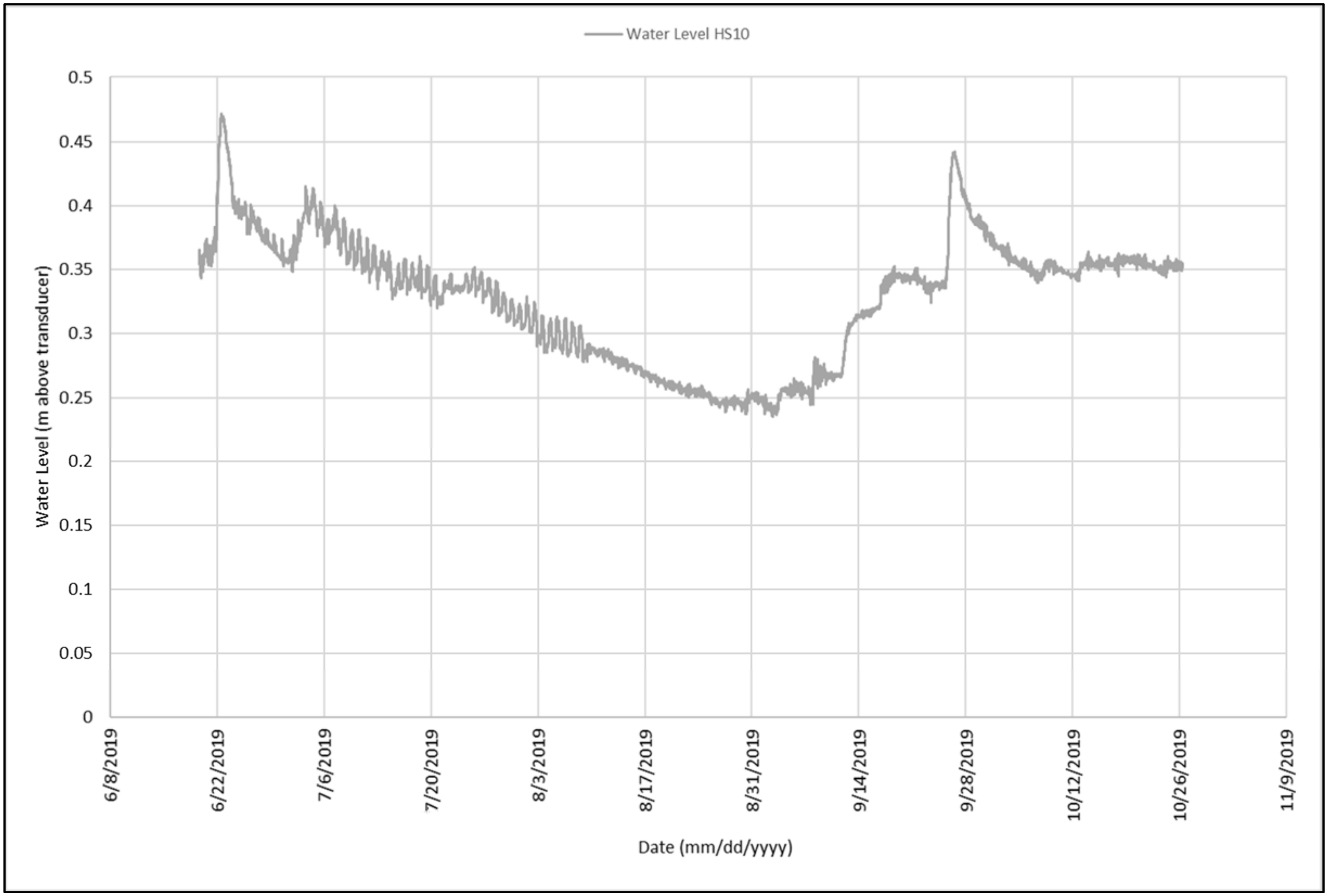


Figure 4.22 Lake Level at Monitoring Station HS10

HS11

Hydrometric monitoring station HS11 is located in an unnamed watercourse downstream of the Victory Pit (Figure 4.4). The watercourse drains to the Victoria River. The site is characterized as an open meadow with wetland vegetation (Photo 4.8). Substrate is a mixture of fines with some cobble and gravel and instream vegetation. The HS11 station has a drainage area of approximately 1.756 km^2. Eight flow monitoring events were completed at this site during the monitoring period.

Photo 4.8 Hydrometric Monitoring Station HS11

Flow measurements collected throughout the baseline monitoring period and used in the development of a rating curve at HS11 are provided in Table 4.30.

Table 4.30 HS11 Field Flow Measurement Summary Table

Date	19-Jun-19	21-Jun-19	4-Aug-19	8-Aug-19	26-Sep-19	27-Sep-19	28-Sep-19	6-Oct-19
Measured Flow (m^3/s)	0.0112	0.0088	0.0016	0.0026	0.1433	0.0728	0.0399	0.003

A rating curve was developed in the AQUARIUS platform using the field measured flow rates and corresponding barometrically corrected water stage, as recorded by the HS11 pressure transducer. The rating curve equation is not constant and is adjusted at various stage measurements as shown in Table 4.31 and Figure 4.23.

Table 4.31 HS11 Rating Curve Equation Table

Stage	Rating Curve Equation
0.4867	-----
0.5243	X = 0.57292 * Y^9.31448
0.5648	X = 0.57331 * Y^9.31554
0.6084	X = 0.43502 * Y^8.83233
0.6554	X = 0.45808 * Y^8.93627
0.706	X = 0.45697 * Y^8.93054
0.7605	X = 0.44993 * Y^8.88593
0.8192	X = 0.45260 * Y^8.90756
0.8824	X = 0.45097 * Y^8.88946
0.9505	X = 0.45102 * Y^8.89047
1.1144	X = 0.47253 * Y^9.80787

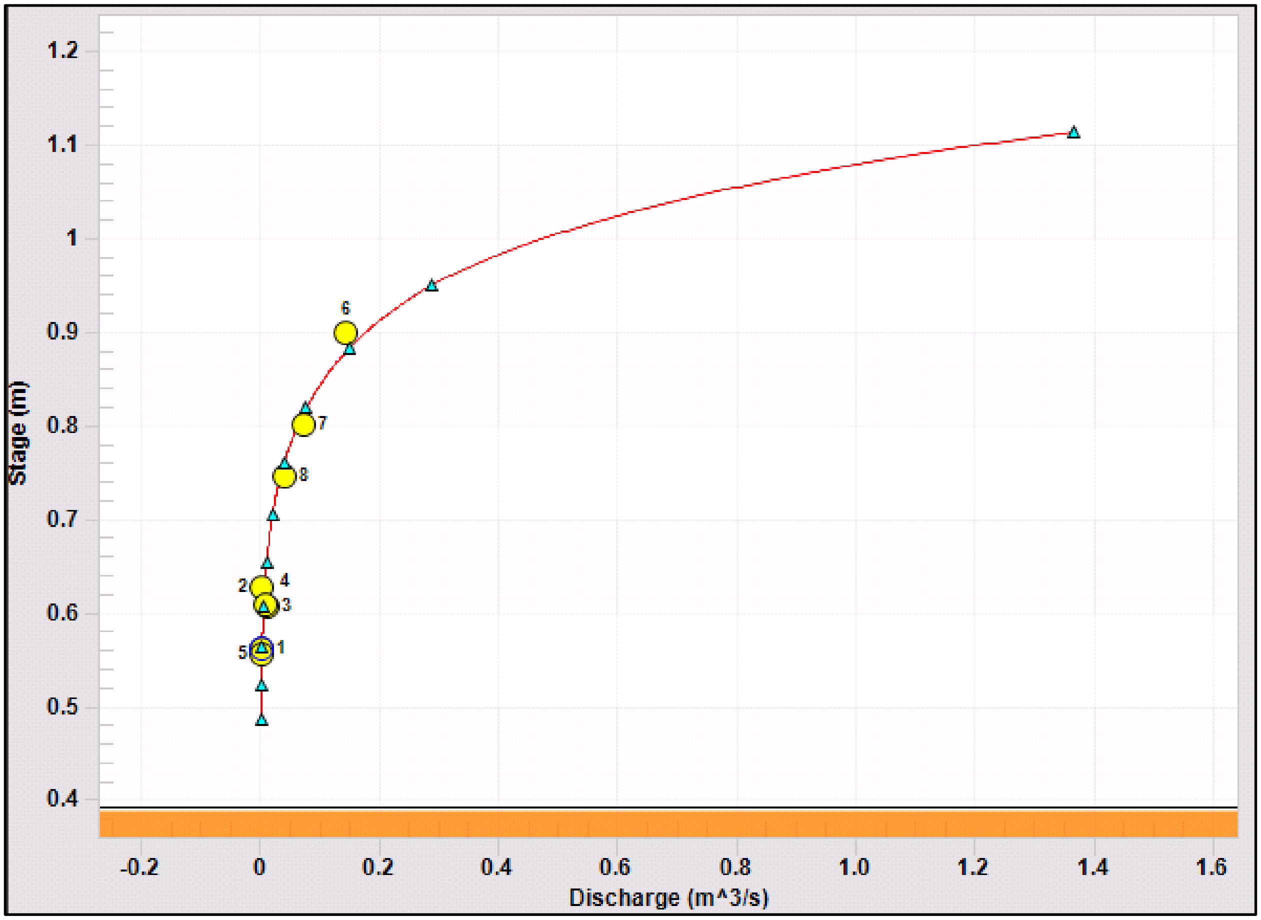


Figure 4.23 HS11 Rating Curve

Figure 4.24 presents the stream flows generated for HS11 for the period of June to October 2019 based on the rating curve developed. The highest flow of 0.808 m^3/s occurred in June 2019 and the lowest flow of 0.002 m^3/s occurred during August 2019.

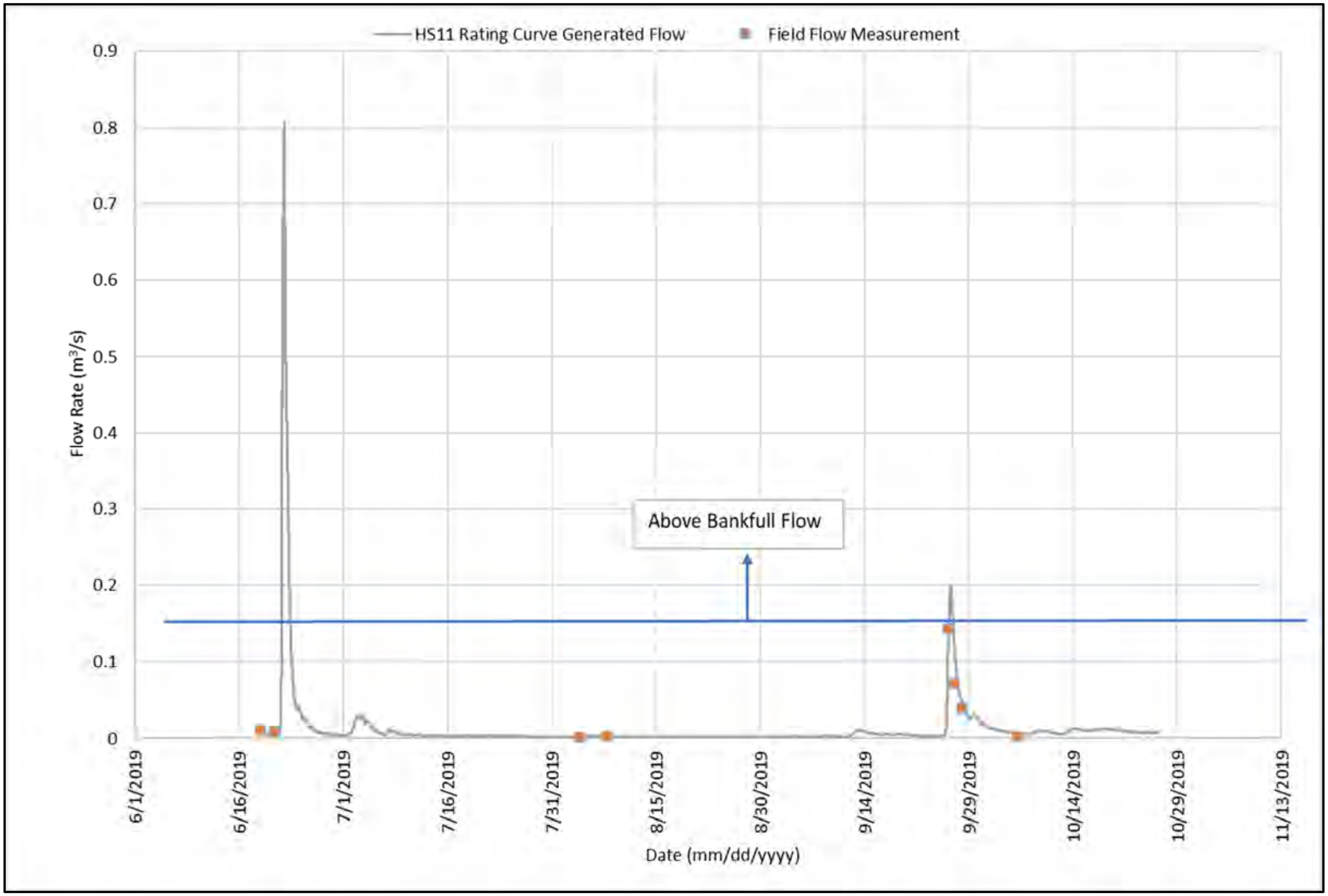


Figure 4.24 Daily Stream Flow at Stream Flow Monitoring Station HS11

HS12

Hydrometric monitoring station HS12 is located in an unnamed watercourse approximately 20 metres downstream of the Site Access Road (Figure 4.4). The watercourse drains to the Victoria River. The site is characterized as an overgrown area with thick shrub and alder growth (Photo 4.9). Substrate is a mixture of fines with some cobble and gravel and instream vegetation. The HS12 station has a drainage area of approximately 1.099 km^2. Eight flow monitoring events were completed at this site during the monitoring period.

Photo 4.9 Hydrometric Monitoring Station HS12

Flow measurements collected throughout the baseline monitoring period and used in the development of a rating curve at HS12 are provided in Table 4.32.

Table 4.32 HS12 Field Flow Measurement Summary Table

Date	18-Jun-19	21-Jun-19	4-Aug-19	9-Aug-19	26-Sep-19	27-Sep-19	28-Sep-19	6-Oct-19
Measured Flow (m^3/s)	0.0065	0.0046037	0.0001	0.0027	0.1163	0.0736	0.0501	0.0048

A rating curve was developed in the AQUARIUS platform using the field measured flow rates and corresponding barometrically corrected water stage, as recorded by the HS12 pressure transducer. The rating curve equation is not constant and is adjusted at various stage measurements as shown in Table 4.33 and Figure 4.25.

Table 4.33 HS12 Rating Curve Equation Table

Stage	Rating Curve Equation
0.1339	-----
0.1622	-----
0.1965	X = 0.07150 * Y^3.61330
0.238	X = 2.25234 * Y^5.73364
0.2883	X = 3.35851 * Y^6.01196
0.3493	X = 2.93548 * Y^5.90372
0.4231	X = 2.52619 * Y^5.76096
0.5125	X = 2.54604 * Y^5.77006
0.6209	X = 2.54739 * Y^5.77085
0.8034	X = 6.97881 * Y^7.88550
0.9168	X = 69.53114 * Y^18.38741

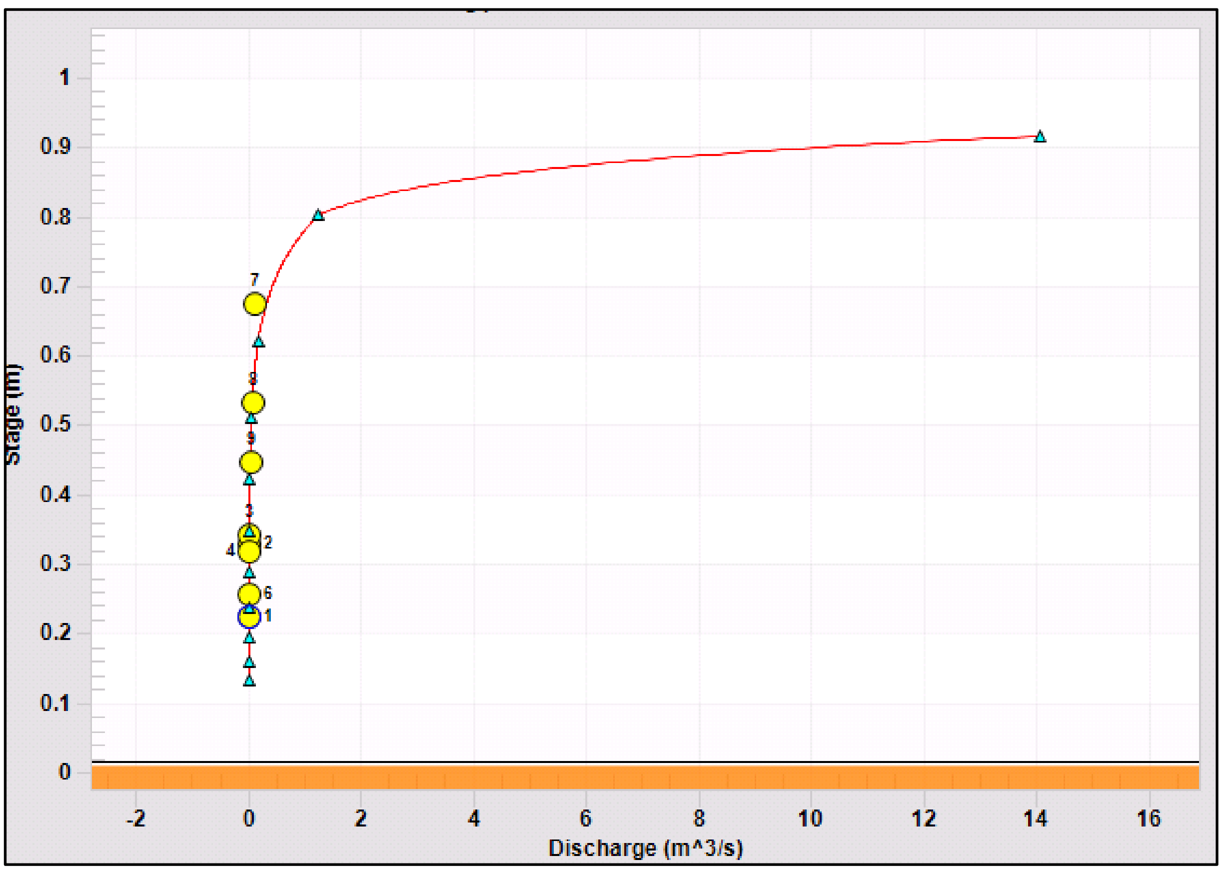


Figure 4.25 HS12 Rating Curve

Figure 4.26 presents the stream flows generated for HS12 for the period of June to October 2019 based on the rating curve developed. The highest flow of 0.739 m^3/s occurred in June 2019 and the lowest flow of 0.0001 m^3/s occurred during August 2019.

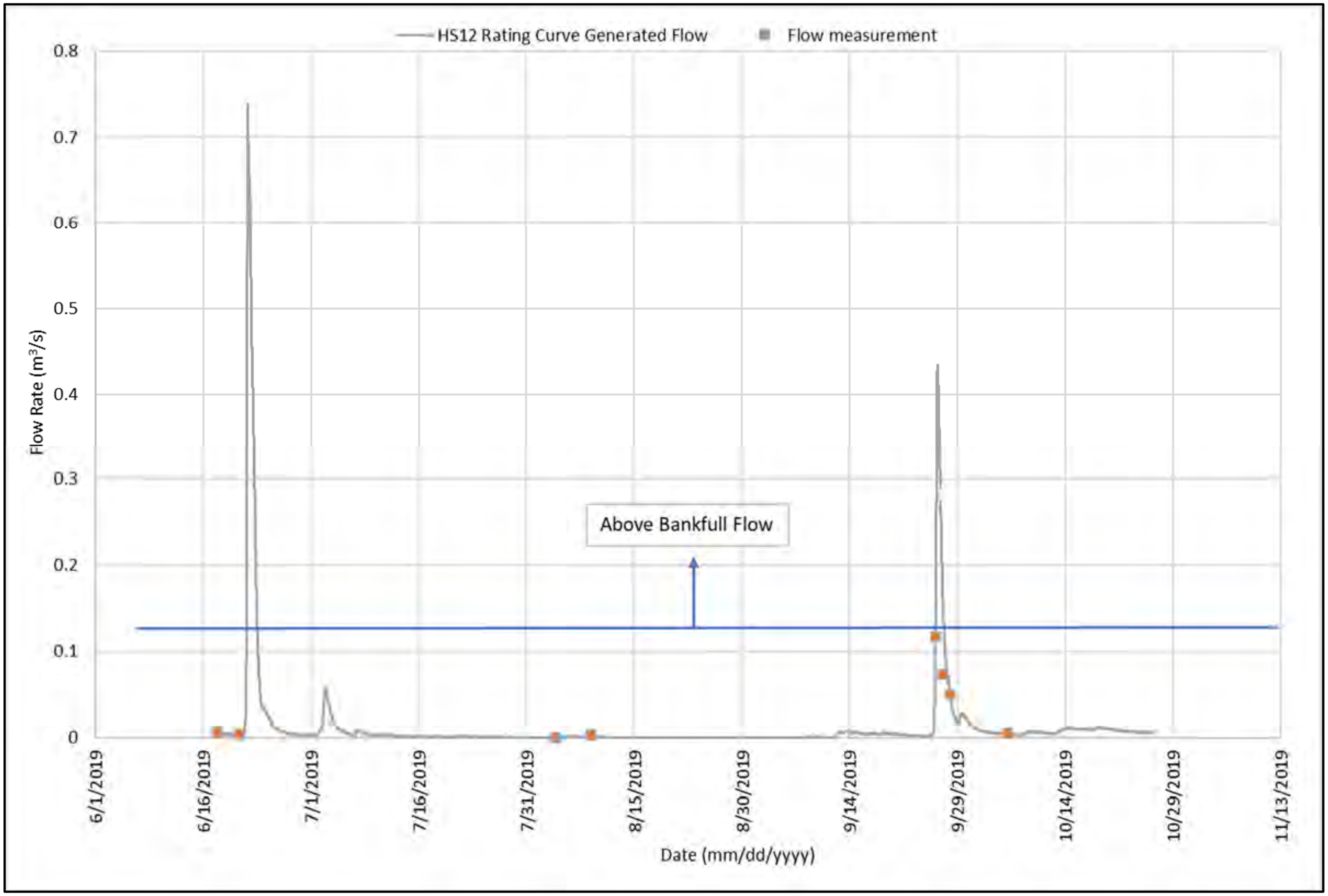


Figure 4.26 Daily Stream Flow at Stream Flow Monitoring Station HS12

4.2.2.2 Bathymetry

The localized areas of bathymetry that were collected in Valentine Lake showed that Valentine Lake was generally less than 10 m in water depth along its southern shore. There were two deep holes (>20 m) noted from the bathymetry in the southwestern end of Valentine Lake (Figure 4.27). Maximum depth observed during the bathymetric survey was 25.4 m.

The localized areas of bathymetry that were collected in Victoria Lake showed that it was generally less than 15 m in water depth along its northern shore. One deep hole (>40 m) was noted from the bathymetry in the southwestern end of the mapped area (Figure 4.28). Maximum depth observed during the bathymetric survey was 41.1 m.

Bathymetry was collected in four smaller lakes within the Project Area, including VALP1, VALP3, VICP1, and VICP2 (Figure 7-12). These waterbodies are generally shallow, with depths up to 1.5 m, with the exception of VICP1 which reported depths up to 4 m. Additional bathymetry data for selected streams is presented in the Fisheries Baseline Report (Stream Habitat Classification Data Table – BSA.4-E).

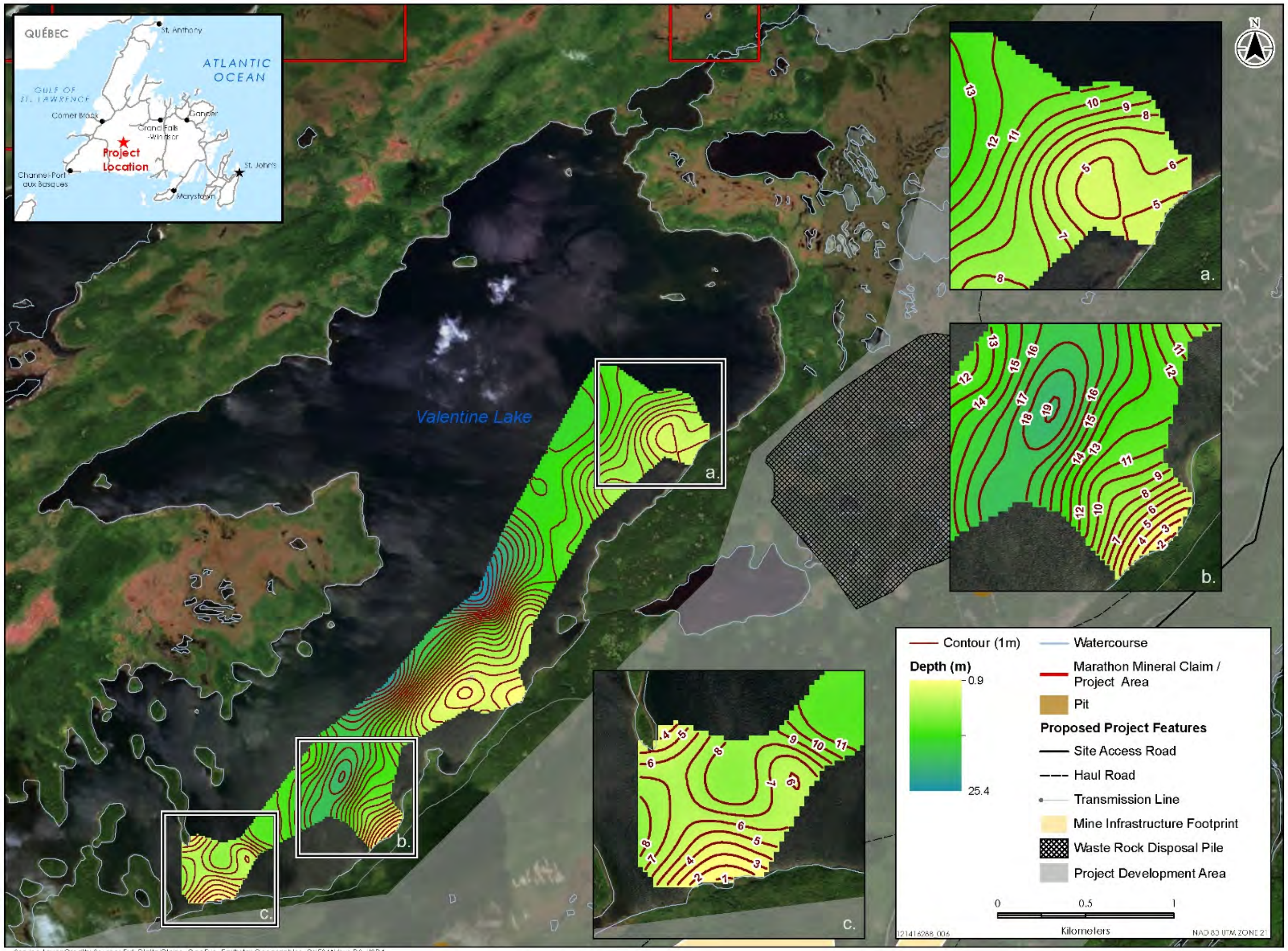
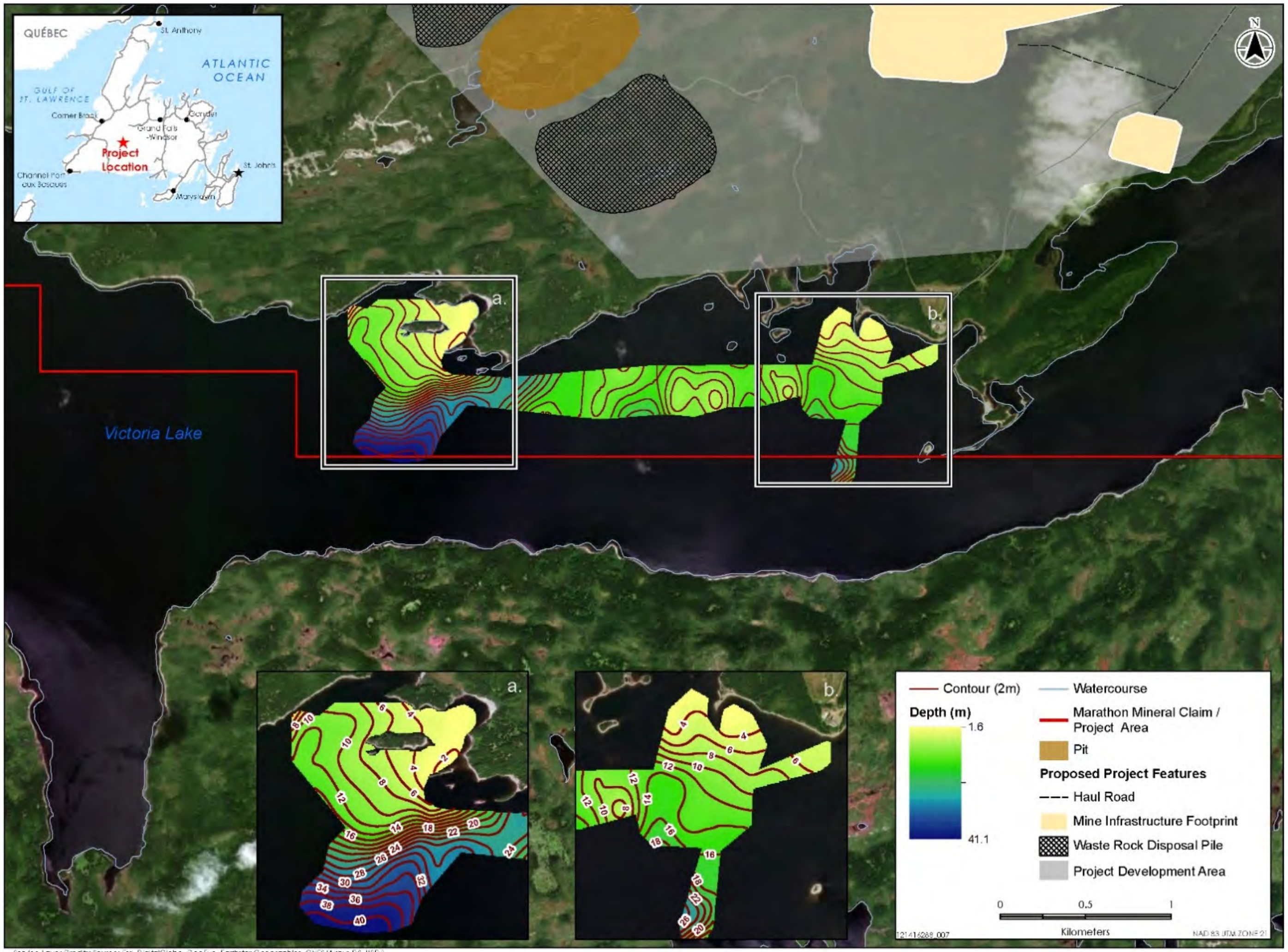


Figure 4.27 Bathymetry in Valentine Lake



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 4.28 Bathymetry in Victoria Lake

4.3 WATER QUALITY

4.3.1 Regional Water Quality

Regional water quality data was obtained from both federally ECCC managed sites (ID NF02YN0001 and NF02YO0107) and provincially WRMD managed sites (ID NF02YO0190 and NF02YO0192).

Water quality reported at the WRMD managed sites includes *in-situ* field parameters including DO, pH, specific conductivity, total dissolved solids (TDS), turbidity, and temperature. Monthly minimum, maximum, and mean values for each of these parameters is reported for the period of December 2018 to December 2019. Data from NF02YO0190 and NF02YO0192 are provided in Table C-1 and C-2, Appendix C.

Regional water quality reported at the ECCC managed sites includes metals, nutrients, and physical parameters. Data collected at these sites has a longer period of record than those reported at the WRMD sites, with water quality data reported between 2003 and 2019. Available data from stations NF02YN0001 and NF02YO0107 has been summarized in Table 4.34 below.

Total Alkalinity (as CaCO3) ranges from below detection limit 1.22 mg/L to 11 mg/L. Low alkalinity values suggest limited acid buffering potential in streams. Parameters were generally below the applicable CWQG with at least one reported exceedance (i.e. maximum) for aluminum, cadmium, copper, iron, lead reported at station NF02YO0107, and aluminum and selenium at station NF02YN0001.

Table 4.34 Regional Water Quality Summary Statistics

	Units	CWQG-FAL[1]	count	min	max	mean	count	min	max	mean
			NF02YN0001				NF02YO0107			
Alkalinity gran ($CaCO_3$)	mg/L		55	1.94	14.2	5.984	64	3.81	9.82	5.464
Alkalinity total ($CaCO_3$)	mg/L		43	1.22	20	11.007	31	4	20	10.188
Aluminum total	µg/L	5 if pH < 6.5, 100 if pH > 6.5	72	37.8	146	87.678	76	0.5	150	64.632
Antimony total	µg/L		67	0.001	0.02	0.012	69	0.001	0.032	0.022
Arsenic total	µg/L	5	72	0.1	0.88	0.446	76	0.01	1.53	0.298
Barium total	µg/L		72	2.14	3.68	2.831	76	0.05	87.3	41.438
Beryllium total	µg/L		72	0.001	0.05	0.008	76	0.003	0.05	0.014
Bismuth total	µg/L		67	0.001	0.002	0.001	69	0	0.007	0.001
Boron total	µg/L	29,000 (short-term); 1,500 (long-term)	67	0.1	3.1	2.021	69	0.1	2.6	1.696
Cadmium total	µg/L	Hardness adjusted (range of 0.04 to 0.37)	67	0.001	0.016	0.004	69	0.001	0.3	0.048

Table 4.34 Regional Water Quality Summary Statistics

	Units	CWQG-FAL[1]	count	min	max	mean	count	min	max	mean
			NF02YN0001				NF02YO0107			
Calcium dissolved	mg/L		55	1.3	5.25	2.839	62	0.9	4.45	2.459
Carbon dissolved inorganic	mg/L		62	1	3	1.679	68	1	3.1	1.472
Carbon dissolved organic	mg/L		62	3.7	9	5.871	69	4	9.6	5.083
Chloride total	mg/L	120	22	2.28	5.5	3.532	31	1.39	1.95	1.751
Chromium total	µg/L		67	0.093	0.23	0.151	69	0.01	0.37	0.098
Cobalt total	µg/L		67	0.011	0.056	0.033	69	0.002	0.117	0.021
Colour apparent	TCU	Narrative	74	25.6	80.6	49.088	77	24	59.3	30.315
Conductance (field)	µS/CM		68	5.1	58.3	29.251	75	0	26.7	18.239
Copper total	µg/L	Hardness adjusted (range of 2 to 4)	72	0.0002	0.91	0.173	76	0.0016	2.25	1.401
Gallium total	µg/L		67	0.002	0.014	0.008	69	0	0.04	0.007
Iron total	µg/L	300	72	52.7	224	129.915	76	0.5	504	75.278
Lanthanum total	µg/L		67	0.047	0.2	0.104	69	0.001	0.37	0.108
Lead total	µg/L	Hardness adjusted (range of 1 to 7)	67	0.02	0.187	0.062	76	0.005	6.43	1.854
Lithium total	µg/L		67	0.033	0.2	0.149	69	0	0.53	0.145
Magnesium dissolved	mg/L		55	0.32	1.1	0.554	62	0.36	0.6	0.427
Manganese total	µg/L		72	2.43	16.5	8.145	76	0.05	70.3	9.898
Molybdenum total	µg/L	73	67	0.007	0.083	0.051	69	0.019	0.103	0.059
Nickel total	µg/L	Hardness adjusted (range of 25 to 150)	67	0.02	0.17	0.095	76	0.02	0.92	0.169
Nitrogen total	mg/L		74	0.129	0.26	0.185	77	0.18	0.344	0.225
Oxygen dissolved	mg/L	Variable (6.5 – 9.5 (cold water – life stage))	67	2.86	14.93	11.008	73	7.95	15.85	11.748
Ph		6.5 – 9.0	74	6.07	7.48	6.880	77	6.4	7.23	6.867
Ph (field)			68	4.96	7.72	6.656	75	4.39	7.58	6.414

Table 4.34 Regional Water Quality Summary Statistics

	Units	CWQG-FAL[1]	count	min	max	mean	count	min	max	mean
			NF02YN0001				NF02YO0107			
Phosphorus total	mg/L	<.004 - >.1 (trophic status)	74	0.0021	0.0122	0.004	77	0.0005	0.0062	0.003
Potassium unfiltered	mg/L		40	0.12	0.51	0.223	50	0	0.38	0.157
Rubidium total	µg/L		67	0.23	0.412	0.317	69	0.001	0.723	0.276
Selenium total	µg/L	1	67	0.03	2.21	0.086	69	0	0.23	0.046
Silver total	µg/L	0.25	67	0.001	0.006	0.001	69	0	0.038	0.004
Sodium unfiltered	mg/L		40	1.68	3.2	2.288	50	1.11	1.62	1.413
Specific conductance	µS/CM		74	20.1	49.8	31.454	77	19.4	35.9	23.412
Strontium total	µg/L		72	5	13.8	8.842	76	0.05	13.6	7.696
Sulphate total	mg/L		22	0.89	1.77	1.335	31	0.7	1.45	1.186
Temperature	Deg C		38	-0.15	24.3	9.919	48	-0.15	20.16	7.968
Thallium total	µg/L	0.8	67	0.001	0.024	0.003	69	0.001	0.026	0.011
Total nitrate	mg/L	13	22	0.01	0.03	0.016	31	0	0.13	0.062
Turbidity	NTU	Narrative	73	0.15	1	0.453	77	0.11	8.6	0.627
Uranium total	µg/L	33 (short-term), 15 (long-term)	67	0.0232	0.0953	0.059	69	0.0005	0.0968	0.035
Vanadium total	µg/L		67	0.054	0.286	0.189	76	0.008	0.25	0.093
Zinc total	µg/L	Hardness, pH, and DOC adjusted (30)	72	0.11	2.4	0.610	76	0.2	22.6	14.059

Note:
[1] CWQG FAL – Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2019)

4.3.2 Local Water Quality

Table 4.35 presents summary water quality statistics for the lab analytical general constituents. Lab analytical water quality results are presented in Appendix D. The lab results indicated that pH ranged from 4.61 to 7.78 with mean value of 6.94. The pH value was less than 6.5 of CCME -FAL lower limit at 18 water quality monitoring stations, most notably, 16 times at water quality monitoring station VE08. At the other stations, exceedances were reported no more than five times.

Total Alkalinity (as $CaCO_3$) ranges from below detection limit 5.0 mg/L to 99 mg/L with mean of 14.7 mg/L. Low alkalinity values suggest limited acid buffering potential in streams.

Hardness (as CaCO3) values range from below the detection limit of 5.0 mg/L to 110.0 mg/L with mean of 16.3 mg/L. Hardness within the range of 0 to 60 mg/L is considered as soft water. Concentrations for copper, cadmium, lead and nickel are hardness-adjusted in CWQG-FALs. The lower hardness value results in lower CWQGs thresholds for metals stated above.

Langelier Saturation Index (LSI) values for nearly all monitoring locations and events are negative which is indicative of under-saturation and tends to dissolve solid calcium carbonate (CaCO3). Therefore, water with negative LSI has limited scaling potential. The potential for scale formation is an important consideration in the selection and design of water infrastructure as well as in the use of lime and limestone in the potential treatment of acid rock drainage (ARD). Low LSI and scaling potential align with the low hardness values observed.

Electrical conductivity values for all samples are generally low and range from as low as 14 µs/cm to 200 µs/cm with mean of 39.54 µs/cm. The maximum value of 200 µs/cm is observed at LP04 and the minimum value of 14 µs/cm is observed at station R04.

Ionic balances for all monitoring locations were positive and range from 0% to 76%. This is expected in light of the soft water observations noted above. Concentrations of major cations such as calcium, sodium, potassium, magnesium, manganese, ammonium, iron and aluminum were low as were concentrations of major anions such as chloride, fluoride, sulphate, and nitrate resulting in relatively weak ionic strength.

Total suspended solids concentrations for monitoring stations were low ranging from below the detection limit of 1 mg/L to a maximum of 88.0 mg/L with a mean of 3 mg/L (320 non-detects). Turbidity levels observed are low ranging from below the reportable detection limit to a maximum of 24 NTU with mean of 1.0 NTU. Colour ranged from below the detection limit to 150 TCU with mean of 38 TCU. The mean colour value is above the Canadian Drinking Water Quality Aesthetic Guideline of 15 TCU for colour. Colour in local surface water is expected to be derived from the decomposition of organic humic substances such as tannins derived for soils and tree bark and lignins from woody plants and trees.

4.3.2.1 Nutrients

Table 4.36 presents summary for lab analytical nutrients and the complete results are provided in Appendix D.

Total ammonia-nitrogen ranged from below the reportable detection limit to a maximum of 0.31 mg/L and had a mean of 0.09 mg/L. Concentrations were consistently below the CWQG-FAL of 1.83 mg/L (Ammonia concentration at pH 7.5, temperature 15°C which is the lowest expected value for the Project Area). Un-ionized ammonia has a Metal and Diamond Mining Effluent Regulations (MDMER) limit of 1.0 mg/L (expressed as nitrogen).

Nitrate concentrations ranged from below the reportable detection limit to a maximum of 1.20 mg/L and had a mean of 0.11 mg/L. Reported concentrations were below the long-term CWQG-FAL for nitrate of 13 mg/L. Similarly, nitrite concentrations ranged from below the reportable detection limit to a maximum of

0.18 mg/L with a mean and 75th percentile of 0.005 mg/L and were predominately below the CWQG-FAL of 0.06 mg/L (a single exceedance).

Orthophosphate levels ranged from below the reportable detection limit to a maximum of 0.055 mg/L and had a mean of 0.01 mg/L. Total Phosphorus values ranged from below the reportable detection limit to a maximum of 210 micrograms/litre (μg/L) with a mean of 54 μg/L. The CWQG-FAL indicate that total phosphorus concentrations higher than 100 μg/L is considered hyper-eutrophic and concentrations between 35-100 μg/L is considered eutrophic.

Sulphate concentrations ranged from below the reportable detection limit to a maximum of 5.5 mg/L which is lower than the dissolved sulphate guideline of 128 mg/L for the protection of aquatic life given in the British Columbia ambient water quality guidelines for sulphate (British Columbia Ministry of Environment and Climate Change Strategy 2017). No CWQG-FAL exists for sulphate.

Table 4.35 Summary of General Constituents in Water Quality Monitoring Stations

Parameter	Units	CWQG-FAL	Number of Samples	Min[D]	Max[D]	Mean[D]	75th Percentile[D]	# of Exceedances	# of Non-detects
Anion Sum	me/L		686	0.03	2.14	0.37	0.45	-	0
Bicarb. Alkalinity (calc. as $CaCO_3$)	mg/L		686	5	98	15	19	-	42
Calculated TDS	mg/L		686	5	120	23	28	-	0
Carb. Alkalinity (calc. as $CaCO_3$)	mg/L		686	nd	nd	nd	0.5	-	686
Cation Sum	me/L		686	0.15	2.32	0.42	0.52	-	0
Conductivity	µS/cm		686	14	200	39	47	-	0
Colour	TCU	Note A	686	5	420	38	47	-	2
Dissolved Chloride (Cl)	mg/L		686	1	14	3	3	-	8
Hardness ($CaCO_3$)	mg/L		686	4.0	110.0	16.3	20	-	0
Ion Balance (% Diff.)	%		686	0.00	76.00	9.60	11.1	-	0
Langelier Index (@20C)	N/A		644	-4.22	0.01	-2.51	-1.87	-	0
Langelier Index (@4C)	N/A		644	-4.48	-0.24	-2.77	-2.28	-	0
pH	pH	6.5-9.0	686	4.61	7.78	6.93	6.59-7.36	55	0
Reactive Silica (SiO_2)	mg/L		686	0.5	10.0	2.6	3.7	-	45
Saturation pH (@20C)	N/A		644	7.77	10.40	9.49	-	-	0
Saturation pH (@4C)	N/A		644	8.02	10.60	9.74	-	-	0
Total Alkalinity ($CaCO_3$)	mg/L		686	5.0	99.0	14.7	19	-	42

Table 4.35 Summary of General Constituents in Water Quality Monitoring Stations

Parameter	Units	CWQG-FAL	Number of Samples	Min[D]	Max[D]	Mean[D]	75th Percentile[D]	# of Exceedances	# of Non-detects
Total Suspended Solids	mg/L	Note B	686	1	880	3	2.1	-	320
Turbidity	NTU	Note C	686	0.1	24.0	1.0	0.945	-	37

Notes:
N/A – not-applicable
[A] True Color: The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
[B] Maximum increase of 25 mg/L from background levels for short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
[C] Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
[D] The statistical results here include water quality monitoring locations from October 2012 to October 2019. For statistical calculations, ½ of the nd value was used.
Nd – non-detect – below laboratory detection limit.
“-“indicates no data in cell

Table 4.36 Summary of Nutrients in Water Quality Monitoring Stations

Parameter	Units	CWQG-FAL	Number of Samples	Min[D]	Max[D]	Mean[D]	75th Percentile[D]	# of Exceedances	# of Non-detects
Nitrate + Nitrite	mg/L		686	0.05	1.20	0.11	0.12	-	263
Nitrate	mg/L	Note A	686	0.05	1.20	0.11	-	-	269
Nitrite	mg/L	0.06	686	0.005	0.18	0.005	0.005	1	667
Nitrogen (Ammonia Nitrogen)	mg/L	Note B	686	0.05	0.31	0.03	0.025	-	623
Dissolved Sulphate	mg/L		686	1.4	5.5	1	1	-	647
Orthophosphate	mg/L		686	0.01	0.06	0.01	0.005	-	665
Total Organic Carbon	mg/L		686	2.1	41.0	6.9	8.4	-	1
Total Phosphorus	µg/L	Note C	20	0.005	0.02	0.01	-	-	0

Notes
[A] 550 mg/L for short term exposure and 13 mg/L for long term exposure
[B] Ammonia concentration under different pH and temperature, please see table at: http://st-ts.ccme.ca/en/index.html?chems=5&chapters=1
[C] Ultra-oligotrophic <4 µg/L, oligotrophic 4-10 µg/L, mesotrophic 10-20 µg/L, meso-eutrophic 20-35 µg/L, eutrophic 35-100 µg/L, hyper-eutrophic >100 µg/L
[D] The statistical results here include water quality monitoring locations from October 2012 to October 2019. For statistical calculations, ½ of the nd value was used.
"-"indicates no data in cell

4.3.2.2 Metals

Table 4.37 presents summary statistics for lab analytical metals results. Lab analytical metals results are provided in Appendix D.

Aluminum concentrations ranged from below the reportable detection limit to a maximum of 1,640 µg/L with mean of 106 µg/L and a 75th percentile of 106 µg/L. The CWQG-FAL for aluminum is 5 µg/L if pH < 6.5 and 100 µg/L if pH > 6.5. The aluminum concentrations were found to exceed the CWQG-FAL at all the water quality monitoring stations at least once except for locations R01, VIC01 and VAL01.

Arsenic concentrations ranged from below the reportable detection limit of 1.0 µg/L to a maximum of 22.0 µg/L with mean of 1.2 µg/L and a 75th percentile of 1.3 µg/L. Arsenic concentrations were below the CWQG-FAL of 5 µg/L for all the monitoring locations with the exception of R01, R02, R03, R05, VL01, FZ01, and FZ02.

Cadmium concentrations ranged from below the reportable detection limit to a maximum of 2.25 µg/L with a mean of 0.017 µg/L and a 75th percentile of 0.0085 µg/L. The hardness adjusted CWQG-FAL for cadmium ranges from 0.04 to 0.37 µg/L (long-term). The total cadmium values exceeded the lower limit long-term CWQG-FAL at stations VE02, VE05, VE06, VE07, VE09 VE10, RO3, RO5, VL01, and FZ01 at least once over the sampling duration.

Copper concentration ranged from below the reportable detection limit to a maximum of 220 µg/L with a mean of 1.4 µg/L and a 75th percentile of 1.0 µg/L. The CWQG-FAL for copper is based on hardness and is 2.0 µg/L when hardness is between 0 and 82 mg/L (mean water hardness for all the water quality monitoring stations was 16.7 mg/L). Reported copper concentrations were below the CWQG-FAL at all locations except LP03, VE02, VE03, VE04, VE08, VE10, R02, R03, R04, VL01, VICRV, VIC01, and VAL01.

Lead concentrations ranged from below the reportable detection limit to a maximum of 2.72 µg/L with mean of 0.27 µg/L and a 75th percentile of 0.25 µg/L. The CWQG-FAL for lead is based on hardness and is 1 µg/L when hardness is less than 60 mg/L. Reported lead concentrations were below the CWQG-FAL for all locations except LP01, VE05, VE07, FZ01, and VIC01.

Iron concentrations ranged from below the reportable detection limit to a maximum of 8,900 µg/L with mean of 286 µg/L and a 75th percentile of 231 µg/L. All locations reported at least a single exceedance of the CWQG-FAL of 300 µg/L except stations VIC01 and VAL01.

Zinc concentrations ranged from below the reportable detection limit to a maximum of 91.3 µg/L with mean of 4.4 µg/L and a 75th percentile of 6.6 µg/L. Zinc concentrations were below the CWQG-FAL limit of 30 µg/L for all locations except LP01, VE04, VE05, and R04.

Concentrations of other metals including boron, molybdenum, selenium, silver, thallium, and uranium were all below the applicable CWQG-FAL.

Local water quality was found to be similar to regional water quality in that both were found to have low alkalinity, and therefore limited acid buffering potential. Some metals were also detected above CWQG guidelines at both the regional and local water quality monitoring locations (aluminum, cadmium, copper, iron, and lead). These results indicate that metals are found in naturally elevated levels local and regional surface water.

Table 4.37 Summary of Metals for Water Quality Monitoring Stations

Parameter	Units	CWQG-FAL [A]	MDMER[B]	Number of Samples	Min[C]	Max[C]	Mean[C]	75th Percentile[C]	# of Exceedances	# of Non-detects
Total Aluminum (Al)	µg/L	Note D		619	9	1640	106	106.25	221	0
Total Antimony (Sb)	µg/L			619	DL	2	0.5	0.5	0	618
Total Arsenic (As)	µg/L	5	1000	619	DL	22	1.2	1.3	16	413
Total Barium (Ba)	µg/L			621	DL	35	2.8	3.425	0	54
Total Beryllium (Be)	µg/L			619	DL	DL	0.5	0.5	0	619
Total Bismuth (Bi)	µg/L			619	DL	DL	1.0	1	0	619
Total Boron (B)	µg/L	1,500[E]		619	DL	DL	25	25	0	619
Total Cadmium (Cd)	µg/L	Note F		619	DL	2.250	0.017	0.0085	17	501
Total Calcium (Ca)	µg/L			619	1000	39000	5166	5640	0	0
Total Chromium (Cr)	µg/L			619	DL	160	2.2	2.625	0	505
Total Cobalt (Co)	µg/L			619	DL	6	0.27	0.2	0	556
Total Copper (Cu)	µg/L	Note G	600	619	DL	220	1.4	1	10	550
Total Iron (Fe)	µg/L	300		620	DL	8900	286	230.75	114	42
Total Lead (Pb)	µg/L	Note H	400	619	DL	3	0.27	0.25	3	607
Total Magnesium (Mg)	µg/L			619	240	3600	794	904.5	0	0
Total Manganese (Mn)	µg/L			619	4	10000	240.5	153.75	0	0
Mercury	µg/L	0.026		618	DL	0	0.007	0.0065	0	588
Total Molybdenum (Mo)	µg/L	73		619	DL	55	1.3	1	0	612
Total Nickel (Ni)	µg/L	Note I	1000	619	DL	8	1.0	1	0	602
Total Potassium (K)	µg/L			623	DL	1240	183	195	0	117
Total Selenium (Se)	µg/L	1		620	DL	0	0.5	0.5	0	620
Total Silver (Ag)	µg/L	0.25		619	DL	0	0.05	0.05	0	619

Table 4.37 Summary of Metals for Water Quality Monitoring Stations

Parameter	Units	CWQG-FAL A	MDMER B	Number of Samples	Min C	Max C	Mean C	75th Percentile C	# of Exceedances	# of Non-detects
Total Sodium (Na)	µg/L			619	896	5220	1842	1952.5	0	0
Total Strontium (Sr)	µg/L			619	3	95	15.3	15.825	0	0
Total Thallium (Tl)	µg/L	0.8		619	DL	0	0.05	0.05	0	619
Total Tin (Sn)	µg/L			619	DL	0	1.0	1	0	619
Total Titanium (Ti)	µg/L			619	DL	115	3.3	3.2	0	331
Total Uranium (U)	µg/L	Note J		619	DL	0	0.05	0.05	0	599
Total Vanadium (V)	µg/L			619	DL	6	1.0	1	0	613
Total Zinc (Zn)	µg/L	Note K	500	620	DL	91	4.4	6.6	3	449

Notes:
DL – detection limit
[A] CWQG-FAL – Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life
[B] MDMER – Metal and Diamond Mining Effluent Regulations, values presented in the table are maximum authorized concentration in grab samples
[C] The statistical results here include water quality monitoring locations from October 2012 to October 2019. For statistical calculations, ½ of the nd value was used.
[D] varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5
[E] Short term 29,000 ug/L, long term 1,500 ug/L
[F] Guideline Equation is based on hardness = 10{[0.83log(hardness)]-2.46} µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L).
[G] Guideline Equation is based on hardness = 0.2 * e{0.8545[ln(hardness)]-1.465} µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
[H] Guideline Equation is based on hardness = e{1.273[ln(hardness)]-4.705} µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
[I] Guideline Equation is based on hardness = e {0.76[ln(hardness)]+1.06} µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
[J] Short term 33 ug/L, long term 15 ug/L
[K] Guideline Equation is based on hardness = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG-FAL equation is valid between hardness 23.4 and 399 mg $CaCO_3$·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)

5.0 SUMMARY

This report describes the climate, hydrology and water quality conditions in the watersheds potentially affected by the proposed project. Field work and desktop analysis were conducted.

The field assessment included a flow monitoring program with the installation of 12 local hydrometric monitoring stations and an additional 26 water quality sampling locations were established. The desktop assessment included the completion of a climate assessment, regional hydrological assessment using extensive historical datasets from the region, and analysis of the data collected during the field assessment. Hydrologic variables addressed by the baseline study include annual water flows, monthly flows, peak flows, IDFs, baseflow, environmental water balance and flow duration curves.

Water quality variables addressed include general constituents, nutrients, and metals. Baseline water quality data were compared with the Canadian Water Quality Guidelines (CWQG) and the *Metal and Diamond Mining Effluent Regulation* (MDMER). Local and regional water quality were considered in this report.

The conclusions of the Hydrology and Surface Water Quality Monitoring Baseline Report are as follows:

- Climate normal annual precipitation for the PDA is 1,236 mm. Precipitation in the driest year on record (1950) was 683 mm and in the wettest year on record (2000) was 1,563 mm. Based on statistical analysis the 100-Year return period wet and dry annual precipitation were estimated as 1,836 mm and 616 mm, respectively
- The coldest month in the PDA is January with average temperature of -8.2ºC. The warmest month is July with average temperature of 16.3ºC. Average annual temperature is 3.8ºC. The average daily temperature typically drops below freezing in November and remains below zero until March
- Appreciable snowfall in a climate normal year typically lasts from late October to early may. The maximum monthly snow fall of 88 cm is observed in January
- IDF data from the Stephenville Climate Station was selected as it is an active station and has a similar mean annual precipitation as the PDA. Potential effects of climate change on the IDF curve was also considered and showed a projected increase in rainfall intensity
- The average observed water levels recorded in Victoria Lake were determined and presented
- A runoff rate for the PDA was calculated to be 62.5%. This was based on the climate normal precipitation and the expected evapotranspiration at the PDA
- Annual flow regression was developed based on selected regional WSC stations. The mean unit flow varies between 0.020 $m^3/s/km^2$ and 0.036 $m^3/s/km^2$. The lowest monthly flows are observed in July; the highest flows are observed during freshet (i.e., in April and May)
- The regional relationships for peak flows and low flows were provided
- Flow duration curves for selected WSC stations were established and showed reasonable regional homogeneity
- An environmental water balance for the PDA was developed for climate normal, wet-year, and dry-year conditions

- Monthly baseflow index (BFI) was calculated for a WSC station considered to be representative of the PDA. The mean BFI calculated was 35%
- Local hydrology analysis was conducted using the 2012 – 2019 data collected at twelve hydrometric stations. *In-situ* flow measurement results, rating curves, and station hydrographs for each applicable hydrometric station were developed and presented. Hydrometric station watershed areas ranged from 0.4 to 5.3 km^2. A minimum of seven *in-situ* flow measurements were collected at each hydrometric station that a rating curve was developed for
- Regional water quality was assessed four using ECCC and WRMD managed locations
- Local water quality conditions were presented using the water quality data from the 26 locations in the PDA
- Local and regional water quality was found to be quite similar, with low acid buffering potential, and naturally elevated metals (aluminum, cadmium, copper, iron, and lead)

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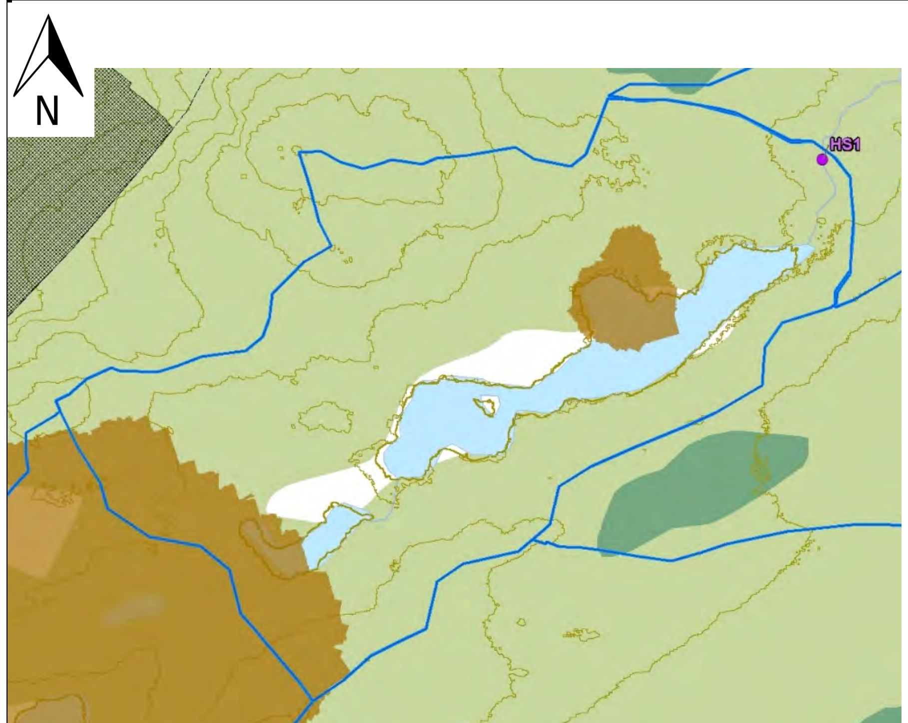
APPENDIX A

Summary of Hydrometric Monitoring Stations and Monitoring Results

Baseline Hydrology - Hydrometric Monitoring Station Summary

Station ID	HS1	**Instrument Serial**	Levelogger (SN 2014121) Barologger (SN 2014647)
Location	Downstream of Middle Pond	**Various Measurements**	Water Temperature, Water Level
Installation Date	16-Oct-12	**Spot Measurement**	Flow Measurement: depths and velocities at cross section
Coordinates	48° 21' 51.934" N 57° 9' 58.051" W	**Main Channel**	steep banks, clean and winding
Access	Via quads from the Marathon prospect camp site	**Channel Bottom**	soft fines and vegetation
Drainage Area	0.397 km^2	**Flood Plain**	Dense Brush
Period of Record	October 2012 to October 2019	**Comments**	
Active	Year Round in Continous Mode		



Map: HS1

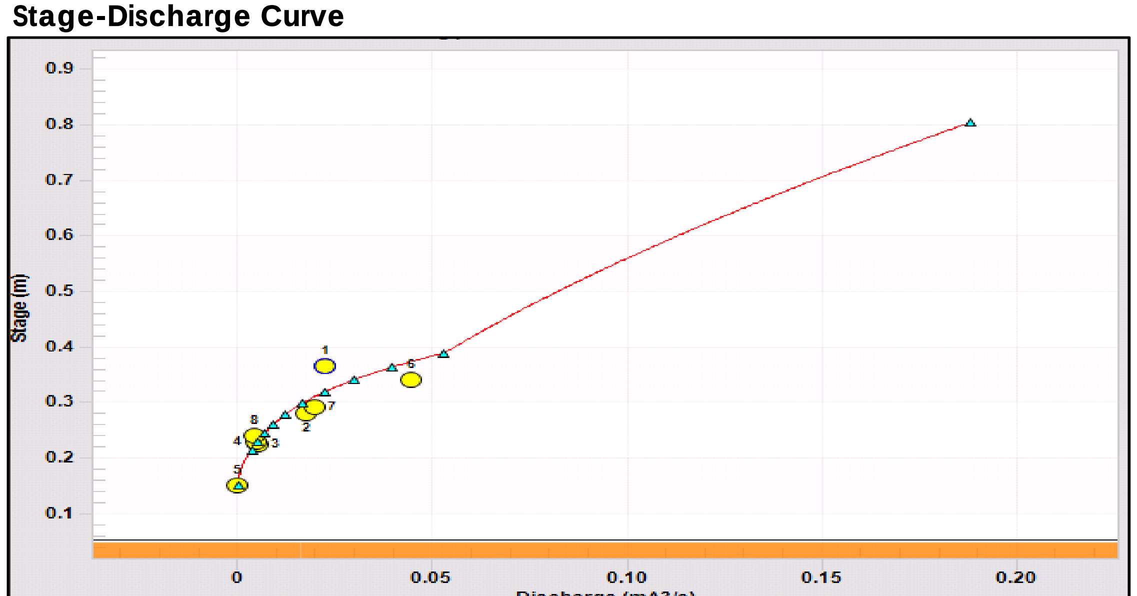
HS1 - Looking Downstream (2012)

HS1 - Looking Downstream (2019)

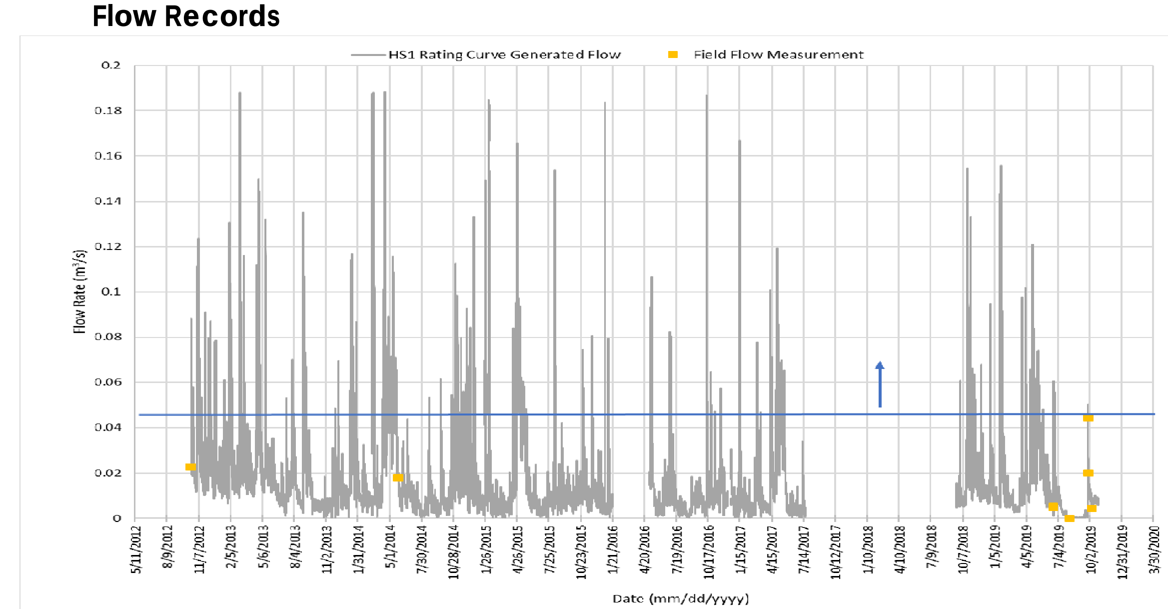
Flow Measurements

Date	Measured Flow (m^3/s)
16-Oct-12	0.0226
26-May-14	0.0178
20-Jun-19	0.0054
21-Jun-19	0.0047
5-Aug-19	0
26-Sep-19	0.0446
28-Sep-19	0.0199
7-Oct-19	0.0042

Stage-Discharge Curve

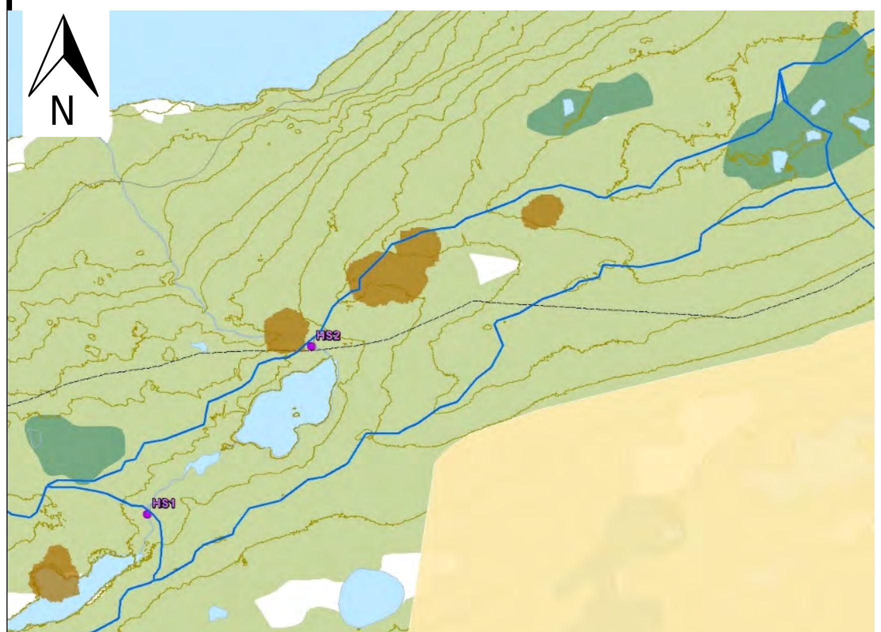


Flow Records



Baseline Hydrology - Hydrometric Monitoring Station Summary

Station ID	HS2	**Instrument Serial**	Levelogger (SN 2014183)
Location	Downstream of East Pond	**Various Measurements**	Water Temperature, Water Level
Installation Date	16-Oct-12	**Spot Measurement**	Flow Measurement: depths and velocities at cross section
Coordinates	48° 22' 7.201" N 57° 9' 36.299" W	**Main Channel**	Clear, fast moving, rocky substrate (cobbles and gravels)
Access	Via quads from the Marathon prospect camp site	**Channel Bottom**	Mixture of cobble and boulder with some gravel
Drainage Area	1.047 km^2	**Flood Plain**	Dense Brush
Period of Record	October 2012 to October 2019	**Comments**	Bridge just downstream of this station
Active	Year Round in Continous Mode		



Map: HS2

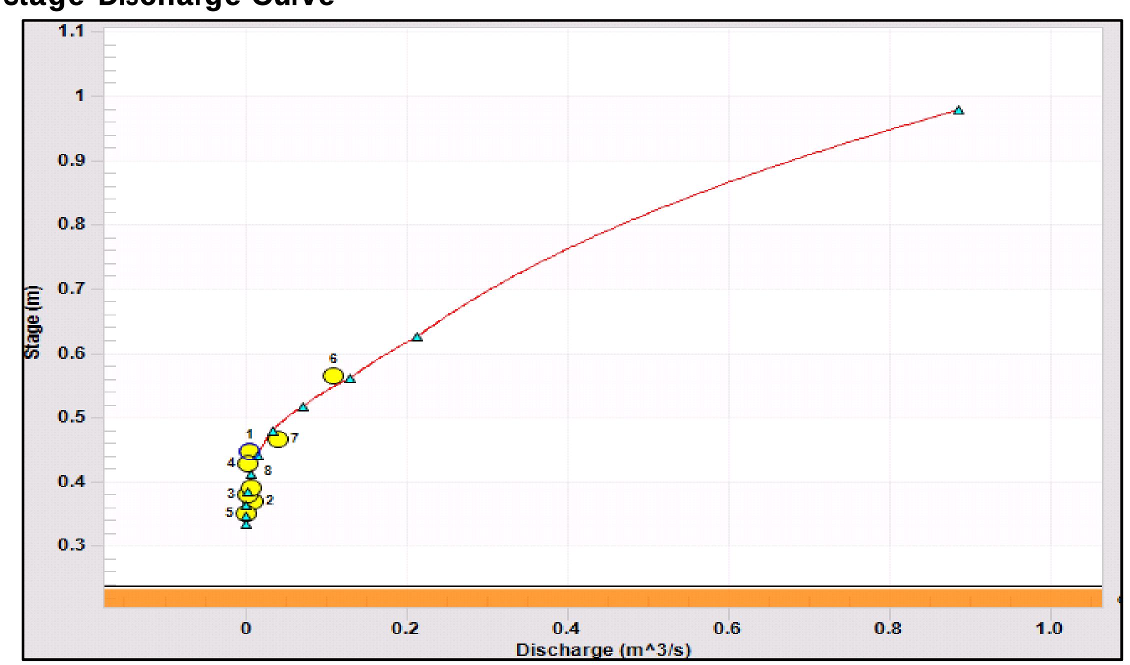
HS2 - Looking Upstream (2019)

HS2 - Looking Upstream (2012)

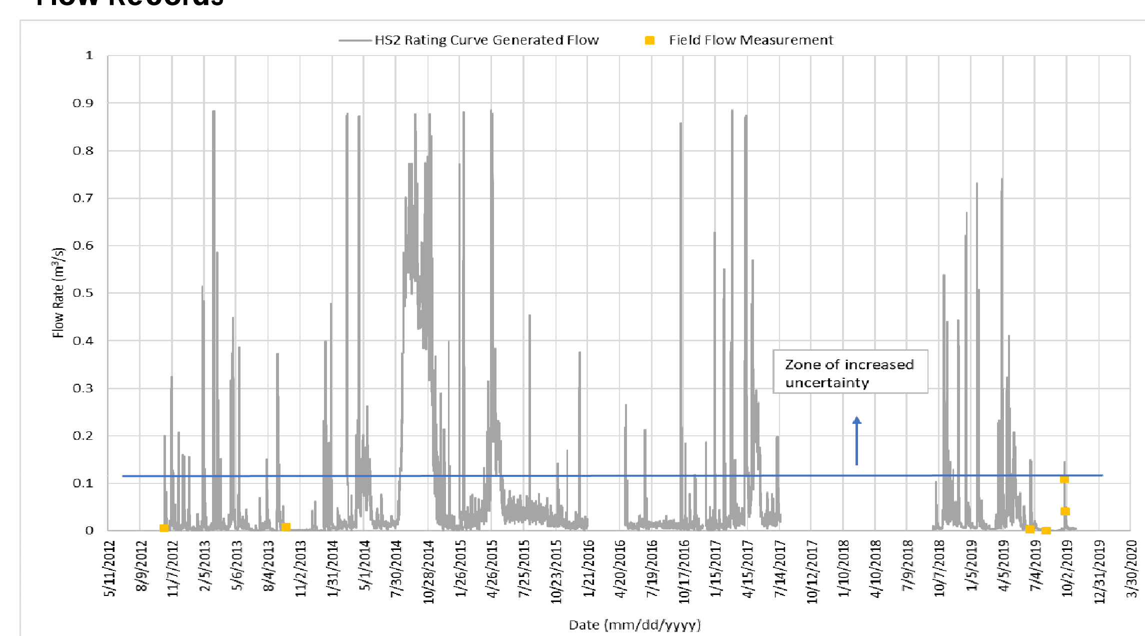
Flow Measurements

Date	Measured Flow (m^3/s)
16-Oct-12	0.0059
24-Sep-13	0.0089
20-Jun-19	0.0026
21-Jun-19	0.0025
5-Aug-19	0.0001
26-Sep-19	0.11
28-Sep-19	0.041
7-Oct-19	0.0078

Stage-Discharge Curve

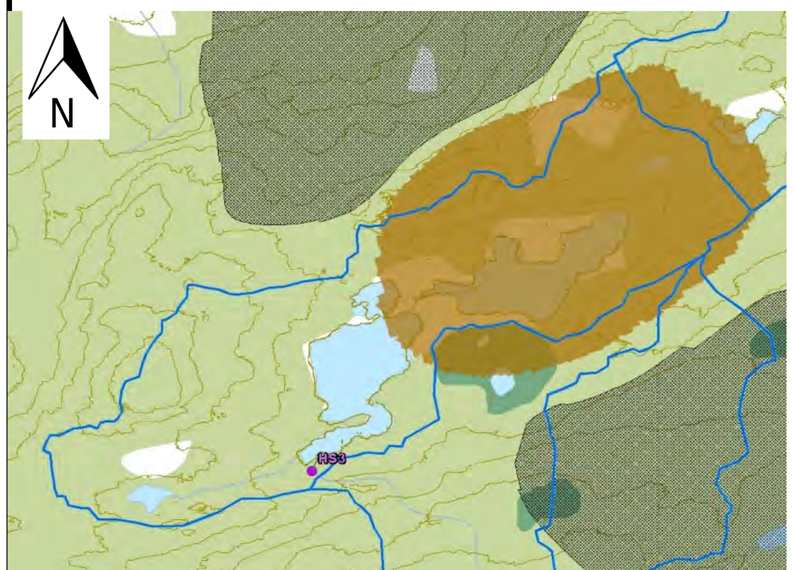


Flow Records



Baseline Hydrology - Hydrometric Monitoring Station Summary

Station ID	HS3	**Instrument Serial**	Levelogger (SN 2014117)
Location	Downstream of West Pond	**Various Measurements**	Water Temperature, Water Level
Installation Date	16-Oct-12	**Spot Measurement**	Flow Measurement: depths and velocities at cross section
Coordinates	48° 21' 8.759" N 57° 11' 20.641" W	**Main Channel**	
Access	Via quads from the Marathon prospect camp site	**Channel Bottom**	Mixture of cobble and gravel with some instream vegetation
Drainage Area	0.702 km^2	**Flood Plain**	Dense Brush
Period of Record	October 2012 to October 2019	**Comments**	
Active	Year Round in Continous Mode		



Map: HS3

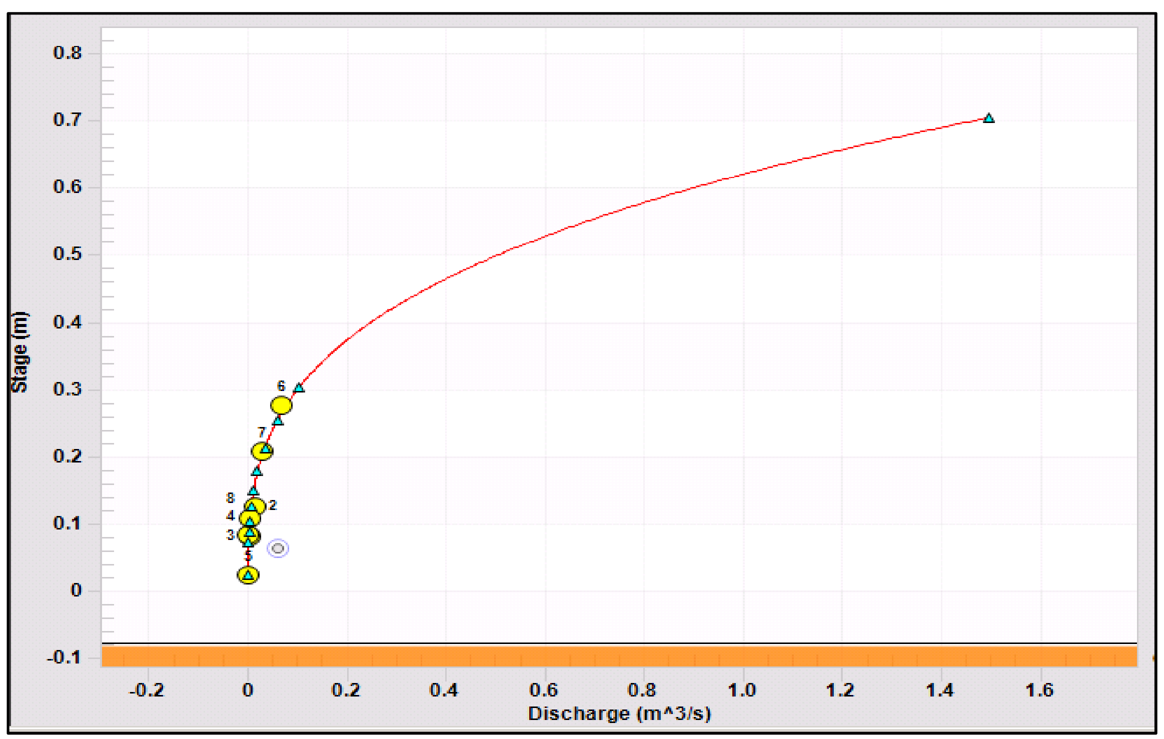
HS3 (2012)

HS3 (2012)

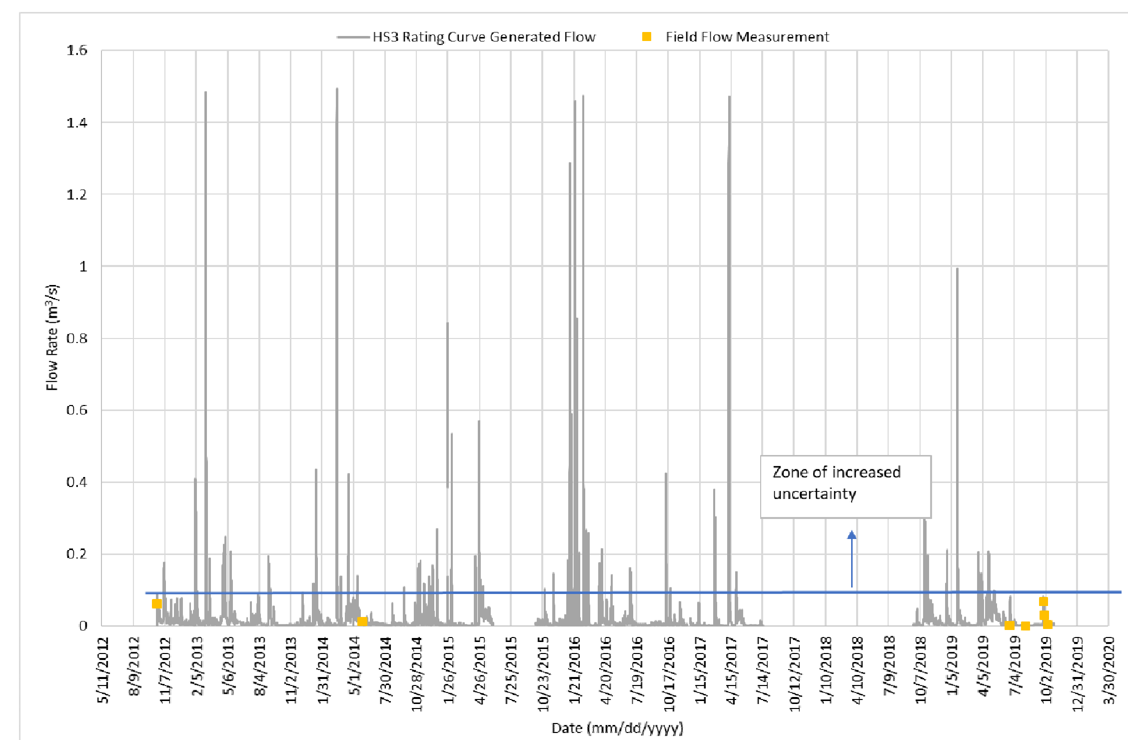
Flow Measurements

Date	Measured Flow (m^3/s)
16-Oct-12	0.0616
26-May-14	0.0123
20-Jun-19	0.002
21-Jun-19	0.0009
5-Aug-19	0
26-Sep-19	0.0667
28-Sep-19	0.0286
7-Oct-19	0.0037

Stage-Discharge Curve

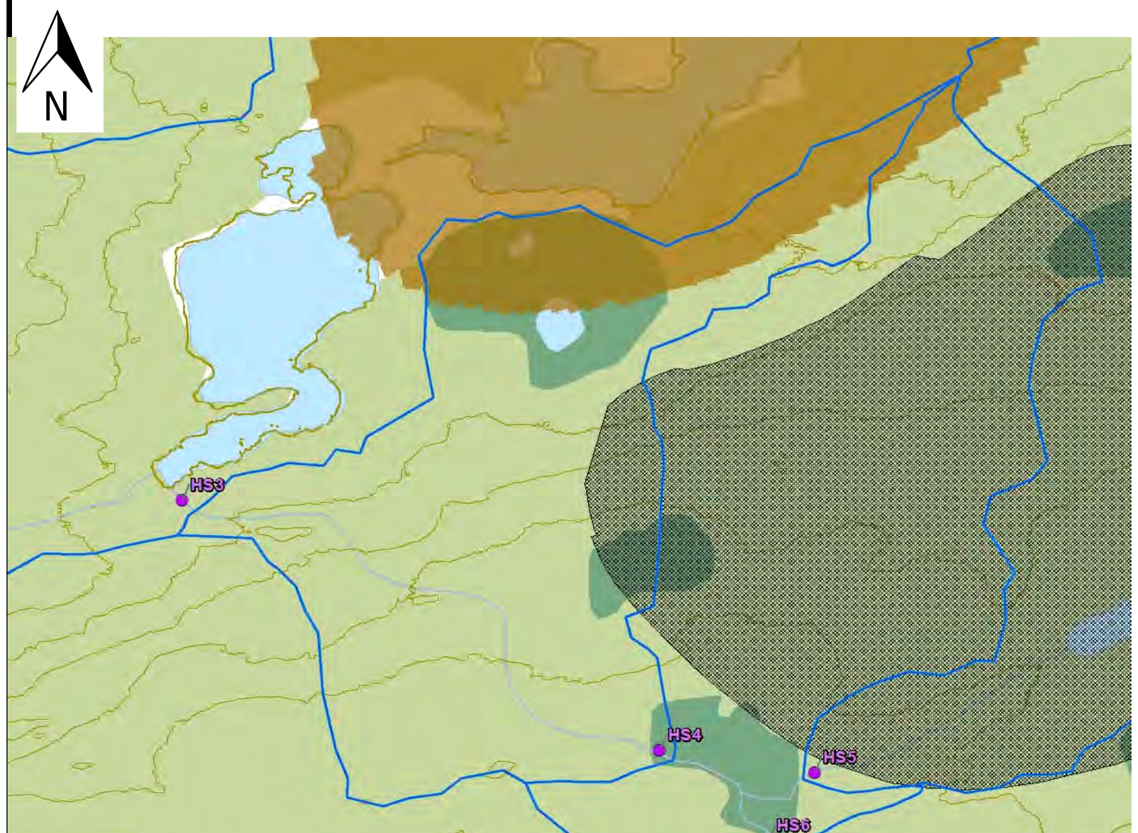


Flow Records



Baseline Hydrology - Hydrometric Monitoring Station Summary

Station ID	HS4	**Instrument Serial**	Not Applicable
Location	Downstream of West Pond before confluence	**Various Measurements**	Not Applicable
Installation Date	Not applicable	**Spot Measurement**	Flow Measurement: depths and velocities at cross section
Coordinates	48° 20' 59.065" N 57° 10' 55.387" W	**Main Channel**	Slow, meandering flow
Access	Via quads from the Marathon prospect camp site	**Channel Bottom**	Soft sediments and vegetation
Drainage Area	1.006 km^2	**Flood Plain**	Thick brush (alders)
Period of Record	Not applicable	**Comments**	
Active	Not applicable		



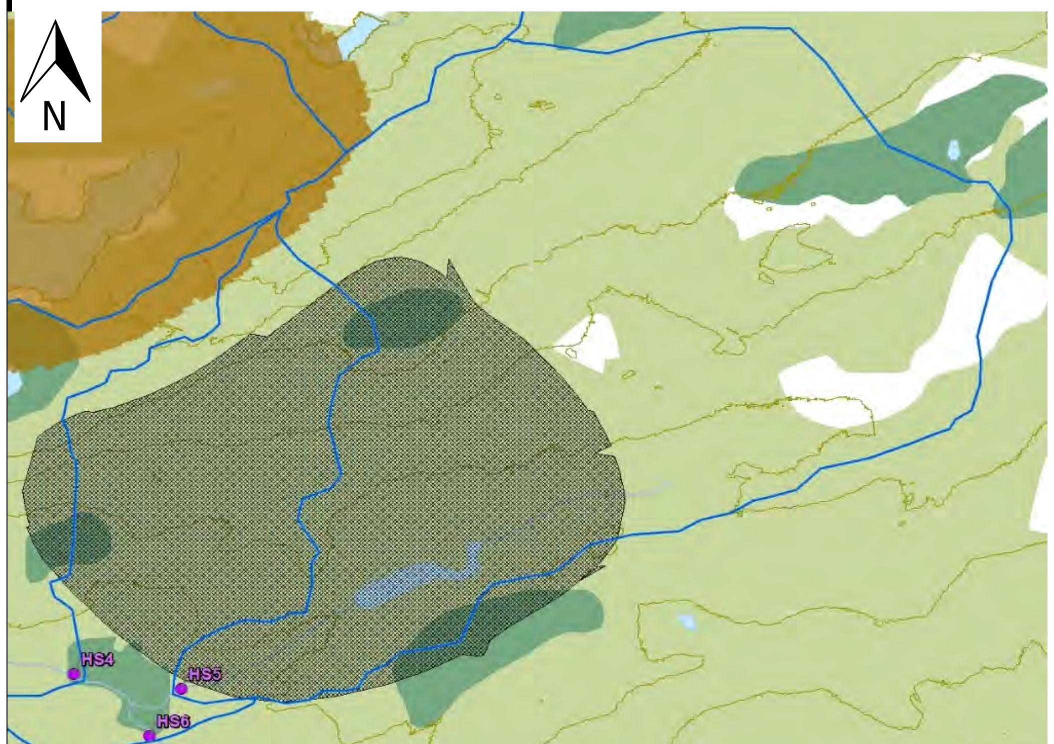
Map: HS4

HS4 (2019)

HS4 (2019)

Baseline Hydrology - Hydrometric Monitoring Station Summary

Station ID	HS5	**Instrument Serial**	Not applicable
Location	Upstream of confluence with outlet from West Pond	**Various Measurements**	Not applicable
Installation Date	Not applicable	**Spot Measurement**	Flow Measurement: depths and velocities at cross section
Coordinates	48° 20' 57.775" N 57° 10' 43.459" W	**Main Channel**	Steep banks
Access	Via quads from the Marathon prospect camp site	**Channel Bottom**	Rocky substrate (cobbles and boulders) and some roots
Drainage Area	1.009 km^2	**Flood Plain**	Thick brush / forest
Period of Record	Not applicable	**Comments**	
Active	Not applicable		



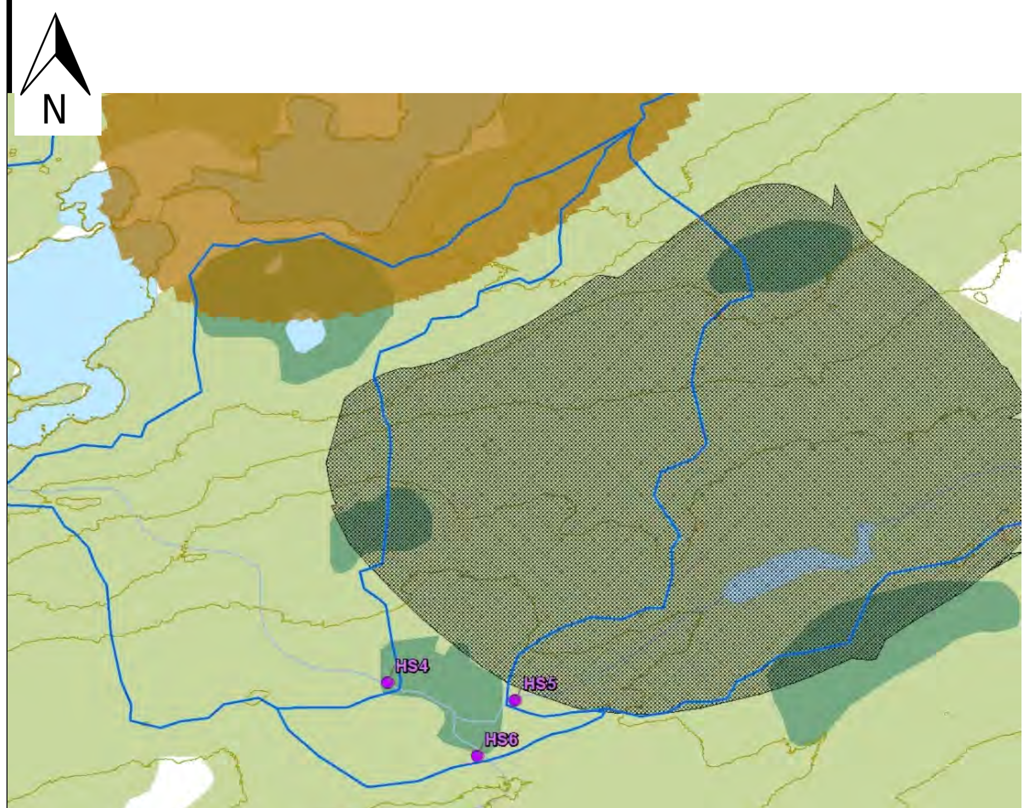
Map: HS5

HS5 (2019)

HS5 (2019)

Baseline Hydrology - Hydrometric Monitoring Station Summary

Station ID	HS6	**Instrument Serial**	Not applicable
Location	Downstream of West Pond and confluence	**Various Measurements**	Not applicable
Installation Date	Not applicable	**Spot Measurement**	Flow Measurement: depths and velocities at cross section
Coordinates	48° 20' 54.991" N 57° 10' 46.173" W	**Main Channel**	Staight and fast moving
Access	Via quads from the Marathon prospect camp site	**Channel Bottom**	Rocky substrate (cobbles and gravels)
Drainage Area	2.332 km^2	**Flood Plain**	Vegetated and forest
Period of Record	Not applicable	**Comments**	Just downstream of small pond
Active	Not applicable		



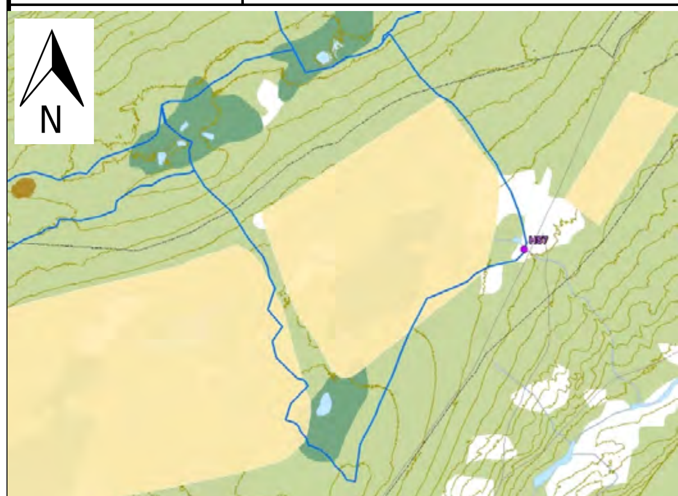
Map: HS6

HS6 (2019)

HS6 (2019)

Baseline Hydrology - Hydrometric Monitoring Station Summary

Station ID	HS7	**Instrument Serial**	Levelogger 0022097844, Barologger 0012097744
Location	Left bank, ~25m upstream (west) of the Mine access road	**Various Measurements**	Temperature, Water Level, Atmospheric Pressure
Installation Date	27-Nov-18	**Spot Measurement**	Flow
Coordinates	48° 22' 5.904" N 57° 6' 58.913" W	**Main Channel**	Overgrown, Winding
Access	Park along the Mine access road and follow the channel upstream ~25m	**Channel Bottom**	Cobbles, Boulders
Drainage Area	1.781 km^2	**Flood Plain**	Medium to dense trees and bush
Period of Record	November 2018 - October 2019	**Comments**	This station is located west (upstream) of the existing mine access road crossing and will provide baseline flow and water level data. This station will also continue to provide data during construction and operation of the project development area.
Active	Year Round in Continous Mode		



Map: HS7

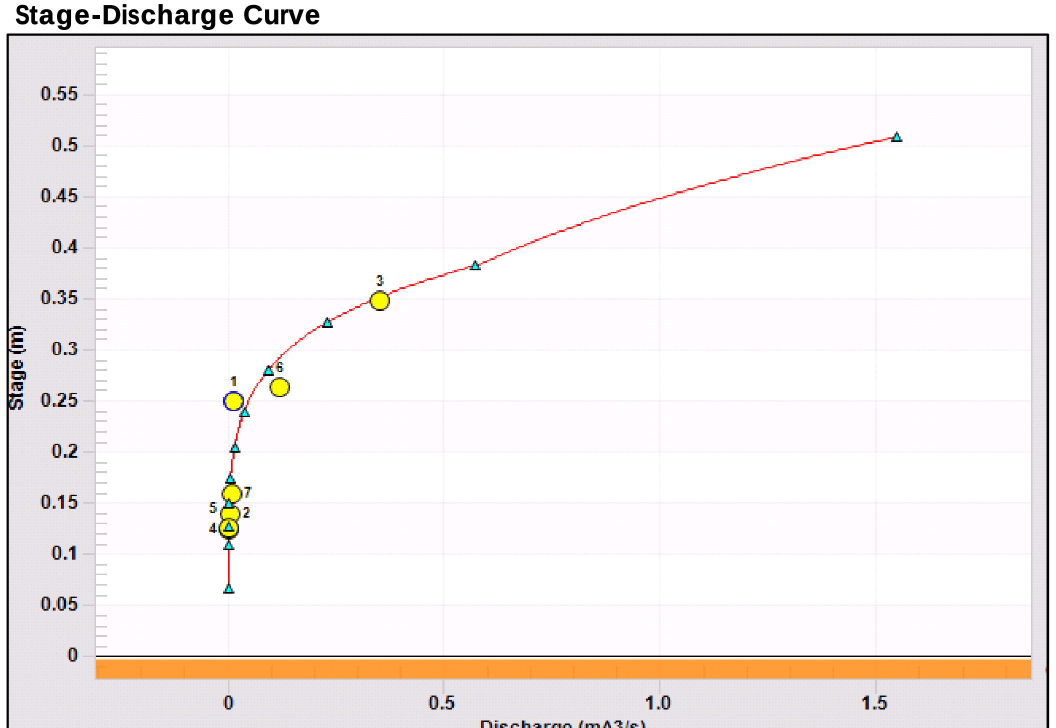
HS7 (2012)

HS7 (2012)

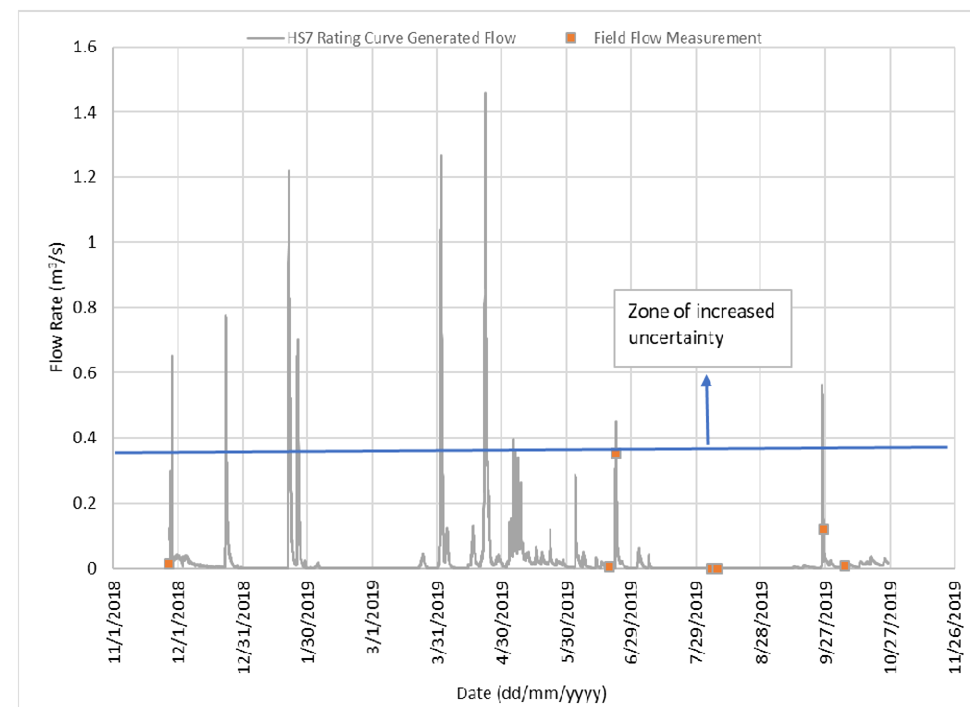
Flow Measurements

Date	Measured Flow (m^3/s)
27-Nov-18	0.0137
19-Jun-19	0.0044
22-Jun-19	0.3519
5-Aug-19	0.0008
8-Aug-19	0.0002
26-Sep-19	0.1186
6-Oct-19	0.009

Stage-Discharge Curve

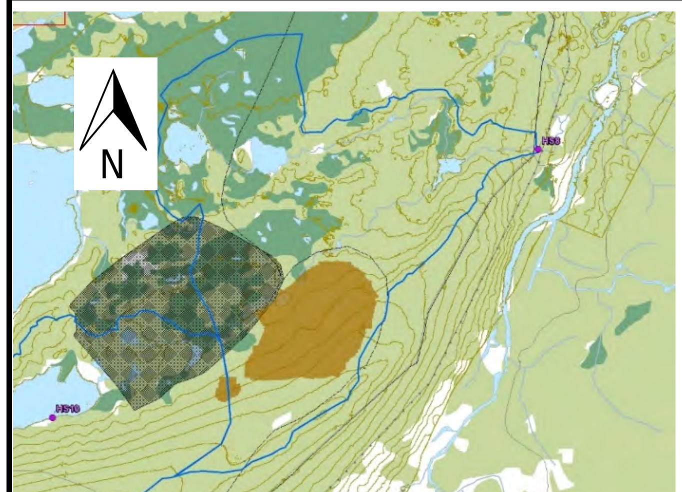


Flow Records



Baseline Hydrology - Hydrometric Monitoring Station Summary

Station ID	HS8	**Instruments Serial #:**	Levelogger 0022097867
Location	Left bank, ~6m downstream (east) of the Mine access road	**Various Measurements:**	Temperature, Water Level
Installation Date	27-Nov-18	**Spot Measurements:**	Flow
Coordinates	48° 24' 30.927" N 57° 4' 36.203" W	**Main Channel:**	Overgrown, Winding
Access	Park along the Mine access road and follow the channel downstream ~6m	**Channel Bottom:**	Cobbles, Boulders
Drainage Area	5.325 km^2	**Flood Plain:**	Medium to dense trees and bush
Period of Record	November 2018 - October 2019	**Comments:**	This station is located east (downstream) of the existing mine access road crossing and will provide baseline flow and water level data.
Active	Year Round in Continous Mode		



Map: HS8

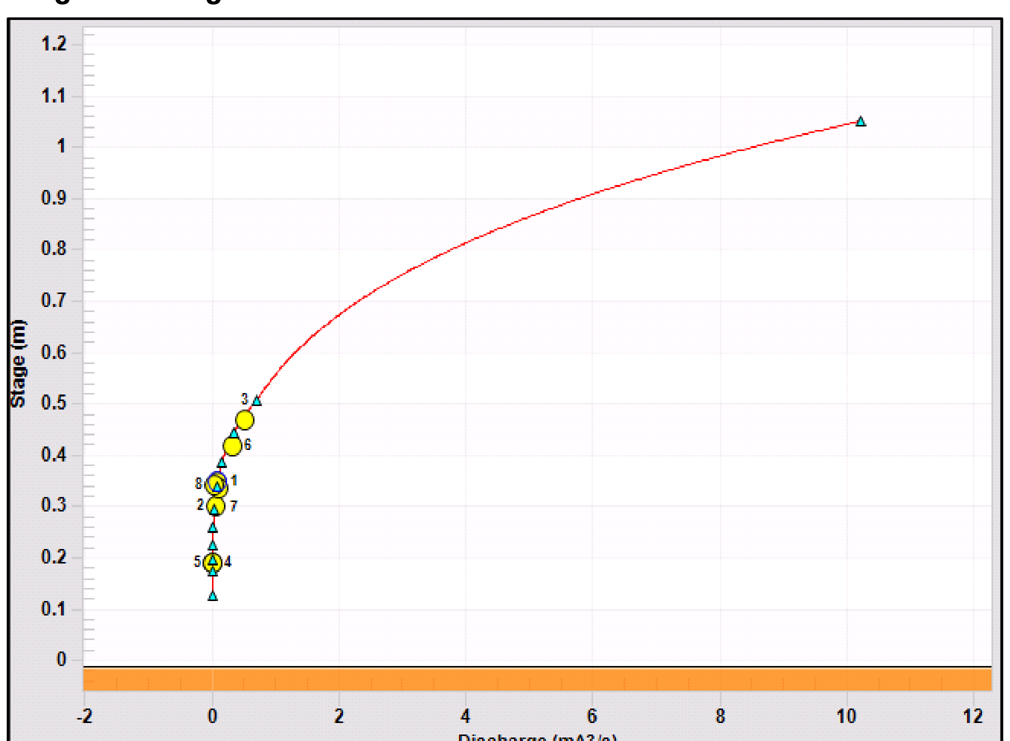
HS8 (2018)

HS8 (2018)

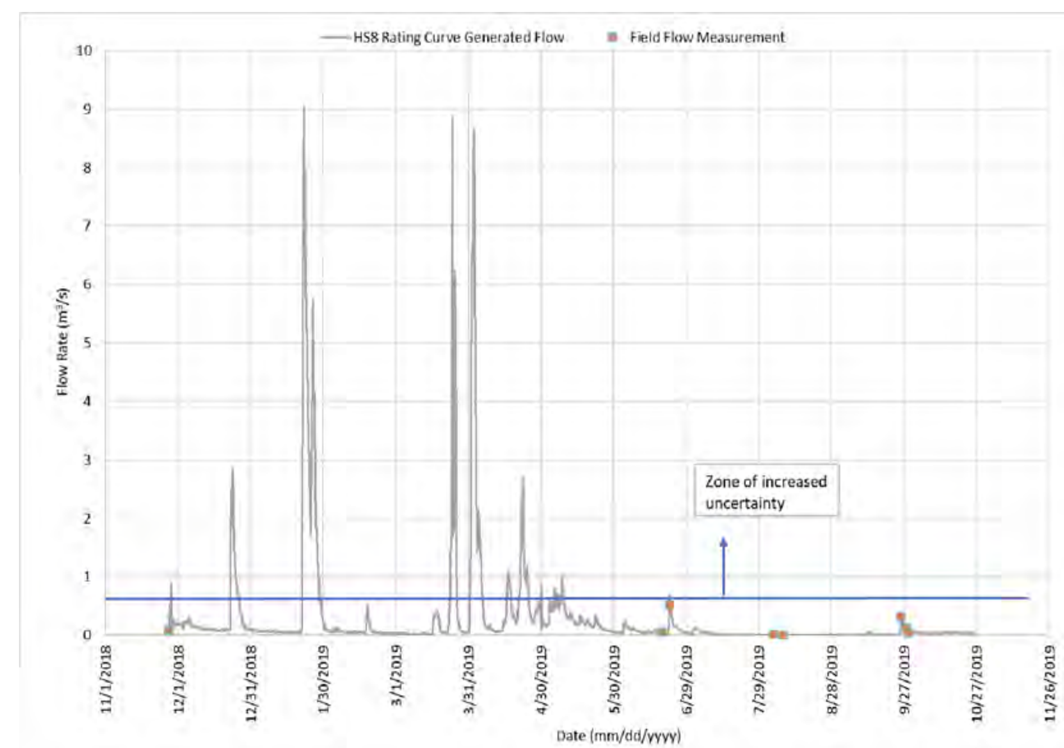
Flow Measurements

Date	Measured Flow (m^3/s)
27-Nov-18	0.071
19-Jun-19	0.0475
22-Jun-19	0.5159
4-Aug-19	0.0041
8-Aug-19	0.0027
26-Sep-19	0.3139
28-Sep-19	0.1108
6-Oct-19	0.0403

Stage-Discharge Curve



Flow Records



Baseline Hydrology - Hydrometric Monitoring Station Summary

Station ID	HS9	**Instruments Serial #:**	Levelogger 0022097868
Location	Left bank, ~35m downstream (west) of the outlet of VALP3 pond	**Various Measurements:**	Temperature, Water Level
Installation Date	28-Nov-18	**Spot Measurements:**	Flow
Coordinates	48° 23' 21.920" N 57° 8' 12.291" W	**Main Channel:**	Overgrown, Winding
Access	From Marathon prospect camp north along the main mine road, then west on Frozen Ear access road for 2.1 km continuing straight past the Marathon Deposit until reaching a narrow, overgrown access path on the north side of the road leading to VALP3. Frequent boulders, shrubs, and pooled water may restrict reliable access along this path.	**Channel Bottom:**	Cobbles, Boulders
Drainage Area	3.031 km^2	**Flood Plain:**	Medium to dense trees and bush
Period of Record	November 2018 - October 2019	**Comments:**	This station is located along the outlet channel of pond VALP3 and will provide baseline water level data. From VALP3, access is then via foot, following west along the southern shore of the pond until reaching the outlet stream and the install site is approximately 35 m downstream on the left bank.
Active	Year Round in Continous Mode		

Map: HS9

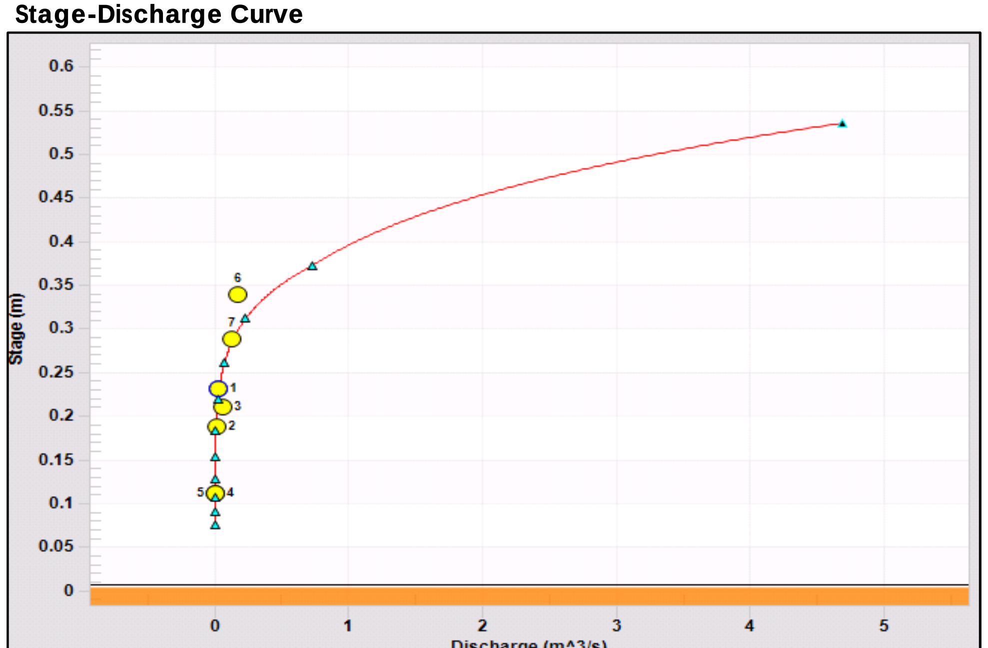
HS9 (2018)

HS9 (2018)

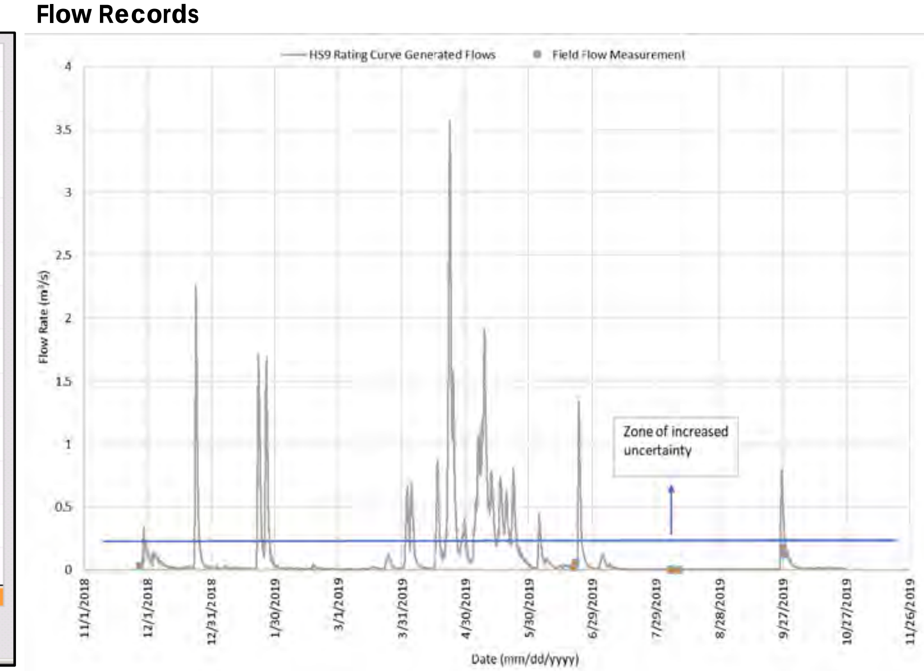
Flow Measurements

Date	Measured Flow (m^3/s)
27-Nov-18	0.0294
20-Jun-19	0.019
21-Jun-19	0.0563
5-Aug-19	0.0004
9-Aug-19	0.0001
27-Sep-19	0.1731
28-Sep-19	0.127

Stage-Discharge Curve



Flow Records



Baseline Hydrology - Hydrometric Monitoring Station Summary

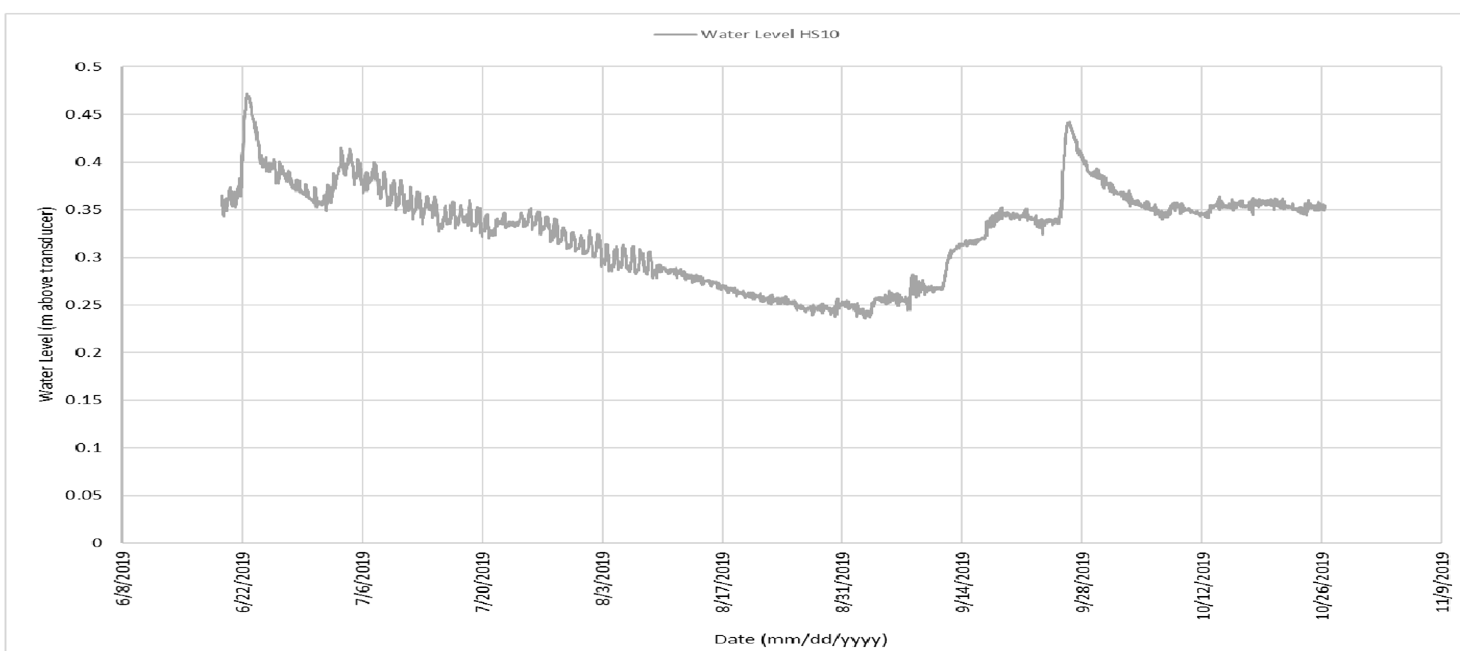
Station ID	HS10	**Instrument Serial**	2097865
Location	Southern shore of Frozen Ears Lake	**Various Measurements**	Water Temperature, Water Level
Installation Date	19-Jun-19	**Spot Measurement**	Surveyed water level at time of installation relative to benchmarks on shore
Coordinates	48° 23' 24.766" N 57° 7' 45.633" W	**Main Channel**	Installed ~5 metres off of the lake shore
Access	Via quads from the Marathon prospect camp site	**Channel Bottom**	Soft silt overlaying large cobbles and boulders
Drainage Area	3.031 km^2 (assuming same as outlet)	**Flood Plain**	
Period of Record	June 19, 2019 - ongoing	**Comments**	No flow measurements collected here as logger is deployed in a lake.
Active	Year Round in Continous Mode		

Map: HS10

Photo 1: HS10

Photo 2: HS10

Water Level Record



Baseline Hydrology - Hydrometric Monitoring Station Summary

Station ID	HS11	**Instrument Serial**	2097853
Location	Downstream of Victory Pit	**Various Measurements**	Water Temperature, Water Level
Installation Date	19-Jun-19	**Spot Measurement**	Flow Measurement: depths and velocities at cross section
Coordinates	48° 26' 20.154" N 57° 2' 50.054" W	**Main Channel**	
Access	Via truck or quads from the Marathon prospect camp site	**Channel Bottom**	Soft orgranics with vegetation
Drainage Area	1.756 km^2	**Flood Plain**	Long grasses
Period of Record	June 2019 to ongoing	**Comments**	Flow measurements taken ~5 metres upstream of logger. Flagged in vegeation
Active	Year Round in Continous Mode		

Map: HS11

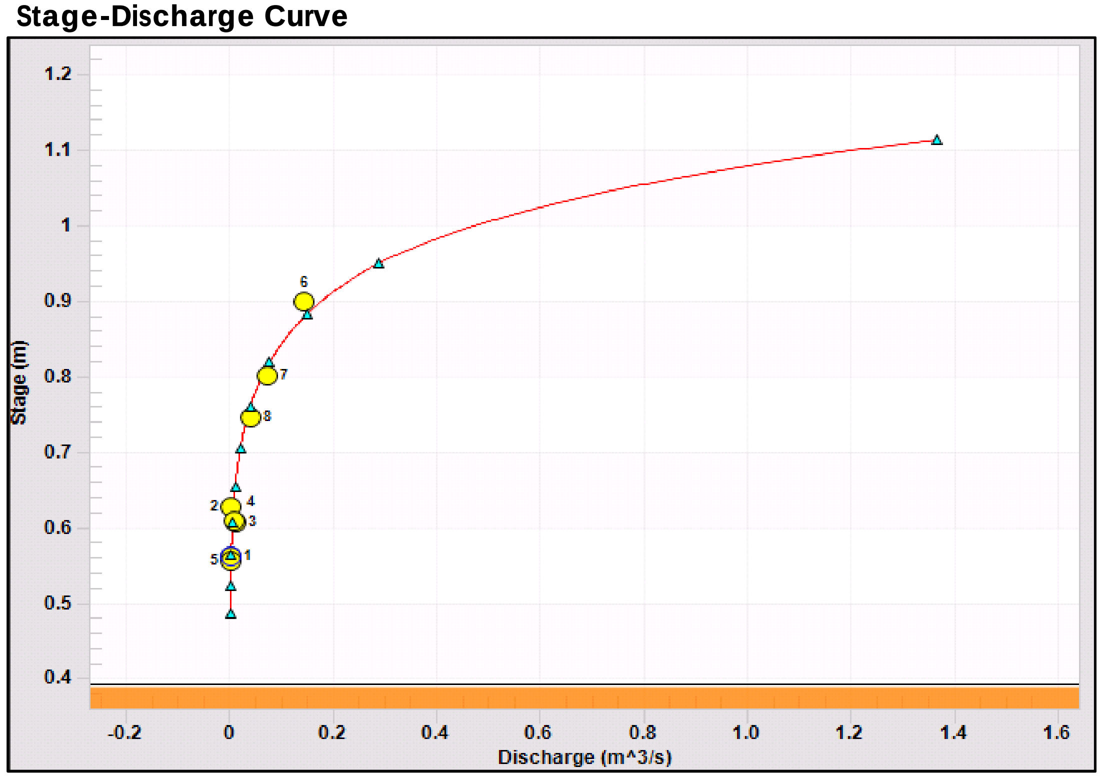
Photo 1: HS11

Photo 2: HS11

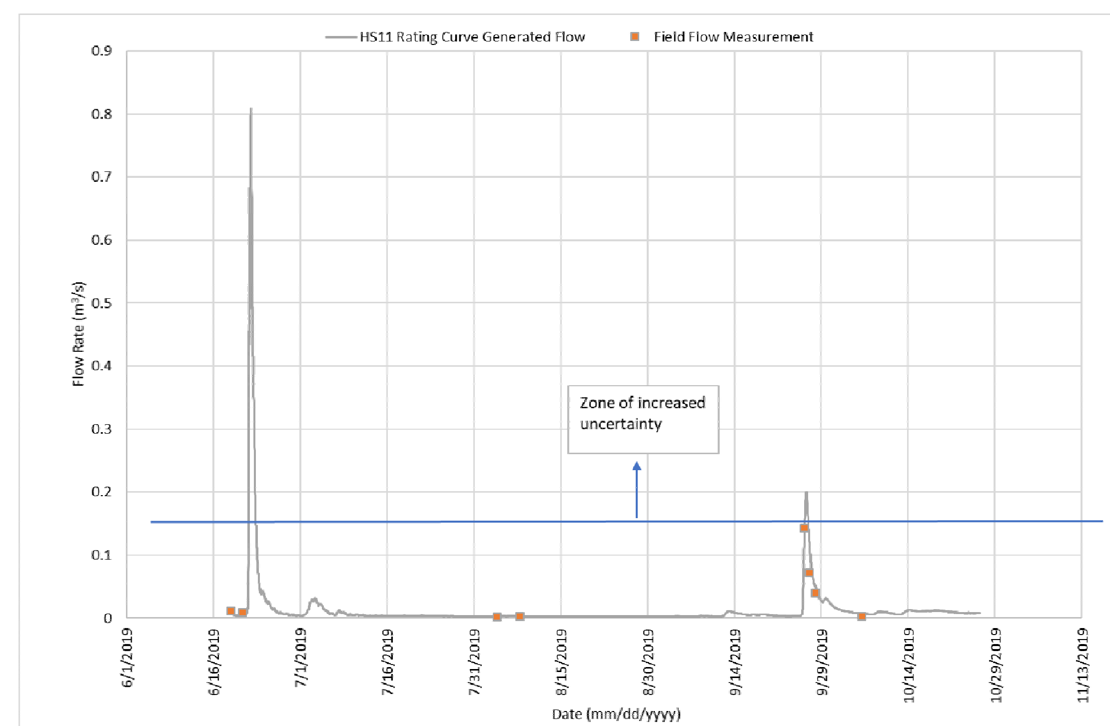
Flow Measurements

Date	Measured Flow (m^3/s)
19-Jun-19	0.0112
21-Jun-19	0.0088
4-Aug-19	0.0016
8-Aug-19	0.0026
26-Sep-19	0.1433
27-Sep-19	0.0728
28-Sep-19	0.0399
6-Oct-19	0.003

Stage-Discharge Curve

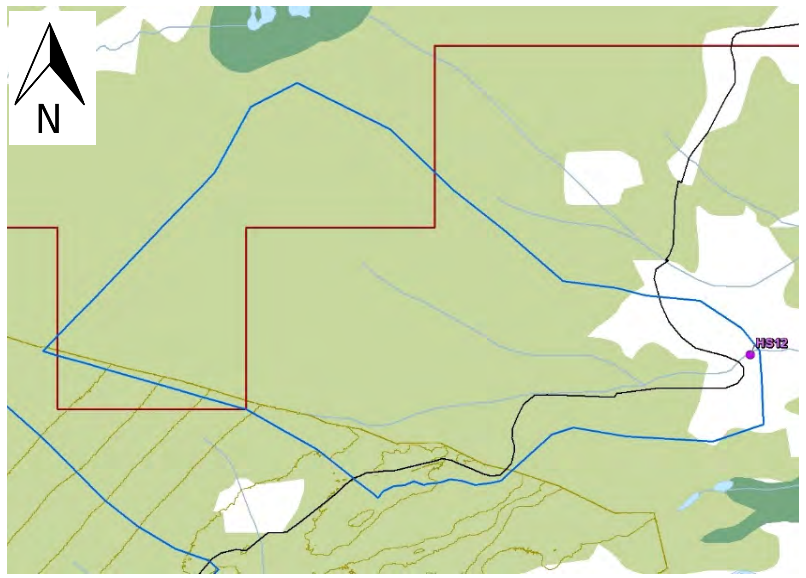


Flow Records



Baseline Hydrology - Hydrometric Monitoring Station Summary

Station ID	HS12	**Instrument Serial**	2107015
Location	Reference site just north of the Project Development Area	**Various Measurements**	Water Temperature, Water Level
Installation Date	19-Jun-19	**Spot Measurement**	Flow Measurement: depths and velocities at cross section
Coordinates	48° 27' 12.653" N 57° 1' 56.824" W	**Main Channel**	
Access	Via truck from the Marathon Camp site	**Channel Bottom**	soft organics with some gravel and woody debris
Drainage Area	1.099 km^2	**Flood Plain**	Alders and short grasses - obvious frequent flooding
Period of Record	June 2019 to ongoing	**Comments**	
Active	Year Round in Continous Mode		



Map: HS12

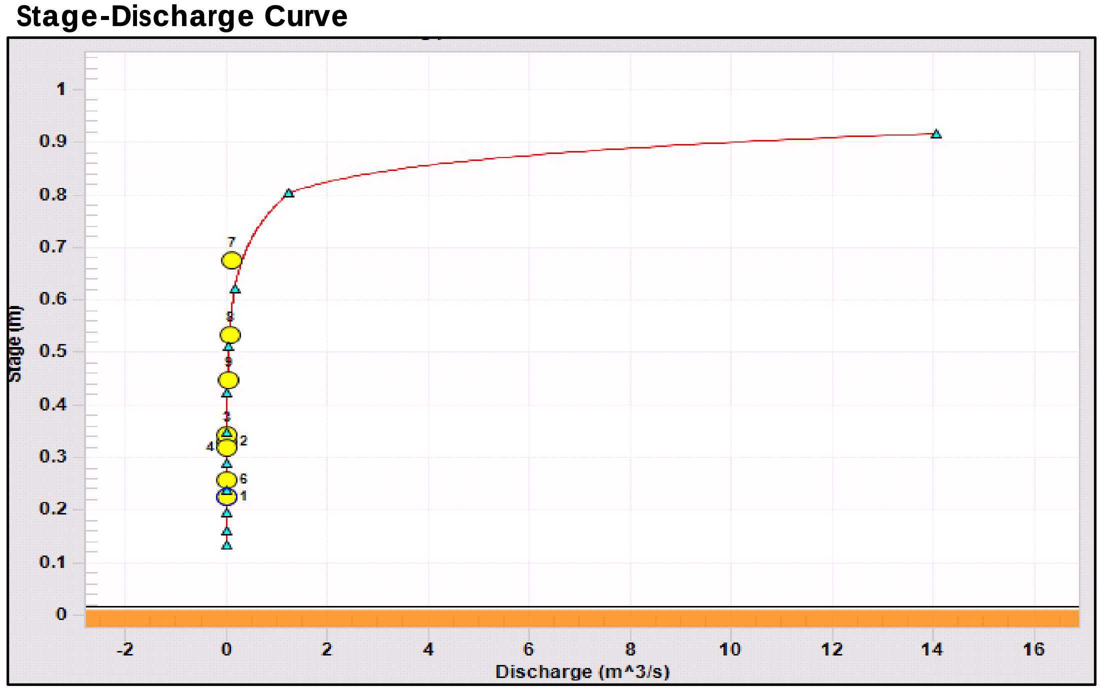
Photo 1: HS12

Photo 2: HS12

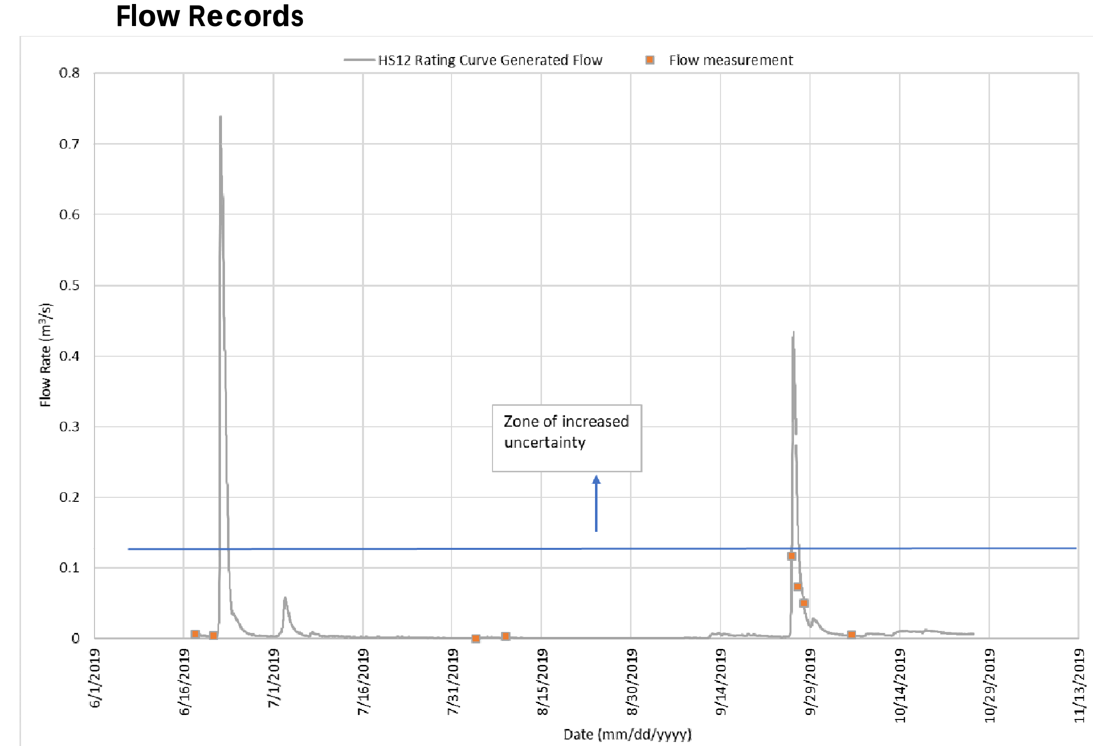
Flow Measurements

Date	Measured Flow (m^3/s)
18-Jun-19	0.0065
21-Jun-19	0.0046037
4-Aug-19	0.0001
9-Aug-19	0.0027
26-Sep-19	0.1163
27-Sep-19	0.0736
28-Sep-19	0.0501
6-Oct-19	0.0048

Stage-Discharge Curve



Flow Records



APPENDIX B

Water Survey of Canada Hydrometric Stations Flow Statistics

Appendix B
Project Name: Valentine Gold Project
Project No: 121416288
Subject: Water Survey of Canada Hydrometric Stations Flow Statistics - NE Hydrological Region of Newfoundland

				Mean Monthly Flow (m^3/s)																	
Column1	Column110	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column9	Column10	Column11	Column12	Column13	Column14	Column15	Column16	Column17	Column18	Column182	Column19	Column20
Station ID	Distance to PDA (km)	Name	Drainage Area (km^2)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean Annual Flow (m^3/s)	Unit Flow Rate ($m^3/s/km^2$)	Runoff Depth (mm)	ET Depth (mm)[1]	Runoff/Precipitation	Period of Record
02YO006	153	Peters River near Botwood	177	2.76	2.72	4.31	12.95	7.08	3.26	2.06	2.17	3.37	4.36	5.21	4.06	4.522	0.026	806	463	64%	1981 - 2018
02YO008	131	Great Rattling Brook above Tote River	773	13.90	17.44	24.04	61.15	35.35	14.55	9.22	9.68	16.78	20.82	26.98	20.07	22.463	0.029	916	463	66%	1984 - 2018
02YO010	108	Junction Brook Near Badger	61.6	0.68	0.74	1.26	3.79	3.11	1.43	0.74	0.47	0.61	1.16	1.49	1.21	1.407	0.023	721	463	61%	1985 - 1997
02YO012	179	Southwest Brook at Lewisporte	58.7	1.07	1.05	1.38	3.96	2.68	1.22	0.71	0.63	1.20	1.54	1.94	1.45	1.567	0.027	842	463	65%	1989 - 2018
02YP001	149	Shoal Arm Brook Near Bager Bay	63.8	0.96	0.84	1.56	4.19	5.64	1.84	0.97	0.94	1.00	1.36	1.71	1.28	1.869	0.029	924	463	67%	1982 - 1997
02YQ005	180	Salmon River near Glenwood	80.8	1.49	1.59	2.34	7.01	4.23	1.61	0.95	1.00	1.89	2.70	3.12	2.25	2.513	0.031	981	463	68%	1987 - 2018
02YR001	220	Middle Brook near Gambo	275	5.99	5.58	7.05	14.05	13.60	6.24	3.43	2.51	3.18	4.97	7.60	7.49	6.833	0.025	784	463	63%	1959 - 2018
02YR003	252	Indian Bay Brook near Northwest Arm	554	12.34	10.60	13.37	30.89	26.49	10.90	6.22	5.23	7.22	11.60	15.96	15.96	13.898	0.025	791	463	63%	1981 - 2018
02YS003	235	Southwest Brook at Terra Nova National Park	36.7	0.77	0.88	1.11	2.44	1.54	0.67	0.43	0.45	0.73	1.11	1.33	1.09	1.046	0.028	899	463	66%	1967 - 2017
02YS006	217	Northwest River at Terra Nova National Park	663	18.01	18.60	20.87	44.86	25.24	10.88	8.01	7.79	14.21	20.77	27.99	26.26	20.263	0.031	964	463	68%	1995 - 2018
02ZH001	218	Pipers Hole River at Mothers Brook	764	26.63	28.56	31.17	51.66	29.60	14.04	10.11	9.25	14.34	23.93	33.36	31.23	25.267	0.033	1043	463	69%	1953 - 2018
02ZJ003	230	Shoal Harbour River near Clarenville	106	3.04	3.71	3.79	7.50	4.35	2.00	1.40	0.97	1.93	3.24	4.21	3.90	3.328	0.031	990	463	68%	1986 - 2018
Notes																					
1 - Mean Evapotranspiration rate of 473mm/year was taken based on NE Hydrologic Zone location in accordance with NLDOEC. (1992). Water Resources Atlas of Newfoundland. Retrieved from Municipal Affairs and Environment: https://www.mae.gov.nl.ca/waterres/cycle/hydrologic/atlas.html																					

APPENDIX C

Regional Water Quality Tables

Table C-1
Regional Water Quality - Station ID NF02YO0190

STAT_NUM	WSC_NUM	MM/YYYY	NUM_READINGS	DO_AVG (mg/L)	DO_MIN (mg/L)	DO_MAX (mg/L)	FLOW_AVG (m3/s)	FLOW_MIN (m3/s)	FLOW_MAX (m3/s)	PER_SATUR_AVG (%)	PER_SATUR_MIN (%)	PER_SATUR_MAX (%)	PH_AVG (pH Units)	PH_MIN (pH Units)	PH_MAX (pH Units)
NF02YO0190	02YO014	18-Dec	6878	13.2454849	12.37	13.63	0.231115166	0.052	1.66	89.44197138	83.4	92.5	6.60154213	6.02	6.88
NF02YO0190	02YO014	19-Jan	5680	13.03838835	11.83	13.75	1.915373239	0.014	16.127	88.03805825	79.8	92.9	6.533895349	5.91	6.91
NF02YO0190	02YO014	19-Feb	7347	13.0663024	12.13	13.61	0.22796747	0.108	0.847	88.37365269	82.1	92	6.976062874	6.48	7.2
NF02YO0190	02YO014	19-Mar	8051	13.36106901	12.63	13.78	0.169650727	0.061	0.418	90.64857531	85.4	93.3	7.066883469	6.5	7.24
NF02YO0190	02YO014	19-Apr	7565	12.94862518	12.1	13.45	0.663347389	0.224	2.312	89.33208092	83.7	95.1	6.500951009	6.08	7.05
NF02YO0190	02YO014	19-May	7641	11.47883453	9.3	13.31	0.40204044	0.094	0.847	92.58994253	88.6	99.5	6.577988506	6.12	7.12
NF02YO0190	02YO014	19-Jun	784	9.808357964	8.39	11.42	0.199389031	0.094	1.343	94.74220033	83.3	100	7.250361248	6.44	7.53
NF02YO0190	02YO014	19-Jul	744	8.889260753	7.68	10.17	0.260173387	0.061	0.46	94.44247312	90	98.9	7.228548387	6.8	7.51
NF02YO0190	02YO014	19-Aug	744	8.728830645	7.79	10.42	0.137553763	0.025	0.279	94.98629032	91.9	99.1	7.054139785	6.53	7.36
NF02YO0190	02YO014	19-Sep	720	9.998625	8.63	11.42	0.1307875	0.02	1.441	93.42722222	83.6	99	6.404680556	5.71	7.24
NF02YO0190	02YO014	19-Oct	743	11.38367568	10.14	12.94	0.07809825	0.03	0.19	93.44251012	90.3	97.8	6.857873486	6.51	7.12
NF02YO0190	02YO014	19-Nov	715	12.6311236	10.12	13.65	0.290885315	0.052	1.441	91.09255618	86.8	95.7	6.403053221	5.94	6.98
NF02YO0190	02YO014	19-Dec	5	12.804	12.73	12.87	0.3204	0.297	0.336	87.72	87.3	88	6.31	6.3	6.33

Due to the volume and frequent updating of the data available on this Web site the streamflow - climate and water quality data is PROVISIONAL and has not undergone quality control checks. These data may be subject to significant change.

Table C-1
Regional Water Quality - Station ID NF02YO0190

STAT_NUM	WSC_NUM	MM/YYYY	SPEC_CONDUCT_AVG (ÂµS/cm)	SPEC_CONDUCT_MIN (ÂµS/cm)	SPEC_CONDUCT_MAX (ÂµS/cm)	STAGE_AVG (m)	STAGE_MIN (m)	STAGE_MAX (m)	TDS_AVG (g/L)	TDS_MIN (g/L)	TDS_MAX (g/L)	TURBIDITY_AVG (NTU)	TURBIDITY_MIN (NTU)
NF02YO0190	02YO014	18-Dec	159.2486486	35.5	234	1.301631288	1	1.555	0.10195	0.0227	0.15	0.1354531	0
NF02YO0190	02YO014	19-Jan	183.4172481	51.1	421	1.407590493	1.152	1.999	0.11738314	0.0327	0.269	0.018604651	0
NF02YO0190	02YO014	19-Feb	926.4356287	377	1214	1.32127957	1.273	1.472	0.59291018	0.241	0.777	0.026646707	0
NF02YO0190	02YO014	19-Mar	984.6184032	333	1252	1.299410384	1.232	1.389	0.630605156	0.213	0.801	0.094181326	0
NF02YO0190	02YO014	19-Apr	250.369697	36.2	698	1.42838427	1.332	1.607	0.160249711	0.0232	0.447	0.41426513	0
NF02YO0190	02YO014	19-May	208.5836442	33.5	505	1.376949614	1.264	1.469	0.133494261	0.0214	0.323	2.331994261	0
NF02YO0190	02YO014	19-Jun	401.6680921	77.2	627	1.306570153	1.256	1.527	0.257078947	0.0494	0.401	1.03261944	0
NF02YO0190	02YO014	19-Jul	766.5797297	377	1012	1.338401882	1.23	1.398	0.49140457	0.242	0.648	1.351612903	0
NF02YO0190	02YO014	19-Aug	1038.145161	910	1102	1.266337366	1.176	1.353	0.664416667	0.582	0.705	0.063978495	0
NF02YO0190	02YO014	19-Sep	662.4745125	126	1102	1.261433333	1.179	1.542	0.424581667	0.0807	0.705	0.049583333	0
NF02YO0190	02YO014	19-Oct	252.5446694	111.4	397	1.252117093	1.198	1.338	0.161635762	0.0713	0.254	0.006756757	0
NF02YO0190	02YO014	19-Nov	137.8245442	39.4	371	1.369760839	1.228	1.537	0.088204769	0.0252	0.237	0.015568022	0
NF02YO0190	02YO014	19-Dec	88.08	87.5	88.6	1.3948	1.393	1.396	0.05636	0.056	0.0567	0	0

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Table C-1
Regional Water Quality - Station ID NF02YO0190

STAT_NUM	WSC_NUM	MM/YYYY	TURBIDITY_MAX (NTU)	WATER_TEMP_AVG (C)	WATER_TEMP_MIN (C)	WATER_TEMP_MAX (C)
NF02YO0190	02YO014	18-Dec	33.1	0.085500795	0.03	0.7
NF02YO0190	02YO014	19-Jan	2.3	0.079922481	0.03	0.14
NF02YO0190	02YO014	19-Feb	3.8	0.041497006	0.02	0.09
NF02YO0190	02YO014	19-Mar	14.5	0.142615176	0.03	1.58
NF02YO0190	02YO014	19-Apr	24.4	0.845260116	0	5.58
NF02YO0190	02YO014	19-May	20.7	6.959224138	0.04	17.68
NF02YO0190	02YO014	19-Jun	21	13.88921182	7.82	22.38
NF02YO0190	02YO014	19-Jul	10.1	18.34985215	11.46	26.67
NF02YO0190	02YO014	19-Aug	10	19.48798387	11.15	26.84
NF02YO0190	02YO014	19-Sep	10.4	12.39038889	6.33	20.41
NF02YO0190	02YO014	19-Oct	4.9	6.898640646	1.94	11.61
NF02YO0190	02YO014	19-Nov	4.5	1.973174825	-0.4	10.42
NF02YO0190	02YO014	19-Dec	0	0.05	-0.04	0.11

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Table C-2
Regional Water Quality - Station ID NF02YO0192

STAT_NUM	WSC_NUM	MM/YYYY	NUM_READINGS	DO_AVG (mg/L)	DO_MIN (mg/L)	DO_MAX (mg/L)	FLOW_AVG (m3/s)	FLOW_MIN (m3/s)	FLOW_MAX (m3/s)	PER_SATUR_AVG (%)	PER_SATUR_MIN (%)	PER_SATUR_MAX (%)	PH_AVG (pH Units)	PH_MIN (pH Units)	PH_MAX (pH Units)
NF02YO0192	02YO015	Dec-18	8892	13.15741192	12.56	13.76	5.118261565	0.412	49.585	89.3201897	85.3	93.3	6.48691475	6.18	6.71
NF02YO0192	02YO015	Jan-19	8868	13.05932157	12.14	13.58	6.036242513	0.454	49.585	88.57710027	82.3	92.1	6.453058187	5.86	6.88
NF02YO0192	02YO015	Feb-19	7956	13.01822995	12.21	13.49	5.03645604	0.454	49.585	88.28971256	82.8	91.5	6.228761329	5.93	6.52
NF02YO0192	02YO015	Mar-19	8844	13.08136054	11.8	13.51	4.177103588	0.216	49.585	88.75353261	80	91.7	5.83601626	5.52	6.22
NF02YO0192	02YO015	Apr-19	8352	13.02966954	12.03	13.52	4.700078719	1.005	47.673	89.44971264	83.3	93.2	5.51079023	5.29	5.88
NF02YO0192	02YO015	May-19	8928	10.91043011	8.7	13.3	2.358740143	0.499	4.582	90.55819892	87.3	99.5	5.887876344	5.42	6.82
NF02YO0192	02YO015	Jun-19	8640	9.796791667	8.51	11.42	1.201279282	0.454	5.284	95.94763889	92.2	100.3	6.780194444	6.5	6.91
NF02YO0192	02YO015	Jul-19	8928	8.990861373	7.51	10.62	0.606085013	0.122	1.671	95.31763122	89.5	100.2	6.744293405	6.4	6.94
NF02YO0192	02YO015	Aug-19	8923	8.727244624	7.64	10.82	0.101444918	0.043	0.19	93.30766129	86.7	102	6.395188172	5.87	6.7
NF02YO0192	02YO015	Sep-19	8640	9.966986111	8.36	11.65	0.646423495	0.032	4.926	93.06638889	86.8	101.8	6.299722222	5.73	7.2
NF02YO0192	02YO015	Oct-19	8916	10.91780619	9.7	12.55	0.632687304	0.303	1.58	91.54037685	89.2	96.5	6.607187079	6.15	6.84
NF02YO0192	02YO015	Nov-19	6016	11.82218884	9.96	13.14	2.028063664	0.335	3.328	90.81244635	87.9	94	6.095905172	5.6	6.62
NF02YO0192	02YO015	Dec-19	56				3.0525	3.045	3.185						

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Table C-2
Regional Water Quality - Station ID NF02YO0192

STAT_NUM	WSC_NUM	MM/YYYY	SPEC_CONDUCT_AVG (ÂµS/cm)	SPEC_CONDUCT_MIN (ÂµS/cm)	SPEC_CONDUCT_MAX (ÂµS/cm)	STAGE_AVG (m)	STAGE_MIN (m)	STAGE_MAX (m)	TDS_AVG (g/L)	TDS_MIN (g/L)	TDS_MAX (g/L)	TURBIDITY_AVG (NTU)	TURBIDITY_MIN (NTU)
NF02YO0192	02YO015	Dec-18	27.33612991	21.3	33.6	1.421436122	1.011	6.569	0.01749567	0.0136	0.0215	2.152103121	1.8
NF02YO0192	02YO015	Jan-19	28.54403794	17.5	36.2	1.514505413	1.021	8.144	0.018268022	0.0112	0.0231	2.180597015	1.7
NF02YO0192	02YO015	Feb-19	31.87836611	20.1	39.8	1.454544118	1.02	7.349	0.020398336	0.0129	0.0255	2.044024206	1.4
NF02YO0192	02YO015	Mar-19	37.74607046	27.6	44.6	1.344605043	0.946	7.446	0.024155224	0.0177	0.0285	2.347482993	1.9
NF02YO0192	02YO015	Apr-19	18.60316092	12.4	28	1.42232148	1.115	7.761	0.011907184	0.008	0.0179	4.736781609	1.3
NF02YO0192	02YO015	May-19	17.32997312	14	23.2	1.252773297	1.031	1.425	0.011090457	0.009	0.0148	1.360349462	0.2
NF02YO0192	02YO015	Jun-19	22.125	16.9	26.8	1.126404167	1.02	1.468	0.01416	0.0108	0.0172	1.858333333	0.8
NF02YO0192	02YO015	Jul-19	26.89623149	19.4	36.5	1.037389113	0.907	1.198	0.017213997	0.0124	0.0233	1.221265141	0
NF02YO0192	02YO015	Aug-19	39.58924731	32.9	44.4	0.896167769	0.859	0.944	0.025336425	0.021	0.0284	0.17983871	0
NF02YO0192	02YO015	Sep-19	41.66	26.7	56.7	0.997262153	0.848	1.45	0.026663611	0.0171	0.0363	0.504305556	0
NF02YO0192	02YO015	Oct-19	30.1846568	26.5	37.6	1.051261552	0.984	1.189	0.019317093	0.017	0.0241	0	0
NF02YO0192	02YO015	Nov-19	28.2012931	22.9	35.5	1.232784741	0.991	1.345	0.01803691	0.0147	0.0227	0.186266094	0
NF02YO0192	02YO015	Dec-19				1.331232143	1.325	1.338					

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Table C-2
Regional Water Quality - Station ID NF02YO0192

STAT_NUM	WSC_NUM	MM/YYYY	TURBIDITY_MAX (NTU)	WATER_TEMP_AVG (C)	WATER_TEMP_MIN (C)	WATER_TEMP_MAX (C)
NF02YO0192	02YO015	Dec-18	4.6	0.058959459	0.01	1.05
NF02YO0192	02YO015	Jan-19	5.1	0.029133965	0.01	0.04
NF02YO0192	02YO015	Feb-19	2.8	0.024826546	0.02	0.04
NF02YO0192	02YO015	Mar-19	3.4	0.037560976	0.02	0.09
NF02YO0192	02YO015	Apr-19	959	0.461695402	0	4.63
NF02YO0192	02YO015	May-19	10.9	7.899610215	0.01	18.54
NF02YO0192	02YO015	Jun-19	6.2	14.561125	7.74	22.22
NF02YO0192	02YO015	Jul-19	8.1	18.38787349	10.96	28.63
NF02YO0192	02YO015	Aug-19	7.1	18.79299731	9.24	27.89
NF02YO0192	02YO015	Sep-19	8.8	12.46775	6.6	22.25
NF02YO0192	02YO015	Oct-19	0	7.790888291	1.99	12.72
NF02YO0192	02YO015	Nov-19	19.7	4.45375	0.31	10.94
NF02YO0192	02YO015	Dec-19				

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APPENDIX D

Local Water Quality Tables

TABLE D-1

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																	
			LP01																	
Sampling Date			9-Mar-11	30-Mar-11	18-May-11	25-Jun-11	7-Aug-11	5-Sep-11	8-Oct-11	12-Nov-11	17-Jan-12	22-Feb-12	17-Mar-12	15-May-12	21-Jun-12	3-Aug-12	16-Sep-12	31-Oct-12	26-Nov-12	12-Jan-13
Calculated Parameters																				
Anion Sum	me/L	-	0.460	0.440	0.430	0.490	0.610	0.790	0.710	0.530	0.680	0.650	1.180	0.570	0.800	0.710	0.570	0.490	0.490	0.660
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	17	13	17	20	26	34	30	22	26.6	25.7	49	23	33	30	23	20	19	27
Calculated TDS	mg/L	-	29	27	25	26	34	41	41	32	40	37	63	32	42	40	33	29	28	37
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.57	0.5	0.55	0.54	0.69	0.78	0.86	0.65	0.76	0.72	1.1	0.67	0.87	0.86	0.69	0.63	0.56	0.74
Hardness (CaCO3)	mg/L	-	20	16	21	20	26	31	30	23	28	26	42	24	33	32	26	24	21	29
Ion Balance (% Difference)	%	-	10.7	6.38	12.2	4.85	6.15	0.64	9.55	10.2	5.56	5.11	3.51	8.06	4.19	9.55	9.52	12.5	6.67	5.71
Langelier Index (@ 20C)	N/A	-	-2.33	-2.82	-2.04	-1.48	-1.79	-1.31	-1.44	-1.69	-1.75	-1.87	-1.27	-1.68	-1.19	-1.29	-1.38	-1.56	-1.74	-1.64
Langelier Index (@ 4C)	N/A	-	-2.58	-3.07	-2.29	-1.73	-2.04	-1.56	-1.7	-1.95	-2	-2.12	-1.52	-1.94	-1.44	-1.54	-1.63	-1.81	-1.99	-1.89
Nitrate (N)	mg/L	13	0.06	0.025	0.025	0.025	0.07	0.025	0.025	0.060	0.11	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.055	0.069
Saturation pH (@ 20C)	N/A	-	9.25	9.46	9.21	9.17	8.96	8.76	8.84	9.09	8.92	8.96	8.49	9.04	8.75	8.81	8.99	9.1	9.17	8.9
Saturation pH (@ 4C)	N/A	-	9.5	9.71	9.46	9.42	9.21	9.01	9.1	9.35	9.17	9.21	8.74	9.30	9.00	9.06	9.24	9.35	9.42	9.15
Inorganics																				
Total Alkalinity (Total as CaCO3)	mg/L	-	17	13	17	20	26	35	30	22	27	26	50	23	33	30	24	20	19	27
Dissolved Chloride (Cl)	mg/L	120	4	6	3	3	3	4	4	3	4.7	4.9	6.7	3.9	4.6	3.7	3.5	3.4	3.4	4.0
Colour	TCU	Note 5	44	55	31	27	36	20	41	49	51	37	36	33	18	24	35	26	30	34
Nitrate + Nitrite (N)	mg/L		0.06	0.025	0.025	0.025	0.07	0.025	0.025	0.06	0.11	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.055	0.069
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<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	Note 6	<0.05	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.052	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.051
Total Organic Carbon (C)	mg/L	-	6.2	6.3	4.7	6.8	8.9	7.6	10	8.4	9.0	6.4	6.8	6.8	7.4	7.6	8.9	7.4	7.6	7.9
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.055	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.92	6.64	7.17	7.69	7.17	7.45	7.40	7.40	7.17	7.09	7.22	7.36	7.56	7.52	7.61	7.54	7.43	7.26
Reactive Silica (SiO2)	mg/L	-	2.4	2.2	0.7	<0.5	0.6	0.6	1.1	1.7	2.4	2.1	4.3	<0.50	<0.50	0.67	0.93	0.77	1.2	2.0
Total Suspended Solids	mg/L	Note 7	<1	3	2	8	4	2	20	15	2.4	4.0	5.2	4.0	4.4	<1.0	1.4	2.2	2.6	3.8
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	1.0	1.7	0.9	5.9	2.3	1.5	23	8.6	3.5	3.7	5.0	6.0	1.1	0.99	1.4	1.5	1.4	1.9
Conductivity	uS/cm	-	51	48	49	50	61	79	71	57	72	71	120	58	78	74	62	55	49	67

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-1

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID													
			LP01													
Sampling Date			21-Feb-13	27-May-13	29-Jul-13	6-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	7-Sep-18	28-Apr-19	5-Aug-19	2-Nov-19
Calculated Parameters																
Anion Sum	me/L	-	0.710	0.360	0.580	0.610	0.090	0.460	0.630	0.460	0.780	0.420	0.670	0.260	0.880	0.800
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	30	14	24	27	<1.0	19	28	20	34	16	30	11	40	29
Calculated TDS	mg/L	-	40	21	30	34	10	27	31	25	43	24	35	15	47	43
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
Cation Sum	me/L	-	0.75	0.47	0.6	0.57	0.25	0.53	0.58	0.54	0.79	0.44	0.69	0.27	0.90	0.80
Hardness (CaCO3)	mg/L	-	30	18	25	23	7.0	22	25	22	33	17	29	9.8	36	31
Ion Balance (% Difference)	%	-	2.74	13.3	1.69	3.39	47.1	7.07	4.13	8.00	0.64	2.33	1.47	1.89	1.12	0.00
Langelier Index (@ 20C)	N/A	-	-1.55	-2.09	-1.57	-2.26	NC	-2.10	-1.14	-1.67	-1.77	-2.26	-1.41	-2.98	-1.52	-1.39
Langelier Index (@ 4C)	N/A	-	-1.8	-2.34	-1.82	-2.51	NC	-2.36	-1.40	-1.92	-2.03	-2.52	-1.66	-3.24	-1.77	-1.64
Nitrate (N)	mg/L	13	0.055	0.025	0.025	0.025	0.064	0.072	0.025	0.067	0.098	0.025	0.025	0.025	0.055	0.025
Saturation pH (@ 20C)	N/A	-	8.83	9.38	9.00	9.00	NC	9.16	8.91	9.12	8.73	9.33	8.83	9.72	8.61	8.82
Saturation pH (@ 4C)	N/A	-	9.08	9.63	9.25	9.25	NC	9.41	9.17	9.37	8.98	9.59	9.08	9.97	8.87	9.08
Inorganics																
Total Alkalinity (Total as CaCO3)	mg/L	-	30	14	24	27	<5.0	19	28	20	34	16	30	11	40	29
Dissolved Chloride (Cl)	mg/L	120	3.7	3.2	3.5	2.9	3.1	2.9	2.5	2.1	3.5	3.6	2.5	1.4	3.0	4.7
Colour	TCU	Note 5	30	28	15	36	22	35	12	18	30	33	12	48	12	13
Nitrate + Nitrite (N)	mg/L		0.055	0.025	0.025	0.025	0.064	0.072	0.025	0.067	0.11	0.025	0.025	0.025	0.055	0.025
Nitrite (N)	mg/L	0.06	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	0.062	0.025	0.025	0.13	0.025	0.025	0.025	0.089	0.025	0.025	0.025	0.025	0.058	0.025
Total Organic Carbon (C)	mg/L	-	6.3	4.9	6.1	4.3	3.2	5.6	3.4	4.6	6.4	5.3	4.9	7.4	4.1	5
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
pH	pH	6.5-9.0	7.28	7.29	7.43	6.74	6.62	7.05	7.77	7.45	6.96	7.07	7.42	6.74	7.10	7.44
Reactive Silica (SiO2)	mg/L	-	2.7	<0.50	<0.50	2.7	1.4	2.2	<0.50	<0.50	3.0	1.8	0.51	1.5	1.1	0.82
Total Suspended Solids	mg/L	Note 7	1.4	1.2	2.4	<1.0	**42**	4.6	<1.0	<1.0	3.0	1.6	1.0	2.0	<2.0	2.2
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	3.8
Turbidity	NTU	Note 8	1	0.96	1.3	0.52	1.5	0.86	0.53	1.8	1.3	0.7	0.73	4.7	0.33	1.8
Conductivity	uS/cm	-	73	44	59	57	19	48	57	49	77	46	65	25	88	71

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30
9. **Bold & Underlined = parameter concentration exceeds the applicable standard**
10. NC = Not Calculated

TABLE D-2

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																	
			LP02																	
Sampling Date			9-Mar-11	30-Mar-11	18-May-11	25-Jun-11	8-Aug-11	5-Sep-11	8-Oct-11	12-Nov-11	17-Jan-12	22-Feb-12	17-Mar-12	15-May-12	21-Jun-12	3-Aug-12	16-Sep-12	31-Oct-12	26-Nov-12	13-Jan-13
Calculated Parameters																				
Anion Sum	me/L	-	0.400	0.380	0.190	0.290	0.400	0.460	0.430	0.350	0.620	0.480	0.800	0.300	0.340	0.490	0.550	0.480	0.370	0.550
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	15	12	7	11	16	19	17	14	24.5	17.7	34	12	13	20	22	19	15	22
Calculated TDS	mg/L	-	24	23	10	16	21	24	24	21	35.0	28.0	44.0	16.0	21.0	28.0	31	29	18	33
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.460	0.420	0.220	0.350	0.400	0.460	0.510	0.420	0.640	0.510	0.810	0.340	0.520	0.590	0.660	0.640	0.260	0.640
Hardness (CaCO3)	mg/L	-	16	14	8	12	15	18	19	14	24	18	31	12	19	22	25	24	9.8	24
Ion Balance (% Difference)	%	-	6.98	5.00	7.32	9.38	0.00	0.00	8.51	9.09	1.59	3.03	0.620	6.25	20.9	9.26	9.09	14.3	17.5	7.56
Langelier Index (@ 20C)	N/A	-	-2.47	-2.87	-3.40	-2.24	-2.18	-1.99	-2.04	-2.38	-1.93	-2.39	-1.73	-2.60	-1.85	-1.74	-1.39	-1.60	-2.28	-1.88
Langelier Index (@ 4C)	N/A	-	-2.72	-3.12	-3.65	-2.49	-2.44	-2.24	-2.29	-2.64	-2.17	-2.65	-1.98	-2.85	-2.11	-1.99	-1.64	-1.85	-2.53	-2.14
Nitrate (N)	mg/L	13	0.05	0.08	<0.05	<0.05	0.06	<0.05	<0.05	0.06	0.080	0.053	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	0.062
Saturation pH (@ 20C)	N/A	-	9.37	9.53	10.0	9.62	9.37	9.25	9.27	9.49	9.02	9.27	8.76	9.64	9.38	9.14	9.03	9.11	9.59	9.05
Saturation pH (@ 4C)	N/A	-	9.62	9.78	10.3	9.87	9.63	9.50	9.52	9.75	9.27	9.53	9.01	9.89	9.64	9.39	9.28	9.36	9.84	9.31
Inorganics																				
Total Alkalinity (Total as CaCO3)	mg/L	-	15	12	7	11	16	19	17	14	25	18	34	12	13	20	22	19	15	22
Dissolved Chloride (Cl)	mg/L	120	3	5	2	2	2	3	3	3	4.5	4.2	4.1	2.3	2.9	3.0	3.5	3.4	2.5	3.3
Colour	TCU	Note 5	45	48	37	33	31	16	34	57	47	42	35	47	13	21	35	31	21	33
Nitrate + Nitrite (N)	mg/L		0.05	0.08	<0.05	<0.05	0.06	0.06	<0.05	0.06	0.080	0.053	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	<0.050	0.062
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.050	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.010	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6.2	6.0	5.2	6.5	8.1	7.9	8.4	8.6	8.5	6.5	6.2	6.2	7.0	7.9	8.8	7.5	5.0	7.5
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.055	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.90	6.66	6.60	7.38	7.19	7.26	7.23	7.11	7.10	6.88	7.03	7.04	7.53	7.40	7.64	7.51	7.31	7.17
Reactive Silica (SiO2)	mg/L	-	2.2	1.7	<0.5	<0.5	<0.5	<0.5	0.7	1.3	2.2	2.0	2.7	<0.50	<0.50	0.61	0.84	0.85	0.84	2.1
Total Suspended Solids	mg/L	Note 7	<1	2	2	2	<2	1	4	14	<1.0	2.8	3.2	1.8	4.4	<1.0	2.2	7.8	6.6	11
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.6	1.2	0.5	1.1	0.9	1.0	3.4	9.6	2.8	3.4	1.9	1.3	0.50	0.71	1.1	5.1	1.8	5.1
Conductivity	uS/cm	-	46	42	22	31	39	47	45	36	63	53	82	31	48	51	59	54	39	59

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-2

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID													
			LP02													
Sampling Date			21-Feb-13	27-May-13	29-Jul-13	6-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	7-Sep-18	28-Apr-19	5-Aug-19	2-Nov-19
Calculated Parameters																
Anion Sum	me/L	-	0.660	0.270	0.390	0.510	0.450	0.500	0.470	0.420	0.780	0.430	0.450	0.190	0.580	0.590
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	28	9.3	14	21	19	21	20	18	34	16	20	7.8	25	18
Calculated TDS	mg/L	-	38	16	20.0	29	23	29	23	22	43	24	23	11	31	32
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
Cation Sum	me/L	-	0.730	0.370	0.390	0.510	0.460	0.560	0.430	0.450	0.80	0.44	0.49	0.21	0.59	0.51
Hardness (CaCO3)	mg/L	-	29	13	15	20	19	23	18	19	33	17	20	7.3	23	19
Ion Balance (% Difference)	%	-	5.04	15.6	0.00	0.00	1.10	5.66	4.44	3.45	1.27	1.15	4.26	5.00	0.85	7.27
Langelier Index (@ 20C)	N/A	-	-1.60	-2.53	-2.34	-2.52	-1.92	-2.19	-1.81	-1.71	-1.73	-2.45	-1.78	-3.14	-1.7	-2.04
Langelier Index (@ 4C)	N/A	-	-1.85	-2.78	-2.6	-2.77	-2.17	-2.44	-2.07	-1.97	-1.98	-2.7	-2.03	-3.4	-1.95	-2.29
Nitrate (N)	mg/L	13	0.073	<0.050	<0.050	0.060	<0.050	0.079	<0.050	0.051	<0.050	<0.050	<0.050	<0.050	0.075	<0.050
Saturation pH (@ 20C)	N/A	-	8.88	9.67	9.44	9.14	9.23	9.08	9.20	9.24	8.73	9.35	9.16	10	9.01	9.24
Saturation pH (@ 4C)	N/A	-	9.13	9.92	9.70	9.39	9.48	9.33	9.46	9.49	8.98	9.6	9.42	10.3	9.26	9.49
Inorganics																
Total Alkalinity (Total as CaCO3)	mg/L	-	28	9.3	14	21	19	21	20	18	34	16	20	7.8	25	18
Dissolved Chloride (Cl)	mg/L	120	3.7	3.1	4.0	2.9	2.5	2.7	2.2	2.0	3.5	4.2	1.6	1.2	2.7	4.0
Colour	TCU	Note 5	28	31	23	45	9.4	30	11	22	30	38	11	47	29	28
Nitrate + Nitrite (N)	mg/L		0.073	<0.050	<0.050	0.060	<0.050	0.079	<0.050	0.051	0.052	<0.050	<0.050	<0.050	0.075	<0.050
Nitrite (N)	mg/L	0.06	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	0.066	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.26	<0.050	<0.050	<0.050	0.057	<0.050
Total Organic Carbon (C)	mg/L	-	6.3	5.7	6.9	5.0	4.8	5.0	4.4	5.0	6.3	5.8	6.8	6.8	7.5	6.8
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
pH	pH	6.5-9.0	7.28	7.14	7.10	6.62	7.31	6.89	7.39	7.53	7.00	6.91	7.39	6.85	7.31	7.20
Reactive Silica (SiO2)	mg/L	-	2.6	<0.50	<0.50	2.5	<0.50	2.0	<0.50	<0.50	3.0	1.9	<0.50	1.3	0.7	0.94
Total Suspended Solids	mg/L	Note 7	<2.0	1.4	2.2	1.6	<1.0	6.8	<1.0	<1.0	1.6	<1.0	1.6	1.8	<2.0	2.8
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	5.5
Turbidity	NTU	Note 8	2.2	0.66	0.56	0.94	0.48	0.52	0.67	1.1	1.1	0.57	1.4	2.9	0.63	3
Conductivity	uS/cm	-	73	34	37	48	44	52	41	44	77	46	47	18	56	45

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-3

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																	
			LP03																	
Sampling Date			9-Mar-11	30-Mar-11	18-May-11	25-Jun-11	8-Aug-11	6-Sep-11	8-Oct-11	12-Nov-11	17-Jan-12	22-Feb-12	17-Mar-12	15-May-12	21-Jun-12	4-Aug-12	16-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13
Calculated Parameters																				
Anion Sum	me/L	-	0.220	0.300	0.210	0.350	0.530	0.770	0.380	0.280	0.450	0.400	0.570	0.170	0.070	0.180	0.070	0.060	0.380	0.550
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	6	11	8	15	24	35	15	10	16.6	15.2	20	5.5	<1.0	5.3	<1.0	<1.0	15	22
Calculated TDS	mg/L	-	15	20	13	19	30	41	23	17	27	25	32	11	8	11	8	8	22	32
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.28	0.37	0.26	0.36	0.6	0.72	0.46	0.32	0.47	0.44	0.5	0.2	0.2	0.21	0.19	0.2	0.46	0.63
Hardness (CaCO3)	mg/L	-	10	14	10	14	25	31	18	12	18	17	20	5.9	5.8	5.9	5.7	5.7	17	24
Ion Balance (% Difference)	%	-	12	10.5	10.6	1.41	6.19	3.36	9.52	6.67	2.17	4.76	6.54	8.11	48.2	7.69	46.2	53.9	9.52	6.78
Langelier Index (@ 20C)	N/A	-	-3.46	-2.86	-3.01	-2.24	-1.8	-1.18	-2.23	-2.72	-2.18	-2.17	-1.93	-3.78	NC	-3.66	NC	NC	-2.09	-1.77
Langelier Index (@ 4C)	N/A	-	-3.71	-3.11	-3.26	-2.49	-2.05	-1.44	-2.48	-2.97	-2.43	-2.43	-2.19	-4.03	NC	-3.91	NC	NC	-2.35	-2.02
Nitrate (N)	mg/L	13	0.06	0.09	<0.05	<0.05	0.07	0.07	<0.05	<0.05	0.12	0.095	0.24	0.052	0.065	0.065	0.077	0.07	<0.050	<0.050
Saturation pH (@ 20C)	N/A	-	9.99	9.62	9.85	9.46	9.01	8.75	9.34	9.69	9.31	9.37	9.18	10.3	NC	10.3	NC	NC	9.38	9.05
Saturation pH (@ 4C)	N/A	-	10.2	9.87	10.1	9.71	9.26	9.01	9.59	9.94	9.56	9.63	9.44	10.5	NC	10.6	NC	NC	9.64	9.3
Inorganics																				
Total Alkalinity (Total as CaCO3)	mg/L	-	6	11	9	15	24	35	15	11	17	15	20	5.5	<5.0	5.3	<5.0	<5.0	15	22
Dissolved Chloride (Cl)	mg/L	120	3	3	1	2	2	2	3	2	3.7	3.3	5.1	2.0	2.2	2.4	2.4	2.1	2.8	3.6
Colour	TCU	Note 5	41	36	45	37	31	23	39	52	30	29	28	25	22	22	20	23	40	32
Nitrate + Nitrite (N)	mg/L		0.06	0.09	<0.05	<0.05	0.07	0.07	<0.05	<0.05	0.12	0.095	0.24	0.052	0.065	0.065	0.077	0.07	<0.050	0.062
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.013
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6	4.8	6.2	6.7	6.7	6.1	7.9	8.1	5.4	4.7	4.5	3.3	3.9	4.0	4.0	4.0	8.0	7.1
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.53	6.76	6.84	7.22	7.21	7.57	7.11	6.97	7.13	7.2	7.25	6.52	6.72	6.66	6.79	6.73	7.29	7.28
Reactive Silica (SiO2)	mg/L	-	2.6	3	1.3	0.9	1.6	2.8	1.7	1.8	3.1	3.3	3.7	1.8	1.4	1.3	1.3	1.5	1.4	2.2
Total Suspended Solids	mg/L	Note 7	3	<1	<1	<1	<2	<1	<1	2	<1.0	2	<1.0	3.6	2.6	1.2	<1.0	<1.0	1.6	7.6
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.4	0.5	0.3	0.5	0.3	0.6	1.1	2.5	0.76	1.1	0.57	0.53	1.9	0.44	0.2	0.63	1.6	3.0
Conductivity	uS/cm	-	28	34	25	32	51	71	41	30	46	45	52	21	19	20	19	19	39	60

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-3

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID												
			LP03												
Sampling Date			21-Feb-13	27-May-13	29-Jul-13	6-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	7-Sep-18	5-Aug-19	3-Nov-19
Calculated Parameters															
Anion Sum	me/L	-	0.710	0.090	0.470	0.380	0.660	0.400	0.190	0.420	0.780	0.330	0.720	0.640	0.450
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	30	<1.0	18	15	29	16	5.4	18	34	9.6	32	27	13
Calculated TDS	mg/L	-	39	12	26	23	35	25	12	22	43	20	39	36	25
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
Cation Sum	me/L	-	0.73	0.34	0.48	0.38	0.7	0.44	0.19	0.46	0.81	0.35	0.72	0.64	0.41
Hardness (CaCO3)	mg/L	-	29	12	20	15	29	18	5.5	19	35	13	30	27	16
Ion Balance (% Difference)	%	-	1.39	58.1	1.05	0	2.94	4.76	0	4.55	1.89	2.94	0	0	4.65
Langelier Index (@ 20C)	N/A	-	-1.56	NC	-1.94	-2.51	-1.48	-2.24	-3.67	-1.82	-1.71	-2.84	-1.25	-1.63	-2.49
Langelier Index (@ 4C)	N/A	-	-1.81	NC	-2.19	-2.76	-1.73	-2.5	-3.92	-2.07	-1.96	-3.09	-1.5	-1.88	-2.74
Nitrate (N)	mg/L	13	0.059	<0.050	<0.050	0.091	<0.050	0.15	0.06	0.072	<0.050	0.088	0.13	0.31	0.079
Saturation pH (@ 20C)	N/A	-	8.84	NC	9.21	9.45	8.84	9.33	10.4	9.24	8.72	9.68	8.81	8.92	9.46
Saturation pH (@ 4C)	N/A	-	9.09	NC	9.46	9.7	9.09	9.58	10.6	9.49	8.97	9.93	9.06	9.18	9.71
Inorganics															
Total Alkalinity (Total as CaCO3)	mg/L	-	30	<5.0	18	15	29	16	5.4	18	34	9.6	32	27	13
Dissolved Chloride (Cl)	mg/L	120	3.6	3.1	3.6	3	2.6	2.8	2.9	2.2	3.8	4.5	2.6	2.8	4.5
Colour	TCU	Note 5	27	39	33	32	18	24	21	23	33	33	21	15	33
Nitrate + Nitrite (N)	mg/L		0.059	<0.050	<0.050	0.091	<0.050	0.15	0.06	0.072	<0.050	0.088	0.13	0.31	0.079
Nitrite (N)	mg/L	0.06	<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	Note 6	0.065	<0.050	<0.050	<0.050	0.067	<0.050	<0.050	0.055	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6.2	5.5	6.6	3.8	4.1	4.0	3.3	5.7	6.3	5.6	6.1	4.2	7.1
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
pH	pH	6.5-9.0	7.28	6.50	7.27	6.94	7.36	7.09	6.68	7.42	7.01	6.84	7.56	7.3	6.98
Reactive Silica (SiO2)	mg/L	-	2.6	1.9	1.4	3.3	0.5	3.3	1.4	<0.50	3.0	2.6	2.5	2.7	2
Total Suspended Solids	mg/L	Note 7	1.8	<1.0	<1.0	1.0	<1.0	1.2	3.8	<1.0	<1.0	<1.0	1.4	2	1.2
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	2.5
Turbidity	NTU	Note 8	1.0	0.37	0.45	0.54	1.5	0.25	0.67	1.0	0.55	0.28	0.44	0.95	0.98
Conductivity	uS/cm	-	73	27	44	35	64	42	19	43	77	38	69	65	40

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-4

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																	
			LP04																	
Sampling Date			9-Mar-11	30-Mar-11	18-May-11	25-Jun-11	8-Aug-11	5-Sep-11	8-Oct-11	12-Nov-11	17-Jan-12	22-Feb-12	17-Mar-12	15-May-12	21-Jun-12	3-Aug-12	16-Sep-12	31-Oct-12	26-Nov-12	13-Jan-13
Calculated Parameters																				
Anion Sum	me/L	-	0.220	0.600	0.190	0.280	0.400	0.730	0.380	0.240	0.500	0.340	0.800	0.230	0.600	0.390	0.470	0.260	0.330	0.460
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	7	24	8	11	17	33	15	9	19.3	13.2	35	9	28	17	20	8.3	13	19
Calculated TDS	mg/L	-	16	33	11	15	21	37	21	15	30	21	45	12	31	23	27	19	20	27
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.33	0.61	0.24	0.33	0.44	0.74	0.44	0.3	0.55	0.39	0.79	0.27	0.65	0.54	0.57	0.43	0.4	0.52
Hardness (CaCO3)	mg/L	-	11	25	10	13	18	32	18	11	22	15	33	11	28	22	24	15	16	21
Ion Balance (% Difference)	%	-	20	0.83	11.6	8.2	4.76	0.68	7.32	11.1	4.76	6.85	0.63	8.0	4.0	16.1	9.62	24.6	9.59	6.12
Langelier Index (@ 20C)	N/A	-	-3.36	-2.22	-3.06	-2.47	-2.16	-1.51	-2.35	-2.96	-2.22	-2.68	-1.68	-2.94	-1.57	-2.24	-1.7	-2.66	-2.41	-2.11
Langelier Index (@ 4C)	N/A	-	-3.62	-2.47	-3.32	-2.72	-2.41	-1.76	-2.6	-3.21	-2.48	-2.93	-1.93	-3.2	-1.82	-2.49	-1.95	-2.91	-2.67	-2.36
Nitrate (N)	mg/L	13	<0.05	<0.05	<0.05	<0.05	0.11	<0.05	0.07	<0.05	0.17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Saturation pH (@ 20C)	N/A	-	9.89	9.02	9.88	9.60	9.29	8.77	9.37	9.78	9.16	9.48	8.74	9.79	8.91	9.24	9.09	9.67	9.48	9.18
Saturation pH (@ 4C)	N/A	-	10.1	9.27	10.1	9.85	9.54	9.02	9.62	10	9.42	9.73	8.99	10.0	9.16	9.49	9.34	9.92	9.74	9.43
Inorganics																				
Total Alkalinity (Total as CaCO3)	mg/L	-	7	24	8	11	17	33	15	9	19	13	35	9	28	17	20	8.3	13	19
Dissolved Chloride (Cl)	mg/L	120	3	4	1	2	1	2	3	2	3.7	2.8	3.5	1.6	1.8	2.0	2.1	3.3	2.8	2.8
Colour	TCU	Note 5	66	46	47	55	56	36	50	75	79	54	47	49	28	42	72	69	84	57
Nitrate + Nitrite (N)	mg/L		<0.05	<0.05	<0.05	<0.05	0.11	<0.05	0.07	<0.05	0.17	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<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	Note 6	<0.05	<0.05	<0.05	<0.05	0.07	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.056
Total Organic Carbon (C)	mg/L	-	6.5	5.5	6	8.9	9.7	8.8	10	9.3	9.8	6.3	5.1	6.2	8.1	11	12	11	9.7	8.0
Orthophosphate (P)	mg/L	-	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.53	6.80	6.82	7.13	7.13	7.26	7.02	6.82	6.94	6.80	7.06	6.85	7.34	7.00	7.39	7.01	7.07	7.07
Reactive Silica (SiO2)	mg/L	-	2.4	2.8	<0.5	<0.5	<0.5	0.9	0.8	1.5	2.8	2.1	3.6	<0.50	<0.50	0.61	1.9	1.8	2.0	3.0
Total Suspended Solids	mg/L	Note 7	<1	<1	1	2	<2	2	3	8	4.0	<2.0	4.4	1.6	2.0	<1.0	1.4	<1.0	<1.0	<1.0
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	1	0.7	0.4	0.6	1	1	0.6	2.9	0.95	0.86	1.8	0.31	0.60	0.76	0.48	0.42	0.53	0.2
Conductivity	uS/cm	-	29	61	22	30	41	70	38	27	54	40	77	24	59	45	50	33	36	49

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-4 **INORGANIC GENERAL CHEMISTRY - SURFACE WATER**

Marathon Gold Corp.

Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report

Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID													
			LP04													
Sampling Date			21-Feb-13	27-May-13	29-Jul-13	6-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	7-Sep-18	29-Apr-19	5-Aug-19	2-Nov-19
Calculated Parameters																
Anion Sum	me/L	-	0.940	0.180	0.400	0.900	0.780	2.140	0.560	0.320	1.250	0.400	0.610	0.200	0.720	0.520
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	42	5.4	15	41	35	98	25	13	55	15	27	8.4	33	19
Calculated TDS	mg/L	-	52	12	22	49	41	120	28	18	69	24	32	12	38	28
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
Cation Sum	me/L	-	0.95	0.3	0.43	0.87	0.81	2.32	0.56	0.42	1.24	0.42	0.65	0.21	0.75	0.55
Hardness (CaCO3)	mg/L	-	41	11	18	38	36	110	24	17	55	17	27	7.8	33	23
Ion Balance (% Difference)	%	-	0.53	25	3.61	1.69	1.89	4.04	0.00	13.5	0.400	2.44	3.17	2.44	2.04	2.80
Langelier Index (@ 20C)	N/A	-	-1.13	-3.1	-2.27	-1.63	-1.42	0.012	-1.69	-2.06	-1.29	-2.49	-1.85	-3.43	-1.41	-1.96
Langelier Index (@ 4C)	N/A	-	-1.38	-3.35	-2.52	-1.88	-1.67	-0.239	-1.94	-2.31	-1.54	-2.74	-2.1	-3.69	-1.66	-2.21
Nitrate (N)	mg/L	13	<0.050	<0.050	<0.050	<0.050	<0.050	0.077	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Saturation pH (@ 20C)	N/A	-	8.56	9.99	9.36	8.61	8.7	7.77	9.02	9.43	8.34	9.4	8.94	9.95	8.74	9.17
Saturation pH (@ 4C)	N/A	-	8.81	10.2	9.61	8.86	8.95	8.02	9.28	9.68	8.59	9.65	9.19	10.2	9.00	9.42
Inorganics																
Total Alkalinity (Total as CaCO3)	mg/L	-	42	5.4	15	41	35	99	25	13	55	15	27	8.4	34	19
Dissolved Chloride (Cl)	mg/L	120	3.0	2.6	3.6	2.8	2.6	2.6	2.4	2.0	3.6	3.9	2.4	1.0	1.8	3.5
Colour	TCU	Note 5	28	59	45	47	29	5.1	22	62	38	52	45	60	28	44
Nitrate + Nitrite (N)	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	0.077	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrite (N)	mg/L	0.06	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	0.17	<0.050	0.059	0.059	<0.050	<0.050	<0.050	0.054	0.19	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	4.4	6.7	8.3	4.6	5.8	<0.50	6.6	8.8	5.6	7.0	11	8.3	8.2	9.6
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
pH	pH	6.5-9.0	7.43	6.89	7.09	6.98	7.28	7.78	7.33	7.37	7.05	6.91	7.09	6.52	7.34	7.21
Reactive Silica (SiO2)	mg/L	-	4.8	0.52	0.51	4.3	1.6	7.6	<0.50	<0.50	5.5	2.6	0.53	1.6	1.8	0.91
Total Suspended Solids	mg/L	Note 7	<1.0	2.2	1.6	<1.0	<1.0	2.8	1.0	<1.0	3.8	<1.0	9.6	<1.0	<2.0	3
Dissolved Sulphate (SO4)	mg/L	-	<2.0	<2.0	<2.0	<2.0	<2.0	4.1	<2.0	<2.0	2.2	<2.0	<2.0	<2.0	<2.0	2.2
Turbidity	NTU	Note 8	0.39	0.68	0.44	0.38	0.24	0.22	2.9	1.1	1.4	0.30	0.95	0.31	0.44	2.4
Conductivity	uS/cm	-	93	27	39	82	76	200	51	38	110	44	60	19	72	46

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-5

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																	
			LP05																	
Sampling Date			9-Mar-11	30-Mar-11	18-May-11	25-Jun-11	7-Aug-11	5-Sep-11	8-Oct-11	12-Nov-11	17-Jan-12	22-Feb-12	17-Mar-12	15-May-12	21-Jun-12	3-Aug-12	16-Sep-12	31-Oct-12	26-Nov-12	13-Jan-13
Calculated Parameters																				
Anion Sum	me/L	-	0.490	0.530	0.170	0.290	0.370	0.510	0.390	0.180	0.500	0.370	0.680	0.320	0.780	0.370	0.430	0.280	0.450	0.410
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	20	21	9	12	16	23	16	6	20.2	14.3	30	14	34	16	19	9.4	18	17
Calculated TDS	mg/L	-	30	30	11	15	19	26	22	13	29	22	37	18	42	21	26	18	27	25
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.59	0.57	0.26	0.33	0.4	0.52	0.46	0.28	0.52	0.4	0.68	0.37	0.88	0.5	0.57	0.38	0.54	0.47
Hardness (CaCO3)	mg/L	-	24	23	10	13	17	22	19	11	21	16	29	15	39	21	25	15	22	20
Ion Balance (% Difference)	%	-	9.26	3.64	20.9	6.45	3.9	0.97	8.24	21.7	1.96	3.9	0.00	7.25	6.02	14.9	14	15.2	9.09	6.82
Langelier Index (@ 20C)	N/A	-	-2.17	-2.29	-2.95	-2.05	-2.2	-1.71	-2.42	-3.22	-2.14	-2.58	-1.77	-2.42	-0.981	-2.03	-1.83	-2.41	-1.93	-2.11
Langelier Index (@ 4C)	N/A	-	-2.42	-2.54	-3.2	-2.3	-2.45	-1.96	-2.68	-3.47	-2.39	-2.83	-2.03	-2.68	-1.23	-2.28	-2.08	-2.66	-2.19	-2.37
Nitrate (N)	mg/L	13	0.08	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.058
Saturation pH (@ 20C)	N/A	-	9.1	9.1	9.8	9.57	9.33	9.07	9.29	9.96	9.15	9.43	8.83	9.43	8.67	9.27	9.12	9.63	9.16	9.26
Saturation pH (@ 4C)	N/A	-	9.35	9.35	10.1	9.82	9.58	9.32	9.55	10.2	9.4	9.68	9.09	9.69	8.92	9.52	9.37	9.88	9.42	9.52
Inorganics																				
Total Alkalinity (Total as CaCO3)	mg/L	-	20	21	9	12	16	23	16	6	20	14	30	14	34	16	19	9.5	18	17
Dissolved Chloride (Cl)	mg/L	120	3	4	<1	2	2	2	2	2	3.3	2.9	2.7	1.7	1.8	1.9	2.1	3.2	2.9	2.7
Colour	TCU	Note 5	68	43	54	56	57	27	49	71	61	65	51	57	25	37	69	39	58	47
Nitrate + Nitrite (N)	mg/L		0.08	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.058
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<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	Note 6	0.06	<0.05	<0.05	<0.05	0.07	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6.7	6.5	6.5	8.8	9.7	8.3	9.4	10	8.8	6.8	5.9	6.9	7.6	9.7	13	8.3	8.1	7.0
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.93	6.81	6.85	7.52	7.13	7.36	6.87	6.74	7.01	6.85	7.06	7.01	7.69	7.24	7.29	7.22	7.23	7.15
Reactive Silica (SiO2)	mg/L	-	3.1	2.6	0.6	<0.5	<0.5	<0.5	0.9	1.9	2.8	2.3	3.3	0.67	<0.50	<0.50	1.7	1.5	2.5	2.9
Total Suspended Solids	mg/L	Note 7	<1	<1	<1	2	2	2	2	3	1.8	<2.0	<1.0	1.0	<1.0	1.0	<1.0	1.4	1.2	<1.0
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	2.4	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.5	0.7	0.4	0.7	0.8	0.9	0.6	1.3	0.74	0.8	0.40	0.41	0.40	0.70	0.66	0.86	0.55	0.15
Conductivity	uS/cm	-	55	56	24	30	38	50	40	26	53	39	69	35	74	40	48	33	46	45

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-5

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID													
			LP05													
Sampling Date			21-Feb-13	27-May-13	29-Jul-13	6-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	7-Sep-18	29-Apr-19	5-Aug-19	2-Nov-19
Calculated Parameters																
Anion Sum	me/L	-	0.940	0.180	0.440	0.720	0.540	0.660	0.560	0.340	1.090	0.370	0.480	0.200	1.390	0.460
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	43	5.1	17	33	23	29	25	14	49	13	20	8.6	61	15
Calculated TDS	mg/L	-	53	12	23	41	28	38	28	19	60	23	26	12	75	26
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
Cation Sum	me/L	-	0.94	0.29	0.44	0.75	0.58	0.74	0.52	0.41	1.11	0.42	0.54	0.22	1.39	0.46
Hardness (CaCO3)	mg/L	-	41	11	19	33	25	32	23	17	49	16	23	8	64	19
Ion Balance (% Difference)	%	-	0	23.4	0	2.04	3.57	5.71	3.7	9.33	0.91	6.33	5.88	4.76	0	0
Langelier Index (@ 20C)	N/A	-	-1.14	-3.14	-2.11	-1.9	-1.56	-1.53	-1.64	-2.12	-1.39	-2.75	-1.81	-3.26	-0.459	-2.26
Langelier Index (@ 4C)	N/A	-	-1.39	-3.4	-2.36	-2.15	-1.81	-1.78	-1.89	-2.38	-1.64	-3	-2.06	-3.51	-0.71	-2.51
Nitrate (N)	mg/L	13	<0.050	<0.050	<0.050	<0.050	<0.050	0.089	<0.050	0.051	0.053	<0.050	0.12	<0.050	0.23	<0.050
Saturation pH (@ 20C)	N/A	-	8.56	10	9.29	8.76	9.02	8.81	9.02	9.39	8.43	9.46	9.12	9.92	8.19	9.34
Saturation pH (@ 4C)	N/A	-	8.81	10.3	9.54	9.01	9.27	9.06	9.27	9.64	8.68	9.71	9.37	10.2	8.44	9.59
Inorganics																
Total Alkalinity (Total as CaCO3)	mg/L	-	43	5.2	17	33	23	29	25	14	49	13	20	8.6	62	15
Dissolved Chloride (Cl)	mg/L	120	3	2.6	3.6	2.2	2.5	2.3	2.2	1.8	3.6	3.9	2.4	1.1	2.8	3.8
Colour	TCU	Note 5	29	51	37	43	17	37	17	46	40	50	28	55	10	38
Nitrate + Nitrite (N)	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050	0.089	<0.050	0.051	0.053	<0.050	0.12	<0.050	0.23	<0.050
Nitrite (N)	mg/L	0.06	<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	Note 6	0.17	<0.050	<0.050	0.053	<0.050	0.07	<0.050	0.088	0.12	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	4.5	6.5	8.0	4.1	6.1	4.6	5.5	7.3	5.4	6.7	9.3	7.8	3.2	8.1
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
pH	pH	6.5-9.0	7.42	6.87	7.18	6.86	7.46	7.28	7.38	7.27	7.04	6.71	7.31	6.67	7.73	7.08
Reactive Silica (SiO2)	mg/L	-	4.9	0.51	0.55	4.1	<0.50	3.2	0.74	0.52	5.3	2.5	0.61	1.7	4.1	1.3
Total Suspended Solids	mg/L	Note 7	<2.0	1.8	1.4	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	3.4
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	2.8	2.7
Turbidity	NTU	Note 8	0.46	0.6	0.51	0.26	0.66	0.31	0.82	0.49	0.36	0.3	0.86	0.33	0.19	2.1
Conductivity	uS/cm	-	93	27	41	70	53	67	49	36	100	42	49	18	130	41

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-6

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																	
			R01																	
Sampling Date			19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	17-Mar-12	18-May-12	21-Jun-12	4-Aug-12	16-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13	8-Mar-13	26-May-13
Calculated Parameters																				
Anion Sum	me/L	-	0.200	0.300	0.520	0.700	0.370	0.170	0.380	0.310	0.350	0.250	0.420	0.510	0.360	0.230	0.230	0.260	0.190	0.200
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	8	13	23	32	14	5	14.6	11.7	14	10	19	23	15	6.7	7.5	10	5.8	7.0
Calculated TDS	mg/L	-	12	17	29	39	22	12	23	21	22	15	24	30	22	16	15	18	13	14
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<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	me/L	-	0.25	0.33	0.55	0.67	0.4	0.24	0.36	0.34	0.33	0.27	0.44	0.58	0.41	0.3	0.25	0.29	0.22	0.31
Hardness (CaCO3)	mg/L	-	9	13	24	29	16	9	14	13	13	10	18	25	17	11	9.4	11	7.2	11
Ion Balance (% Difference)	%	-	11.1	4.76	2.8	2.19	3.9	17.1	2.7	4.62	2.94	3.85	2.33	6.42	6.49	13.2	4.17	5.45	7.32	21.6
Langelier Index (@ 20C)	N/A	-	-3.06	-2.38	-1.9	-1.31	-2.37	-3.25	-2.37	-2.45	-2.59	-2.9	-1.77	-1.51	-2.00	-2.92	-3.00	-2.70	-3.66	-2.96
Langelier Index (@ 4C)	N/A	-	-3.31	-2.64	-2.16	-1.56	-2.62	-3.5	-2.62	-2.71	-2.84	-3.16	-2.02	-1.77	-2.26	-3.17	-3.25	-2.95	-3.91	-3.21
Nitrate (N)	mg/L	13	<0.05	<0.05	0.15	<0.05	<0.05	<0.05	0.099	<0.050	0.086	<0.050	0.058	<0.050	<0.050	0.05	0.068	0.085	0.058	<0.050
Saturation pH (@ 20C)	N/A	-	9.87	9.5	9.02	8.8	9.4	10.1	9.46	9.57	9.53	9.73	9.23	9.00	9.36	9.9	9.91	9.71	10.1	9.85
Saturation pH (@ 4C)	N/A	-	10.1	9.76	9.28	9.05	9.65	10.3	9.71	9.83	9.78	9.99	9.48	9.26	9.62	10.1	10.2	9.96	10.4	10.1
Inorganics																				
Total Alkalinity (Total as CaCO3)	mg/L	-	8	13	23	32	14	5	15	12	14	10	19	23	15	6.7	7.5	10	5.8	7.0
Dissolved Chloride (Cl)	mg/L	120	1	1	2	2	3	2	2.9	2.6	2.5	1.5	1.3	1.4	2.1	3.4	2.6	2	2.5	2
Colour	TCU	Note 5	46	29	31	27	30	38	17	25	26	42	17	28	34	40	30	20	44	34
Nitrate + Nitrite (N)	mg/L		<0.05	<0.05	0.15	<0.05	<0.05	<0.05	0.099	<0.050	0.086	<0.050	0.058	<0.050	<0.050	0.050	0.068	0.085	0.058	<0.050
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<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	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	0.051	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6.6	5.7	6.4	5.8	6.4	5.7	3.4	4.5	4.7	7.0	4.9	6.4	7.5	7.2	5.3	3.3	4.6	5.5
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.81	7.12	7.12	7.49	7.03	6.82	7.09	7.12	6.94	6.83	7.46	7.49	7.36	6.98	6.91	7.01	**6.48**	6.89
Reactive Silica (SiO2)	mg/L	-	1	0.9	2.5	4	2.4	1.8	4.3	4.1	4.0	1.7	1.9	3.0	2.6	2.2	2.5	4.1	2.1	1.1
Total Suspended Solids	mg/L	Note 7	<1	<1	<2	2	<1	<1	<1.0	<2.0	<1.0	2.0	1.8	<1.0	<1.0	1.6	<1.0	<1.0	<1.0	<1.0
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.2	<0.1	0.5	1.3	0.4	<0.1	0.29	0.46	<0.10	<0.10	0.21	0.63	0.6	0.4	0.2	<0.10	0.11	0.14
Conductivity	uS/cm	-	22	29	48	66	36	23	37	35	35	25	39	49	36	27	24	30	22	28

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-6

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID R01											
Sampling Date			29-Jul-13	6-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	5-Aug-19	1-Nov-19
Calculated Parameters														
Anion Sum	me/L	-	0.420	0.250	0.710	0.220	0.460	0.300	0.310	0.240	0.610	0.190	0.690	0.280
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	17	9.6	33	8.2	21	12	11	6.1	27	7.8	28	8.1
Calculated TDS	mg/L	-	24	17	40	13	25	18	20	17	35	12	36	19
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
Cation Sum	me/L	-	0.44	0.27	0.76	0.25	0.44	0.35	0.32	0.28	0.64	0.18	0.62	0.35
Hardness (CaCO3)	mg/L	-	19	9.9	34	9.3	19	14	12	9.3	27	6.4	27	13
Ion Balance (% Difference)	%	-	2.33	3.85	3.4	6.38	2.22	7.69	1.59	7.69	2.4	2.7	5.34	11.1
Langelier Index (@ 20C)	N/A	-	-2.12	-3.11	-1.17	-3.01	-1.96	-2.37	-2.84	-3.35	-1.45	-3.36	-1.34	-3.15
Langelier Index (@ 4C)	N/A	-	-2.38	-3.36	-1.42	-3.26	-2.21	-2.62	-3.09	-3.6	-1.7	-3.61	-1.59	-3.41
Nitrate (N)	mg/L	13	<0.050	0.059	<0.050	0.077	<0.050	0.064	0.12	0.065	<0.050	0.074	0.095	0.084
Saturation pH (@ 20C)	N/A	-	9.24	9.79	8.73	9.87	9.17	9.51	9.63	10	8.91	10.1	8.89	9.75
Saturation pH (@ 4C)	N/A	-	9.5	10	8.98	10.1	9.42	9.76	9.88	10.3	9.16	10.3	9.14	10
Inorganics														
Total Alkalinity (Total as CaCO3)	mg/L	-	17	9.6	33	8.2	21	12	11	6.1	27	7.8	28	8.1
Dissolved Chloride (Cl)	mg/L	120	2.6	2	1.8	1.9	1.6	1.6	2.9	4.2	2.4	1.2	4.1	3.9
Colour	TCU	Note 5	35	30	18	7.2	23	34	24	34	30	42	15	56
Nitrate + Nitrite (N)	mg/L		<0.050	0.059	<0.050	0.077	<0.050	0.064	0.12	0.065	<0.050	0.074	0.095	0.084
Nitrite (N)	mg/L	0.06	<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	Note 6	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	7.7	3.6	5	2.3	5.5	5.8	4.5	5.5	7.8	6.3	5.2	9.3
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
pH	pH	6.5-9.0	7.12	6.68	7.56	6.85	7.22	7.14	6.79	6.67	7.46	6.71	7.55	6.59
Reactive Silica (SiO2)	mg/L	-	2.1	3.4	3.5	0.85	2.3	1.5	4.0	2.7	3.5	2.0	2.6	2.3
Total Suspended Solids	mg/L	Note 7	1.0	1.8	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	1.8
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
Turbidity	NTU	Note 8	0.34	0.37	0.13	0.25	0.57	0.31	0.48	0.16	0.77	0.67	0.28	1.2
Conductivity	uS/cm	-	39	24	68	24	40	31	33	29	59	16	74	30

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-7

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																
			RO-2																
Sampling Date			19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	17-Mar-12	18-May-12	24-Jun-12	4-Aug-12	17-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13	8-Mar-13
Calculated Parameters																			
Anion Sum	me/L	-	0.230	0.250	0.380	0.620	0.300	0.0600	0.450	0.320	0.350	0.240	0.450	0.430	0.290	0.320	0.270	0.340	0.200
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	9	10	17	28	11	<1	17	13	14	9.8	20	19	12	11	9.1	14	5.8
Calculated TDS	mg/L	-	14	14	20	34	18	8	27	20	21	14	26	25	19	21	17	22	14
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.27	0.28	0.37	0.61	0.34	0.23	0.43	0.35	0.35	0.27	0.54	0.5	0.39	0.41	0.29	0.41	0.25
Hardness (CaCO3)	mg/L	-	10	11	16	27	14	9	18	14	14	10	23	21	15	16	11	17	8.8
Ion Balance (% Difference)	%	-	8	5.66	1.33	0.81	6.25	58.6	2.27	4.48	0	5.88	9.09	7.53	14.7	12.3	3.57	9.33	11.1
Langelier Index (@ 20C)	N/A	-	-2.91	-2.59	-2.14	-1.39	-2.57	NC	-2.05	-2.29	-2.35	-2.81	-1.51	-1.74	-2.23	-2.21	-2.77	-2.05	-3.4
Langelier Index (@ 4C)	N/A	-	-3.16	-2.84	-2.39	-1.64	-2.83	NC	-2.3	-2.54	-2.61	-3.07	-1.76	-2.00	-2.49	-2.46	-3.02	-2.3	-3.65
Nitrate (N)	mg/L	13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.32	0.078	0.086	<0.050	0.070	<0.050	<0.050	<0.050	0.063	0.095	0.079
Saturation pH (@ 20C)	N/A	-	9.77	9.68	9.32	8.89	9.56	NC	9.29	9.49	9.45	9.75	9.11	9.16	9.49	9.52	9.76	9.41	10.1
Saturation pH (@ 4C)	N/A	-	10	9.93	9.57	9.14	9.82	NC	9.54	9.74	9.71	10.0	9.36	9.42	9.75	9.77	10.0	9.66	10.3
Inorganics																			
Total Alkalinity (Total as CaCO3)	mg/L	-	9	11	17	28	11	<5	17	13	14	9.8	20	19	12	11	9.1	14	5.8
Dissolved Chloride (Cl)	mg/L	120	1	2	2	2	3	2	3.0	2.1	2.2	1.7	1.8	1.7	2.1	3.3	2.9	2.1	2.8
Colour	TCU	Note 5	46	50	47	23	53	88	40	37	36	49	17	30	71	41	54	46	61
Nitrate + Nitrite (N)	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.32	0.078	0.086	<0.050	0.070	<0.050	<0.050	<0.050	0.063	0.095	0.079
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<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	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6.0	6.8	7.6	5.4	8.9	9.0	4.6	4.7	4.0	7.2	4.5	7.1	10	7.2	8.2	4.7	5.3
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.86	7.09	7.18	7.50	6.99	6.72	7.24	7.20	7.10	6.94	7.60	7.42	7.26	7.31	6.99	7.36	6.65
Reactive Silica (SiO2)	mg/L	-	1.4	0.8	1.5	2.9	1.8	1.6	4.000	3.2	3.3	1.5	1.1	1.8	1.8	2.7	2.5	3.7	1.8
Total Suspended Solids	mg/L	Note 7	<1	<1	<2	1	1	1	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.5	0.2	0.6	0.5	0.6	0.6	0.39	0.39	0.13	0.24	<0.10	0.36	0.64	0.70	0.60	0.23	0.30
Conductivity	uS/cm	-	24	25	36	59	29	21	44	35	36	25	49	43	31	36	27	38	22

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-7 **INORGANIC GENERAL CHEMISTRY - SURFACE WATER**
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID												
			RO-2												
Sampling Date			26-May-13	29-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	5-Aug-19	1-Nov-19
Calculated Parameters															
Anion Sum	me/L	-	0.190	0.370	0.300	0.700	0.240	0.570	0.330	0.460	0.280	0.800	0.210	0.960	0.470
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	6.3	14	12	32	8	25	13	18	7.8	35	8.4	38	15
Calculated TDS	mg/L	-	13	21	19	38	19	30	20	29	18	44	12	52	31
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
Cation Sum	me/L	-	0.29	0.39	0.33	0.72	0.32	0.53	0.41	0.52	0.31	0.8	0.21	0.89	0.56
Hardness (CaCO3)	mg/L	-	11	16	13	31	11	23	16	22	11	34	7.6	39	22
Ion Balance (% Difference)	%	-	20.8	2.63	4.76	1.41	14.3	3.64	10.8	6.12	5.08	0	0	3.78	8.74
Langelier Index (@ 20C)	N/A	-	-2.95	-2.21	-2.66	-1.1	-3.22	-1.54	-2.16	-1.93	-3.05	-1.07	-3.08	-0.982	-2.24
Langelier Index (@ 4C)	N/A	-	-3.2	-2.46	-2.91	-1.36	-3.48	-1.8	-2.42	-2.18	-3.3	-1.32	-3.33	-1.23	-2.5
Nitrate (N)	mg/L	13	<0.050	<0.050	0.083	0.059	0.21	<0.050	0.054	0.11	0.08	<0.050	<0.050	0.082	0.17
Saturation pH (@ 20C)	N/A	-	9.92	9.38	9.56	8.78	9.82	9	9.42	9.17	9.82	8.7	9.95	8.61	9.26
Saturation pH (@ 4C)	N/A	-	10.2	9.63	9.81	9.04	10.1	9.26	9.67	9.42	10.1	8.96	10.2	8.86	9.52
Inorganics															
Total Alkalinity (Total as CaCO3)	mg/L	-	6.3	14	12	32	8	25	13	18	7.8	35	8.4	39	15
Dissolved Chloride (Cl)	mg/L	120	2.4	2.8	2	2.3	2.4	2.3	2.1	3.2	4	3.3	1.4	4.7	3.8
Colour	TCU	Note 5	41	47	46	12	17	17	58	44	48	20	47	12	56
Nitrate + Nitrite (N)	mg/L		<0.050	<0.050	0.083	0.059	0.21	<0.050	0.054	0.11	0.08	<0.050	<0.050	0.082	0.17
Nitrite (N)	mg/L	0.06	<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	Note 6	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.069	<0.050	<0.050	<0.050	<0.050	0.078	<0.050
Total Organic Carbon (C)	mg/L	-	5.5	8.6	4.1	3.5	3.4	4.6	7.2	4.9	6.4	6.2	6.5	3.9	9.2
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
pH	pH	6.5-9.0	6.97	7.17	6.90	7.68	6.60	7.46	7.25	7.24	6.78	7.64	6.88	7.63	7.02
Reactive Silica (SiO2)	mg/L	-	1.0	1.7	3.2	2.3	4.4	1.8	1.3	4.4	2.5	3.6	1.8	3.4	3
Total Suspended Solids	mg/L	Note 7	<1.0	<1.0	<1.0	<1.0	6.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	15
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	2.7	2.6
Turbidity	NTU	Note 8	0.20	0.40	0.17	0.10	0.19	0.30	0.59	0.32	0.22	0.38	0.26	<0.10	2.2
Conductivity	uS/cm	-	26	35	30	69	28	50	35	49	32	73	19	87	45

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-8

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																	
			R03																	
Sampling Date			19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	17-Mar-12	18-May-12	24-Jun-12	4-Aug-12	17-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13	8-Mar-13	26-May-13
Calculated Parameters																				
Anion Sum	me/L	-	0.200	0.300	0.400	0.660	0.360	0.050	0.500	0.380	0.370	0.260	0.540	0.450	0.310	0.300	0.240	0.380	0.180	0.200
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	8	13	18	30	12	<1	20.7	15.8	15	11	24	20	12	10	7.7	16	5.2	6.9
Calculated TDS	mg/L	-	13	17	23	37	22	9	32	25	23	16	30	28	20	20	16	26	13	14
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<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	me/L	-	0.26	0.33	0.44	0.65	0.39	0.24	0.53	0.43	0.36	0.3	0.63	0.57	0.39	0.37	0.3	0.44	0.23	0.32
Hardness (CaCO3)	mg/L	-	10	13	19	28	16	9	21	18	15	12	26	24	16	14	11	18	8.2	12
Ion Balance (% Difference)	%	-	13	4.76	4.76	0.76	4	65.5	2.91	6.17	1.37	7.14	7.69	11.8	11.4	10.5	11.1	7.32	12.2	23.1
Langelier Index (@ 20C)	N/A	-	-3.01	-2.53	-2.11	-1.4	-2.5	NC	-1.94	-2.19	-2.4	-2.8	-1.44	-1.68	-2.27	-2.59	-2.99	-2.16	-3.57	-2.96
Langelier Index (@ 4C)	N/A	-	-3.26	-2.78	-2.36	-1.65	-2.76	NC	-2.19	-2.44	-2.65	-3.05	-1.69	-1.94	-2.52	-2.85	-3.24	-2.41	-3.82	-3.22
Nitrate (N)	mg/L	13	<0.05	<0.05	<0.05	0.07	0.34	<0.05	0.13	0.092	<0.050	<0.050	<0.050	<0.050	<0.050	0.055	0.059	0.11	0.067	<0.050
Saturation pH (@ 20C)	N/A	-	9.83	9.54	9.25	8.85	9.46	NC	9.12	9.32	9.40	9.66	8.97	9.09	9.47	9.59	9.82	9.31	10.1	9.83
Saturation pH (@ 4C)	N/A	-	10.1	9.79	9.5	9.1	9.72	NC	9.37	9.57	9.65	9.91	9.22	9.35	9.72	9.85	10.1	9.56	10.4	10.1
Inorganics																				
Total Alkalinity (Total as CaCO3)	mg/L	-	8	13	18	30	12	<5	21	16	15	11	24	20	12	10	7.7	16	5.2	6.9
Dissolved Chloride (Cl)	mg/L	120	1	2	2	2	3	2	2.7	2.2	1.9	1.4	2.0	1.6	2.2	3.1	2.8	2.1	2.6	2.2
Colour	TCU	Note 5	49	47	47	27	52	67	23	23	27	53	21	36	69	36	53	21	47	44
Nitrate + Nitrite (N)	mg/L		<0.05	<0.05	<0.05	0.07	0.34	<0.05	0.13	0.092	0.10	<0.050	<0.050	<0.050	<0.050	0.055	0.059	0.11	0.067	<0.050
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	**<u>0.18</u>**	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.063	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6.1	7.1	7.2	5.5	9.0	8.9	3.4	3.7	3.7	7.5	5.4	6.9	11	6.9	7.8	3.2	5.3	5.6
Orthophosphate (P)	mg/L	-	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.82	7.01	7.14	7.45	6.96	6.7	7.18	7.13	7.00	6.86	7.53	7.41	7.20	7.00	6.83	7.15	6.56	6.87
Reactive Silica (SiO2)	mg/L	-	1.7	1.3	2.5	3.8	2.7	2	5.1	4.5	4.1	2.0	1.2	2.4	2.6	3.0	2.8	4.9	2.3	1.5
Total Suspended Solids	mg/L	Note 7	2	1	<2	1	<1	<1	2.8	<1.0	1.6	<1.0	1.0	9.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.3	0.2	0.7	0.8	0.3	0.1	0.44	0.16	<0.10	0.23	0.55	0.70	0.46	0.34	0.35	<0.10	0.23	<0.10
Conductivity	uS/cm	-	24	29	41	64	36	22	50	43	37	26	54	47	33	34	25	43	22	28

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-8

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID											
			R03											
Sampling Date			29-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	5-Aug-19	1-Nov-19
Calculated Parameters														
Anion Sum	me/L	-	0.370	0.320	0.840	0.440	0.610	0.360	0.410	0.240	0.690	0.180	0.760	0.320
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	14	12	16	18	27	15	17	6.2	30	7.7	31	10
Calculated TDS	mg/L	-	22	24	50	29	32	21	27	16	40	11	41	22
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
Cation Sum	me/L	-	0.41	0.42	0.79	0.49	0.6	0.43	0.47	0.27	0.77	0.18	0.77	0.41
Hardness (CaCO3)	mg/L	-	17	16	34	21	26	17	19	9.7	33	6.3	33	16
Ion Balance (% Difference)	%	-	5.13	13.5	3.07	5.38	0.83	8.86	6.82	5.88	5.48	0	0.65	12.3
Langelier Index (@ 20C)	N/A	-	-2.39	-2.79	-1.42	-2.15	-1.54	-2.23	-2.16	-3.34	-1.3	-3.35	-1.19	-2.98
Langelier Index (@ 4C)	N/A	-	-2.65	-3.05	-1.67	-2.4	-1.79	-2.48	-2.41	-3.59	-1.55	-3.61	-1.44	-3.23
Nitrate (N)	mg/L	13	<0.050	0.074	0.13	0.17	<0.050	0.054	0.11	0.068	0.13	<0.050	0.1	0.2
Saturation pH (@ 20C)	N/A	-	9.37	9.47	9.05	9.18	8.92	9.33	9.26	9.97	8.77	10.1	8.76	9.55
Saturation pH (@ 4C)	N/A	-	9.63	9.73	9.3	9.43	9.17	9.59	9.51	10.2	9.02	10.3	9.01	9.81
Inorganics														
Total Alkalinity (Total as CaCO3)	mg/L	-	14	12	16	18	27	15	17	6.3	31	7.7	31	10
Dissolved Chloride (Cl)	mg/L	120	3.0	2.3	14	2.1	2.3	1.6	2.3	3.8	2.6	1.1	4.2	3.7
Colour	TCU	Note 5	48	33	<5.0	19	24	45	24	39	29	49	20	78
Nitrate + Nitrite (N)	mg/L		<0.050	0.074	0.13	0.17	<0.050	0.054	0.11	0.068	0.13	<0.050	0.1	0.2
Nitrite (N)	mg/L	0.06	<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	Note 6	0.059	<0.050	<0.050	<0.050	<0.050	<0.050	0.12	<0.050	<0.050	<0.050	0.061	<0.050
Total Organic Carbon (C)	mg/L	-	8.0	5.0	3.6	3.0	4.7	6.6	3.7	5.7	6.9	6.7	5.7	12
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
pH	pH	6.5-9.0	6.98	6.68	7.63	7.03	7.38	7.10	7.10	6.64	7.47	6.71	7.57	6.58
Reactive Silica (SiO2)	mg/L	-	2.2	4.1	4.9	5.0	2.0	1.8	4.7	2.9	3.6	1.8	2.7	3.1
Total Suspended Solids	mg/L	Note 7	<1.0	79	<1.0	<1.0	<1.0	<1.0	12	<1.0	<1.0	<1.0	1.4	1.4
Dissolved Sulphate (SO4)	mg/L	-	<2.0	<2.0	5.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.18	13	0.58	<0.10	0.33	0.94	2.0	0.17	0.41	0.23	0.42	1.3
Conductivity	uS/cm	-	37	32	76	47	55	37	46	30	70	15	70	35

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-9

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID															
			R04															
Sampling Date			19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	25-Feb-12	17-Mar-12	18-May-12	24-Jun-12	4-Aug-12	17-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13	8-Mar-13
Calculated Parameters																		
Anion Sum	me/L	-	0.0300	0.260	0.320	0.390	0.310	0.170	0.230	0.230	0.200	0.350	0.360	0.280	0.260	0.210	0.400	0.080
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	10	13	16	11	5	7.7	8.4	7.7	14	15	11	8	6.2	17	<1.0
Calculated TDS	mg/L	-	5	16	20	24	19	13	17	16	14	23	24	19	18	15	26	10
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.17	0.28	0.36	0.41	0.35	0.25	0.26	0.25	0.24	0.37	0.44	0.35	0.33	0.28	0.43	0.21
Hardness (CaCO3)	mg/L	-	6	11	14	17	14	10	9.5	9.4	8.8	14	17	14	12	11	18	7.1
Ion Balance (% Difference)	%	-	70	3.7	5.88	2.5	6.06	19.1	6.12	4.17	9.09	2.78	10.0	11.1	11.9	14.3	3.61	44.8
Langelier Index (@ 20C)	N/A	-	NC	-2.87	-2.5	-2.36	-2.73	-3.53	-3.3	-3.26	-3.37	-2.47	-2.30	-2.54	-3.05	-3.33	-1.97	NC
Langelier Index (@ 4C)	N/A	-	NC	-3.12	-2.75	-2.61	-2.98	-3.78	-3.55	-3.51	-3.62	-2.72	-2.56	-2.79	-3.3	-3.58	-2.22	NC
Nitrate (N)	mg/L	13	0.06	0.07	0.10	0.19	<0.05	<0.05	0.15	0.12	<0.050	0.14	0.12	0.053	0.058	0.053	0.11	0.068
Saturation pH (@ 20C)	N/A	-	NC	9.72	9.5	9.35	9.56	10	9.9	9.86	9.92	9.48	9.35	9.58	9.77	9.96	9.3	NC
Saturation pH (@ 4C)	N/A	-	NC	9.97	9.75	9.6	9.81	10.3	10.1	10.1	10.2	9.73	9.61	9.83	10	10.2	9.55	NC
Inorganics																		
Total Alkalinity (Total as CaCO3)	mg/L	-	<5	10	13	16	11	5	7.7	8.5	7.7	14	15	11	8.0	6.2	17	<5.0
Dissolved Chloride (Cl)	mg/L	120	1	2	2	2	3	2	2.4	1.9	1.7	2.1	1.7	2.2	3.3	2.8	2.2	2.7
Colour	TCU	Note 5	39	39	32	25	40	73	29	38	48	13	18	43	76	70	21	62
Nitrate + Nitrite (N)	mg/L		0.06	0.07	0.1	0.19	<0.05	<0.05	0.15	0.17	<0.050	0.14	0.12	0.053	0.058	0.053	0.11	0.068
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	0.054	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	5.9	6.9	6.2	5.5	9.2	10	5.2	5.0	7.6	3.0	5.2	9.6	9.3	8.8	3.4	6.7
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	**6.49**	6.85	7	6.99	6.83	6.52	6.6	6.6	6.55	7.01	7.05	7.04	6.72	6.63	7.33	**6.33**
Reactive Silica (SiO2)	mg/L	-	0.7	1.8	2.9	3.3	2.7	2.2	4.0	3.7	2.3	4.7	3.7	2.8	2.7	2.7	4.9	2.4
Total Suspended Solids	mg/L	Note 7	2	<1	3	<1	<1	<1	3.2	1.8	<1.0	2.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.3	<0.1	1.1	0.5	0.1	<0.1	0.30	<0.10	<0.10	0.19	0.91	0.20	0.4	0.19	<0.10	0.26
Conductivity	uS/cm	-	15	24	33	40	31	22	27	25	22	35	36	32	26	22	43	20

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-9

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID												
			R04												
Sampling Date			26-May-13	29-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	5-Aug-19	1-Nov-19
Calculated Parameters															
Anion Sum	me/L	-	0.080	0.290	0.200	0.500	0.370	0.380	0.270	0.320	0.100	0.480	0.170	0.460	0.320
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	<1.0	10	6.3	20	15	15	10	11	<1.0	20	6.4	17	7.5
Calculated TDS	mg/L	-	10	18	15	31	24	22	18	22	11	28	11	29	22
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
Cation Sum	me/L	-	0.26	0.32	0.23	0.51	0.44	0.35	0.34	0.34	0.23	0.49	0.17	0.45	0.38
Hardness (CaCO3)	mg/L	-	9.3	13	8.2	20	18	14	12	13	6.5	20	5.7	17	14
Ion Balance (% Difference)	%	-	52.9	4.92	6.98	0.99	8.64	4.11	11.5	3.03	39.4	1.03	0	1.1	8.57
Langelier Index (@ 20C)	N/A	-	NC	-2.95	-3.63	-2.00	-2.22	-2.43	-2.62	-2.77	NC	-1.97	-3.61	-2.03	-3.49
Langelier Index (@ 4C)	N/A	-	NC	-3.21	-3.88	-2.25	-2.47	-2.68	-2.87	-3.03	NC	-2.22	-3.87	-2.28	-3.74
Nitrate (N)	mg/L	13	0.07	<0.050	0.11	0.23	0.13	0.099	0.10	0.27	0.11	0.09	0.052	0.21	0.22
Saturation pH (@ 20C)	N/A	-	NC	9.64	10	9.16	9.32	9.44	9.65	9.63	NC	9.19	10.2	9.30	9.74
Saturation pH (@ 4C)	N/A	-	NC	9.9	10.3	9.41	9.57	9.69	9.91	9.88	NC	9.44	10.4	9.55	9.99
Inorganics															
Total Alkalinity (Total as CaCO3)	mg/L	-	<5.0	10	6.3	20	15	15	10	11	<5.0	20	6.4	17	7.5
Dissolved Chloride (Cl)	mg/L	120	2.8	3	2.4	2.7	2.2	2.3	2.1	2.7	3.3	2.9	1.3	3.7	3.9
Colour	TCU	Note 5	39	44	33	13	48	18	36	25	27	19	63	16	100
Nitrate + Nitrite (N)	mg/L		0.07	<0.050	0.11	0.23	0.13	0.099	0.1	0.27	0.11	0.09	0.052	0.21	0.22
Nitrite (N)	mg/L	0.06	<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	Note 6	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.098	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6.0	7.8	4.2	2.6	4.6	4.1	5.4	5.7	6.1	5.1	8.6	3.2	16
Orthophosphate (P)	mg/L	-	<0.010	0.016	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.51	6.69	**<u>6.42</u>**	7.16	7.10	7.01	7.03	6.86	**<u>6.20</u>**	7.22	6.57	7.26	**<u>6.25</u>**
Reactive Silica (SiO2)	mg/L	-	1.9	2.2	3.6	4.7	3.4	2.7	2.5	4.9	2.5	3.7	2.0	4.5	2.8
Total Suspended Solids	mg/L	Note 7	<1.0	<1.0	2.4	<1.0	2.4	<1.0	<1.0	1.8	35	<1.0	<1.0	4.0	2.0
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	2.1
Turbidity	NTU	Note 8	<0.10	0.12	0.17	0.20	0.28	0.38	0.66	0.39	1.9	0.14	0.23	0.48	1.0
Conductivity	uS/cm	-	25	30	22	50	39	34	30	34	23	46	14	44	32

Notes: **Notes:**
1. ' -' = no sta 1. ' -' = no standard available; n/a = not applicable
2. <# = param 2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = 3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FA 4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colou 5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies dep 6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum i 7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs (e.g., inputs lasting between 24 h and 30 d).
8. Maximum i 8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Un</u>** 9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not (10. NC = Not Calculated

TABLE D-10

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																	
			R05																	
Sampling Date			19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	17-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13	8-Mar-13	26-May-13
Calculated Parameters																				
Anion Sum	me/L	-	0.180	0.200	0.200	0.240	0.240	0.200	0.260	0.240	0.240	0.220	0.210	0.230	0.220	0.210	0.240	0.220	0.230	0.060
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	7	8	7	9	9	8	10.0	9.3	9.1	8.4	8.0	9.2	8.0	8.2	9.1	8.2	7.9	<1.0
Calculated TDS	mg/L	-	10	11	11	13	13	12	14.0	14	13	12	12	13	12	13	14	13	14	7
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<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	me/L	-	0.21	0.23	0.23	0.24	0.26	0.23	0.25	0.26	0.25	0.23	0.25	0.27	0.25	0.26	0.26	0.26	0.26	0.22
Hardness (CaCO3)	mg/L	-	8	8	9	10	10	9	9.0	9.2	9.4	8.4	9.5	10	9.5	9.7	9.7	9.7	9.3	8.1
Ion Balance (% Difference)	%	-	7.69	6.98	6.98	0	4	6.98	1.96	4.00	2.04	2.22	8.7	8.0	6.38	10.6	4.0	8.33	6.12	57.1
Langelier Index (@ 20C)	N/A	-	-3.29	-3.11	-2.98	-2.84	-2.89	-2.9	-2.80	-2.82	-2.83	-2.96	-2.67	-2.68	-2.71	-2.82	-2.76	-2.71	-3.02	NC
Langelier Index (@ 4C)	N/A	-	-3.54	-3.36	-3.24	-3.1	-3.15	-3.16	-3.06	-3.08	-3.08	-3.21	-2.92	-2.94	-2.96	-3.07	-3.01	-2.97	-3.28	NC
Nitrate (N)	mg/L	13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.070	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.068	<0.050
Saturation pH (@ 20C)	N/A	-	10	9.95	9.94	9.8	9.79	9.92	9.8	9.83	9.82	9.90	9.87	9.78	9.87	9.85	9.81	9.85	9.89	NC
Saturation pH (@ 4C)	N/A	-	10.3	10.2	10.2	10.1	10	10.2	10.1	10.1	10.1	10.2	10.1	10.0	10.1	10.1	10.1	10.1	10.1	NC
Inorganics																				
Total Alkalinity (Total as CaCO3)	mg/L	-	7	8	7	9	9	8	10	9.3	9.1	8.4	8.0	9.2	8.1	8.2	9.1	8.3	7.9	<5.0
Dissolved Chloride (Cl)	mg/L	120	1	2	2	2	2	2	1.9	1.9	1.9	1.7	1.8	1.6	1.9	1.7	2.1	2.1	2.3	2.3
Colour	TCU	Note 5	12	11	10	9	12	18	8.7	11	8.9	10	7.1	10	12	12	12	8.7	17	12
Nitrate + Nitrite (N)	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.068	<0.050
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<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	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.14	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	3.2	3.1	3.2	2.8	3.7	3.7	2.8	3.00	3.0	3.2	2.9	3.0	4.0	4.1	3.7	2.7	3.4	3.1
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.72	6.84	6.96	6.96	6.90	7.02	7.00	7.01	6.99	6.94	7.20	7.10	7.16	7.03	7.05	7.14	6.87	6.88
Reactive Silica (SiO2)	mg/L	-	0.5	<0.5	<0.5	0.8	0.6	0.8	0.8	0.83	0.86	0.63	<0.50	0.50	0.71	1.0	0.74	0.77	1.1	0.55
Total Suspended Solids	mg/L	Note 7	3	2	12	<1	1	4	1.4	<1.0	1.8	2.8	<1.0	1.0	2.0	6.8	1.2	<1.0	<1.0	<1.0
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.3	0.3	0.9	0.5	0.3	0.9	0.35	0.66	<0.10	0.18	<0.10	0.35	2.0	0.28	0.97	0.10	0.16	0.16
Conductivity	uS/cm	-	22	22	23	25	25	24	26	26	26	23	23	24	24	23	23	25	25	23

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-10

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID											
			R05											
Sampling Date			29-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	5-Aug-19	1-Nov-19
Calculated Parameters														
Anion Sum	me/L	-	0.240	0.240	0.240	0.0700	0.260	0.200	0.240	0.260	0.250	0.270	0.260	0.270
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	7.7	9.2	9.0	<1.0	9.7	7.1	8.4	8.3	8.8	9.2	7.9	8.6
Calculated TDS	mg/L	-	13	13	13	10	13	11	14	15	14	15	14	15
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
Cation Sum	me/L	-	0.24	0.25	0.23	0.220	0.230	0.240	0.250	0.270	0.260	0.240	0.230	0.250
Hardness (CaCO3)	mg/L	-	9.0	9.0	8.9	7.0	8.5	8.6	9.4	9.2	9.5	8.3	8.3	9.3
Ion Balance (% Difference)	%	-	0.00	2.04	2.13	51.7	6.12	9.09	2.04	1.89	1.96	5.88	6.12	3.85
Langelier Index (@ 20C)	N/A	-	-2.98	-3.05	-2.68	NC	-3.08	-2.92	-2.86	-3.04	-2.72	-3.11	-2.90	-2.94
Langelier Index (@ 4C)	N/A	-	-3.23	-3.3	-2.93	NC	-3.34	-3.17	-3.11	-3.30	-2.97	-3.36	-3.15	-3.19
Nitrate (N)	mg/L	13	<0.050	<0.050	<0.050	0.15	<0.050	<0.050	<0.050	<0.050	<0.050	0.33	0.071	0.17
Saturation pH (@ 20C)	N/A	-	9.91	9.84	9.85	NC	9.83	9.96	9.86	9.88	9.83	9.87	9.93	9.85
Saturation pH (@ 4C)	N/A	-	10.2	10.1	10.1	NC	10.1	10.2	10.1	10.1	10.1	10.1	10.2	10.1
Inorganics														
Total Alkalinity (Total as CaCO3)	mg/L	-	7.7	9.2	9	<5.0	9.7	7.1	8.4	8.4	8.8	9.2	7.9	8.6
Dissolved Chloride (Cl)	mg/L	120	3	2	2.3	2.2	2.3	2	2.7	3.1	2.7	2	1.8	3.2
Colour	TCU	Note 5	11	13	7.3	32	8.6	11	10	8.6	8.5	17	9	18
Nitrate + Nitrite (N)	mg/L		<0.050	<0.050	<0.050	0.15	<0.050	<0.050	<0.050	<0.050	<0.050	0.33	0.071	0.17
Nitrite (N)	mg/L	0.06	<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	Note 6	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	3.2	2.6	2.2	4.2	2.4	3.1	2.8	3.2	3.2	4.4	3.8	4.3
Orthophosphate (P)	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010
pH	pH	6.5-9.0	6.93	6.79	7.17	**<u>6.24</u>**	6.75	7.04	7.00	6.84	7.11	6.76	7.03	6.91
Reactive Silica (SiO2)	mg/L	-	0.52	0.72	0.54	2.1	<0.50	<0.50	0.82	0.72	0.6	1.2	0.7	1.1
Total Suspended Solids	mg/L	Note 7	1.4	<1.0	<1.0	22	<1.0	<1.0	<1.0	17	<1.0	22	<1.0	1.2
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	2.2	<2.0
Turbidity	NTU	Note 8	0.23	0.14	0.24	0.80	0.57	0.82	0.15	0.85	0.55	5.2	0.29	0.71
Conductivity	uS/cm	-	23	23	25	21	24	23	26	27	26	22	24	23

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-11

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID															
			FZ-01															
Sampling Date			31-Oct-12	26-Nov-12	13-Jan-13	21-Feb-13	27-May-13	30-Jul-13	06-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	7-Sep-18	5-Aug-19	3-Nov-19
Calculated Parameters																		
Anion Sum	me/L	-	0.260	0.390	0.310	0.290	0.190	0.350	0.880	0.080	0.420	0.200	0.080	0.330	0.310	0.540	0.580	0.320
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	7.9	15	11	9.6	5.1	11	34	<1.0	15	5.6	<1.0	12	7.4	22	24	9.2
Calculated TDS	mg/L	-	20	23	20	20	14	21	69	8	34	12	8	24	21	30	40	21
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
Cation Sum	me/L	-	0.37	0.45	0.33	0.33	0.3	0.41	1.26	0.2	0.67	0.18	0.19	0.38	0.35	0.59	0.79	0.4
Hardness (CaCO3)	mg/L	-	12	16	11	12	9.7	15	36	5.9	18	5.2	5.3	13	11	22	24	14
Ion Balance (% Difference)	%	-	17.5	7.14	3.13	6.45	22.5	7.89	17.8	42.9	22.9	5.26	40.7	7.04	6.06	4.42	15.3	11.1
Langelier Index (@ 20C)	N/A	-	-3.02	-2.11	-2.93	-2.89	-3.51	-3.16	-2.62	NC	-2.95	-3.69	NC	-2.78	-3.65	-2.24	-2.65	-3.17
Langelier Index (@ 4C)	N/A	-	-3.27	-2.36	-3.18	-3.14	-3.76	-3.41	-2.87	NC	-3.2	-3.94	NC	-3.03	-3.9	-2.49	-2.9	-3.42
Nitrate (N)	mg/L	13	<0.050	<0.050	0.12	0.11	<0.050	<0.050	<0.050	<0.050	0.071	0.057	0.085	0.077	<0.050	<0.050	0.057	0.086
Saturation pH (@ 20C)	N/A	-	9.77	9.38	9.66	9.71	10.1	9.55	8.72	NC	9.34	10.3	NC	9.58	9.85	9.09	9.01	9.67
Saturation pH (@ 4C)	N/A	-	10	9.63	9.91	9.96	10.3	9.8	8.97	NC	9.59	10.6	NC	9.83	10.1	9.34	9.26	9.93
Inorganics																		
Total Alkalinity (Total as CaCO3)	mg/L	-	7.9	15	11	9.6	5.1	11	34	<5.0	15	5.6	<5.0	12	7.4	22	24	9.2
Dissolved Chloride (Cl)	mg/L	120	3.7	3.1	2.6	3.3	3.1	4.7	7.3	2.9	3.9	3	2.8	3	5.9	3.8	3.6	4.8
Colour	TCU	Note 5	89	39	19	45	43	100	140	25	150	23	27	11	59	64	110	86
Nitrate + Nitrite (N)	mg/L		<0.050	<0.050	0.12	0.11	<0.050	<0.050	<0.050	<0.050	0.071	0.057	0.085	0.077	<0.050	<0.050	0.057	0.086
Nitrite (N)	mg/L	0.06	<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	Note 6	<0.050	<0.050	0.092	<0.050	<0.050	<0.050	<0.050	<0.050	0.05	<0.050	0.052	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	10	8.0	3.7	6.7	6.6	14	17	2.9	10	3.4	4.6	3.5	8.7	15	17	15
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
pH	pH	6.5-9.0	6.75	7.27	6.73	6.82	6.57	**6.39**	**6.10**	6.72	**6.39**	6.65	6.64	6.80	**6.20**	6.85	**6.36**	6.51
Reactive Silica (SiO2)	mg/L	-	4.0	1.4	3.7	3.8	2.1	1.1	10	1.3	4.6	1.4	1.2	3.7	3.5	1.4	3.1	1.9
Total Suspended Solids	mg/L	Note 7	<1.0	1.6	1.2	<1.0	<1.0	<1.0	**87**	<1.0	9.8	<1.0	<1.0	7.4	<1.0	2.8	19	2.0
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
Turbidity	NTU	Note 8	0.33	1.6	1.2	0.2	0.38	0.38	24	0.21	1.4	0.57	0.85	1.3	0.24	0.75	5.3	0.67
Conductivity	uS/cm	-	31	40	34	33	29	34	88	20	47	19	20	33	39	52	59	33

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-12

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID													
			FZ02													
Sampling Date			31-Oct-12	26-Nov-12	13-Jan-13	21-Feb-13	27-May-13	30-Jul-13	06-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	7-Sep-18	5-Aug-19
Calculated Parameters																
Anion Sum	me/L	-	0.260	0.390	0.310	0.290	0.190	0.350	0.880	0.080	0.420	0.200	0.080	0.310	0.700	0.750
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	7.9	15	11	9.6	5.1	11	34	<1.0	15	5.6	<1.0	10	30	34
Calculated TDS	mg/L	-	20	23	20	20	14	21	69	8	34	12	8	23	40	42
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
Cation Sum	me/L	-	0.37	0.45	0.33	0.33	0.3	0.41	1.26	0.2	0.67	0.18	0.19	0.36	0.67	0.72
Hardness (CaCO3)	mg/L	-	12	16	11	12	9.7	15	36	5.9	18	5.2	5.3	13	28	31
Ion Balance (% Difference)	%	-	17.5	7.14	3.13	6.45	22.5	7.89	17.8	42.9	22.9	5.26	40.7	7.46	2.19	2.04
Langelier Index (@ 20C)	N/A	-	-3.02	-2.11	-2.93	-2.89	-3.51	-3.16	-2.62	NC	-2.95	-3.69	NC	-2.97	-1.7	-1.72
Langelier Index (@ 4C)	N/A	-	-3.27	-2.36	-3.18	-3.14	-3.76	-3.41	-2.87	NC	-3.2	-3.94	NC	-3.23	-1.96	-1.97
Nitrate (N)	mg/L	13	<0.050	<0.050	0.12	0.11	<0.050	<0.050	<0.050	<0.050	0.071	0.057	0.085	0.41	0.089	0.1
Saturation pH (@ 20C)	N/A	-	9.77	9.38	9.66	9.71	10.1	9.55	8.72	NC	9.34	10.3	NC	9.64	8.85	8.76
Saturation pH (@ 4C)	N/A	-	10	9.63	9.91	9.96	10.3	9.8	8.97	NC	9.59	10.6	NC	9.9	9.11	9.01
Inorganics																
Total Alkalinity (Total as CaCO3)	mg/L	-	7.9	15	11	9.6	5.1	11	34	<5.0	15	5.6	<5.0	10	30	34
Dissolved Chloride (Cl)	mg/L	120	3.7	3.1	2.6	3.3	3.1	4.7	7.3	2.9	3.9	3	2.8	2.9	3.1	2.6
Colour	TCU	Note 5	89	39	19	45	43	100	140	25	150	23	27	10	15	14
Nitrate + Nitrite (N)	mg/L		<0.050	<0.050	0.12	0.11	<0.050	<0.050	<0.050	<0.050	0.071	0.057	0.085	0.41	0.089	0.1
Nitrite (N)	mg/L	0.06	<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	Note 6	<0.050	<0.050	0.092	<0.050	<0.050	<0.050	<0.050	<0.050	0.05	<0.050	0.052	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	10	8.0	3.7	6.7	6.6	14	17	2.9	10	3.4	4.6	3.2	3.9	2.9
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
pH	pH	6.5-9.0	6.75	7.27	6.73	6.82	6.57	**6.39**	**6.10**	6.72	**6.39**	6.65	6.64	6.67	7.15	7.04
Reactive Silica (SiO2)	mg/L	-	4.0	1.4	3.7	3.8	2.1	1.1	10	1.3	4.6	1.4	1.2	3.8	3.5	3.0
Total Suspended Solids	mg/L	Note 7	<1.0	1.6	1.2	<1.0	<1.0	<1.0	87	<1.0	12	<1.0	<1.0	4.4	<1.0	1.2
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
Turbidity	NTU	Note 8	0.33	1.6	1.2	0.2	0.38	0.38	24	0.21	1.4	0.57	0.85	1.6	0.39	0.62
Conductivity	uS/cm	-	31	40	34	33	29	34	88	20	47	19	20	36	67	71

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-13

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																	
			VL-01																	
Sampling Date			19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	17-Mar-12	15-May-12	21-Jun-12	3-Aug-12	17-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13	21-Feb-13	27-May-13
Calculated Parameters																				
Anion Sum	me/L	-	0.170	0.210	0.280	0.340	0.500	0.220	0.360	0.290	0.350	0.210	0.230	0.290	0.160	0.350	0.320	0.280	0.300	0.070
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	6	8	12	15	21	8	13.0	9.9	13	8.1	9.5	12	6.4	12	10	11	10	<1.0
Calculated TDS	mg/L	-	11	12	15	19	30	14	23	19	22	13	13	17	11	24	24	19	20	9
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<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	me/L	-	0.22	0.24	0.29	0.35	0.54	0.29	0.37	0.32	0.38	0.24	0.29	0.37	0.2	0.41	0.39	0.3	0.35	0.23
Hardness (CaCO3)	mg/L	-	8	9	12	14	22	11	14	11	14	8.5	11	14	6.5	15	14	12	13	7.5
Ion Balance (% Difference)	%	-	12.8	6.67	1.75	1.45	3.85	13.7	1.37	4.92	4.11	6.67	11.5	12.1	11.1	7.89	9.86	3.45	7.69	53.3
Langelier Index (@ 20C)	N/A	-	-3.29	-2.66	-2.57	-2.4	-2.09	-2.90	-2.67	-3.06	-2.67	-3.19	-2.63	-2.43	-3.40	-2.3	-2.66	-2.55	-2.8	NC
Langelier Index (@ 4C)	N/A	-	-3.55	-2.92	-2.82	-2.65	-2.34	-3.16	-2.92	-3.31	-2.92	-3.45	-2.88	-2.69	-3.65	-2.55	-2.91	-2.80	-3.05	NC
Nitrate (N)	mg/L	13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.11	0.12	0.094	<0.050	<0.050	<0.050	<0.050	<0.050	0.19	0.087	0.086	<0.050
Saturation pH (@ 20C)	N/A	-	10.1	9.9	9.64	9.46	9.17	9.84	9.52	9.74	9.5	9.92	9.75	9.55	10.2	9.52	9.65	9.67	9.67	NC
Saturation pH (@ 4C)	N/A	-	10.3	10.2	9.89	9.71	9.42	10.1	9.77	9.99	9.75	10.2	10.0	9.81	10.4	9.77	9.9	9.92	9.92	NC
Inorganics																				
Total Alkalinity (Total as CaCO3)	mg/L	-	6	8	12	15	21	8	13	9.9	13	8.1	9.5	12	6.4	12	10	11	10	<5.0
Dissolved Chloride (Cl)	mg/L	120	1	2	2	2	3	2	3.3	3.1	2.9	1.9	1.6	2.0	1.2	3.8	3.6	2.0	3.2	2.6
Colour	TCU	Note 5	41	34	36	23	33	47	30	42	34	31	23	23	16	26	57	19	42	42
Nitrate + Nitrite (N)	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.11	0.12	0.094	<0.050	<0.050	<0.050	<0.050	<0.050	0.19	0.087	0.086	<0.050
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1.0	<1.0	<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	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<1.0	<1.0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6.2	6.7	8.0	6.9	7.4	8.3	6.0	6.5	5.4	5.9	6.3	7.0	5.5	5.6	10	3.4	6.6	6.4
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1.0	<1.0	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.015
pH	pH	6.5-9.0	6.77	7.24	7.07	7.06	7.08	6.94	6.85	6.68	6.83	6.73	7.12	7.12	6.76	7.22	6.99	7.12	6.87	6.66
Reactive Silica (SiO2)	mg/L	-	1.5	0.7	0.9	1.4	4.4	1.8	4.3	3.2	3.7	1.6	<0.50	0.98	1.7	5.1	5.9	3.7	3.7	1.3
Total Suspended Solids	mg/L	Note 7	1	2	2	3	<1	<1	<1.0	<1.0	<1.0	1.2	2.0	1.2	4.4	1.2	7.0	<1.0	<1.0	1.4
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<1.0	<1.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.2	0.2	0.7	0.9	0.5	0.5	0.72	0.45	0.14	0.71	0.82	0.91	1.2	0.4	1.3	<0.10	0.23	0.37
Conductivity	uS/cm	-	20	22	28	33	47	28	38	32	37	23	26	31	18	37	34	29	34	21

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-13

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID											
			VL-01											
Sampling Date			29-Jul-13	6-Feb-14	25-Jul-14	25-Jan-15	3-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	7-Sep-18	29-Apr-19	5-Aug-19	3-Nov-19
Calculated Parameters														
Anion Sum	me/L	-	0.280	0.290	0.330	0.380	0.330	0.250	0.320	0.260	0.330	0.190	0.560	0.380
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	10	11	13	15	14	9.3	9.9	5.6	13	7	19	12
Calculated TDS	mg/L	-	16	19	18	27	18	15	22	18	19	13	32	22
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
Cation Sum	me/L	-	0.32	0.29	0.34	0.44	0.32	0.31	0.39	0.3	0.38	0.22	0.53	0.38
Hardness (CaCO3)	mg/L	-	12	11	13	17	12	11	14	10	14	6.8	22	14
Ion Balance (% Difference)	%	-	6.67	0	1.49	7.32	1.54	10.7	9.86	7.14	7.04	7.32	2.75	0
Langelier Index (@ 20C)	N/A	-	-2.7	-3.21	-2.36	-2.5	-2.49	-2.72	-3.11	-3.53	-2.23	-3.56	-1.87	-2.49
Langelier Index (@ 4C)	N/A	-	-2.95	-3.46	-2.61	-2.75	-2.74	-2.98	-3.36	-3.78	-2.48	-3.82	-2.12	-2.74
Nitrate (N)	mg/L	13	<0.050	0.055	<0.050	0.1	<0.050	<0.050	0.091	0.065	<0.050	0.064	0.3	0.05
Saturation pH (@ 20C)	N/A	-	9.67	9.7	9.53	9.34	9.53	9.75	9.66	10	9.49	10.1	9.13	9.54
Saturation pH (@ 4C)	N/A	-	9.92	9.95	9.78	9.6	9.78	10	9.91	10.3	9.74	10.3	9.39	9.8
Inorganics														
Total Alkalinity (Total as CaCO3)	mg/L	-	10	11	13	15	14	9.3	10	5.6	14	7.1	19	12
Dissolved Chloride (Cl)	mg/L	120	2.6	2.5	2.4	2.6	2.0	2.1	4.0	5.0	2.3	1.6	3.4	2.8
Colour	TCU	Note 5	28	34	20	13	14	40	58	42	18	59	10	23
Nitrate + Nitrite (N)	mg/L		<0.050	0.055	<0.050	0.1	<0.050	<0.050	0.091	0.065	<0.050	0.064	0.3	0.05
Nitrite (N)	mg/L	0.06	<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	Note 6	<0.050	<0.050	<0.050	<0.050	<0.050	0.096	0.12	<0.050	<0.050	<0.050	0.057	<0.050
Total Organic Carbon (C)	mg/L	-	6.9	4.6	5.0	2.6	5.3	7.2	8.6	7.0	7.8	8.4	3.2	7.1
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
pH	pH	6.5-9.0	6.97	<u>**6.49**</u>	7.17	6.85	7.04	7.03	6.55	6.51	7.26	6.53	7.26	7.06
Reactive Silica (SiO2)	mg/L	-	0.76	4.0	1.1	6.5	0.95	1.2	4.0	2.8	1.6	2.0	2.5	1.4
Total Suspended Solids	mg/L	Note 7	1.8	<1.0	<1.0	2.8	1.2	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	1.6
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	2.8	2.7
Turbidity	NTU	Note 8	0.46	0.2	0.37	<0.10	0.86	0.57	3.1	0.37	0.55	0.46	0.16	0.82
Conductivity	uS/cm	-	28	30	33	41	31	30	35	35	35	19	54	34

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. <u>**Bold & Underlined**</u> = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-14

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																
			VE01																
Sampling Date			9-Mar-11	31-Mar-11	19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12
Calculated Parameters																			
Anion Sum	me/L	-	0.190	0.270	0.200	0.190	0.420	0.510	0.320	0.170	0.350	0.320	0.390	0.260	0.560	0.370	0.260	0.220	0.200
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	5	9	8	8	18	22	12	5	12.7	11.6	16	11	25	16	9.9	5.6	6.2
Calculated TDS	mg/L	-	16	19	13	14	26	31	19	13	23	23	24	16	36	23	17	17	14
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.26	0.32	0.26	0.37	0.48	0.53	0.36	0.26	0.38	0.4	0.37	0.29	0.68	0.45	0.33	0.31	0.27
Hardness (CaCO3)	mg/L	-	9	12	10	14	19	22	14	10	14	13	14	11	28	18	12	10	9.2
Ion Balance (% Difference)	%	-	15.6	8.47	13	32.1	6.67	1.92	5.88	20.9	4.11	11.1	2.63	5.45	9.68	9.76	11.9	17	14.9
Langelier Index (@ 20C)	N/A	-	-3.73	-3.12	-3.1	-2.87	-1.58	-1.87	-2.62	-3.39	-2.51	-2.66	-2.42	-2.88	-1.4	-2.02	-2.56	-3.63	-3.38
Langelier Index (@ 4C)	N/A	-	-3.98	-3.37	-3.35	-3.12	-1.83	-2.12	-2.87	-3.65	-2.76	-2.91	-2.67	-3.14	-1.65	-2.27	-2.81	-3.88	-3.63
Nitrate (N)	mg/L	13	0.24	0.15	<0.05	<0.05	0.07	0.09	<0.05	0.06	0.14	0.092	0.13	<0.050	0.12	0.093	<0.050	0.10	<0.050
Saturation pH (@ 20C)	N/A	-	10.1	9.75	9.9	9.72	9.24	9.11	9.55	10.1	9.52	9.61	9.42	9.71	8.95	9.32	9.69	10.1	10
Saturation pH (@ 4C)	N/A	-	10.4	10	10.2	9.97	9.49	9.36	9.8	10.3	9.77	9.86	9.67	9.97	9.2	9.57	9.94	10.3	10.3
Inorganics																			
Total Alkalinity (Total as CaCO3)	mg/L	-	5	9	8	8	18	22	12	5	13	12	16	11	25	16	9.9	5.6	6.2
Dissolved Chloride (Cl)	mg/L	120	3	2	1	1	2	2	3	2	2.9	2.8	2.3	1.6	2.0	1.4	2.2	3.6	2.8
Colour	TCU	Note 5	43	32	46	28	36	40	37	49	32	27	26	37	19	24	40	73	62
Nitrate + Nitrite (N)	mg/L		0.24	0.15	<0.05	<0.05	0.07	0.09	<0.05	0.06	0.140	0.092	0.130	<0.050	0.120	0.093	<0.050	0.10	<0.050
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6.4	4.9	6	4.2	6.3	6.9	8.2	8.7	5.6	5.0	4.1	6.4	3.8	5.8	8.9	12	9.9
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	0.037	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	**6.41**	6.63	6.8	6.85	7.66	7.24	6.93	6.70	7.01	6.95	7.00	6.83	7.55	7.30	7.13	**6.43**	6.64
Reactive Silica (SiO2)	mg/L	-	3.8	4.2	1.8	0.6	3.4	4.3	2.3	2.4	4.2	4.5	4.6	2.1	5.0	2.5	2.3	2.6	2.2
Total Suspended Solids	mg/L	Note 7	<1	3	<1	<1	<1	1	<1	<1	5.2	12	1.4	<1.0	2.4	1.4	1.0	5.4	1.6
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.3	0.7	0.4	<0.1	0.4	0.8	0.4	0.2	0.97	0.47	0.21	0.13	0.34	0.50	0.25	1.9	0.88
Conductivity	uS/cm	-	26	30	24	20	42	50	32	25	38	38	38	26	56	39	28	25	23

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-14

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	**UNITS**	**CWQG FAL**	**Sample ID**														
			VE01														
Sampling Date			13-Jan-13	8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	3-Aug-15	18-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	29-Apr-19	6-Aug-19	1-Nov-19
Calculated Parameters																	
Anion Sum	me/L	-	0.310	0.210	0.220	0.260	0.270	0.310	0.280	0.270	0.230	0.370	0.260	0.590	0.210	0.870	0.390
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	12	5.9	7.1	8.5	9.1	13	10	10	8.7	13	6.8	25	8	36	9.2
Calculated TDS	mg/L	-	24	15	15	16	19	19	20	15	14	26	18	35	14	51	27
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
Cation Sum	me/L	-	0.39	0.26	0.28	0.29	0.3	0.36	0.37	0.26	0.29	0.42	0.28	0.62	0.2	0.86	0.46
Hardness (CaCO3)	mg/L	-	14	8.4	9.6	11	11	14	14	9.5	10	16	9.6	25	7.1	37	16
Ion Balance (% Difference)	%	-	11.4	10.6	12	5.45	5.26	7.46	13.9	1.89	11.5	6.33	3.7	2.48	2.44	0.58	8.24
Langelier Index (@ 20C)	N/A	-	-2.41	-3.5	-3.16	-3.16	-3	-2.44	-2.76	-2.86	-2.95	-2.57	-3.5	-1.64	-3.44	-1.07	-3.14
Langelier Index (@ 4C)	N/A	-	-2.66	-3.76	-3.41	-3.41	-3.25	-2.69	-3.02	-3.11	-3.2	-2.82	-3.75	-1.89	-3.69	-1.32	-3.39
Nitrate (N)	mg/L	13	0.14	0.11	0.054	<0.050	0.16	0.13	0.12	0.061	0.08	0.18	0.091	0.084	0.16	0.18	0.54
Saturation pH (@ 20C)	N/A	-	9.57	10.1	9.95	9.81	9.77	9.54	9.62	9.77	9.83	9.47	9.97	8.99	10	8.66	9.62
Saturation pH (@ 4C)	N/A	-	9.82	10.3	10.2	10.1	10	9.79	9.87	10	10.1	9.72	10.2	9.24	10.3	8.91	9.87
Inorganics																	
Total Alkalinity (Total as CaCO3)	mg/L	-	12	5.9	7.1	8.5	9.1	13	10	10	8.7	13	6.8	25	8	37	9.2
Dissolved Chloride (Cl)	mg/L	120	2.5	2.9	2.5	3.3	2.6	1.8	2.5	2	1.7	3.5	4.2	3	1.3	2.6	4.6
Colour	TCU	Note 5	23	47	20	59	37	27	49	26	57	67	37	30	44	24	69
Nitrate + Nitrite (N)	mg/L		0.14	0.11	0.054	<0.050	0.16	0.13	0.12	0.061	0.08	0.19	0.091	0.084	0.16	0.18	0.54
Nitrite (N)	mg/L	0.06	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<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
Total Organic Carbon (C)	mg/L	-	4.9	5.6	5.2	11	5.1	6.7	6.5	7.3	10	7.7	6.6	6.6	7.4	4.5	10
Orthophosphate (P)	mg/L	-	<0.010	<0.010	<0.010	<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	pH	6.5-9.0	7.16	6.59	6.79	6.65	6.77	7.1	6.86	6.91	6.88	6.9	**<u>6.47</u>**	7.35	6.58	7.58	**<u>6.48</u>**
Reactive Silica (SiO2)	mg/L	-	5.2	3.2	2.0	1.1	4.1	1.3	3.1	0.78	0.66	4.8	3.4	4.6	2.7	6.5	3.6
Total Suspended Solids	mg/L	Note 7	18	1.8	<1.0	3.6	<1.0	<1.0	2.4	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<2.0	1.0
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	2.3	2
Turbidity	NTU	Note 8	3.9	0.83	0.11	0.98	0.13	1.1	<0.10	0.52	0.48	0.53	0.22	0.66	1.5	0.33	2.1
Conductivity	uS/cm	-	35	23	27	24	28	32	33	24	26	40	31	57	20	84	39

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-15

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																
			VE02																
Sampling Date			9-Mar-11	31-Mar-11	19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12
Calculated Parameters																			
Anion Sum	me/L	-	0.220	0.250	0.170	0.260	0.360	0.450	0.280	0.170	0.360	0.290	0.330	0.230	0.500	0.340	0.270	0.220	0.230
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	6	9	7	11	15	19	11	6	13.4	10.1	13	9.4	22	14	10	5.8	7.5
Calculated TDS	mg/L	-	17	18	12	16	22	26	17	13	22	20	21	16	33	21	17	21	15
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.28	0.31	0.23	0.32	0.4	0.45	0.33	0.26	0.35	0.32	0.34	0.31	0.58	0.4	0.32	0.51	0.28
Hardness (CaCO3)	mg/L	-	10	11	9	12	16	19	13	10	13	12	13	10	24	15	12	14	9.7
Ion Balance (% Difference)	%	-	12	10.7	15	10.3	5.26	0	8.2	20.9	1.41	4.92	1.49	14.8	7.41	8.11	8.47	39.7	9.8
Langelier Index (@ 20C)	N/A	-	-3.29	-3.13	-3.21	-2.77	-2.21	-2.02	-2.7	-3.24	-2.53	-2.7	-2.54	-2.98	-1.68	-2.19	-2.54	-3.42	-3.17
Langelier Index (@ 4C)	N/A	-	-3.54	-3.38	-3.46	-3.03	-2.46	-2.28	-2.95	-3.49	-2.78	-2.95	-2.8	-3.23	-1.93	-2.44	-2.80	-3.67	-3.43
Nitrate (N)	mg/L	13	0.22	0.16	<0.05	0.05	0.08	0.14	<0.05	0.07	0.14	0.11	0.14	<0.050	0.12	0.088	<0.050	0.093	0.053
Saturation pH (@ 20C)	N/A	-	10	9.78	10	9.65	9.39	9.23	9.65	10	9.54	9.71	9.54	9.79	9.07	9.44	9.68	9.88	9.9
Saturation pH (@ 4C)	N/A	-	10.3	10	10.2	9.91	9.64	9.49	9.9	10.3	9.79	9.96	9.8	10.0	9.32	9.69	9.94	10.1	10.2
Inorganics																			
Total Alkalinity (Total as CaCO3)	mg/L	-	6	9	7	11	15	19	11	6	13	10	13	9.4	22	14	10	5.8	7.5
Dissolved Chloride (Cl)	mg/L	120	3	2	1	1	2	2	3	2	2.9	2.7	2.1	1.6	2.0	1.8	2.2	3.6	2.7
Colour	TCU	Note 5	38	34	40	33	31	24	36	47	32	31	28	35	16	19	40	85	97
Nitrate + Nitrite (N)	mg/L		0.22	0.16	<0.05	0.05	0.08	0.14	<0.05	0.07	0.14	0.11	0.14	<0.050	0.12	0.088	<0.050	0.093	0.053
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6.3	5.2	6.4	6.6	6.3	6.1	8.6	8.8	6.3	5.3	4.4	6.6	2.8	5.4	8.8	12	9.7
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.72	6.65	6.79	6.88	7.18	7.21	6.95	6.79	7.01	7.01	7.00	6.81	7.39	7.25	7.14	**6.46**	6.73
Reactive Silica (SiO2)	mg/L	-	3.7	3.7	1.3	1.6	2.7	3.3	1.9	2.1	3.7	4	4.1	1.5	5.5	2.2	2.3	2.5	2.1
Total Suspended Solids	mg/L	Note 7	<2	2	2	1	<1	4	2	<1	1	2	4.8	2.0	1.0	<1.0	<1.0	6.0	1.6
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.3	0.4	0.2	<0.1	<0.1	0.8	0.3	0.2	0.2	0.22	0.2	1.2	0.16	0.25	0.27	1.2	0.85
Conductivity	uS/cm	-	28	28	21	26	36	44	29	25	35	32	35	24	51	34	28	25	24

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-15

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID														
			VE02														
Sampling Date			13-Jan-13	8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	3-Aug-15	18-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	29-Apr-19	6-Aug-19	1-Nov-19
Calculated Parameters																	
Anion Sum	me/L	-	0.290	0.210	0.180	0.090	0.270	0.320	0.300	0.270	0.210	0.370	0.250	0.500	0.210	0.530	0.380
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	10	6.2	5.8	<1.0	9.6	12	11	11	8.1	13	6.1	21	7.9	22	7.9
Calculated TDS	mg/L	-	20	16	14	11	19	22	20	15	14	26	17	29	13	33	25
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
Cation Sum	me/L	-	0.33	0.28	0.3	0.25	0.3	0.4	0.37	0.27	0.29	0.43	0.27	0.51	0.2	0.56	0.37
Hardness (CaCO3)	mg/L	-	13	9.4	10	8.2	11	13	14	9.6	10	15	8.9	20	6.9	23	13
Ion Balance (% Difference)	%	-	6.45	14.3	25	47.1	5.26	11.1	10.5	0	16	7.5	3.85	0.99	2.44	2.75	1.33
Langelier Index (@ 20C)	N/A	-	-2.54	-3.36	-3.22	NC	-3.05	-2.58	-2.74	-2.85	-3.11	-2.55	-3.36	-1.87	-3.31	-1.85	-3.22
Langelier Index (@ 4C)	N/A	-	-2.8	-3.62	-3.47	NC	-3.3	-2.83	-2.99	-3.1	-3.37	-2.8	-3.61	-2.12	-3.57	-2.1	-3.47
Nitrate (N)	mg/L	13	0.14	0.11	0.052	<0.050	0.13	0.14	0.12	0.058	0.078	0.18	0.12	0.11	0.11	0.48	0.53
Saturation pH (@ 20C)	N/A	-	9.66	10	10	NC	9.74	9.57	9.58	9.75	9.86	9.47	10.1	9.15	10	9.07	9.78
Saturation pH (@ 4C)	N/A	-	9.92	10.3	10.3	NC	9.99	9.82	9.83	10	10.1	9.72	10.3	9.4	10.3	9.33	10
Inorganics																	
Total Alkalinity (Total as CaCO3)	mg/L	-	10	6.2	5.8	<5.0	9.7	12	11	11	8.1	13	6.1	21	7.9	22	7.9
Dissolved Chloride (Cl)	mg/L	120	2.5	2.9	2	3.3	2.5	2.5	2.6	1.9	1.7	3.4	4.1	2.4	1.4	2.1	4.3
Colour	TCU	Note 5	27	51	18	88	37	28	47	27	60	76	18	21	44	18	43
Nitrate + Nitrite (N)	mg/L		0.14	0.11	0.052	<0.050	0.13	0.14	0.12	0.058	0.078	0.18	0.12	0.11	0.11	0.48	0.53
Nitrite (N)	mg/L	0.06	<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	Note 6	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.22	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	5.6	5.7	5.3	16	5.1	6.4	6.5	7.0	11	7.9	4.8	5.8	7.3	3.4	8.3
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
pH	pH	6.5-9.0	7.12	6.65	6.79	**<u>5.81</u>**	6.69	6.99	6.84	6.9	6.75	6.92	6.71	7.28	6.72	7.23	6.56
Reactive Silica (SiO2)	mg/L	-	4.1	3.2	2.0	2.9	4.1	1.2	3.1	0.79	0.65	4.8	3.6	3.4	2.5	4.9	3.0
Total Suspended Solids	mg/L	Note 7	<1.0	1.0	<1.0	2.8	<1.0	5.4	1.8	<1.0	<1.0	3.4	2.0	<1.0	3.4	<1.0	2.6
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	2.9
Turbidity	NTU	Note 8	<0.10	0.71	<0.10	0.43	0.15	4.2	0.22	0.82	0.57	0.82	0.23	0.38	0.37	0.17	0.94
Conductivity	uS/cm	-	32	23	27	20	28	32	33	24	26	39	31	47	17	57	33

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-16

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																
			VE03																
Sampling Date			9-Mar-11	31-Mar-11	19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12
Calculated Parameters																			
Anion Sum	me/L	-	0.220	0.240	0.160	0.220	0.330	0.400	0.280	0.170	0.330	0.260	0.330	0.220	0.460	0.330	0.250	0.270	0.210
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	6	8	6	9	14	17	10	5	11.4	8.8	12	8.5	17	14	9.1	5.6	6.6
Calculated TDS	mg/L	-	17	17	10	13	20	24	17	12	21	18	21	13	30	20	16	20	14
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.28	0.30	0.22	0.29	0.37	0.44	0.33	0.25	0.35	0.31	0.34	0.25	0.50	0.38	0.32	0.38	0.27
Hardness (CaCO3)	mg/L	-	9	11	8	11	15	18	12	9	13	11	13	8.8	20	15	12	11	9.4
Ion Balance (% Difference)	%	-	12	11.1	15.8	13.7	5.71	4.76	8.2	19.1	2.94	8.77	1.49	6.38	4.17	7.04	12.3	16.9	12.5
Langelier Index (@ 20C)	N/A	-	-3.34	-3.16	-3.34	-2.9	-2.3	-2.04	-2.75	-3.35	-2.62	-2.79	-2.55	-3.08	-1.75	-2.22	-2.63	-3.6	-3.25
Langelier Index (@ 4C)	N/A	-	-3.59	-3.41	-3.59	-3.15	-2.56	-2.29	-3	-3.6	-2.87	-3.04	-2.8	-3.33	-2.00	-2.47	-2.88	-3.85	-3.51
Nitrate (N)	mg/L	13	0.23	0.18	<0.05	<0.05	0.08	0.14	<0.05	0.08	0.19	0.098	0.15	<0.050	0.20	0.088	0.051	0.10	<0.050
Saturation pH (@ 20C)	N/A	-	10	9.84	10.1	9.8	9.46	9.3	9.68	10.1	9.63	9.80	9.58	9.90	9.25	9.47	9.74	10.0	9.97
Saturation pH (@ 4C)	N/A	-	10.3	10.1	10.3	10	9.72	9.55	9.93	10.3	9.88	10.00	9.83	10.2	9.50	9.72	9.99	10.3	10.2
Inorganics																			
Total Alkalinity (Total as CaCO3)	mg/L	-	6	8	6	9	14	17	10	5	11	8.8	12	8.5	17	14	9.1	5.6	6.6
Dissolved Chloride (Cl)	mg/L	120	3	2	1	1	2	2	3	2	3.2	2.8	2.6	1.6	1.9	1.8	2.3	5.2	2.7
Colour	TCU	Note 5	40	41	40	32	30	24	34	49	34	32	28	37	9.6	22	40	68	69
Nitrate + Nitrite (N)	mg/L		0.23	0.18	<0.05	<0.05	0.08	0.14	<0.05	0.08	0.19	0.098	0.15	<0.050	0.20	0.088	0.051	0.10	<0.050
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	0.100	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6.8	5.7	6.4	7.1	6.9	6.6	8.7	9.0	6.6	5.7	4.8	6.7	2.1	6.3	9.3	9.8	10
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.69	6.68	6.75	6.90	7.16	7.26	6.93	6.74	7.01	7.01	7.03	6.82	7.5	7.25	7.11	**<u>6.44</u>**	6.72
Reactive Silica (SiO2)	mg/L	-	3.6	3.4	0.9	1.1	1.9	2.5	1.7	1.9	3.4	3.8	3.9	1.0	4.3	1.9	2	2.6	2.1
Total Suspended Solids	mg/L	Note 7	<1	1	<1	<1	<1	2	1	<1	<1.0	<1.0	23	<1.0	<1.0	<1.0	2.2	7.6	<1.0
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	2.6	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.3	0.4	0.3	1	0.1	0.7	0.4	0.3	0.27	0.20	0.2	0.28	<0.10	0.33	0.3	2.2	0.72
Conductivity	uS/cm	-	28	27	20	24	33	42	28	24	34	31	34	22	48	33	27	32	24

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-16

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID														
			VE03														
Sampling Date			13-Jan-13	8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	3-Aug-15	18-Jul-16	4-Feb-17	10-Feb-18	5-Sep-18	29-Apr-19	6-Aug-19	1-Nov-19
Calculated Parameters																	
Anion Sum	me/L	-	0.290	0.090	0.190	0.260	0.260	0.320	0.310	0.280	0.190	0.380	0.260	0.450	0.210	0.530	0.300
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	10	<1.0	5.4	8.3	9.4	12	11	11	6.7	13	6.2	19	8.4	18	7
Calculated TDS	mg/L	-	20	12	14	16	19	22	21	15	13	25	18	26	13	33	22
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
Cation Sum	me/L	-	0.33	0.25	0.28	0.3	0.31	0.42	0.37	0.26	0.29	0.41	0.29	0.47	0.18	0.51	0.38
Hardness (CaCO3)	mg/L	-	12	8.2	9.9	11	11	15	14	9.5	10	16	9.7	19	6.1	21	13
Ion Balance (% Difference)	%	-	6.45	47.1	19.2	7.14	8.77	13.5	8.82	3.7	20.8	3.8	5.45	2.17	7.69	1.92	11.8
Langelier Index (@ 20C)	N/A	-	-2.56	NC	-3.25	-3.16	-2.97	-2.45	-2.74	-2.84	-3.11	-2.52	-3.45	-1.87	-3.35	-1.86	-3.28
Langelier Index (@ 4C)	N/A	-	-2.81	NC	-3.51	-3.42	-3.22	-2.7	-2.99	-3.09	-3.36	-2.78	-3.7	-2.12	-3.6	-2.12	-3.53
Nitrate (N)	mg/L	13	0.15	0.11	0.054	<0.050	0.062	0.14	0.11	0.081	0.074	0.086	0.10	0.11	0.11	0.6	0.65
Saturation pH (@ 20C)	N/A	-	9.67	NC	10.1	9.81	9.75	9.53	9.59	9.74	9.94	9.45	10.0	9.23	10.1	9.2	9.82
Saturation pH (@ 4C)	N/A	-	9.92	NC	10.3	10.1	10	9.78	9.84	10	10.2	9.7	10.3	9.48	10.3	9.46	10.1
Inorganics																	
Total Alkalinity (Total as CaCO3)	mg/L	-	10	<5.0	5.4	8.3	9.4	12	11	11	6.7	13	6.2	19	8.4	18	7.0
Dissolved Chloride (Cl)	mg/L	120	2.5	2.9	2.6	3.3	2.3	2.5	3	1.8	1.7	3.6	4.6	2.2	1.4	1.7	4.2
Colour	TCU	Note 5	28	54	18	59	37	24	48	29	67	61	38	18	47	9.7	47
Nitrate + Nitrite (N)	mg/L		0.15	0.11	0.054	<0.050	0.062	0.14	0.11	0.081	0.074	0.086	0.1	0.11	0.11	0.6	0.65
Nitrite (N)	mg/L	0.06	<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	Note 6	<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
Total Organic Carbon (C)	mg/L	-	5.7	5.8	5.3	12	5.1	6.4	6.5	7.1	9.8	7.6	6.8	6.1	7.6	3.2	9.3
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
pH	pH	6.5-9.0	7.11	6.58	6.8	6.65	6.78	7.08	6.85	6.9	6.83	6.93	6.56	7.36	6.72	7.34	6.54
Reactive Silica (SiO2)	mg/L	-	4.1	3.2	2	1.2	4.2	1.2	3.1	0.80	0.67	4.8	3.4	2.9	2.3	4.0	2.6
Total Suspended Solids	mg/L	Note 7	<1.0	1.0	<1.0	3.2	6.6	3.0	1.6	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	2.0
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	3.4	<2.0
Turbidity	NTU	Note 8	<0.10	0.9	<0.10	1.2	0.33	1.2	0.83	0.58	0.54	0.57	0.16	0.46	0.22	0.2	0.98
Conductivity	uS/cm	-	32	23	27	24	28	32	33	24	24	39	30	43	16	51	33

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-17

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																
			VE04																
Sampling Date			9-Mar-11	31-Mar-11	19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12
Calculated Parameters																			
Anion Sum	me/L	-	0.240	0.250	0.0300	0.190	0.270	0.350	0.270	0.200	0.330	0.300	0.280	0.190	0.360	0.290	0.240	0.250	0.220
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	7	9	<1	8	11	14	10	7	11.5	10.1	10	7.0	14	12	8.5	7.4	6.7
Calculated TDS	mg/L	-	18	18	6	11	16	19	16	13	21	20	20	10	23	17	15	17	15
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.31	0.32	0.22	0.24	0.31	0.35	0.34	0.26	0.35	0.32	0.34	0.21	0.42	0.35	0.31	0.32	0.28
Hardness (CaCO3)	mg/L	-	11	11	6	8	12	14	13	10	13	12	12	6.9	16	13	12	11	9.7
Ion Balance (% Difference)	%	-	12.7	12.3	76	11.6	6.9	0	11.5	13	2.94	3.23	9.68	5.00	7.69	9.38	12.7	12.3	12
Langelier Index (@ 20C)	N/A	-	-3.18	-3.17	NC	-3.13	-2.62	-2.41	-2.79	-3.26	-2.61	-2.75	-2.73	-3.46	-2.20	-2.49	-2.8	-3.1	-3.27
Langelier Index (@ 4C)	N/A	-	-3.43	-3.42	NC	-3.38	-2.87	-2.66	-3.04	-3.51	-2.87	-3	-2.98	-3.72	-2.46	-2.74	-3.06	-3.35	-3.52
Nitrate (N)	mg/L	13	0.10	0.1	<0.05	<0.05	0.24	0.06	<0.05	<0.05	0.11	0.13	0.067	<0.050	0.36	0.069	<0.050	0.077	<0.050
Saturation pH (@ 20C)	N/A	-	9.88	9.8	NC	9.94	9.66	9.47	9.67	9.95	9.59	9.7	9.68	10.1	9.44	9.59	9.76	9.86	9.95
Saturation pH (@ 4C)	N/A	-	10.1	10.1	NC	10.2	9.91	9.72	9.92	10.2	9.85	9.95	9.93	10.3	9.70	9.84	10.0	10.1	10.2
Inorganics																			
Total Alkalinity (Total as CaCO3)	mg/L	-	7	9	<5	8	11	14	10	7	11	10	10	7	14	12	8.5	7.5	6.7
Dissolved Chloride (Cl)	mg/L	120	3	2	1	1	1	2	2	2	3.4	3	2.7	1.6	1.6	1.8	2.4	3.3	3.1
Colour	TCU	Note 5	79	58	53	52	56	35	52	69	58	47	46	49	31	35	75	55	69
Nitrate + Nitrite (N)	mg/L		0.1	0.1	<0.05	<0.05	0.24	0.06	<0.05	<0.05	0.11	0.13	0.067	<0.050	0.37	0.069	<0.050	0.077	<0.050
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	7.5	7.2	7.1	8.7	10	8.9	11	10	8.6	6.8	6.5	7.6	7.5	9.6	13	11	9.9
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.7	6.63	6.62	6.81	7.04	7.06	6.88	6.69	6.98	6.95	6.95	6.60	7.24	7.10	6.96	6.76	6.68
Reactive Silica (SiO2)	mg/L	-	3.5	3.4	<0.5	<0.5	0.7	1.3	1.1	1.6	3	3.9	3.8	<0.50	2.1	1.0	1.5	1.9	2.0
Total Suspended Solids	mg/L	Note 7	2	42	2	<1	<1	2	1	1	1.2	<1.0	12	3.6	9.8	4.6	<2.0	4.6	1.4
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.4	0.7	0.4	0.2	0.3	0.8	0.6	0.6	0.43	0.28	0.72	0.87	1.3	0.56	1.8	1.3	0.94
Conductivity	uS/cm	-	29	27	16	20	27	34	28	24	35	33	33	19	37	29	26	26	23

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-17 **INORGANIC GENERAL CHEMISTRY - SURFACE WATER**

Marathon Gold Corp.

Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report

Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID														
			VE04														
Sampling Date			13-Jan-13	8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	5-Aug-19	1-Nov-19
Calculated Parameters																	
Anion Sum	me/L	-	0.250	0.090	0.070	0.270	0.290	0.340	0.310	0.270	0.210	0.380	0.230	0.370	0.170	0.620	0.330
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	8.5	<1.0	<1.0	9.1	11	13	11	10	7.6	13	5.4	14	6.3	24	8.8
Calculated TDS	mg/L	-	18	11	7	16	19	19	20	15	13	27	17	22	11	39	20
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
Cation Sum	me/L	-	0.3	0.24	0.22	0.30	0.30	0.34	0.36	0.26	0.28	0.47	0.3	0.38	0.19	0.56	0.34
Hardness (CaCO3)	mg/L	-	11	7.8	7.3	11	11	12	14	9.5	9.6	18	10	14	6	20	12
Ion Balance (% Difference)	%	-	9.09	45.5	51.7	5.26	1.69	0	7.46	1.89	14.3	10.6	13.2	1.33	5.56	5.08	1.49
Langelier Index (@ 20C)	N/A	-	-2.83	NC	NC	-2.94	-2.84	-2.45	-2.77	-2.92	-3.05	-2.37	-3.45	-2.41	-3.44	-2.06	-3.08
Langelier Index (@ 4C)	N/A	-	-3.08	NC	NC	-3.19	-3.09	-2.7	-3.02	-3.17	-3.3	-2.62	-3.7	-2.66	-3.7	-2.32	-3.33
Nitrate (N)	mg/L	13	0.072	0.071	<0.050	<0.050	<0.050	0.13	0.12	0.058	0.077	0.1	<0.050	0.26	0.06	1.2	0.25
Saturation pH (@ 20C)	N/A	-	9.8	NC	NC	9.76	9.66	9.57	9.58	9.77	9.9	9.37	10	9.48	10.2	9.13	9.74
Saturation pH (@ 4C)	N/A	-	10.1	NC	NC	10	9.91	9.82	9.83	10	10.2	9.62	10.3	9.73	10.4	9.38	9.99
Inorganics																	
Total Alkalinity (Total as CaCO3)	mg/L	-	8.5	<5.0	<5.0	9.1	11	13	11	10	7.6	13	5.4	14	6.3	24	8.8
Dissolved Chloride (Cl)	mg/L	120	2.6	3.0	2.3	3.1	2.3	2.7	2.7	1.8	1.7	3.7	4.5	2.1	1.4	1.9	3.3
Colour	TCU	Note 5	53	60	47	47	68	25	48	28	73	67	52	42	71	55	49
Nitrate + Nitrite (N)	mg/L		0.072	0.071	<0.050	<0.050	<0.050	0.13	0.12	0.058	0.077	0.1	<0.050	0.26	0.06	1.2	0.25
Nitrite (N)	mg/L	0.06	<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	0.011	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<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	0.31	<0.050
Total Organic Carbon (C)	mg/L	-	8.4	6.2	7.4	10	6.5	6.5	6.5	7.2	10	8.0	8.2	11	8.5	10	10
Orthophosphate (P)	mg/L	-	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.97	**<u>6.46</u>**	6.57	6.82	6.82	7.12	6.81	6.85	6.86	7.00	6.59	7.07	6.74	7.06	6.66
Reactive Silica (SiO2)	mg/L	-	3.4	3.0	<0.50	0.88	3.4	1.3	3.0	0.86	0.66	4.7	2.9	1.6	2.2	2.3	1.4
Total Suspended Solids	mg/L	Note 7	3.0	<1.0	<1.0	2.2	<1.0	3.4	1.8	<1.0	<1.0	<1.0	1.0	1.0	<1.0	<1.0	1.8
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	2.2
Turbidity	NTU	Note 8	1.4	0.25	0.45	0.67	0.43	0.84	0.3	0.93	0.85	0.37	0.41	1.3	0.36	1.7	1.1
Conductivity	uS/cm	-	28	22	20	26	26	32	34	24	25	38	30	36	16	64	30

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-18 **INORGANIC GENERAL CHEMISTRY - SURFACE WATER**
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																	
			VE05																	
Sampling Date			9-Mar-11	31-Mar-11	19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12	13-Jan-13
Calculated Parameters																				
Anion Sum	me/L	-	0.220	0.260	0.210	0.290	0.390	0.490	0.330	0.220	0.360	0.370	0.400	0.270	0.840	0.500	0.350	0.140	0.230	0.340
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	6	8	8	12	19	21	12	7	12.4	13.1	15	11	34	22	14	<1.0	6.8	13
Calculated TDS	mg/L	-	18	20	15	15	26	32	27	17	24	25	27	18	47	31	22	16	16	24
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.29	0.33	0.28	0.16	0.48	0.53	0.51	0.3	0.36	0.37	0.41	0.30	0.86	0.61	0.36	0.34	0.26	0.4
Hardness (CaCO3)	mg/L	-	10	12	10	6	18	19	16	11	13	15	16	11	37	26	14	11	9.2	15
Ion Balance (% Difference)	%	-	13.7	11.9	14.3	28.9	10.3	3.92	21.4	15.4	0.00	0.00	1.23	5.26	1.18	9.91	1.41	41.7	6.12	8.11
Langelier Index (@ 20C)	N/A	-	-3.42	-3.23	-3.12	-2.97	-2.26	-2.08	-2.67	-3.25	-2.65	-2.45	-2.46	-2.94	-1.32	-1.86	-2.25	NC	-3.33	-2.35
Langelier Index (@ 4C)	N/A	-	-3.67	-3.49	-3.37	-3.22	-2.51	-2.33	-2.92	-3.5	-2.9	-2.7	-2.71	-3.19	-1.57	-2.11	-2.51	NC	-3.58	-2.6
Nitrate (N)	mg/L	13	0.3	0.38	0.12	0.1	0.11	0.3	0.09	0.1	0.34	0.30	0.33	0.069	0.053	<0.050	0.058	0.29	0.18	0.22
Saturation pH (@ 20C)	N/A	-	10	9.81	9.88	9.92	9.25	9.21	9.52	9.91	9.60	9.52	9.42	9.72	8.69	9.03	9.53	NC	10	9.54
Saturation pH (@ 4C)	N/A	-	10.3	10.1	10.1	10.2	9.5	9.46	9.77	10.2	9.85	9.77	9.67	9.97	8.94	9.28	9.79	NC	10.3	9.79
Inorganics																				
Total Alkalinity (Total as CaCO3)	mg/L	-	6	8	8	12	19	21	13	7	12	13	15	11	34	22	14	<5.0	6.8	13
Dissolved Chloride (Cl)	mg/L	120	3	2	1	1	<1	2	2	2	2.9	3	2.6	1.6	2.0	1.9	2.4	4.1	2.9	2.6
Colour	TCU	Note 5	28	22	36	29	37	29	32	44	14	17	18	35	22	43	23	90	27	14
Nitrate + Nitrite (N)	mg/L		0.3	0.38	0.12	0.10	0.11	0.30	0.09	0.10	0.34	0.3	0.33	0.069	0.053	<0.050	0.058	0.29	0.18	0.22
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<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	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	5.9	4.8	6.8	6.6	6.9	6.7	8.6	9.2	4.3	5.0	5.0	7.4	6.5	9.4	8.1	12	7.8	5.9
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.61	6.58	6.76	6.95	6.99	7.13	6.85	6.66	6.95	7.07	6.96	6.78	7.37	7.17	7.28	**<u>6.41</u>**	6.69	7.19
Reactive Silica (SiO2)	mg/L	-	4	4.4	2.6	2.5	3.9	4.5	4.0	3.3	4.9	5.6	5.5	3.3	2.3	3.3	2.6	3.5	3.6	5
Total Suspended Solids	mg/L	Note 7	5	<1	3	3	5	2	24	<1	9.8	<1.0	2.8	<1.0	4.0	1.4	<1.0	11	<1.0	3.0
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	4.2	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	1.2	0.4	0.1	0.3	1.3	0.8	2.0	0.2	0.73	0.53	4.0	<0.10	0.70	0.40	1.3	2.9	0.26	9.0
Conductivity	uS/cm	-	29	30	25	31	40	46	33	27	36	39	40	28	79	54	36	27	25	37

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-18

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID													
			VE05													
Sampling Date			8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	3-Aug-15	18-Jul-16	4-Feb-17	10-Feb-18	5-Sep-18	29-Apr-19	6-Aug-19	1-Nov-19
Calculated Parameters																
Anion Sum	me/L	-	0.260	0.180	0.080	0.580	0.770	0.490	0.810	0.390	0.390	0.280	0.330	0.210	0.640	0.360
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	8.3	5.3	<1.0	22	34	19	34	17	13	6.7	11	8.0	32	8.5
Calculated TDS	mg/L	-	18	14	11	37	46	33	45	25	28	19	24	14	43	26
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
Cation Sum	me/L	-	0.29	0.29	0.25	0.56	0.77	0.53	0.76	0.46	0.42	0.31	0.56	0.2	0.73	0.42
Hardness (CaCO3)	mg/L	-	10	10	8.2	23	32	22	33	17	17	10	22	6.8	28	15
Ion Balance (% Difference)	%	-	5.45	23.4	51.5	1.75	0	3.92	3.18	8.24	3.7	5.08	25.8	2.44	6.57	7.69
Langelier Index (@ 20C)	N/A	-	-3.17	-3.42	NC	-2.18	-1.23	-2.07	-1.61	-2.3	-2.47	-3.4	-3.24	-3.29	-1.93	-3.35
Langelier Index (@ 4C)	N/A	-	-3.42	-3.67	NC	-2.43	-1.48	-2.32	-1.86	-2.55	-2.72	-3.65	-3.49	-3.54	-2.18	-3.61
Nitrate (N)	mg/L	13	0.2	0.11	<0.050	0.13	0.13	0.55	0.083	0.11	0.55	0.21	<0.050	0.17	0.11	0.66
Saturation pH (@ 20C)	N/A	-	9.87	10.1	NC	9.08	8.75	9.16	8.73	9.34	9.44	9.98	9.41	10.1	8.85	9.69
Saturation pH (@ 4C)	N/A	-	10.1	10.3	NC	9.33	9	9.41	8.98	9.59	9.7	10.2	9.66	10.3	9.11	9.94
Inorganics																
Total Alkalinity (Total as CaCO3)	mg/L	-	8.3	5.3	<5.0	22	35	19	34	17	13	6.7	11	8	32	8.5
Dissolved Chloride (Cl)	mg/L	120	2.8	2.5	2.9	2.5	2.4	2.4	2.2	1.5	3.1	4.5	3.7	1.3	<1.0	5.1
Colour	TCU	Note 5	47	52	89	31	16	13	24	42	21	23	420	33	54	67
Nitrate + Nitrite (N)	mg/L		0.2	0.11	<0.050	0.13	0.13	0.55	0.083	0.11	0.55	0.21	<0.050	0.17	0.11	0.66
Nitrite (N)	mg/L	0.06	<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	Note 6	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.071	<0.050	<0.050	<0.050	<0.050	0.18	<0.050
Total Organic Carbon (C)	mg/L	-	5.3	10	14	4.4	5.7	3.8	6.2	6.9	5.2	5.2	41.0	7.3	8.3	11
Orthophosphate (P)	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	0.01	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.7	6.65	**5.78**	6.9	7.52	7.09	7.12	7.04	6.98	6.58	**6.17**	6.77	6.92	**6.34**
Reactive Silica (SiO2)	mg/L	-	3.7	2.1	2.9	6.1	5.8	6.1	4.1	3.7	5.8	3.8	2.2	3.0	5.4	4.4
Total Suspended Solids	mg/L	Note 7	1.0	1.2	3.0	7.2	30	<1.0	<1.0	<1.0	6.4	2.6	2.4	<1.0	5.6	1.6
Dissolved Sulphate (SO4)	mg/L	-	<2.0	<2.0	<2.0	2.7	<2.0	<2.0	2.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.51	0.48	0.4	1.6	2.7	0.44	0.72	1.1	1.4	0.18	2.4	0.35	2.8	0.69
Conductivity	uS/cm	-	28	25	20	56	70	51	73	43	40	31	38	18	64	36

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-19

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																
			VE06																
Sampling Date			9-Mar-11	31-Mar-11	19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	31-Oct-12	27-Nov-12
Calculated Parameters																			
Anion Sum	me/L	-	0.250	0.400	0.280	0.310	0.410	0.750	0.310	0.190	0.640	0.380	0.390	0.280	0.740	0.530	0.280	0.240	0.220
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	8	16	11	13	17	34	12	6	27.8	13.8	15	12	31	24	11	5.6	6.5
Calculated TDS	mg/L	-	19	28	19	19	25	41	21	15	40	26	26	18	41	33	21	19	16
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.32	0.49	0.37	0.36	0.49	0.74	0.41	0.27	0.66	0.40	0.40	0.36	0.80	0.63	0.34	0.34	0.26
Hardness (CaCO3)	mg/L	-	12	20	15	14	20	32	16	10	28	16	16	14	34	26	13	11	9.1
Ion Balance (% Difference)	%	-	12.3	10.1	13.9	7.46	8.89	0.67	13.9	17.4	1.54	2.56	1.27	12.5	3.9	8.62	9.68	17.2	8.33
Langelier Index (@ 20C)	N/A	-	-3.07	-2.48	-2.57	-2.57	-2.27	-1.36	-2.64	-3.44	-1.73	-2.42	-2.47	-2.69	-1.48	-1.81	-2.51	-3.64	-3.34
Langelier Index (@ 4C)	N/A	-	-3.32	-2.73	-2.82	-2.82	-2.52	-1.62	-2.9	-3.69	-1.98	-2.67	-2.72	-2.94	-1.73	-2.07	-2.76	-3.89	-3.59
Nitrate (N)	mg/L	13	0.21	0.25	0.06	<0.05	0.20	0.05	0.06	0.11	0.17	0.29	0.30	<0.050	<0.050	0.053	0.072	0.3	0.16
Saturation pH (@ 20C)	N/A	-	9.81	9.29	9.54	9.51	9.25	8.75	9.51	10	8.89	9.46	9.43	9.57	8.77	8.99	9.65	10	10
Saturation pH (@ 4C)	N/A	-	10.1	9.54	9.79	9.76	9.5	9.01	9.77	10.3	9.14	9.71	9.68	9.82	9.02	9.25	9.90	10.3	10.3
Inorganics																			
Total Alkalinity (Total as CaCO3)	mg/L	-	8	16	11	13	17	34	12	6	28	14	15	12	31	24	11	5.6	6.5
Dissolved Chloride (Cl)	mg/L	120	2	2	2	2	2	2	3	2	2.5	2.8	2.5	1.8	2.1	2.0	2.1	3.9	2.8
Colour	TCU	Note 5	46	34	55	67	63	29	61	64	28	16	19	57	28	39	37	77	26
Nitrate + Nitrite (N)	mg/L		0.21	0.25	0.06	<0.05	0.20	0.05	0.06	0.11	0.17	0.29	0.30	<0.050	<0.050	0.053	0.072	0.3	0.16
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6.4	4.5	7.1	8.7	9.3	6.3	12	10	4.1	5.0	5.1	9.3	8.3	9.1	10	11	7.7
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.74	6.81	6.97	6.94	6.98	7.39	6.87	6.58	7.16	7.04	6.96	6.88	7.29	7.18	7.14	**<u>6.41</u>**	6.7
Reactive Silica (SiO2)	mg/L	-	4.2	5.2	2.4	1.8	2.4	3.2	3.4	3.1	6.6	5.6	5.5	2.4	0.89	3.4	4.6	3.5	3.7
Total Suspended Solids	mg/L	Note 7	2	<1	2	1	<2	1	2	<1	1.8	<1.0	4.8	1.6	4.6	<1.0	<1.0	9.0	<1.0
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	3.1	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.6	0.5	0.3	0.6	0.7	1	0.6	0.6	0.40	0.44	4.1	0.60	0.99	0.48	0.43	2.5	0.3
Conductivity	uS/cm	-	31	45	34	35	47	73	35	25	69	39	40	32	70	55	30	29	24

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-19

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID														
			VE06														
Sampling Date			13-Jan-13	8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	3-Aug-15	18-Jul-16	4-Feb-17	10-Feb-18	5-Sep-18	29-Apr-19	6-Aug-19	1-Nov-19
Calculated Parameters																	
Anion Sum	me/L	-	0.330	0.230	0.080	0.080	0.580	0.780	0.500	0.800	0.420	0.360	0.400	0.950	0.220	0.990	0.400
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	12	7.3	<1.0	<1.0	22	35	19	34	19	13	13	41	8.3	41	9.3
Calculated TDS	mg/L	-	24	17	11	11	41	45	33	45	27	27	25	55	15	57	28
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
Cation Sum	me/L	-	0.41	0.29	0.31	0.25	0.67	0.73	0.52	0.78	0.48	0.44	0.39	0.98	0.22	0.98	0.46
Hardness (CaCO3)	mg/L	-	15	10	11	8.2	26	32	22	34	18	17	15	43	7.5	43	17
Ion Balance (% Difference)	%	-	10.8	11.5	59	51.5	7.2	3.31	1.96	1.27	6.67	10	1.27	1.55	0	0.51	6.98
Langelier Index (@ 20C)	N/A	-	-2.35	-3.2	NC	NC	-2.11	-1.19	-2.12	-1.54	-2.17	-2.55	-2.64	-1.05	-3.38	-0.818	-2.83
Langelier Index (@ 4C)	N/A	-	-2.6	-3.46	NC	NC	-2.36	-1.44	-2.37	-1.79	-2.42	-2.81	-2.89	-1.30	-3.63	-1.07	-3.09
Nitrate (N)	mg/L	13	0.24	0.21	0.12	<0.050	0.12	0.13	0.69	0.067	0.11	0.49	0.2	0.071	0.21	0.12	0.66
Saturation pH (@ 20C)	N/A	-	9.55	9.91	NC	NC	9.03	8.75	9.17	8.73	9.28	9.45	9.49	8.55	10	8.54	9.61
Saturation pH (@ 4C)	N/A	-	9.80	10.2	NC	NC	9.28	9.00	9.42	8.98	9.53	9.70	9.74	8.80	10.3	8.79	9.86
Inorganics																	
Total Alkalinity (Total as CaCO3)	mg/L	-	12	7.3	<5.0	<5.0	22	35	19	34	19	13	13	41	8.3	42	9.3
Dissolved Chloride (Cl)	mg/L	120	2.6	2.5	2.4	2.7	2.7	2.5	2.5	2.3	1.4	2.4	4.3	2.7	1.3	2	4.4
Colour	TCU	Note 5	12	49	57	90	29	15	12	27	40	17	32	25	36	27	71
Nitrate + Nitrite (N)	mg/L		0.24	0.21	0.12	<0.050	0.12	0.13	0.69	0.067	0.11	0.49	0.2	0.071	0.21	0.12	0.66
Nitrite (N)	mg/L	0.06	<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	Note 6	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.11	0.057	<0.050	<0.050	<0.050	0.06	<0.050
Total Organic Carbon (C)	mg/L	-	5	5.4	9.9	14	4.3	5.6	3.7	6.0	6.7	5.3	5.7	6.7	7.8	6.1	12
Orthophosphate (P)	mg/L	-	<0.010	<0.010	<0.010	<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	pH	6.5-9.0	7.2	6.71	6.57	**<u>5.78</u>**	6.92	7.56	7.05	7.19	7.11	6.9	6.85	7.5	6.62	7.72	6.77
Reactive Silica (SiO2)	mg/L	-	5.0	3.6	2.1	2.9	6.0	5.8	6.1	4.1	3.6	5.7	4.3	5.6	3.0	6.2	4.0
Total Suspended Solids	mg/L	Note 7	21	<1.0	<1.0	3.0	6.8	1.2	<1.0	<1.0	11	17	1.2	8.8	<1.0	<1.0	3.4
Dissolved Sulphate (SO4)	mg/L	-	<2.0	<2.0	<2.0	<2.0	2.6	<2.0	<2.0	2.8	<2.0	<2.0	<2.0	2.4	<2.0	4.4	2.1
Turbidity	NTU	Note 8	4.1	1.2	0.54	0.47	2.0	0.13	0.76	0.54	1.3	2.6	0.2	0.87	0.39	0.65	2.8
Conductivity	uS/cm	-	37	28	25	20	55	71	50	73	41	42	41	92	21	90	43

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-20

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																
			VE07																
Sampling Date			9-Mar-11	31-Mar-11	19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12
Calculated Parameters																			
Anion Sum	me/L	-	0.200	0.420	0.260	0.340	0.510	0.640	0.330	0.190	0.600	0.360	0.370	0.290	0.880	0.470	0.290	0.130	0.220
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	6	14	11	15	21	28	12	6	25.5	12.8	14	12	37	21	11	<1.0	6.6
Calculated TDS	mg/L	-	17	28	17	21	32	36	23	15	39	25	31	19	48	29	21	15	16
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.31	0.44	0.34	0.42	0.58	0.65	0.43	0.27	0.64	0.36	0.57	0.39	0.87	0.58	0.35	0.33	0.27
Hardness (CaCO3)	mg/L	-	11	18	13	17	24	28	17	10	26	14	19	15	38	24	13	11	9.4
Ion Balance (% Difference)	%	-	21.6	2.33	13.3	10.5	6.42	0.78	13.2	17.4	3.23	0	21.3	14.7	0.57	10.5	9.38	43.5	10.2
Langelier Index (@ 20C)	N/A	-	-3.43	-2.66	-2.71	-2.48	-2.11	-1.71	-2.62	-3.41	-1.82	-2.47	-2.51	-2.7	-1.24	-1.91	-2.53	NC	-3.33
Langelier Index (@ 4C)	N/A	-	-3.68	-2.92	-2.97	-2.73	-2.37	-1.96	-2.87	-3.66	-2.07	-2.73	-2.76	-2.96	-1.49	-2.16	-2.78	NC	-3.58
Nitrate (N)	mg/L	13	0.22	0.29	0.08	0.06	0.61	0.17	0.06	0.11	0.21	0.35	0.32	<0.050	0.060	<0.050	0.074	0.2	0.17
Saturation pH (@ 20C)	N/A	-	9.98	9.41	9.62	9.39	9.09	8.9	9.48	10	8.96	9.54	9.44	9.53	8.64	9.09	9.64	NC	10
Saturation pH (@ 4C)	N/A	-	10.2	9.67	9.88	9.64	9.35	9.15	9.73	10.3	9.21	9.8	9.69	9.79	8.89	9.34	9.89	NC	10.3
Inorganics																			
Total Alkalinity (Total as CaCO3)	mg/L	-	6	14	11	15	21	28	12	6	26	13	14	12	37	21	11	<5.0	6.6
Dissolved Chloride (Cl)	mg/L	120	2	2	2	2	2	2	3	2	2.7	2.7	2.6	1.7	1.7	1.9	2.2	4	2.8
Colour	TCU	Note 5	42	28	45	52	47	32	61	59	20	17	20	56	19	54	40	100	30
Nitrate + Nitrite (N)	mg/L		0.22	0.29	0.08	0.06	0.61	0.17	0.06	0.11	0.21	0.35	0.32	<0.050	0.060	<0.050	0.074	0.2	0.17
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	0.09	<0.05	<0.050	<0.050	<0.050	<0.050	0.052	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6.4	4.3	7.1	8.1	7.7	6.5	11	9.6	4.6	4.9	5.1	8.8	5.7	12	11	13	7.4
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	0.015	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.55	6.75	6.91	6.91	6.98	7.19	6.86	6.61	7.14	7.07	6.93	6.83	7.40	7.18	7.11	**6.1**	6.69
Reactive Silica (SiO2)	mg/L	-	4	5	2.4	2	3.5	3.7	3.6	3.2	6.4	5.5	5.5	2.6	2.5	2.7	4.8	3.3	3.7
Total Suspended Solids	mg/L	Note 7	<1	1	1	1	2	1	2	<1	17	<1.0	39	<1.0	<1.0	<1.0	<1.0	10	<1.0
Dissolved Sulphate (SO4)	mg/L	-	<2	3	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	4.3	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.5	0.3	0.2	0.3	0.4	0.8	0.7	0.7	4.6	0.48	10	0.33	0.36	0.63	0.65	1.1	0.23
Conductivity	uS/cm	-	29	41	32	36	54	65	36	26	66	39	40	32	82	48	31	25	24

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-20

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID														
			VE07														
Sampling Date			13-Jan-13	8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	3-Aug-15	17-Jul-16	4-Feb-17	10-Feb-18	5-Sep-18	29-Apr-19	6-Aug-19	1-Nov-19
Calculated Parameters																	
Anion Sum	me/L	-	0.340	0.250	0.070	0.260	0.600	0.770	0.480	0.800	0.410	0.390	0.360	0.860	0.210	1.040	0.330
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	13	8.1	<1.0	8.5	23	34	20	34	18	13	11	39	7.8	44	7.9
Calculated TDS	mg/L	-	24	18	11	16	38	45	32	45	26	29	23	51	14	60	25
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
Cation Sum	me/L	-	0.4	0.29	0.28	0.29	0.59	0.74	0.53	0.75	0.47	0.47	0.35	0.95	0.21	1.02	0.45
Hardness (CaCO3)	mg/L	-	15	10	9.8	11	24	32	22	33	18	18	13	41	7.5	45	17
Ion Balance (% Difference)	%	-	8.11	7.41	60	5.45	0.84	1.99	4.95	3.23	6.82	9.3	1.41	4.97	0	0.97	15.4
Langelier Index (@ 20C)	N/A	-	-2.34	-3.17	NC	-3.28	-2.14	-1.25	-1.99	-1.59	-2.34	-2.52	-2.9	-1.43	-3.3	-1.21	-3.23
Langelier Index (@ 4C)	N/A	-	-2.59	-3.42	NC	-3.53	-2.39	-1.5	-2.24	-1.85	-2.59	-2.77	-3.15	-1.68	-3.55	-1.46	-3.48
Nitrate (N)	mg/L	13	0.21	0.2	0.12	<0.050	0.12	0.13	0.29	0.099	0.11	0.72	0.2	0.07	0.17	0.13	0.68
Saturation pH (@ 20C)	N/A	-	9.52	9.88	NC	9.81	9.05	8.76	9.14	8.75	9.3	9.42	9.62	8.58	10	8.49	9.69
Saturation pH (@ 4C)	N/A	-	9.77	10.1	NC	10.1	9.3	9.01	9.4	9	9.55	9.67	9.87	8.83	10.3	8.74	9.94
Inorganics																	
Total Alkalinity (Total as CaCO3)	mg/L	-	13	8.1	<5.0	8.5	23	35	20	34	18	13	11	39	7.8	44	7.9
Dissolved Chloride (Cl)	mg/L	120	2.6	2.8	2.4	3.2	2.6	2.5	2.3	2.3	1.4	2.5	4.4	2.4	1.3	2.2	4.5
Colour	TCU	Note 5	14	48	50	59	31	17	11	26	41	18	31	28	43	23	78
Nitrate + Nitrite (N)	mg/L		0.21	0.2	0.12	<0.050	0.12	0.13	0.29	0.099	0.11	0.72	0.2	0.07	0.17	0.13	0.68
Nitrite (N)	mg/L	0.06	<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	Note 6	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.093	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	6.2	5.1	9.9	11	4.2	5.9	3.8	6.2	6.9	5.4	5.5	6.5	7.7	5.7	13
Orthophosphate (P)	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	0.01	<0.010	<0.010	0.011	<0.010	<0.010
pH	pH	6.5-9.0	7.18	6.71	6.62	6.53	6.91	7.51	7.16	7.15	6.96	6.9	6.72	7.16	6.73	7.28	**<u>6.46</u>**
Reactive Silica (SiO2)	mg/L	-	5.0	3.6	2.1	1.1	6.1	5.9	6.1	4.1	3.6	5.7	4.3	6.0	3.0	6.3	4.2
Total Suspended Solids	mg/L	Note 7	32	1.2	<1.0	4.0	10	34	<1.0	<1.0	<1.0	3.0	1.6	2.0	<1.0	2.6	1.8
Dissolved Sulphate (SO4)	mg/L	-	<2.0	<2.0	<2.0	<2.0	2.7	<2.0	<2.0	2.7	<2.0	<2.0	<2.0	<2.0	<2.0	3.9	<2.0
Turbidity	NTU	Note 8	15	1.1	0.6	1.2	1.5	5.4	0.48	0.91	1.3	8.9	0.2	0.63	1.2	0.73	3.0
Conductivity	uS/cm	-	37	29	25	25	55	70	50	72	43	41	38	88	20	96	39

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-21

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID													
			VE08													
Sampling Date			19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	19-Mar-12	18-May-12	17-Sep-12	1-Nov-12	27-Nov-12	13-Jan-13	8-Mar-13	26-May-13
Calculated Parameters																
Anion Sum	me/L	-	0.040	0.120	0.680	0.250	0.220	0.0900	0.230	0.160	0.170	0.150	0.130	0.520	0.260	0.080
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	5	31	10	7	<1	5.6	5.6	5.1	<1.0	<1.0	21	8.0	<1.0
Calculated TDS	mg/L	-	6	9	43	19	17	10	19	11	14	15	13	34	18	8
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.18	0.21	0.76	0.32	0.29	0.2	0.29	0.20	0.22	0.29	0.24	0.55	0.3	0.23
Hardness (CaCO3)	mg/L	-	5	7	32	11	10	7	9.2	6.4	7.5	9.0	7.7	23	10	6.7
Ion Balance (% Difference)	%	-	63.6	27.3	5.56	12.3	13.7	37.9	11.5	11.1	12.8	31.8	29.7	2.8	7.14	48.4
Langelier Index (@ 20C)	N/A	-	NC	-3.85	-1.81	-3.43	-3.66	NC	-4.05	-4.22	-3.93	NC	NC	-1.63	-3.18	NC
Langelier Index (@ 4C)	N/A	-	NC	-4.1	-2.06	-3.68	-3.91	NC	-4.3	-4.48	-4.18	NC	NC	-1.88	-3.44	NC
Nitrate (N)	mg/L	13	0.19	0.17	<0.05	0.18	0.15	0.21	0.49	0.16	0.18	0.49	0.61	0.3	0.2	0.19
Saturation pH (@ 20C)	N/A	-	NC	10.3	8.79	9.81	10	NC	10.2	10.3	10.2	NC	NC	9.10	9.87	NC
Saturation pH (@ 4C)	N/A	-	NC	10.5	9.04	10.1	10.3	NC	10.4	10.5	10.5	NC	NC	9.35	10.1	NC
Inorganics																
Total Alkalinity (Total as CaCO3)	mg/L	-	<5	5	31	10	7	<5	5.6	5.6	5.1	<5.0	<5.0	21	8.0	<5.0
Dissolved Chloride (Cl)	mg/L	120	1	<1	2	2	3	3	2.9	1.2	1.9	4.1	3	2.7	2.9	2.4
Colour	TCU	Note 5	44	39	45	65	41	35	23	41	37	55	29	24	52	44
Nitrate + Nitrite (N)	mg/L		0.19	0.17	<0.05	0.18	0.15	0.21	0.49	0.16	0.18	0.49	0.61	0.3	0.2	0.19
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	9.5	10	10	16	12	8.4	5.1	10	11	9.8	7.6	6.5	5.5	9.6
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	**6.40**	**6.42**	6.98	**6.38**	**6.38**	**6.09**	**6.14**	**6.06**	**6.31**	**5.94**	**5.88**	7.47	6.69	**6.00**
Reactive Silica (SiO2)	mg/L	-	<0.5	0.6	7.8	4.5	3.7	2.8	4.4	1.9	4.0	2.7	2.7	6.6	3.6	<0.5
Total Suspended Solids	mg/L	Note 7	6	24	12	2	2	<1	60	<1.0	<1.0	1.4	<1.0	2.0	<1.0	<1.0
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.1	0.3	3.4	0.7	0.5	0.1	8.4	<0.10	0.25	0.36	0.16	0.18	0.85	0.13
Conductivity	uS/cm	-	16	17	62	28	26	21	26	19	20	26	23	53	28	20

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-21

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID									
			VE08									
Sampling Date			30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	5-Sep-18	28-Apr-19	1-Nov-19
Calculated Parameters												
Anion Sum	me/L	-	0.230	0.110	0.940	0.550	0.480	0.440	0.390	0.350	0.060	0.200
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	6.7	<1.0	43	19	21	19	14	15	<1.0	<1.0
Calculated TDS	mg/L	-	16	14	56	36	31	30	28	24	8	20
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
Cation Sum	me/L	-	0.27	0.25	0.92	0.54	0.48	0.53	0.42	0.36	0.15	0.33
Hardness (CaCO3)	mg/L	-	9.3	7.1	41	23	19	21	17	13	4	11
Ion Balance (% Difference)	%	-	8.0	38.9	1.08	0.92	0	9.28	3.7	1.41	42.9	24.5
Langelier Index (@ 20C)	N/A	-	-4.02	NC	-0.848	-2.07	-2.09	-1.67	-2.51	-3.17	NC	NC
Langelier Index (@ 4C)	N/A	-	-4.27	NC	-1.1	-2.32	-2.34	-1.92	-2.76	-3.42	NC	NC
Nitrate (N)	mg/L	13	0.15	0.72	0.056	0.56	0.091	0.12	0.58	0.066	0.31	0.99
Saturation pH (@ 20C)	N/A	-	10.0	NC	8.55	9.15	9.18	9.18	9.44	9.57	NC	NC
Saturation pH (@ 4C)	N/A	-	10.3	NC	8.8	9.41	9.43	9.43	9.69	9.83	NC	NC
Inorganics												
Total Alkalinity (Total as CaCO3)	mg/L	-	6.7	<5.0	43	19	21	19	14	15	<5.0	<5.0
Dissolved Chloride (Cl)	mg/L	120	3.0	2.1	2.7	2.4	2.0	1.6	2.7	1.7	1.3	4.6
Colour	TCU	Note 5	58	28	23	15	45	43	17	40	37	44
Nitrate + Nitrite (N)	mg/L		0.15	0.72	0.056	0.56	0.091	0.12	0.59	0.066	0.31	0.99
Nitrite (N)	mg/L	0.06	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<0.050	<0.050	<0.050	<0.050	<0.050	0.092	<0.050	0.075	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	13	5.9	7.0	3.9	11	9.1	5.2	17	7.5	8.2
Orthophosphate (P)	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	0.011	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	**<u>6.01</u>**	**<u>4.61</u>**	7.70	7.09	7.09	7.51	6.93	**<u>6.40</u>**	**<u>5.99</u>**	**<u>5.65</u>**
Reactive Silica (SiO2)	mg/L	-	3.0	3.6	9.0	6.0	5.8	5.8	5.8	4.7	2.4	4.2
Total Suspended Solids	mg/L	Note 7	1.2	**<u>88</u>**	3.8	<1.0	25	<1.0	1.4	35	2	<1.0
Dissolved Sulphate (SO4)	mg/L	-	<2.0	<2.0	<2.0	2.8	<2.0	<2.0	<2.0	1.4	<2.0	<2.0
Turbidity	NTU	Note 8	0.12	4.8	0.22	0.49	3.2	0.3	0.39	<2.0	0.44	1.7
Conductivity	uS/cm	-	25	31	86	50	40	46	35	39	15	33

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-22

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID												
			VE09												
Sampling Date			19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12
Calculated Parameters															
Anion Sum	me/L	-	0.300	0.570	0.700	0.740	0.320	0.220	0.400	0.270	0.910	0.660	0.270	0.250	0.230
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	13	27	33	34	12	7	15	11	44	31	11	5.8	6.6
Calculated TDS	mg/L	-	19	31	39	42	22	16	26	17	49	40	19	19	16
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.42	0.57	0.7	0.72	0.4	0.29	0.40	0.34	0.82	0.66	0.35	0.34	0.26
Hardness (CaCO3)	mg/L	-	16	22	28	30	15	11	15	12	34	26	13	11	8.9
Ion Balance (% Difference)	%	-	16.7	0.00	0.00	1.37	11.1	13.7	0.00	11.5	5.2	0.00	12.9	15.3	6.12
Langelier Index (@ 20C)	N/A	-	-2.49	-2.09	-1.79	-1.45	-2.75	-3.23	-2.59	-2.94	-1.48	-1.86	-2.65	-3.5	-3.43
Langelier Index (@ 4C)	N/A	-	-2.74	-2.34	-2.04	-1.7	-3	-3.49	-2.84	-3.20	-1.74	-2.11	-2.9	-3.75	-3.68
Nitrate (N)	mg/L	13	0.06	<0.05	<0.05	0.06	0.23	0.12	0.44	<0.050	<0.050	<0.050	0.054	0.21	0.25
Saturation pH (@ 20C)	N/A	-	9.51	9.07	8.88	8.85	9.57	9.95	9.49	9.69	8.68	8.93	9.66	10	10.1
Saturation pH (@ 4C)	N/A	-	9.76	9.32	9.13	9.1	9.82	10.2	9.74	9.95	8.94	9.18	9.91	10.3	10.3
Inorganics															
Total Alkalinity (Total as CaCO3)	mg/L	-	13	27	33	34	12	7	15	11	44	31	11	5.8	6.6
Dissolved Chloride (Cl)	mg/L	120	1	1	1	2	3	2	2.5	1.4	1.4	1.2	1.6	4.0	2.8
Colour	TCU	Note 5	61	47	36	35	34	53	21	45	23	28	41	66	33
Nitrate + Nitrite (N)	mg/L		0.06	<0.05	<0.05	0.06	0.23	0.12	0.44	<0.050	<0.050	<0.050	0.054	0.21	0.25
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	10	9.0	8.2	8.1	9.2	9.4	5.4	9.1	7.2	8.1	11	11	8.6
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	7.02	6.98	7.09	7.40	6.82	6.72	6.9	6.75	7.2	7.07	7.01	6.52	6.64
Reactive Silica (SiO2)	mg/L	-	0.8	1.4	2.5	4.3	3.2	3.4	4.9	1.9	3.2	3.0	3.4	3.4	3.5
Total Suspended Solids	mg/L	Note 7	1	3	<1	2	1	<1	2.2	<1.0	1.0	1.0	<1.0	9.0	1.0
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.5	0.4	0.6	0.9	0.3	0.2	0.32	0.15	0.91	1.2	0.37	2.0	0.35
Conductivity	uS/cm	-	33	53	62	68	34	27	41	27	78	61	29	27	25

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-22 **INORGANIC GENERAL CHEMISTRY - SURFACE WATER**
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	**UNITS**	**CWQG FAL**	**Sample ID**													
			VE09													
Sampling Date			13-Jan-13	8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	1-Nov-19
Calculated Parameters																
Anion Sum	me/L	-	0.470	0.200	0.210	0.290	0.470	0.830	0.120	0.560	0.370	0.330	0.260	0.970	0.200	0.410
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	19	5.6	7.6	10	21	40	<1.0	26	17	11	5.9	45	7.4	7.5
Calculated TDS	mg/L	-	30	13	14	20	30	50	13	30	23	23	18	57	14	30
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
Cation Sum	me/L	-	0.48	0.22	0.33	0.39	0.52	0.74	0.23	0.47	0.42	0.34	0.24	0.92	0.21	0.48
Hardness (CaCO3)	mg/L	-	18	7.2	12	15	21	26	7.7	18	15	13	7.8	35	6.9	18
Ion Balance (% Difference)	%	-	1.05	4.76	22.2	14.7	5.05	5.73	31.4	8.74	6.33	1.49	4	2.65	2.44	7.87
Langelier Index (@ 20C)	N/A	-	-1.98	-3.66	-3.17	-2.99	-2.21	-1.9	NC	-2.25	-2.55	-2.8	-3.88	-1.62	-3.54	-3.36
Langelier Index (@ 4C)	N/A	-	-2.23	-3.92	-3.42	-3.24	-2.46	-2.15	NC	-2.51	-2.8	-3.05	-4.13	-1.87	-3.79	-3.61
Nitrate (N)	mg/L	13	0.27	0.067	<0.050	<0.050	0.10	<0.050	0.70	<0.050	0.084	0.28	0.28	<0.050	0.2	0.9
Saturation pH (@ 20C)	N/A	-	9.3	10.2	9.87	9.62	9.21	8.82	NC	9.14	9.43	9.63	10.2	8.65	10.1	9.74
Saturation pH (@ 4C)	N/A	-	9.55	10.4	10.1	9.87	9.46	9.07	NC	9.39	9.68	9.89	10.4	8.9	10.4	9.99
Inorganics																
Total Alkalinity (Total as CaCO3)	mg/L	-	19	5.6	7.6	10	21	40	<5.0	26	17	11	5.9	45	7.4	7.5
Dissolved Chloride (Cl)	mg/L	120	2.3	2.8	1.9	2.8	1.7	1.5	2.5	1.4	1.3	3.0	4.4	2.4	1.2	5.5
Colour	TCU	Note 5	20	46	69	44	31	29	23	30	43	25	18	35	50	100
Nitrate + Nitrite (N)	mg/L		0.27	0.067	<0.050	<0.050	0.10	<0.050	0.7	<0.050	0.084	0.29	0.28	<0.050	0.2	0.9
Nitrite (N)	mg/L	0.06	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<0.050	<0.050	<0.050	<0.050	<0.050	0.064	<0.050	<0.050	0.084	<0.050	<0.050	0.15	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	5.0	4.5	11	11	5.6	7.0	4.8	8.2	10	5.7	5.1	10	8.7	12
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
pH	pH	6.5-9.0	7.32	6.5	6.7	6.63	7.00	6.92	**<u>6.01</u>**	6.89	6.88	6.83	**<u>6.30</u>**	7.03	6.58	**<u>6.38</u>**
Reactive Silica (SiO2)	mg/L	-	5.1	2.0	1.1	2.7	5.2	3.3	3.1	2.8	1.9	5.0	3.8	4.7	2.9	4.7
Total Suspended Solids	mg/L	Note 7	8.8	<1.0	<1.0	<1.0	71	3.8	<1.0	25	<1.0	<2.0	4.0	2.2	<1.0	1.0
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	2.1
Turbidity	NTU	Note 8	1.6	0.10	0.20	0.15	0.23	5.8	0.43	1.3	0.57	0.47	0.16	1.7	0.41	1.6
Conductivity	uS/cm	-	49	22	28	27	46	71	24	43	38	34	28	92	19	41

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-23

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID																
			VE10																
Sampling Date			19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	14-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12	13-Jan-13	8-Mar-13
Calculated Parameters																			
Anion Sum	me/L	-	0.370	0.280	0.460	0.630	0.320	0.210	0.370	0.310	0.310	0.260	0.530	0.550	0.290	0.300	0.230	0.290	0.210
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	7	12	21	29	12	7	13.6	11.4	11	11	27	26	12	8.7	7.2	10	6.1
Calculated TDS	mg/L	-	18	16	26	38	21	15	24	23	21	16	27	33	20	21	17	21	13
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	<1	<1	<1	<1	<1	<1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cation Sum	me/L	-	0.24	0.34	0.5	0.62	0.36	0.27	0.35	0.38	0.31	0.30	0.57	0.63	0.38	0.37	0.27	0.34	0.21
Hardness (CaCO3)	mg/L	-	8	13	20	25	14	9	13	13	11	11	23	26	15	13	9.6	13	6.8
Ion Balance (% Difference)	%	-	21.3	9.68	4.17	0.8	5.88	12.5	2.78	10.1	0.00	7.14	3.64	6.78	13.4	10.5	8	7.94	0
Langelier Index (@ 20C)	N/A	-	-3.27	-2.75	-2.19	-1.91	-2.85	-3.49	-2.86	-2.95	-3.15	-3.18	-1.74	-1.87	-2.61	-3.04	-3.31	-2.79	-3.66
Langelier Index (@ 4C)	N/A	-	-3.52	-3.01	-2.44	-2.16	-3.1	-3.74	-3.11	-3.2	-3.4	-3.43	-1.99	-2.13	-2.87	-3.29	-3.56	-3.04	-3.91
Nitrate (N)	mg/L	13	<0.05	<0.05	0.15	0.10	<0.05	0.08	0.22	0.19	0.20	<0.050	<0.050	<0.050	<0.050	0.12	0.15	0.2	0.066
Saturation pH (@ 20C)	N/A	-	10.1	9.62	9.21	8.98	9.61	10	9.58	9.67	9.73	9.77	9.04	9.00	9.58	9.78	10	9.74	10.1
Saturation pH (@ 4C)	N/A	-	10.3	9.88	9.46	9.23	9.86	10.3	9.83	9.92	9.98	10.0	9.29	9.26	9.84	10	10.2	9.99	10.4
Inorganics																			
Total Alkalinity (Total as CaCO3)	mg/L	-	7	12	21	29	12	7	14	11	11	11	27	26	12	8.7	7.2	10	6.1
Dissolved Chloride (Cl)	mg/L	120	8	1	1	2	3	3	3.1	2.5	2.5	1.7	<1.0	1.2	1.8	4.2	2.8	2.4	2.9
Colour	TCU	Note 5	49	35	41	42	32	45	21	22	33	40	22	31	42	44	32	22	42
Nitrate + Nitrite (N)	mg/L		<0.05	<0.05	0.15	0.1	<0.05	0.08	0.22	0.19	0.20	<0.050	<0.050	<0.050	<0.050	0.12	0.15	0.2	0.066
Nitrite (N)	mg/L	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<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	Note 6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Organic Carbon (C)	mg/L	-	8.0	8.1	9.3	9.8	9.4	8.5	4.9	6.6	6.2	8.8	8.5	9.5	11	8.9	8	5.3	4.5
Orthophosphate (P)	mg/L	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
pH	pH	6.5-9.0	6.80	6.87	7.02	7.07	6.76	6.54	6.72	6.72	6.58	6.59	7.30	7.13	6.97	6.74	6.69	6.95	**<u>6.49</u>**
Reactive Silica (SiO2)	mg/L	-	0.6	0.8	2.3	4.6	3.7	3.2	5.1	5.0	5.0	2.2	0.67	3.1	3.9	3.7	3.6	4.9	2.1
Total Suspended Solids	mg/L	Note 7	3	3	5	2	1	<1	1	42	2.2	2.4	<1.0	1.2	<1.0	2.2	<1.0	12	<1.0
Dissolved Sulphate (SO4)	mg/L	-	<2	<2	<2	<2	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Turbidity	NTU	Note 8	0.1	0.3	0.4	1.7	0.4	<0.1	0.2	5.1	<0.10	<0.10	0.32	0.79	0.5	0.78	0.18	3.4	0.13
Conductivity	uS/cm	-	22	27	43	58	32	25	36	35	32	26	50	52	32	32	26	32	22

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-23

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID												
			VE10												
Sampling Date			26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	18-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	5-Aug-19	1-Nov-19
Calculated Parameters															
Anion Sum	me/L	-	0.180	0.380	0.260	1.080	0.100	0.410	0.380	0.330	0.260	0.820	0.220	1.750	0.350
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	6.1	15	9.1	54	<1.0	20	17	11	6.6	38	8.9	87	9.1
Calculated TDS	mg/L	-	12	24	18	58	12	24	21	23	18	46	15	94	26
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
Cation Sum	me/L	-	0.31	0.45	0.28	1.04	0.23	0.45	0.42	0.34	0.28	0.78	0.22	1.45	0.45
Hardness (CaCO3)	mg/L	-	11	18	10	46	7.5	18	16	13	9.4	33	7.6	66	16
Ion Balance (% Difference)	%	-	26.5	8.43	3.7	1.89	39.4	4.65	5	1.49	3.7	2.5	0	9.38	12.5
Langelier Index (@ 20C)	N/A	-	-3.43	-2.63	-3.43	-1.12	NC	-2.34	-2.37	-2.83	-3.42	-1.77	-3.42	-0.985	-3.21
Langelier Index (@ 4C)	N/A	-	-3.68	-2.89	-3.68	-1.37	NC	-2.59	-2.62	-3.08	-3.67	-2.02	-3.67	-1.24	-3.46
Nitrate (N)	mg/L	13	<0.050	<0.050	0.13	0.051	0.34	<0.050	0.064	0.33	0.17	<0.050	0.14	0.06	0.53
Saturation pH (@ 20C)	N/A	-	9.99	9.4	9.86	8.45	NC	9.25	9.39	9.65	10	8.74	9.99	8.09	9.67
Saturation pH (@ 4C)	N/A	-	10.2	9.66	10.1	8.7	NC	9.51	9.64	9.9	10.3	8.99	10.2	8.34	9.92
Inorganics															
Total Alkalinity (Total as CaCO3)	mg/L	-	6.1	15	9.1	54	<5.0	20	17	11	6.6	38	8.9	87	9.1
Dissolved Chloride (Cl)	mg/L	120	1.9	2.9	2.3	<1.0	2.5	<1.0	1.4	3.1	4.3	1.8	1.3	<1.0	4.7
Colour	TCU	Note 5	37	49	30	35	37	33	40	27	20	40	37	42	94
Nitrate + Nitrite (N)	mg/L		<0.050	<0.050	0.13	0.051	0.34	<0.050	0.064	0.34	0.17	<0.050	0.14	0.06	0.53
Nitrite (N)	mg/L	0.06	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<0.050	<0.050	<0.050	0.064	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.14	<0.050
Total Organic Carbon (C)	mg/L	-	7.8	11	5.4	10	5.5	9	8.3	5.7	5.2	11	7.3	13	12
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
pH	pH	6.5-9.0	6.56	6.77	**<u>6.43</u>**	7.33	**<u>6.01</u>**	6.92	7.02	6.82	6.62	6.97	6.57	7.11	**<u>6.45</u>**
Reactive Silica (SiO2)	mg/L	-	0.76	3	4.5	4.2	3.6	2.7	1.5	4.9	4.0	4.4	3.1	3.4	4.4
Total Suspended Solids	mg/L	Note 7	<1.0	1.0	6.0	<1.0	<1.0	<1.0	<1.0	<1.0	<2.0	1.4	<1.0	2.8	1.8
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
Turbidity	NTU	Note 8	<0.10	0.43	0.23	0.49	0.49	0.58	0.3	0.33	0.26	1.4	0.18	0.97	1.4
Conductivity	uS/cm	-	27	36	27	100	22	39	39	34	30	75	21	150	39

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-24

INORGANIC GENERAL CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	Sample ID													
			VICRV-01		VIC01SR		VIC01BT		VIC01MD		VAL01SR		VAL01BT		VAL01MD	
Sampling Date			6-Aug-19	4-Nov-19	4-Aug-19	3-Nov-19	4-Aug-19	3-Nov-19	4-Aug-19	3-Nov-19	4-Aug-19	3-Nov-19	4-Aug-19	3-Nov-19	4-Aug-19	3-Nov-19
Calculated Parameters																
Anion Sum	me/L	-	0.24	0.36	0.08	0.2	0.08	0.21	0.09	0.21	0.23	0.25	0.23	0.26	0.22	0.23
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	8.7	10	<1.0	5.7	<1.0	6	<1.0	5.9	7.6	8.9	8.3	9.7	8	8.6
Calculated TDS	mg/L	-	14	25	9	12	8	12	9	12	13	13	13	13	13	12
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
Cation Sum	me/L	-	0.26	0.41	0.19	0.18	0.18	0.17	0.19	0.18	0.23	0.23	0.24	0.24	0.22	0.22
Hardness (CaCO3)	mg/L	-	9.8	15	5.2	4.9	5.1	4.7	5.3	4.8	8.4	8.5	8.7	8.7	8.2	8
Ion Balance (% Difference)	%	-	4	6.49	40.7	5.26	38.5	10.5	35.7	7.69	0	4.17	2.13	4	0	2.22
Langelier Index (@ 20C)	N/A	-	-2.65	-2.98	NC	-3.78	NC	-3.85	NC	-3.8	-2.86	-2.94	-2.95	-2.84	-2.95	-3.01
Langelier Index (@ 4C)	N/A	-	-2.9	-3.23	NC	-4.04	NC	-4.11	NC	-4.05	-3.11	-3.2	-3.2	-3.09	-3.2	-3.26
Nitrate (N)	mg/L	13	0.051	0.42	0.085	0.075	0.088	0.086	0.079	0.084	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Saturation pH (@ 20C)	N/A	-	9.82	9.62	NC	10.4	NC	10.4	NC	10.4	9.94	9.87	9.88	9.82	9.92	9.9
Saturation pH (@ 4C)	N/A	-	10.1	9.87	NC	10.6	NC	10.6	NC	10.6	10.2	10.1	10.1	10.1	10.2	10.2
Inorganics																
Total Alkalinity (Total as CaCO3)	mg/L	-	8.8	10	<5.0	5.7	<5.0	6	<5.0	5.9	7.6	8.9	8.3	9.8	8.1	8.7
Dissolved Chloride (Cl)	mg/L	120	2.1	4.6	2.5	2.9	2.7	2.9	3	3.2	2.6	2.4	2.4	2.2	2.2	2.1
Colour	TCU	Note 5	18	71	23	22	26	20	24	24	7.8	<5.0	8.7	5.1	8.6	6.3
Nitrate + Nitrite (N)	mg/L		0.051	0.43	0.085	0.1	0.088	0.1	0.079	0.1	<0.050	0.055	<0.050	<0.050	<0.050	<0.050
Nitrite (N)	mg/L	0.06	<0.010	0.012	<0.010	0.027	<0.010	0.016	<0.010	0.016	<0.010	0.011	<0.010	0.012	<0.010	0.014
Nitrogen (Ammonia Nitrogen)	mg/L	Note 6	<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
Total Organic Carbon (C)	mg/L	-	4.2	12	3.9	3.7	3.5	3.8	4.2	3.7	2.7	2.8	3.4	2.8	3.1	2.7
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
pH	pH	6.5-9.0	7.17	6.64	6.57	6.59	6.52	6.5	6.64	6.56	7.08	6.93	6.93	6.98	6.97	6.9
Total Phosphorus	mg/L	<4 - >100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reactive Silica (SiO2)	mg/L	-	1.6	4.4	1.7	1.4	1.3	1.4	1.3	1.4	0.74	0.63	0.84	0.56	0.95	0.63
Total Suspended Solids	mg/L	Note 7	1	1	<1.0	1.4	<1.0	1	<1.0	1.6	<1.0	1.6	<1.0	1.2	<1.0	1.2
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
Turbidity	NTU	Note 8	0.29	2.4	0.25	0.87	0.2	0.35	0.22	0.66	0.19	0.42	0.24	0.26	0.25	0.47
Conductivity	uS/cm	-	25	38	21	18	20	18	20	18	26	21	23	21	24	21

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. True Colour = The mean absorbance of filtered water samples at 456 nm shall not be significantly higher than the seasonally adjusted expected value for the system under consideration.
6. Varies depending on pH and temperature; Ammonia concentration of 1.83 mg/L calculated based on pH of 7.5 and temperature of 15oC
7. Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maxium average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
8. Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g. 24-h period). Maximum average increase of 2 NTUs from background levels for a longer exposure (e.g. 30-d period)
9. **Bold & Underlined** = parameter concentration exceeds the applicable standard
10. NC = Not Calculated

TABLE D-25

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL [4]	MDMER [8]	Sample ID																	
				LP01																	
Sampling Date				9-Mar-11	30-Mar-11	18-May-11	25-Jun-11	8-Aug-11	5-Sep-11	8-Oct-11	12-Nov-11	17-Jan-12	22-Feb-12	17-Mar-12	15-May-12	21-Jun-12	3-Aug-12	16-Sep-12	31-Oct-12	26-Nov-12	12-Jan-13
Metals																					
Aluminum (Al)	ug/L	Note 5		**143**	**232**	**100**	**321**	**231**	51.6	**1200**	**914**	**533**	**208**	**276**	**504**	32.1	65	**108**	85.6	**106**	**164**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	1.0	1.1	<1.0	2.6	2.2	1.4	<1.0	<1.0	1.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		5.8	6.1	3.3	5.8	6.0	4.0	7.9	9.2	8.0	6.4	9.4	6.8	3.3	4.2	3.6	2.9	2.8	5.8
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	0.024	<0.017	0.018	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Calcium (Ca)	ug/L	-		6430	5040	6840	6580	8540	10100	9710	7340	8990	8540	13800	7720	10800	10400	8560	7830	6800	9350
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	<1.0	75.3	4.8	12.0	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.56	0.58	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	2.7	<2.0	<2.0	2.8	2.9	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		184	**328**	225	**374**	**427**	149	**1720**	**1380**	**718**	258	**360**	**725**	**333**	**308**	205	188	186	218
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	1.05	1.1	0.52	2.16	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		902	731	858	851	1150	1280	1490	1080	1300	1230	1730	1050	1410	1420	1150	1030	951	1290
Manganese (Mn)	ug/L	-		312	219	79.8	64.7	144	117	117	262	187	260	599	79.9	229	217	76.8	30.4	22.2	178
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	<0.013	**0.050**	<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.6	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<10	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		625	664	459	577	1030	948	1240	986	1130	850	979	817	1040	844	766	631	570	612
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		3390	3740	2610	2620	3040	3300	3780	2790	3430	3720	5220	3560	4060	4370	3240	2950	2680	3160
Strontium (Sr)	ug/L	-		34.8	26.3	38.9	40.4	47.9	62.3	58.9	44.3	53.3	52.8	95.2	53.2	76.3	73.4	59.7	50.2	39.8	61.4
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		3.8	7.5	4.9	12.8	8.8	<2.0	91.0	53.0	29.5	4.5	3.5	13.5	2.4	2.7	3.5	4.7	4.5	4.7
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	0.10	<0.10	0.24	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.4	2.6	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (Zn)	ug/L	Note 6	500	<20	**73.9**	16.8	<5.0	15.3	<5.0	<5.0	7.5	6.9	11.3	6.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-25

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL [4]	MDMER [8]	Sample ID													
				LP01													
Sampling Date				21-Feb-13	27-May-13	29-Jul-13	6-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	7-Sep-18	28-Apr-19	5-Aug-19	2-Nov-19
Metals																	
Aluminum (Al)	ug/L	Note 5		**<u>125</u>**	71.7	40.8	97	**<u>680</u>**	**<u>170</u>**	49	86	**<u>180</u>**	93	33	**<u>330</u>**	15	65
Antimony (Sb)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	2.9	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		7.5	2.5	2.5	7.5	4.2	4.6	1.6	2.6	5.6	3.1	5.5	4.2	5	4.1
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.014	<0.010	<0.010	0.012	0.022	<0.010
Calcium (Ca)	ug/L	-		9890	5840	8180	7500	1900	7100	8500	7400	11000	5700	10000	3200	12000	10000
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	14	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	0.7	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**<u>2.4</u>**	0.51	<0.50
Iron (Fe)	ug/L	300		160	192	163	220	**<u>950</u>**	160	57	75	250	99	130	**<u>400</u>**	120	110
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		1350	767	979	1000	570	900	980	880	1400	720	1100	420	1300	1300
Manganese (Mn)	ug/L	-		282	41.8	126	1300	65	190	59	91	510	47	140	150	990	28
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	140	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		523	431	426	380	250	290	200	190	270	190	200	200	350	320
Selenium (Se)	ug/L	1		<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		2900	2190	2240	2000	1700	2000	1600	1900	2400	2100	2200	1300	3700	3800
Strontium (Sr)	ug/L	-		71.0	37.6	55.8	48	5.6	41	55	44	71	30	60	19	85	73
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		2.3	2.5	<2.0	<2.0	49	4.9	<2.0	<2.0	2.4	<2.0	<2.0	15	<2.0	3.7
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/L	-		<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
Zinc (Zn)	ug/L	Note 6	500	7.3	<5.0	<5.0	8.6	<5.0	<5.0	<5.0	<5.0	14	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-26

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																	
				LP02																	
Sampling Date				9-Mar-11	30-Mar-11	18-May-11	25-Jun-11	8-Aug-11	5-Sep-11	8-Oct-11	12-Nov-11	17-Jan-12	22-Feb-12	17-Mar-12	15-May-12	21-Jun-12	3-Aug-12	16-Sep-12	31-Oct-12	26-Nov-12	13-Jan-13
Metals																					
Aluminum (Al)	ug/L	Note 5		95.8	**<u>128</u>**	79.3	**<u>121</u>**	60.6	51.2	**<u>246</u>**	**<u>601</u>**	**<u>209</u>**	**<u>204</u>**	**<u>134</u>**	**<u>156</u>**	52.4	70.4	76.2	**<u>281</u>**	56.3	**<u>468</u>**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	1.2	1.6	<1.0	1.8	<1.0	<1.0	<1.0	1.1	1.4	1.2	<1.0	<1.0	<1.0	2.5
Barium (Ba)	ug/L	-		4.9	4.5	2.4	2.7	2.0	2.6	3.6	7.3	5.4	5.7	6.0	3.4	2.3	2.4	3.4	4.1	2.5	12.7
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		0.018	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	0.025
Calcium (Ca)	ug/L	-		5530	4630	2560	4000	4930	5640	6050	4470	7710	5850	10300	3740	6050	6890	8150	7890	3200	7770
Chromium (Cr)	ug/L	-		5.1	5.0	<1.0	<1.0	4.5	8.2	1.8	<1.0	<1.0	<1.0	2.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/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	0.46
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		152	176	112	170	99	132	**<u>346</u>**	**<u>932</u>**	**<u>333</u>**	266	219	292	61	68	**<u>340</u>**	**<u>388</u>**	103	**<u>757</u>**
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.59	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		775	663	357	585	723	824	920	708	1110	849	1370	547	879	1040	1110	1060	435	1130
Manganese (Mn)	ug/L	-		295	110	17	16	20.5	40.8	22.3	113	72.7	230	537	17.4	17.8	19.7	36	64.2	13.8	681
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	<0.013	**<u>0.047</u>**	<0.013	<0.013	0.013	<0.013	<0.013	<0.013	<0.013	0.015	0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		2.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		448	461	181	312	344	380	480	487	867	620	696	385	564	498	661	636	278	571
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		2310	2720	1290	1960	1970	2130	2480	2020	3020	2900	3490	2090	2860	3290	3130	2950	1270	2700
Strontium (Sr)	ug/L	-		33.1	26	15.8	26.1	31.4	36.8	38.1	28	47.8	36.0	71.2	26.9	44.4	53.8	55.6	50.2	19.2	52.5
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		2.2	4.4	3.1	9.7	<2.0	<2.0	13.8	32.7	13.9	4.3	2.8	2.3	<2.0	<2.0	2.4	12.5	2.5	15.1
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<5.0	5.4	<5.0	<5.0	5.3	<5.0	<5.0	5.3	<5.0	<5.0	<5.0	5.1	<5.0	<5.0	<5.0	<5.0	8.5	7.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})\}-2.46}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-26

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID													
				LP02													
Sampling Date				21-Feb-13	27-May-13	29-Jul-13	6-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	7-Sep-18	28-Apr-19	5-Aug-19	2-Nov-19
Metals																	
Aluminum (Al)	ug/L	Note 5		**<u>113</u>**	97.6	52.6	**<u>110</u>**	55	**<u>120</u>**	41	56	94	92	34	**<u>200</u>**	50	64
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	2.1	<1.0
Barium (Ba)	ug/L	-		6.1	2.6	2.8	4.7	2	4.4	2.1	2.1	5.1	3.2	2.5	2.8	2.6	3
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010
Calcium (Ca)	ug/L	-		9480	4380	4860	6600	6000	7700	5900	6200	11000	5500	6500	2400	7700	6200
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	7.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/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
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	3.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.68	0.64	<0.50
Iron (Fe)	ug/L	300		158	168	100	170	63	130	52	<50	130	98	87	240	**<u>320</u>**	110
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		1320	600	686	920	840	980	750	770	1400	720	880	340	890	880
Manganese (Mn)	ug/L	-		276	30.8	34.3	420	39	230	36	42	410	38	37	62	110	23
Mercury (Hg)	ug/L	0.026		0.025	<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	150	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		502	361	261	370	250	310	180	170	280	180	150	170	250	200
Selenium (Se)	ug/L	1		<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		2820	2000	1750	2000	1800	1900	1500	1800	2400	2200	2000	1100	2500	2700
Strontium (Sr)	ug/L	-		69.3	28.9	37.6	44	47	52	44	40	72	32	50	14	56	49
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		2.3	2.7	<2.0	<2.0	<2.0	2.9	<2.0	<2.0	<2.0	2	<2.0	7.6	<2.0	<2.0
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	5.6	<5.0	<5.0	7.5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})\}-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-27

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																					
				LP03																					
Sampling Date				9-Mar-11	30-Mar-11	18-May-11	25-Jun-11	8-Aug-11	6-Sep-11	8-Oct-11	12-Nov-11	17-Jan-12	22-Feb-12	17-Mar-12	15-May-12	21-Jun-12	4-Aug-12	16-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13	21-Feb-13	27-May-13	29-Jul-13	6-Feb-14
Metals																									
Aluminum (Al)	ug/L	Note 5		63.5	50.0	47.9	43.2	30.0	28.8	84.0	**194**	72.8	86.5	42.4	**101**	84.1	67.2	52.4	57.7	**139**	**275**	**121**	98.0	27.1	76
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	1.0	1.5	1.7	2.1	3.2	4.3	2.3	1.7	1.4	1.4	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	3.4	2.1
Barium (Ba)	ug/L	-		2.1	3.1	1.7	2.0	1.5	1.6	1.6	2.3	1.9	1.8	1.5	2.9	2.6	2.3	2.6	2.6	3.9	6.9	6.1	2.6	2.1	2.3
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.010	<0.010
Calcium (Ca)	ug/L	-		2980	4270	3070	4470	8070	10100	5820	3700	5720	5380	6370	1710	1710	1690	1680	1680	5320	7860	9450	3770	6480	4700
Chromium (Cr)	ug/L	-		<1.0	1.6	<1.0	<1.0	16	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0
Cobalt (Co)	ug/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
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		92	111	96	118	180	227	187	**331**	165	156	113	138	104	62	70	75	192	**374**	156	118	158	170
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		522	678	440	641	1170	1440	878	578	861	817	926	401	380	396	375	376	819	1130	1290	587	885	730
Manganese (Mn)	ug/L	-		5.7	28.9	21.9	42.3	112	257	56.0	30.1	34.1	44.5	41.0	15.4	12.7	11.0	13.8	9.4	13.9	227	271	21.9	52.4	120
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	<0.013	**0.035**	<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.013	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		155	237	160	176	215	196	288	290	316	273	280	221	221	180	196	222	431	505	517	302	163	150
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1910	2010	1370	1700	1950	1840	2000	1570	2200	2180	2250	1720	1800	1920	1660	1720	2460	2720	2870	2140	1790	1800
Strontium (Sr)	ug/L	-		9.3	14.3	9.1	16.3	25.5	27.5	21	13.7	21.6	19.5	24.8	5.7	5.7	5.7	5.7	5.5	34.7	52.9	68.3	8.5	24.4	18.0
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		2.6	<2.0	<2.0	<5.0	<2.0	<2.0	3.6	11.1	3.9	<2.0	<2.0	11.9	3.1	2.7	<2.0	<2.0	5.2	6.0	2.6	3.0	<2.0	<2.0
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	**68**	8.6	<5.0	<5.0	6.5	<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	12.8	<5.0	<5.0	5.1

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = $0.2 * e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-27

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER 8	Sample ID								
				LP03								
Sampling Date				25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	7-Sep-18	5-Aug-19	3-Nov-19
Metals												
Aluminum (Al)	ug/L	Note 5		56	40	**250**	47	74	54	18	23	38
Antimony (Sb)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/L	5	500	1.1	1.5	<1.0	<1.0	<1.0	<1.0	3.1	1.7	1.4
Barium (Ba)	ug/L	-		6.1	1.1	2.8	2.1	4.9	1.5	1.2	1.7	1.4
Beryllium (Be)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth (Bi)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.010	<0.010	0.017	<0.010	<0.010	<0.010	0.012	<0.010	<0.010
Calcium (Ca)	ug/L	-		9800	5700	1500	6200	11000	4100	9900	8800	5000
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.68	<0.50
Iron (Fe)	ug/L	300		290	100	**330**	<50	100	84	160	61	82
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		1200	780	410	780	1400	620	1400	1100	760
Manganese (Mn)	ug/L	-		360	42	13	28	370	14	86	140	17
Mercury (Hg)	ug/L	0.026		<0.013	0.018	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	130	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		330	180	210	200	290	110	240	270	190
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.50	<0.50
Silver (Ag)	ug/L	0.25		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/L	-		2000	1800	1600	1800	2500	2100	2300	2400	2200
Strontium (Sr)	ug/L	-		64	21	5.2	42	74	16	35	33	22
Thallium (Tl)	ug/L	0.8		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/L	-		2.2	<2.0	29	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (Zn)	ug/L	Note 6	500	5.3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-28

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																		
				LP04																		
Sampling Date				9-Mar-11	30-Mar-11	18-May-11	25-Jun-11	8-Aug-11	5-Sep-11	8-Oct-11	12-Nov-11	17-Jan-12	22-Feb-12	17-Mar-12	15-May-12	21-Jun-12	3-Aug-12	16-Sep-12	31-Oct-12	26-Nov-12	13-Jan-13	21-Feb-13
Metals																						
Aluminum (Al)	ug/L	Note 5		**<u>156</u>**	81.5	**<u>101</u>**	**<u>124</u>**	99.3	59.7	**<u>128</u>**	**<u>228</u>**	**<u>170</u>**	**<u>121</u>**	**<u>190</u>**	**<u>126</u>**	35.4	85.4	**<u>122</u>**	**<u>155</u>**	**<u>179</u>**	**<u>141</u>**	60.6
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	1.2	1.4	<1.0	<1.0	<1.0	1.0
Barium (Ba)	ug/L	-		2.5	2.2	1.3	1.3	1.9	2.8	1.9	1.9	2.8	1.8	3.9	1.3	1.3	1.7	1.9	1.7	2.1	2.4	2.5
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Calcium (Ca)	ug/L	-		3450	7780	3030	4130	5640	10100	5490	3550	6950	4800	10500	3300	8800	6650	7740	4870	4930	6800	13400
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	<1.0	17.5	<1.0	18.1	<1.0	<1.0	<1.0	3.3	1.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.64	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.43
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	55.9	<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
Iron (Fe)	ug/L	300		270	189	126	160	208	**<u>477</u>**	172	**<u>343</u>**	275	219	**<u>853</u>**	122	191	**<u>325</u>**	273	201	186	193	**<u>356</u>**
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		574	1230	467	679	992	1690	995	596	1150	814	1540	556	1490	1250	1160	767	824	1050	1780
Manganese (Mn)	ug/L	-		195	196	15.3	21.3	37.7	63.8	16.3	37.1	118	142	733	24.9	45.6	102	55.9	38.9	23.3	186	746
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	<0.013	0.024	<0.013	<0.013	0.017	<0.013	<0.013	<0.013	<0.013	<0.013	0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		180	195	111	167	129	192	207	173	230	176	256	192	217	155	146	173	145	134	197
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		2210	2410	1030	1440	1420	1720	1690	1300	2210	1690	2320	1240	1860	1950	1630	2580	1800	1850	2300
Strontium (Sr)	ug/L	-		6.9	14.1	5.2	8.1	11.3	18.7	10.6	6.5	12.5	8.1	18.9	6.4	16.0	13.8	14.6	9.2	8.8	12.4	24.7
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		4.8	2.5	2.7	<5.0	<2.0	<2.0	2.6	4.3	3.1	2.7	3.5	<2.0	<2.0	2.2	<2.0	2.3	3.8	2.5	<2.0
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<20	<5.0	<5.0	<5.0	7.0	6.6	5.1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	8.3	6.9	6.9	6.5	<5.0	5.2

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{(0.8545[\ln(\text{hardness})]-1.465)}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-28

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID												
				LP04												
Sampling Date				27-May-13	29-Jul-13	6-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	7-Sep-18	29-Apr-19	5-Aug-19	2-Nov-19
Metals																
Aluminum (Al)	ug/L	Note 5		**<u>134</u>**	65	95	38	47	74	94	**<u>110</u>**	**<u>110</u>**	53	**<u>140</u>**	28	**<u>110</u>**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	1.1	1.6	<1.0	<1.0	1.1	<1.0	1.4	<1.0	1.8	<1.0
Barium (Ba)	ug/L	-		1.2	1.6	2.4	1.5	<1.0	1.3	<1.0	4.4	1.6	2.1	1.4	1.7	1.4
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.010	<0.010	<0.010	<0.010	0.016	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010
Calcium (Ca)	ug/L	-		3500	5540	12000	11000	39000	7500	5300	17000	5200	8400	2500	11000	7100
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	0.43	<0.40	<0.40	<0.40	<0.40	0.77	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.53	0.53	<0.50
Iron (Fe)	ug/L	300		156	138	**<u>320</u>**	240	520	79	91	**<u>700</u>**	140	**<u>440</u>**	160	**<u>350</u>**	150
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		577	953	1900	1800	3100	1300	920	2700	860	1500	380	1500	1200
Manganese (Mn)	ug/L	-		13.3	25	520	96	62	14	9.5	1000	36	63	26	120	13
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	160	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		145	123	190	150	190	150	110	240	<100	250	120	130	170
Selenium (Se)	ug/L	1		<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1540	1560	2000	1900	2600	1700	1700	2500	2000	2000	1100	1700	2000
Strontium (Sr)	ug/L	-		7.1	11.6	23	20	49	16	11	35	10	18	4.6	21	14
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		3.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.2	<2.0	2.7
Uranium (U)	ug/L	15		<0.10	<0.10	0.12	<0.10	0.24	<0.10	<0.10	0.19	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<5.0	<5.0	6.1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.4	6.4	<5.0	<5.0

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{(0.8545[\ln(hardness)]-1.465)}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-29

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																		
				LP05																		
Sampling Date				9-Mar-11	30-Mar-11	18-May-11	25-Jun-11	7-Aug-11	5-Sep-11	8-Oct-11	12-Nov-11	17-Jan-12	22-Feb-12	17-Mar-12	15-May-12	21-Jun-12	3-Aug-12	16-Sep-12	31-Oct-12	26-Nov-12	13-Jan-13	21-Feb-13
Metals																						
Aluminum (Al)	ug/L	Note 5		**112**	**106**	94.3	91.2	70.0	79.8	76.9	**187**	**134**	**118**	78.9	95.3	47.9	68.4	**115**	83.4	**165**	**103**	60.3
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	1.2	1.3	<1.0	<1.0	1.0
Barium (Ba)	ug/L	-		2.1	2.1	1.4	<1.0	<1.0	1.6	2.0	1.6	2.5	1.6	1.7	1.2	1.1	1.5	1.8	1.3	2.2	2.0	2.6
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Calcium (Ca)	ug/L	-		7630	7440	3370	4230	5460	7220	6120	3340	6840	5030	9590	5020	12600	6470	7880	4740	7230	6340	13300
Chromium (Cr)	ug/L	-		<1.0	2.1	<1.0	<1.0	<1.0	69.3	4.0	<1.0	1.1	<1.0	<1.0	<1.0	2.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/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	0.43
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	2.9	<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
Iron (Fe)	ug/L	300		276	157	114	142	108	107	138	250	190	209	247	120	172	104	245	132	219	131	**352**
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		1120	1100	483	647	819	1050	947	574	1010	742	1330	703	1780	1070	1170	712	985	880	1800
Manganese (Mn)	ug/L	-		322	67.3	14.5	29.6	38.5	43.9	73.9	30.3	55	127	174	17.2	32.2	35.6	56.2	77.5	53.6	168	724
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	0.017	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		170	168	<100	105	<100	193	141	160	171	182	181	158	158	108	152	131	153	<100	177
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		2310	2270	1070	1280	1200	1440	1520	1270	1930	1690	1860	1330	2180	1900	1670	1810	1900	1750	2280
Strontium (Sr)	ug/L	-		18.3	19	7.5	11.4	12.2	16.5	13.1	6.1	15.4	11.2	21.6	13.5	38.8	15.6	14.7	9.5	12.1	11.1	24.8
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		3.8	3.0	<2.0	<5.0	<2.0	<2.0	<2.0	4.1	2.6	2.6	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.6	<2.0	2.2
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<20	6.7	<5.0	<5.0	<5.0	8.1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	7.7	<5.0	5.3	8.1	5.2	<5.0	5.5

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})\}-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-29

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID												
				LP05												
Sampling Date				27-May-13	29-Jul-13	6-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	7-Sep-18	29-Apr-19	5-Aug-19	2-Nov-19
Metals																
Aluminum (Al)	ug/L	Note 5		**<u>105</u>**	50.5	82	60	**<u>140</u>**	30	64	74	**<u>110</u>**	29	**<u>110</u>**	13	78
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	1.4	<1.0	<1.0	1.6	1	1.1	<1.0	<1.0	1.3	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		1.0	1.5	1.5	<1.0	2.5	1.2	1.2	2.1	1.5	1.3	1.1	1.3	1.3
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.010	0.013	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Calcium (Ca)	ug/L	-		3470	5960	11000	8100	11000	7600	5300	16000	5100	7300	2600	23000	6000
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0
Cobalt (Co)	ug/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
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	0.54	<0.50
Iron (Fe)	ug/L	300		110	97	220	78	260	63	90	280	130	68	140	<50	110
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		573	888	1500	1200	1300	970	750	2300	820	1100	380	2000	860
Manganese (Mn)	ug/L	-		9.9	133	280	140	430	73	100	360	37	57	41	22	28
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	140	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		138	<100	140	110	160	<100	120	200	100	120	120	230	140
Selenium (Se)	ug/L	1		<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1530	1450	2000	1800	1800	1400	1600	2400	2200	1800	1100	2300	1900
Strontium (Sr)	ug/L	-		6.9	12.4	22	16	19	14	11	31	10	15	4.6	37	12
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		2.3	<2.0	<2.0	<2.0	3.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.9
Uranium (U)	ug/L	15		<0.10	<0.10	0.10	<0.10	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	<0.10	0.14	<0.10
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<5.0	<5.0	5.8	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.1	<5.0	<5.0	<5.0

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(hardness)\}-2.46}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg $CaCO_3 \cdot L^{-1}$, pH 6.5 and 8.13 and DOC 0.3 to 22.9 $mg \cdot L^{-1}$
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-30

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																	
				VE01																	
Sampling Date				9-Mar-11	31-Mar-11	19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12	13-Jan-13
Metals																					
Aluminum (Al)	ug/L	Note 5		**85.6**	77.7	63.3	50.6	45.3	63.7	56.7	83.3	**133**	63.9	43.9	63.3	47.1	32.2	62.6	**229**	**118**	**206**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		1.7	5.0	2.3	1.4	1.5	1.7	1.1	1.2	2.1	1.5	1.2	1.2	1.6	1.2	1.4	3.9	2.6	4.1
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	0.019	<0.017	<0.017
Calcium (Ca)	ug/L	-		2690	3640	3000	4510	6120	7060	4380	2970	4550	4020	4560	3360	9090	5640	3910	2930	2910	4470
Chromium (Cr)	ug/L	-		3.3	2.7	76.2	4.3	26	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
Cobalt (Co)	ug/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	0.48	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		130	208	88	133	214	229	151	144	**419**	214	118	112	228	136	145	**611**	224	**649**
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		504	597	479	708	937	1040	737	521	719	779	718	559	1340	848	629	668	469	752
Manganese (Mn)	ug/L	-		5.2	83.4	16.9	35.3	79.8	110	33.8	13.4	143	83.6	25.8	20.8	122	88.9	63.2	316	58.7	436
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		126	159	225	123	<100	178	133	125	117	160	149	166	198	119	108	239	135	101
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1770	1690	1460	1830	1960	1820	1670	1350	1760	2800	1730	1530	2370	2020	1630	1850	1650	1850
Strontium (Sr)	ug/L	-		6.9	9.3	8.1	11.2	14.6	16.5	10.5	7.3	10.6	10.3	10.3	8.1	22.7	14.7	11.2	9.2	8.5	10.4
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		3.3	3.6	<2.0	<5.0	<2.0	<2.0	<2.0	<2.0	4.3	<2.0	<2.0	<2.0	2.4	<2.0	<2.0	6.0	2.5	9.4
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<20	8.0	9.9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	7.6	<5.0	<5.0	<5.0	5.0	6.7	6.7	5.1

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-30

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER 8	Sample ID VE01													
Sampling Date				8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	3-Aug-15	18-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	29-Apr-19	6-Aug-19	1-Nov-19
Metals																	
Aluminum (Al)	ug/L	Note 5		**127**	36.9	**130**	56	56	**110**	41	65	85	**61**	28	70	17	**96**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		2.0	<1.0	3.4	<1.0	1.8	2.8	<1.0	1.4	1.6	1.2	1.1	<1.0	1.9	2
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	0.017	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.014	<0.010	<0.010
Calcium (Ca)	ug/L	-		2560	2980	3410	3500	4300	4500	3100	3200	5100	3000	8100	2200	12000	5100
Chromium (Cr)	ug/L	-		1.4	<1.0	<1.0	<1.0	<1.0	2.2	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	0.43	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	3.6	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	0.54	1.3
Iron (Fe)	ug/L	300		278	<50	**418**	120	**390**	280	170	250	**610**	85	210	87	160	260
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		477	537	497	580	670	600	450	510	670	540	1200	370	1500	910
Manganese (Mn)	ug/L	-		149	68.9	270	29	650	180	86	190	220	6.4	72	30	87	31
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	2.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	190	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		139	125	129	100	110	150	140	120	170	<100	230	170	380	530
Selenium (Se)	ug/L	1		<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1790	1830	1440	1600	1700	1800	1500	1700	1800	1900	2300	1300	2400	2400
Strontium (Sr)	ug/L	-		7.2	5.9	11.4	8.8	12	13	9.9	10	16	7.4	20	5.8	32	13
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		3.4	<2.0	2.7	<2.0	2.9	4	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.3
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<5.0	<5.0	<5.0	6.1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg $CaCO_3 \cdot L^{-1}$, pH 6.5 and 8.13 and DOC 0.3 to 22.9 $mg \cdot L^{-1}$)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-31

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																	
				VE02																	
Sampling Date				9-Mar-11	31-Mar-11	19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12	13-Jan-13
Metals																					
Aluminum (Al)	ug/L	Note 5		**<u>109</u>**	62.2	68.3	57.2	36.6	42.3	55.1	90.4	51.0	46.4	45.5	337	**<u>102</u>**	25	57.6	**<u>417</u>**	**<u>104</u>**	50.1
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		1.8	1.5	2.1	2.2	1.2	1.8	<1.0	1.3	1.2	1.0	1.5	8.4	3.8	<1.0	1.2	5.3	2.2	1.6
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	0.049	<0.017	<0.017	<0.017	0.023	<0.017	<0.017
Calcium (Ca)	ug/L	-		2980	3600	2680	3890	5210	5900	4000	3020	4130	3670	4190	3240	7630	4900	3800	4330	3110	3990
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	1.3	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	1.8	<1.0	<1.0	<1.0	<1.0	5.9	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.54	<0.40	<0.40	<0.40	0.48	0.62	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		228	163	82	107	98	155	136	170	116	113	108	**<u>799</u>**	274	69	124	**<u>535</u>**	220	84
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		539	582	429	606	784	917	658	508	667	595	654	531	1070	742	600	793	462	651
Manganese (Mn)	ug/L	-		111	45	32.0	86.2	55.5	142	54.8	54.9	24.8	18.9	30.7	996	277	41.7	42.7	313	48	40
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		139	131	174	140	<100	178	144	130	128	117	143	246	224	122	108	456	155	<100
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1770	1660	1330	1630	1690	1650	1600	1330	1870	1760	1650	1540	2170	1990	1590	4590	1730	1740
Strontium (Sr)	ug/L	-		8.7	9.0	7.5	10.9	13.2	15.0	10.6	8.1	10.6	9.1	10.6	8.9	17.8	14.3	11.1	12.6	8.8	9.5
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		3.5	3.2	2.1	<5.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	8.8	3.6	<2.0	<2.0	10.5	2.4	<2.0
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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	2.4	<2.0	<2.0
Zinc (Zn)	ug/L	Note 6	500	29	<5.0	7.9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	15	6.1	<5.0	<5.0	15.9	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
Cadmium guideline = $10^{\{0.83\log(hardness)\}-2.46}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
Copper guideline = 0.2 * $e^{(0.8545[\ln(hardness)]-1.465)}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-31

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID													
				VE02													
Sampling Date				8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	3-Aug-15	18-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	29-Apr-19	6-Aug-19	1-Nov-19
Metals																	
Aluminum (Al)	ug/L	Note 5		**113**	43.8	**292**	59	**350**	**120**	46	72	**110**	61	25	83	17	91
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	3.2	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		2.2	<1.0	2.6	<1.0	11	3.2	1	1.3	2.3	<1.0	1.4	<1.0	2	1.8
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	0.02	<0.010	0.045	0.014	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010
Calcium (Ca)	ug/L	-		2940	3170	2250	3600	4300	4600	3100	3200	5100	2700	6500	2100	7600	4100
Chromium (Cr)	ug/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	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	1.7	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	0.6	0.56
Iron (Fe)	ug/L	300		183	<50	**500**	130	**1500**	**300**	160	290	**730**	95	140	110	76	260
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		511	587	635	590	670	590	440	530	670	550	1000	380	970	750
Manganese (Mn)	ug/L	-		105	78.5	63.8	33	2100	210	77	220	370	28	110	25	92	76
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	2.8	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	100	<2.0	<2.0	<2.0	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		146	127	<100	<100	130	170	130	130	170	<100	160	130	260	170
Selenium (Se)	ug/L	1		<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1840	2020	1480	1600	1800	1700	1500	1700	1800	1900	2100	1300	2000	2200
Strontium (Sr)	ug/L	-		9.8	6.4	5.7	9.4	13	15	10	9.5	15	5.6	17	5.2	19	12
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		2.6	<2.0	7.4	<2.0	14	3.4	<2.0	<2.0	<2.0	2.8	<2.0	<2.0	<2.0	3.4
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	13.8	<5.0	<5.0	5.0	11	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-32

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																	
				VE03																	
Sampling Date				9-Mar-11	31-Mar-11	19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12	13-Jan-13
Metals																					
Aluminum (Al)	ug/L	Note 5		95.0	53.7	79.1	52.2	44.2	**101**	63.2	89.5	61.3	50.1	57.7	69.5	37.4	43.1	68.9	**469**	99.9	50
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.6	<1.0	<1.0
Barium (Ba)	ug/L	-		2.3	1.1	1.3	<1.0	1.3	1.7	1.2	1.2	1.3	<1.0	1.1	1.0	1.7	1.5	1.5	7.7	2.2	1.7
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	0.028	<0.017	<0.017
Calcium (Ca)	ug/L	-		2880	3490	2430	3370	4720	5790	3870	2910	3950	3440	4050	2750	6470	4660	3780	3110	3020	3920
Chromium (Cr)	ug/L	-		<1.0	1.1	<1.0	1.6	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/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	0.94	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		205	186	109	86	104	177	146	156	126	120	131	115	60	94	139	**1210**	215	86
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		540	561	385	540	733	876	660	490	644	568	649	461	959	707	606	763	447	637
Manganese (Mn)	ug/L	-		21.3	16.1	58.0	16.0	81.0	159	72.8	42.8	33.3	22.4	49.1	37.5	106	99.0	60.2	642	56.1	38.8
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		163	131	181	130	<100	179	149	131	130	122	141	194	245	116	116	271	139	<100
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1950	1660	1270	1540	1640	1600	1620	1310	2030	1700	1650	1430	2040	1960	1670	2560	1690	1740
Strontium (Sr)	ug/L	-		9.0	9.5	7.3	10.5	13.4	16.2	10.6	7.9	10.4	9.4	10.7	7.3	17.7	14.0	11.7	10.4	8.7	9.8
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		3.6	2.7	3.2	<5.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.1	<2.0	21	<2.0	<2.0
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	28	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	8.7	<5.0	<5.0	6.3	9.0	<5.0	<5.0

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-32

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID													
				VE03													
Sampling Date				8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	3-Aug-15	18-Jul-16	4-Feb-17	10-Feb-18	5-Sep-18	29-Apr-19	6-Aug-19	1-Nov-19
Metals																	
Aluminum (Al)	ug/L	Note 5		**<u>104</u>**	40.3	**<u>131</u>**	**<u>100</u>**	**<u>170</u>**	**<u>120</u>**	39	78	79	63	17	80	12	98
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	1.3	<1.0	1.7	<1.0	<1.0	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		1.7	<1.0	3.5	1.8	5.2	2.9	<1.0	1.8	1.3	1	1.1	<1.0	1.2	2
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	0.011	0.038	0.025	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Calcium (Ca)	ug/L	-		2520	3030	3460	3600	4700	4500	3100	3200	5100	3000	6000	1900	6800	4100
Chromium (Cr)	ug/L	-		<1.0	<1.0	1.1	2.0	2.6	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	1.2	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	0.59	0.64
Iron (Fe)	ug/L	300		185	<50	**<u>395</u>**	220	**<u>1100</u>**	**<u>310</u>**	170	290	**<u>600</u>**	86	95	110	<50	250
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		456	559	498	580	820	610	440	510	660	540	940	330	910	720
Manganese (Mn)	ug/L	-		109	79.9	249	130	1800	190	84	250	200	18	53	16	47	56
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	31
Nickel (Ni)	ug/L	Note 6	500	2.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	140	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		133	127	127	120	120	150	140	130	160	110	170	120	250	200
Selenium (Se)	ug/L	1		<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1740	1880	1470	1600	1800	1800	1500	1800	1800	2100	2000	1300	2000	2300
Strontium (Sr)	ug/L	-		6.6	6.1	10.7	8.6	13	14	9.6	10	15	8.5	17	5.5	19	12
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		2.3	<2.0	3.1	2.4	7.4	4.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.6
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<5.0	<5.0	<5.0	6.2	8.3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})\}-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-33

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																	
				VE04																	
Sampling Date				9-Mar-11	31-Mar-11	19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12	13-Jan-13
Metals																					
Aluminum (Al)	ug/L	Note 5		**<u>128</u>**	**<u>246</u>**	**<u>466</u>**	62.6	56.7	51.5	65.6	89.7	80.7	73.5	**<u>142</u>**	97.3	90.0	61.0	**<u>114</u>**	**<u>147</u>**	**<u>104</u>**	**<u>112</u>**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	3.2	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	1.2	1.2	<1.0	<1.0
Barium (Ba)	ug/L	-		2.1	4.3	7.0	1.1	1.6	1.3	1.3	1.5	1.5	1.8	2.2	1.5	2.3	1.7	2.4	3.5	2.1	2.8
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Calcium (Ca)	ug/L	-		3360	3420	1890	2730	3850	4470	4060	3060	4240	3770	3990	2250	4780	4180	3780	3520	3150	3510
Chromium (Cr)	ug/L	-		1.3	3.0	1.7	<1.0	18.2	<1.0	1.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	0.44	0.51	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.46	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		**<u>344</u>**	**<u>573</u>**	**<u>1360</u>**	160	188	201	225	226	201	236	**<u>468</u>**	223	**<u>536</u>**	176	299	**<u>469</u>**	217	273
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.93	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		507	669	297	376	549	638	623	441	598	579	594	319	998	613	547	547	456	494
Manganese (Mn)	ug/L	-		163	260	291	45.4	68.4	153	77.5	44.4	50.7	58.3	234	109	264	73.5	123	358	53.4	145
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		165	184	163	115	<100	122	158	152	140	121	134	166	208	107	203	232	148	114
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1930	1670	1130	1410	1470	1380	1600	1290	1850	1690	1610	1270	1800	1780	1450	1860	1700	1600
Strontium (Sr)	ug/L	-		11.1	10.3	6.4	9.2	11.6	13.4	12	8.8	12.9	10.6	11.2	6.6	13.0	13.4	12.3	11.6	9.2	10.9
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		4.4	10.3	15.3	<5.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	5.4	<2.0	4.9	4.5	3.8	3.3	<2.0	<2.0
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	5.2	**<u>91.3</u>**	5.2	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	6.0	5.2	<5.0	<5.0	8.5	5.1	<5.0

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-33

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID													
				VE04													
Sampling Date				8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	5-Aug-19	1-Nov-19
Metals																	
Aluminum (Al)	ug/L	Note 5		**<u>81.1</u>**	84.9	55.9	82	66	86	51	68	87	70	47	86	43	87
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	1.2	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	1.1	<1.0
Barium (Ba)	ug/L	-		1.5	1.6	2.2	1.1	2.0	1.7	1.2	1.5	1.4	1.7	1.5	1.4	4.3	2.2
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	0.032	<0.010	<0.010	<0.010	0.01	<0.010	0.011	<0.010	<0.010	<0.010	0.033	0.011
Calcium (Ca)	ug/L	-		2470	2360	3600	3700	4000	4500	3000	3100	6100	3200	4400	1900	6200	3900
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	4.7	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.61	<0.40	0.69	<0.40	1.6	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	1.1	<0.50
Iron (Fe)	ug/L	300		167	172	236	250	280	170	190	240	**<u>610</u>**	140	**<u>470</u>**	180	**<u>850</u>**	180
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		398	340	483	510	570	590	460	480	690	490	720	300	1200	610
Manganese (Mn)	ug/L	-		41.8	73.2	132	100	320	66	94	160	190	23	350	26	4200	36
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	2.9	<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
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	140	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		133	176	155	130	130	180	130	<100	180	<100	140	180	530	220
Selenium (Se)	ug/L	1		<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1810	1530	1570	1500	1700	1800	1500	1700	1900	2100	1900	1300	2100	2000
Strontium (Sr)	ug/L	-		7.3	7.4	11.8	12	12	14	10	10	16	9.5	13	6	18	13
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		<2.0	<2.0	<2.0	<2.0	2.9	2.5	<2.0	<2.0	2.4	<2.0	<2.0	<2.0	2.2	2.3
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	9.5	<5.0	<5.0	5.1	6.9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	6.4	<5.0	<5.0

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-34

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																	
				VE05																	
Sampling Date				9-Mar-11	31-Mar-11	19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12	13-Jan-13
Metals																					
Aluminum (Al)	ug/L	Note 5		**<u>104</u>**	**<u>101</u>**	86.2	41.8	**<u>105</u>**	**<u>224</u>**	**<u>433</u>**	**<u>180</u>**	**<u>102</u>**	79.5	**<u>167</u>**	91.5	66.5	49.2	72.9	**<u>337</u>**	96.3	**<u>289</u>**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	1.0	2.7	4.1	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		3.8	3.6	1.9	1.2	3.9	7.8	13.5	2.8	3.2	1.3	2.2	1.5	2.7	1.4	4.7	3.6	1.5	4.7
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		0.02	<0.017	<0.017	<0.017	0.022	0.044	0.065	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	0.018	0.021	<0.017	0.023
Calcium (Ca)	ug/L	-		2900	3520	3040	1830	5650	5900	4730	3180	3950	4490	4920	3320	12200	8230	4050	3120	2650	4440
Chromium (Cr)	ug/L	-		2.6	22.9	<1.0	6.5	2.7	31.7	<1.0	<1.0	<1.0	2.7	2.4	<1.0	6.3	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	<0.40	0.69	1.44	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.54	0.47	<0.40	0.51
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.5	<2.0
Iron (Fe)	ug/L	300		155	**<u>445</u>**	94	104	**<u>713</u>**	**<u>1730</u>**	**<u>3270</u>**	**<u>552</u>**	**<u>747</u>**	102	265	121	**<u>446</u>**	265	284	**<u>737</u>**	58	**<u>603</u>**
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	2.72	<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
Magnesium (Mg)	ug/L	-		632	730	602	354	1040	1110	960	640	788	830	919	695	1520	1190	831	825	628	947
Manganese (Mn)	ug/L	-		32.7	174	20.3	37.6	392	882	1290	201	347	115	122	30.7	501	236	1600	335	13.9	441
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	0.015	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.013	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		172	160	163	<100	<100	206	132	118	<100	182	217	193	316	144	116	293	<100	<100
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1970	1740	1570	896	1990	1820	1790	1460	1710	1640	1620	1640	2270	2110	1860	1980	1700	1790
Strontium (Sr)	ug/L	-		6.4	8.4	7.0	4.7	13.9	14.9	11.6	7.5	8.8	9.8	10.9	7.6	28.8	19.8	9.2	8.2	6.1	9.2
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		2.9	3.7	2.7	<5.0	<2.0	5.5	14	4.4	2.5	2.2	6.5	<2.0	3.4	2.1	<2.0	15.0	<2.0	11.8
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	**<u>61.3</u>**	27.9	<5.0	<5.0	<5.0	6.6	7.0	<5.0	<5.0	<5.0	9.3	<5.0	10.4	<5.0	<5.0	7.4	7.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-34

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID													
				VE05													
Sampling Date				8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	3-Aug-15	18-Jul-16	4-Feb-17	10-Feb-18	5-Sep-18	29-Apr-19	6-Aug-19	1-Nov-19
Metals																	
Aluminum (Al)	ug/L	Note 5		**119**	**228**	**292**	**450**	**240**	45	27	64	**140**	65	**530**	87	55	**130**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	1.9	<1.0	2.7	<1.0
Barium (Ba)	ug/L	-		1.4	2.2	2.6	5.5	5.1	1.3	1.8	3	1.6	1.5	5.1	1.3	11	2.7
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	0.014	0.029	0.030	<0.010	<0.010	0.013	<0.010	<0.010	**0.057**	<0.010	0.033	0.014
Calcium (Ca)	ug/L	-		3110	3030	2240	7500	10000	7200	11000	5300	5300	2900	6500	2000	8900	4600
Chromium (Cr)	ug/L	-		<1.0	2.4	<1.0	8.8	<1.0	5.3	1.1	<1.0	5.8	<1.0	1.4	<1.0	1.2	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	0.52	0.63	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.93	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**2.1**	0.62	0.91	1.1
Iron (Fe)	ug/L	300		177	299	**466**	**460**	**590**	110	210	**480**	250	100	**610**	62	**2000**	210
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		615	635	634	1100	1500	1000	1400	1000	900	710	1300	440	1300	860
Manganese (Mn)	ug/L	-		105	102	57.3	920	1600	180	320	550	190	37	420	15	3100	36
Mercury (Hg)	ug/L	0.026		<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	0.015
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	55
Nickel (Ni)	ug/L	Note 6	500	3.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	150	<100	<100	<100	**120**	<100	**180**	<100
Potassium (K)	ug/L	-		158	218	<100	170	280	210	240	150	150	130	380	180	390	280
Selenium (Se)	ug/L	1		<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1700	1660	1510	1800	2100	1900	2000	2100	1600	2100	2100	1300	2100	2300
Strontium (Sr)	ug/L	-		6.7	6.9	5.7	17	22	15	25	13	11	6.8	17	4.6	23	12
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		3.6	10.7	7.5	3.6	17	<2.0	<2.0	<2.0	5.5	<2.0	7.5	<2.0	<2.0	5.7
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.37	<0.10	<0.10	<0.10
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<5.0	<5.0	<5.0	8.0	5.5	<5.0	<5.0	<5.0	<5.0	<5.0	5.5	<5.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-35

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																	
				VE06																	
Sampling Date				9-Mar-11	31-Mar-11	19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13
Metals																					
Aluminum (Al)	ug/L	Note 5		**<u>129</u>**	66.8	**<u>108</u>**	**<u>222</u>**	79.1	39.8	**<u>135</u>**	**<u>169</u>**	54.6	78.9	**<u>173</u>**	**<u>127</u>**	61.1	52.3	**<u>143</u>**	**<u>385</u>**	96.8	**<u>421</u>**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		2.0	1.8	2.3	3.7	1.9	1.5	1.6	1.7	1.8	1.4	2.1	1.4	2.4	2.4	2.1	4.2	1.6	5.3
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	0.018	<0.017	0.037
Calcium (Ca)	ug/L	-		3560	6380	4790	4450	6340	10400	5010	2970	9370	4860	4790	4390	11100	8470	3960	3030	2630	4450
Chromium (Cr)	ug/L	-		52.9	<1.0	1.1	2.8	5.8	<1.0	<1.0	<1.0	2.4	1.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.5
Cobalt (Co)	ug/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	0.47	<0.40	0.61
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<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
Iron (Fe)	ug/L	300		154	160	156	**<u>468</u>**	293	247	250	262	164	103	243	167	**<u>431</u>**	**<u>357</u>**	186	**<u>864</u>**	56	**<u>767</u>**
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		640	977	684	729	989	1440	872	601	1210	884	908	693	1490	1220	766	853	622	965
Manganese (Mn)	ug/L	-		195	377	90.4	349	363	283	134	79.9	550	122	130	53.4	675	583	410	364	13.9	439
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.013	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		203	181	206	174	137	252	171	169	195	223	205	226	314	170	108	278	<100	118
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1700	1830	1550	1410	1740	1960	1690	1370	1780	1750	1580	1620	2320	2170	1670	1940	1680	1760
Strontium (Sr)	ug/L	-		8.2	14.2	10.1	10.8	14.0	23.3	11.0	6.8	19.6	10.6	10.6	9.5	25.1	20.6	9.8	7.6	5.9	9.4
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		4.0	3.2	4.2	11.3	2.0	<2.0	3.4	4.0	2.6	2.7	6.0	2.6	3.1	2.3	3.2	20.7	<2.0	17.4
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	14.8	<5.0	6.4	<5.0	<5.0	6.4	<5.0	<5.0	<5.0	<5.0	<5.0	6.9	15.2	5.9	<5.0	5.5	<5.0	6.1

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-35 **INORGANIC METALS CHEMISTRY - SURFACE WATER**

Marathon Gold Corp.

Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report

Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID													
				VE06													
Sampling Date				8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	3-Aug-15	18-Jul-16	4-Feb-17	10-Feb-18	5-Sep-18	29-Apr-19	6-Aug-19	1-Nov-19
Metals																	
Aluminum (Al)	ug/L	Note 5		**<u>113</u>**	**<u>199</u>**	**<u>302</u>**	**<u>530</u>**	35	40	30	83	**<u>200</u>**	68	36	89	27	**<u>180</u>**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		1.4	1.7	3.1	16	2.7	1.4	1.8	3.6	2.4	1.3	2.4	1.3	1.2	2.2
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	0.017	0.074	0.016	<0.010	<0.010	0.022	0.014	<0.010	<0.010	0.011	0.015	0.016
Calcium (Ca)	ug/L	-		3150	3150	2220	8400	10000	7000	11000	5500	5300	4700	14000	2200	14000	5200
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	15	<1.0	<1.0	2.4	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	1.6	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.61	0.81	**<u>2.3</u>**
Iron (Fe)	ug/L	300		171	248	**<u>527</u>**	**<u>1600</u>**	110	110	220	**<u>490</u>**	**<u>380</u>**	93	160	100	140	**<u>330</u>**
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		618	661	640	1200	1500	1000	1500	1000	920	790	1900	470	1700	1000
Manganese (Mn)	ug/L	-		104	103	62.3	2800	1000	170	350	570	260	70	560	18	360	71
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	3.6	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	150	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		159	235	<100	200	230	220	230	170	170	120	270	170	330	410
Selenium (Se)	ug/L	1		<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1740	1820	1450	2000	2100	1800	2100	2100	1700	2000	2500	1300	2300	2100
Strontium (Sr)	ug/L	-		6.7	7.3	5.7	19	23	15	26	15	12	11	32	4.8	32	13
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		3.1	5.0	8.6	15	2.8	<2.0	<2.0	3.5	9.1	<2.0	<2.0	<2.0	<2.0	9.7
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<5.0	<5.0	<5.0	9.2	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	6

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})\}-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-36

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID VE07																	
Sampling Date				9-Mar-11	31-Mar-11	19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12	13-Jan-13
Metals																					
Aluminum (Al)	ug/L	Note 5		**106**	63.1	84.8	77.5	57.9	54.4	**128**	**147**	**217**	75.9	**1640**	**134**	19.9	69.6	**129**	**305**	98.3	**176**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		1.9	2.2	1.7	1.9	1.8	2.1	1.9	1.7	4.8	1.3	12	1.6	1.6	1.4	2.0	3.5	1.7	3.9
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	0.048	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	0.031	<0.017	0.129	<0.017	<0.017	<0.017	<0.017	0.017	<0.017	0.026
Calcium (Ca)	ug/L	-		3190	5500	4200	5260	7580	8900	5100	2960	8610	4300	5150	4560	12600	7630	4030	3070	2710	4610
Chromium (Cr)	ug/L	-		6.9	4.9	<1.0	22.1	<1.0	26.5	<1.0	<1.0	<1.0	<1.0	3.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.3
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.51	<0.40	2.19	<0.40	<0.40	<0.40	<0.40	0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	4.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		108	99	110	138	219	204	**309**	223	**814**	100	**3240**	156	162	**423**	197	**670**	62	198
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	0.53	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	1.14	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		620	945	653	843	1170	1280	908	580	1190	791	1460	769	1580	1120	789	808	639	913
Manganese (Mn)	ug/L	-		72.5	120	59.4	89.3	264	327	243	89.9	1100	112	1300	69.8	463	390	398	327	17.7	219
Mercury (Hg)	ug/L	0.026		<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	0.015	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.8	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	104	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		179	187	184	180	119	261	152	139	194	200	334	242	251	135	106	286	<100	116
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1990	1850	1510	1770	2040	1940	1750	1340	1780	1700	1600	1910	2250	2020	1700	1900	1740	1870
Strontium (Sr)	ug/L	-		7.2	13.7	10	13.7	18.1	20	11.3	6.8	19.3	9.3	12.2	10.2	30.3	18.0	9.8	8.0	6.1	9.9
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		3.1	2.8	3.1	<5.0	<2.0	<2.0	3	3.2	9	2.6	115	2.7	<2.0	3.6	4.5	11.8	<2.0	4.2
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.22	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	6.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (Zn)	ug/L	Note 6	500	7.0	11.5	<5.0	<5.0	<5.0	6.7	<5.0	<5.0	5.6	5.4	12.1	5.0	<5.0	<5.0	5.8	6.9	<5.0	6.4

Notes:
1. ' -' = no standard available; n/a = not applicable
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3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = $0.2 * e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-36

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID VE07														
Sampling Date				21-Feb-13	8-Mar-13	26-May-13	30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	3-Aug-15	17-Jul-16	4-Feb-17	10-Feb-18	5-Sep-18	29-Apr-19	6-Aug-19	1-Nov-19
Metals																		
Aluminum (Al)	ug/L	Note 5		**<u>120</u>**	**<u>120</u>**	**<u>177</u>**	**<u>123</u>**	**<u>240</u>**	**<u>120</u>**	43	35	98	**<u>450</u>**	56	23	98	22	**<u>160</u>**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0	1.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		1.6	1.6	1.5	3.3	5.0	3.4	1.4	1.8	3.3	4.6	1.4	2.6	3.1	2.8	2.1
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	0.012	0.025	0.018	<0.010	<0.010	0.014	0.031	0.012	<0.010	<0.010	0.018	0.015
Calcium (Ca)	ug/L	-		3100	3100	2930	3440	7700	10000	7100	11000	5400	5600	4100	14000	2300	15000	5000
Chromium (Cr)	ug/L	-		1.1	1.1	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	1.1	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	0.50	<0.40	<0.40	<0.40	<0.40	0.78	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.75	0.76	1
Iron (Fe)	ug/L	300		179	179	213	**<u>391</u>**	**<u>700</u>**	280	110	210	**<u>560</u>**	**<u>920</u>**	65	230	96	290	**<u>320</u>**
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		611	611	596	478	1100	1500	1000	1400	1000	1000	710	1800	440	1700	980
Manganese (Mn)	ug/L	-		106	106	90	267	930	1200	170	340	580	670	16	470	31	860	89
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	40
Nickel (Ni)	ug/L	Note 6	500	3.3	3.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	140	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		172	172	208	117	180	250	190	240	120	190	120	250	170	330	350
Selenium (Se)	ug/L	1		<1.0	<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1720	1720	1660	1440	1900	2100	1800	2000	2100	1700	1900	2500	1300	2400	2200
Strontium (Sr)	ug/L	-		7.1	7.1	6.8	11.4	17	22	15	25	14	12	9	32	5.6	35	13
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		3.1	3.1	5.0	3.1	7.9	9.0	2.2	<2.0	3.5	25	<2.0	<2.0	2.4	<2.0	8.8
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	5.8	5.8	<5.0	<5.0	7.2	5.7	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

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1. ' -' = no standard available; n/a = not applicable
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   Cadmium guideline = $10^{\{(0.83\log(hardness))-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-37

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																	
				VE08																	
Sampling Date				19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	21-Jun-12	3-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12	13-Jan-13	8-Mar-13	26-May-13
Metals																					
Aluminum (Al)	ug/L	Note 5		**183**	**159**	**197**	**171**	**148**	**93.1**	NC	NC	**523**	**125**	NC	NC	**139**	**118**	**100**	91.3	**120**	**126**
Antimony (Sb)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NC	NC	<1.0	<1.0	NC	NC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NC	NC	<1.0	<1.0	NC	NC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		1.2	<1.0	2.3	1.0	<1.0	<1.0	NC	NC	3.3	<1.0	NC	NC	<1.0	<1.0	1.3	2.0	1.4	<1.0
Beryllium (Be)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NC	NC	<1.0	<1.0	NC	NC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth (Bi)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	NC	<2.0	<2.0	NC	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	NC	NC	<50	<50	NC	NC	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	NC	NC	<0.017	<0.017	NC	NC	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Calcium (Ca)	ug/L	-		1490	1840	10400	3000	2620	1780	NC	NC	2210	1720	NC	NC	2090	2450	2050	7490	3140	1840
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NC	NC	3.3	<1.0	NC	NC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	0.62	0.47	<0.40	NC	NC	0.43	<0.40	NC	NC	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	NC	<2.0	<2.0	NC	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		219	259	**400**	**567**	**476**	226	NC	NC	**913**	220	NC	NC	195	**395**	152	138	176	204
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NC	NC	<0.50	<0.50	NC	NC	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		407	526	1440	912	798	529	NC	NC	888	504	NC	NC	562	702	615	1130	628	510
Manganese (Mn)	ug/L	-		34.0	96.7	133	275	208	52.5	NC	NC	99.8	56.4	NC	NC	83.9	38.8	24.4	76.2	114	32.2
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	0.014	<0.013	<0.013	<0.013	NC	NC	<0.013	0.013	NC	NC	<0.013	0.016	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	NC	<2.0	<2.0	NC	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	NC	<2.0	<2.0	NC	NC	<2.0	<2.0	<2.0	<2.0	2.6	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	NC	NC	<100	<100	NC	NC	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		274	<100	267	<100	<100	204	NC	NC	226	259	NC	NC	<100	311	146	195	163	315
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NC	NC	<1.0	<1.0	NC	NC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NC	NC	<0.10	<0.10	NC	NC	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/L	-		1310	1540	2250	1610	1670	1240	NC	NC	1530	1420	NC	NC	1520	1930	1650	1700	1770	1720
Strontium (Sr)	ug/L	-		4.0	5.0	20.1	7.6	6.4	4.3	NC	NC	5.7	4.1	NC	NC	5.2	6.3	4.8	15.5	7.1	4.7
Thallium (Tl)	ug/L	0.8		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NC	NC	<0.10	<0.10	NC	NC	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	NC	<2.0	<2.0	NC	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/L	-		6.1	5.1	7.8	5.9	4.6	2.8	NC	NC	37	2.1	NC	NC	4.4	5.1	2.2	2.5	3.3	3.4
Uranium (U)	ug/L	15		<0.10	<0.10	0.15	<0.10	<0.10	<0.10	NC	NC	<0.10	<0.10	NC	NC	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	NC	<2.0	<2.0	NC	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (Zn)	ug/L	Note 6	500	6.3	<5.0	<5.0	<5.0	<5.0	<5.0	NC	NC	6.9	<5.0	NC	NC	5.4	12.6	5.1	6.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{(0.8545[\ln(\text{hardness})]-1.465)}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-37

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID VE08									
Sampling Date				30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	5-Sep-18	28-Apr-19	1-Nov-19
Metals													
Aluminum (Al)	ug/L	Note 5		**138**	**160**	77	43	**270**	92	**140**	**88**	**91**	**90**
Antimony (Sb)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		1.3	1.3	1.2	1.4	2.9	1.2	1.8	<1.0	<1.0	1.5
Beryllium (Be)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth (Bi)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.010	<0.010	<0.010	0.018	0.025	<0.010	<0.010	0.017	<0.010	<0.010
Calcium (Ca)	ug/L	-		2600	1900	14000	7300	6200	6900	5200	3500	1000	3100
Chromium (Cr)	ug/L	-		<1.0	160	<1.0	9.2	<1.0	<1.0	6.9	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	0.43	<0.40	<0.40	0.57	<0.40	<0.40	1.5	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.6	0.62
Iron (Fe)	ug/L	300		**308**	**530**	170	110	**550**	130	260	**360**	130	260
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		683	580	1600	1100	960	1000	890	970	370	810
Manganese (Mn)	ug/L	-		233	180	170	180	350	34	200	1400	16	29
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	150	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		<100	220	310	220	220	200	150	<100	230	150
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.50
Silver (Ag)	ug/L	0.25		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/L	-		1600	1400	2100	1900	1600	2000	1600	2100	1300	2100
Strontium (Sr)	ug/L	-		7.0	4.8	28	16	13	15	12	8.5	2.6	8.4
Thallium (Tl)	ug/L	0.8		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/L	-		4.8	8.7	4.6	2.1	12	3.1	7.5	2.8	2.2	3.3
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (Zn)	ug/L	Note 6	500	8.9	6.6	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	6	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-38

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																	
				VE09																	
Sampling Date				19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12	13-Jan-13	8-Mar-13	26-May-13
Metals																					
Aluminum (Al)	ug/L	Note 5		**<u>205</u>**	**<u>112</u>**	79.6	69.3	**<u>114</u>**	**<u>165</u>**	NC	NC	95.5	**<u>157</u>**	75.5	85.2	**<u>138</u>**	**<u>268</u>**	**<u>131</u>**	**<u>179</u>**	63.9	**<u>161</u>**
Antimony (Sb)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NC	NC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NC	NC	<1.0	<1.0	1.0	1.3	<1.0	<1.0	<1.0	<1.0	2.7	<1.0
Barium (Ba)	ug/L	-		3.1	3.0	4.9	3.5	3.3	1.9	NC	NC	1.7	2.0	7.5	14.1	2.7	4.3	1.9	5.0	1.6	1.6
Beryllium (Be)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NC	NC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth (Bi)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	NC	NC	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	0.023	<0.017	<0.017	<0.017	NC	NC	<0.017	0.439	0.069	0.055	0.018	<0.017	<0.017	0.022	<0.017	<0.017
Calcium (Ca)	ug/L	-		4370	6240	7880	8230	4340	2850	NC	NC	4250	3390	9660	7490	3880	3100	2410	5110	2260	3290
Chromium (Cr)	ug/L	-		<1.0	<1.0	3.1	4.3	30	<1.0	NC	NC	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	0.44	0.64	0.56	<0.40	<0.40	NC	NC	<0.40	<0.40	0.75	1.50	<0.40	0.64	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		**<u>328</u>**	**<u>342</u>**	**<u>460</u>**	**<u>380</u>**	180	191	NC	NC	85	143	**<u>476</u>**	**<u>1170</u>**	184	**<u>639</u>**	102	**<u>429</u>**	188	186
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NC	NC	<0.50	<0.50	<0.50	<0.50	<0.50	0.53	<0.50	0.8	<0.50	<0.50
Magnesium (Mg)	ug/L	-		1100	1640	1970	2170	1120	811	NC	NC	1090	910	2320	1680	910	898	689	1360	380	869
Manganese (Mn)	ug/L	-		282	828	2040	1510	499	124	NC	NC	115	176	3150	4530	391	428	69.5	805	50.3	115
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	**<u>0.076</u>**	<0.013	<0.013	<0.013	NC	NC	<0.013	<0.013	<0.013	0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.6	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	NC	NC	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		275	191	157	220	133	116	NC	NC	171	179	212	<100	<100	224	<100	117	112	146
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NC	NC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NC	NC	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/L	-		2020	2430	2780	2620	1920	1670	NC	NC	1990	1930	2750	2520	1610	1930	1700	2250	1570	1840
Strontium (Sr)	ug/L	-		15.1	22.7	26.0	26.8	12.6	8.4	NC	NC	12.0	9.8	29.3	23.0	10.6	9.5	6.1	15.1	5.1	9.9
Thallium (Tl)	ug/L	0.8		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NC	NC	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/L	-		10.8	<5.0	2.3	3.2	2.8	3.8	NC	NC	2.2	2.5	2.4	2.4	2.6	13.7	2.1	7.0	3.2	5.1
Uranium (U)	ug/L	15		0.12	0.14	<0.10	<0.10	<0.10	<0.10	NC	NC	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.15	<0.10	<0.10
Vanadium (V)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (Zn)	ug/L	Note 6	500	<5.0	<5.0	<5.0	<5.0	<5.0	6.2	NC	NC	<5.0	6.4	7.5	5.1	<5.0	6.7	<5.0	5.6	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = $0.2 * e^{(0.8545[\ln(\text{hardness})]-1.465)}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-38

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID										
				VE09										
Sampling Date				30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	1-Nov-19
Metals														
Aluminum (Al)	ug/L	Note 5		**133**	**160**	88	**110**	**130**	**140**	87	**67**	**100**	**130**	**200**
Antimony (Sb)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/L	5	500	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		3.4	2.0	17	2.6	4.5	6.4	2	1.3	11	1.4	2.9
Beryllium (Be)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth (Bi)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		0.014	0.025	0.027	0.095	0.02	0.031	<0.010	0.013	0.016	<0.010	0.019
Calcium (Ca)	ug/L	-		4360	5800	7800	2100	5400	4300	4100	2200	10000	1900	4800
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	1.8	<0.40	0.55	0.67	<0.40	<0.40	2	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	3.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.72	1.1
Iron (Fe)	ug/L	300		266	290	**3700**	96	**510**	**820**	140	<50	**1500**	110	**360**
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		1010	1500	1700	610	1200	1000	740	580	2300	510	1400
Manganese (Mn)	ug/L	-		529	420	5900	140	1100	1400	35	33	4400	31	72
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	0.018	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	160	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		<100	160	<100	150	<100	<100	170	<100	520	160	180
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.50
Silver (Ag)	ug/L	0.25		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/L	-		1760	2200	1900	1600	2000	2000	1500	1900	3200	1400	2500
Strontium (Sr)	ug/L	-		12.9	17	22	5.1	15	11	9.2	5.3	31	5.4	15
Thallium (Tl)	ug/L	0.8		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/L	-		3.0	8.9	2.9	3.7	2.6	2.3	<2.0	<2.0	6	<2.0	7.7
Uranium (U)	ug/L	15		<0.10	0.13	<0.10	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (Zn)	ug/L	Note 6	500	5.3	5.2	6.9	<5.0	<5.0	<5.0	<5.0	<5.0	6.1	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
Cadmium guideline = $10^{\{[0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
Copper guideline = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-39

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																	
				VE10																	
Sampling Date				19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	14-Nov-11	22-Jan-12	25-Feb-12	19-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	1-Nov-12	27-Nov-12	13-Jan-13	8-Mar-13	26-May-13
Metals																					
Aluminum (Al)	ug/L	Note 5		89.4	86.6	70.4	**<u>116</u>**	70.9	96.0	53.7	**<u>181</u>**	76.9	**<u>105</u>**	31.1	51.4	93.0	**<u>112</u>**	84.3	**<u>231</u>**	**<u>46.6</u>**	78.6
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.3	<1.0
Barium (Ba)	ug/L	-		1.9	3.5	3.5	6.4	1.8	1.4	2.1	5.4	1.8	1.8	1.6	3.0	2.8	2.6	1.9	3.8	1.4	2.0
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	0.027	0.028	<0.017	<0.017	<0.017	0.024	<0.017	0.936	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Calcium (Ca)	ug/L	-		2360	3710	5820	7310	3870	2630	3740	3630	3190	3060	6620	7520	4240	3670	2660	3420	2160	3100
Chromium (Cr)	ug/L	-		<1.0	<1.0	32.2	4.8	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	1.12	<0.40	<0.40	<0.40	0.75	<0.40	<0.40	<0.40	0.41	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		151	236	**<u>406</u>**	**<u>667</u>**	217	188	141	**<u>843</u>**	155	167	53	**<u>429</u>**	**<u>303</u>**	267	130	**<u>381</u>**	141	153
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		580	859	1370	1670	982	695	953	958	820	762	1650	1670	979	912	715	958	350	765
Manganese (Mn)	ug/L	-		25.6	127	419	1860	92.7	16.2	65.0	604	58.8	58.8	153	738	130	119	15.7	236	30.9	66.5
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.6	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	120	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		141	<100	<100	169	<100	104	<100	190	120	124	174	<100	<100	326	<100	<100	110	140
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1460	1710	1850	2000	1830	1580	1800	1840	1680	1740	2140	2310	1770	2200	1760	1870	1510	1800
Strontium (Sr)	ug/L	-		5.4	10.3	14.3	19.2	8.7	5.6	8.4	8.3	6.8	6.6	16.6	18.5	9.7	8.5	5.9	7.7	4.9	7.0
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		3.1	<5.0	<2.0	6.4	<2.0	2.3	<2.0	6.6	<2.0	<2.0	<2.0	<2.0	3.1	2.8	2.3	10.6	<2.0	<2.0
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<5.0	7.4	6.7	16.8	<5.0	5.1	<5.0	10.3	<5.0	6.1	<5.0	<5.0	<5.0	7.0	5.3	<5.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-39

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID VE10											
Sampling Date				30-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	18-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	5-Aug-19	1-Nov-19
Metals															
Aluminum (Al)	ug/L	Note 5		**<u>103</u>**	**<u>82</u>**	29	**<u>76</u>**	54	58	87	48	43	77	34	**<u>96</u>**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	1.5	<1.0
Barium (Ba)	ug/L	-		3.5	1.5	3.0	1.5	1.9	1.9	2	1.5	6.5	1	8.1	2.6
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		0.029	0.021	0.019	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.051	0.011
Calcium (Ca)	ug/L	-		5100	2900	14000	2000	5300	4700	4000	2700	9500	2100	20000	4600
Chromium (Cr)	ug/L	-		<1.0	9.3	1.3	<1.0	<1.0	<1.0	2	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	0.68	<0.40	<0.40	<0.40	<0.40	<0.40	1.4	<0.40	1.9	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.53	0.65	0.72
Iron (Fe)	ug/L	300		**<u>300</u>**	140	270	130	220	140	140	75	**<u>850</u>**	110	**<u>710</u>**	**<u>420</u>**
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		1160	770	2900	570	1200	1100	760	670	2100	550	3600	1100
Manganese (Mn)	ug/L	-		192	26	2300	58	170	90	35	13	2300	13	10000	84
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	0.015	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	130	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		<100	<100	<100	170	<100	<100	180	<100	<100	160	160	290
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.50	<0.50
Silver (Ag)	ug/L	0.25		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/L	-		2100	1600	2300	1600	1900	2000	1600	1900	2400	1400	2400	2400
Strontium (Sr)	ug/L	-		12.3	6.4	34	4.5	11	11	8.3	5.6	24	4.8	50	11
Thallium (Tl)	ug/L	0.8		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		2.7	2.5	<2.0	2.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	5.6
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	10.4	6.6	7.9	<5.0	<5.0	<5.0	<5.0	<5.0	5.5	<5.0	6.3	<5.0

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = $0.2 * e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-40

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																	
				R01																	
Sampling Date				19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	17-Mar-12	18-May-12	21-Jun-12	4-Aug-12	16-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13	8-Mar-13	26-May-13
Metals																					
Aluminum (Al)	ug/L	Note 5		48.6	28.1	23.5	25.9	36.5	47.3	24.4	37.1	34.6	64.8	38.4	26.5	32.5	52.3	41.2	48.4	**45.4**	54.1
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	3.4	3.6	**6.5**	**8.3**	**5.7**	2.7	2.7	2.8	2.7	3.8	4.6	**9.0**	7.6	4.2	2.6	3.4	2.4	3.7
Barium (Ba)	ug/L	-		2.4	1.2	1.7	2.7	2.1	1.3	1.1	1.5	1.4	1.3	1.3	1.7	1.7	2.3	1.8	2.5	1.4	1.7
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	0.038	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Calcium (Ca)	ug/L	-		3060	4410	7950	9880	5360	2970	4610	4320	4160	3330	5980	8300	5590	3550	3080	3650	2300	3730
Chromium (Cr)	ug/L	-		<1.0	<1.0	90.7	18.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/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
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		128	112	209	**457**	**300**	123	152	180	140	157	139	**361**	291	232	125	220	146	147
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		400	554	932	1120	683	401	617	602	599	443	681	951	669	463	426	512	361	487
Manganese (Mn)	ug/L	-		24.0	29.4	73.9	494	190	33.4	57.8	44.3	45.8	44.7	73.6	139	153	118	41.2	135	27.2	41.1
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		120	<100	166	203	191	114	<100	<100	116	121	185	<100	103	247	<100	<100	<100	162
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1270	1400	1390	1550	1470	1090	1600	1660	1580	1420	1660	1740	1460	1590	1410	1410	1550	1660
Strontium (Sr)	ug/L	-		7.2	10.6	17.4	21.8	11.1	6.4	9.8	9.1	8.9	7.1	13.3	18.7	12.8	7.8	6.6	7.6	5.3	8.2
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		2.5	<5.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.1	<2.0	2.5	<2.0	2.7
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<5.0	<5.0	6.0	5.8	<5.0	<5.0	<5.0	<5.0	<5.0	5.2	5.1	<5.0	5.2	7.3	<5.0	<5.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})\}-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{(0.8545[\ln(\text{hardness})]-1.465)}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-40

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID											
				R01											
Sampling Date				29-Jul-13	6-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	5-Aug-19	1-Nov-19
Metals															
Aluminum (Al)	ug/L	Note 5		24.5	47	16	15	18	25	40	44	11	51	8.6	51
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	**<u>7.0</u>**	3.1	**<u>5.4</u>**	<1.0	**<u>5.4</u>**	4.7	2.8	2.1	**<u>9.1</u>**	2.1	4.2	3.7
Barium (Ba)	ug/L	-		2.0	1.3	1.7	4.9	1.3	1.1	1.2	1.5	1.6	<1.0	1	1.7
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.010	0.021	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Calcium (Ca)	ug/L	-		6320	3200	11000	3100	6200	4700	4000	2900	9000	2100	9100	4200
Chromium (Cr)	ug/L	-		<1.0	1.5	<1.0	<1.0	<1.0	<1.0	1	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/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
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	3.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	0.66	<0.50
Iron (Fe)	ug/L	300		220	150	150	<50	130	110	120	**<u>460</u>**	**<u>350</u>**	150	69	190
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		736	470	1300	400	720	550	550	470	1100	300	970	550
Manganese (Mn)	ug/L	-		75	39	68	7.4	80	35	55	36	310	23	56	63
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	8.4	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	150	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		<100	<100	180	150	130	110	<100	<100	130	150	200	330
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.50	<0.50
Silver (Ag)	ug/L	0.25		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/L	-		1400	1400	2000	1400	1400	1500	1600	1900	1900	1100	1800	1800
Strontium (Sr)	ug/L	-		13.6	7.3	24	7.5	14	11	9.1	6.9	20	4.4	19	9.3
Thallium (Tl)	ug/L	0.8		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	ug/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
Titanium (Ti)	ug/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
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<5.0	6.7	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})\}-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-41

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID R02								
Sampling Date				19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	17-Mar-12
Metals												
Aluminum (Al)	ug/L	Note 5		63.8	46.0	33.7	30.9	61.3	89.0	36.3	39.4	34.7
Antimony (Sb)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/L	5	500	2.3	3.9	**<u>6.3</u>**	4.5	**<u>5.1</u>**	3.8	2.8	2.5	2.5
Barium (Ba)	ug/L	-		1.4	<1.0	1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0
Beryllium (Be)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth (Bi)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Calcium (Ca)	ug/L	-		3360	3700	5360	9000	4620	3020	5870	4720	4780
Chromium (Cr)	ug/L	-		<1.0	<1.0	4.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		120	157	191	166	240	221	206	173	145
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		443	439	618	1020	556	352	699	571	576
Manganese (Mn)	ug/L	-		21.6	16.5	23.5	43.5	28.4	17.1	20.9	20.3	18.2
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		104	<100	<100	127	109	<100	<100	<100	<100
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/L	-		1320	1220	1130	1580	1250	1010	1630	1470	1410
Strontium (Sr)	ug/L	-		6.7	7.9	10.4	16.1	8.0	5.6	10.4	8.2	8.2
Thallium (Tl)	ug/L	0.8		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/L	-		<2.0	<5.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (Zn)	ug/L	Note 6	500	5.5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID R02								
Sampling Date				18-May-12	24-Jun-12	4-Aug-12	17-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13	8-Mar-13	26-May-13
Metals												
Aluminum (Al)	ug/L	Note 5		63	21.8	28.2	67.2	79.8	71.3	44.8	74.3	56.3
Antimony (Sb)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/L	5	500	2.7	2.6	**<u>5.6</u>**	**<u>6.4</u>**	4.2	2.4	3.0	2.3	3.0
Barium (Ba)	ug/L	-		<1.0	<1.0	<1.0	1.0	1.4	1.3	1.4	1.5	<1.0
Beryllium (Be)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth (Bi)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Calcium (Ca)	ug/L	-		3350	7660	7000	5160	5250	3640	5490	2880	3560
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		132	<50	142	256	236	150	186	165	120
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		435	907	789	614	641	495	679	384	448
Manganese (Mn)	ug/L	-		22.9	18.7	27.4	25.6	86.6	34.0	24.1	38.3	20.0
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		<100	152	<100	134	133	<100	<100	<100	<100
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/L	-		1330	1770	1790	1510	1970	1460	1580	1660	1570
Strontium (Sr)	ug/L	-		6.4	15.4	14.2	10.8	10.4	6.8	9.7	6.0	7.2
Thallium (Tl)	ug/L	0.8		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (Zn)	ug/L	Note 6	500	<5.0	<5.0	<5.0	8.1	<5.0	<5.0	<5.0	8.6	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-41

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID												
				R02												
Sampling Date				29-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	Lab-Dup	5-Aug-19	1-Nov-19
Metals																
Aluminum (Al)	ug/L	Note 5		39	49	21	**220**	16	38	41	50	14	57	56	9.6	**170**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	**6.9**	2.7	3.1	2.8	3.2	**5.1**	3.1	1.6	3.7	1.3	1.3	2.7	**6.6**
Barium (Ba)	ug/L	-		1.6	<1.0	<1.0	3.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.4
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.010	<0.010	<0.010	0.039	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.017
Calcium (Ca)	ug/L	-		5530	4300	10000	3600	7700	5400	7300	3600	11000	2500	2400	13000	7200
Chromium (Cr)	ug/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
Cobalt (Co)	ug/L	-		<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
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	<0.50	<0.50	1.1
Iron (Fe)	ug/L	300		231	170	<50	**590**	57	140	180	110	72	99	97	<50	**480**
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		607	540	1200	480	820	610	850	490	1400	360	360	1400	910
Manganese (Mn)	ug/L	-		27.4	17	24	460	22	28	18	12	24	13	13	15	420
Mercury (Hg)	ug/L	0.026		0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013		<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	150	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		<100	<100	120	110	130	<100	<100	<100	190	130	140	210	250
Selenium (Se)	ug/L	1		<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1350	1400	2100	1700	1700	1800	1900	1900	2600	1200	1200	2500	2400
Strontium (Sr)	ug/L	-		10.7	7.9	19	5.7	15	11	14	7.0	21	4.9	4.8	26	14
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		<2.0	<2.0	<2.0	10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.4
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<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

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-42

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID R03																	
Sampling Date				19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	17-Mar-12	18-May-12	24-Jun-12	4-Aug-12	17-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13	8-Mar-13	26-May-13
Metals																					
Aluminum (Al)	ug/L	Note 5		78.6	**<u>116</u>**	54.0	32.7	64.8	90.4	**<u>109</u>**	40.3	39.6	95.3	42.5	77.2	87.8	83.2	91.5	39.6	79.7	61.8
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	1.2	2.5	2.8	3.1	2	1.3	4.3	1.2	<1.0	1.6	3.5	**<u>5.1</u>**	3.1	1.2	1.2	1.2	1.1	1.7
Barium (Ba)	ug/L	-		1.5	2.4	1.1	1.4	<1.0	<1.0	3.6	1.1	<1.0	1.3	1.4	2.4	1.6	1.1	1.6	1.6	<1.0	1.1
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Calcium (Ca)	ug/L	-		3290	4260	6150	9510	5270	3050	7150	5850	4990	3800	8710	7890	5300	4690	3690	5970	2650	3950
Chromium (Cr)	ug/L	-		1.0	<1.0	<1.0	20	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.45	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		111	**<u>303</u>**	213	204	172	138	**<u>521</u>**	109	71	144	225	**<u>374</u>**	240	90	137	90	113	116
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		410	547	791	1130	695	403	841	725	607	491	1000	931	648	578	477	753	376	495
Manganese (Mn)	ug/L	-		24.3	300	81.7	156	51.2	15.1	576	57.1	31.7	37.7	152	323	82.4	29.7	19.3	59.6	22.1	35.7
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		<100	<100	<100	165	113	<100	<100	<100	<100	102	182	102	<100	148	<100	<100	<100	122
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1240	1390	1380	1650	1430	1070	1750	1670	1440	1510	2220	1930	1500	1800	1580	1730	1520	1720
Strontium (Sr)	ug/L	-		5.9	8.8	10.9	17.2	8.5	5.0	11.8	9.6	8.0	6.7	15.7	15.3	10	8.2	5.9	9.4	4.8	7.1
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		4.1	<5.0	<2.0	<2.0	<2.0	<2.0	3.0	<2.0	<2.0	<2.0	4.2	3.2	<2.0	2.0	<2.0	<2.0	<2.0	<2.0
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<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	10.4	6.7	<5.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg $CaCO_3 \cdot L^{-1}$, pH 6.5 and 8.13 and DOC 0.3 to 22.9 $mg \cdot L^{-1}$)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-42

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID											
				R03											
Sampling Date				29-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	5-Aug-19	1-Nov-19
Metals															
Aluminum (Al)	ug/L	Note 5		48.1	**610**	31	35	29	55	82	59	22	77	18	**100**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	2.1	**6.9**	2.5	1.2	2.4	2.3	2.2	<1.0	3	<1.0	3	1.5
Barium (Ba)	ug/L	-		1.5	9.7	<1.0	1.0	1.2	1.1	2.1	<1.0	<1.0	<1.0	<1.0	1.3
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.010	0.084	<0.010	<0.010	0.021	<0.010	0.013	<0.010	<0.010	<0.010	<0.010	<0.010
Calcium (Ca)	ug/L	-		5590	5200	12000	7000	8700	5700	6300	3200	11000	2100	11000	5200
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	1.2	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	0.64	<0.50
Iron (Fe)	ug/L	300		129	**1000**	140	88	120	110	230	93	170	84	100	190
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		686	670	1300	750	970	690	750	430	1300	280	1100	650
Manganese (Mn)	ug/L	-		46.6	1300	84	63	56	53	240	12	49	11	30	44
Mercury (Hg)	ug/L	0.026		0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	160	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		<100	<100	130	100	130	<100	<100	<100	150	120	160	220
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.50	<0.50
Silver (Ag)	ug/L	0.25		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/L	-		1480	1500	2200	1700	1800	2000	1700	1700	2200	1100	2400	1800
Strontium (Sr)	ug/L	-		10	10	21	12	16	11	11	5.6	20	3.9	20	9.9
Thallium (Tl)	ug/L	0.8		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		<2.0	8.9	2.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.1
Uranium (U)	ug/L	15		<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<5.0	12	5.6	<5.0	<5.0	<5.0	<5.0	<5.0	5.2	<5.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = $0.2 * e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-43

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																
				R04																
Sampling Date				19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	17-Mar-12	18-May-12	24-Jun-12	4-Aug-12	17-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13	8-Mar-13
Metals																				
Aluminum (Al)	ug/L	Note 5		78.1	**<u>114</u>**	96.3	48.3	77.7	**<u>107</u>**	NC	84.0	71.5	89.8	36.4	68.9	87.8	89.7	**<u>107</u>**	38.1	**<u>95</u>**
Antimony (Sb)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/L	5	500	<1.0	1.1	1.3	1.0	<1.0	<1.0	NC	<1.0	<1.0	<1.0	<1.0	1.6	1.2	1.2	<1.0	1.1	<1.0
Barium (Ba)	ug/L	-		1.3	2.1	2.4	1.8	1.8	1.4	NC	1.7	1.2	1.3	2.5	3.0	1.9	1.5	1.8	1.6	1.2
Beryllium (Be)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth (Bi)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	NC	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	NC	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Calcium (Ca)	ug/L	-		1790	3470	4630	5450	4550	3150	NC	3080	3090	2890	4500	5600	4570	3990	3350	5870	2310
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	NC	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		114	129	123	70	85	144	NC	114	79	71	60	153	91	146	138	87	150
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	NC	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		263	461	624	734	611	400	NC	449	421	383	622	746	597	492	548	731	319
Manganese (Mn)	ug/L	-		52.9	117	96.2	68.4	42.3	17.2	NC	61.7	19.6	14.9	72.3	223	49	60	31.1	56.9	20.9
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	NC	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	NC	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		<100	<100	<100	100	<100	<100	NC	<100	<100	134	169	124	<100	162	<100	<100	<100
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NC	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NC	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/L	-		1200	1510	1570	1580	1490	1180	NC	1570	1400	1440	1950	2120	1650	1920	1520	1680	1400
Strontium (Sr)	ug/L	-		3.6	5.9	7.5	8.9	7.1	5.0	NC	4.8	4.5	4.5	7.8	9.5	7.7	6.4	4.7	9.4	4.0
Thallium (Tl)	ug/L	0.8		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NC	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium (Ti)	ug/L	-		2.4	<5.0	2.0	<2.0	<2.0	<2.0	NC	<2.0	<2.0	<2.0	<2.0	2.7	<2.0	2.0	<2.0	<2.0	2.0
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NC	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NC	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (Zn)	ug/L	Note 6	500	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	NC	<5.0	<5.0	5.7	<5.0	<5.0	5.1	5.6	5.3	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-43

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]		Sample ID											
					R04											
Sampling Date				26-May-13	29-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	5-Aug-19	1-Nov-19
Metals																
Aluminum (Al)	ug/L	Note 5		77.3	52.5	**<u>66</u>**	32	54	31	79	90	**<u>190</u>**	21	82	31	**<u>130</u>**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	1.1	<1.0	1.2	3.4	<1.0	1.1	<1.0	<1.0	1.2	<1.0	1.3	1.9
Barium (Ba)	ug/L	-		1.4	2.1	<1.0	2.9	1.2	1.7	1.9	1.9	2.5	1.8	1.1	2.9	1.8
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Calcium (Ca)	ug/L	-		3040	4180	2700	6700	6200	4500	4000	4000	2000	6500	1900	5800	4700
Chromium (Cr)	ug/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
Cobalt (Co)	ug/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
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50	0.6	0.57
Iron (Fe)	ug/L	300		67	71	82	100	220	54	120	160	**<u>700</u>**	86	100	200	290
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		402	512	380	860	650	580	520	760	340	810	240	660	590
Manganese (Mn)	ug/L	-		18.4	36.8	29	190	48	52	64	36	220	77	13	190	44
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	27
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	140	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		143	<100	<100	130	120	130	100	170	<100	110	<100	180	190
Selenium (Se)	ug/L	1		<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1680	1500	1400	2200	1600	1700	1900	1600	1800	2100	1100	2100	2000
Strontium (Sr)	ug/L	-		5.2	6.8	4.4	11	11	7.7	7.2	8.6	3.7	10	3.2	9.8	7.8
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		2.2	<2.0	<2.0	2.2	<2.0	<2.0	2	2.2	5	<2.0	<2.0	<2.0	2.8
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	**<u>30.7</u>**	<5.0	<5.0	7.4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-44

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																	
				R05																	
Sampling Date				19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	17-Mar-12	18-May-12	24-Jun-12	5-Aug-12	17-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13	8-Mar-13	26-May-13
Metals																					
Aluminum (Al)	ug/L	Note 5		31.8	46.3	57.8	20.0	20.9	33.0	14.1	55.2	21.8	24.2	15.1	47.7	23.6	92	36.8	22.6	24.8	25.2
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		5.9	6.1	6.6	4.7	4.9	5.4	4.8	7.7	5.4	5.5	5.7	7.4	5.6	25.7	6.1	6.0	5.1	4.7
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	0.034	<0.017	<0.017	<0.017	<0.017
Calcium (Ca)	ug/L	-		2590	2710	2810	3120	3270	2930	2930	2940	3070	2760	3110	3320	3120	3210	3170	3150	3020	2660
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	2.0	<1.0	<1.0	<1.0	1.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt (Co)	ug/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
Copper (Cu)	ug/L	Note 6	300	<2.0	2.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		<50	79	75	<50	<50	58	<50	105	<50	<50	<50	69	<50	<50	73	<50	<50	<50
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		346	364	377	405	455	394	397	450	413	379	418	448	417	418	434	447	429	356
Manganese (Mn)	ug/L	-		17.4	71.3	108	21.4	16.6	18.2	7.7	71.5	17.9	18.7	16.3	83.9	19.2	20.3	28.7	21.8	19.6	11.4
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.4	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		115	121	102	124	145	126	115	127	127	139	134	120	118	201	134	128	136	138
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1180	1300	1160	1210	1230	1160	1320	1670	1320	1290	1380	1400	1250	1410	1420	1430	1520	1290
Strontium (Sr)	ug/L	-		6.5	7.6	7.0	7.7	7.5	6.9	7.0	7.4	7.5	6.7	8.0	8.3	8.1	7.9	7.2	7.5	7.4	6.5
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		3.0	<5.0	2.0	<2.0	<2.0	6.4	<2.0	2.9	<2.0	<2.0	2.1	2.6	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	6.8	<5.0	<5.0	5.6	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.4	11.5	<5.0	<5.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-44

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID											
				R05											
Sampling Date				29-Jul-13	6-Feb-14	26-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	5-Sep-18	28-Apr-19	5-Aug-19	1-Nov-19
Metals															
Aluminum (Al)	ug/L	Note 5		19.2	19	15	**<u>100</u>**	15	21	18	**<u>150</u>**	11	**<u>130</u>**	12	29
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	**<u>5.3</u>**	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		5.8	4.8	4.5	3.3	4.6	5.3	4.9	13	3.6	9.8	4.4	5.6
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.010	<0.010	<0.010	<0.010	<0.010	0.049	<0.010	0.024	<0.010	0.019	<0.010	<0.010
Calcium (Ca)	ug/L	-		2960	2900	2900	2200	2800	2900	3100	3000	3100	2700	2800	3100
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0
Cobalt (Co)	ug/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
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0.72	0.61	<0.50
Iron (Fe)	ug/L	300		<50	<50	<50	**<u>470</u>**	<50	<50	<50	**<u>400</u>**	<50	220	<50	77
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		382	420	370	360	360	360	430	430	400	370	320	410
Manganese (Mn)	ug/L	-		23.1	5.7	17	330	18	19	6.9	260	10	200	14	30
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	140	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		139	130	<100	150	160	160	130	140	130	130	210	160
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.50	<0.50
Silver (Ag)	ug/L	0.25		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/L	-		1270	1500	1300	1400	1300	1400	1400	1500	1500	1400	1300	1400
Strontium (Sr)	ug/L	-		7.9	7.6	6.8	5.1	7.3	7.5	7.6	7.4	8.4	6.5	7.4	8.1
Thallium (Tl)	ug/L	0.8		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		<2.0	<2.0	<2.0	6.3	<2.0	<2.0	<2.0	7.3	<2.0	6.5	<2.0	<2.0
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<5.0	<5.0	5.2	6.1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = $0.2 * e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-45

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID																	
				VL01																	
Sampling Date				19-May-11	26-Jun-11	7-Aug-11	6-Sep-11	9-Oct-11	13-Nov-11	22-Jan-12	25-Feb-12	17-Mar-12	15-May-12	21-Jun-12	3-Aug-12	16-Sep-12	31-Oct-12	27-Nov-12	13-Jan-13	21-Feb-13	27-May-13
Metals																					
Aluminum (Al)	ug/L	Note 5		77.2	56.5	46.6	50.4	63.1	78.9	67.6	73.3	70.1	**<u>119</u>**	**<u>107</u>**	70.6	91.3	62.6	**<u>282</u>**	31.9	94.1	89.4
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	1.4	2.0	2.7	3.3	1.1	2.1	1.4	1.5	1.6	1.7	2.4	3.7	1.5	1.6	1.2	2.7	1.7	1.7
Barium (Ba)	ug/L	-		2.3	1.2	1.3	2.2	1.3	1.9	2.4	2.2	2.3	1.7	3.1	1.8	1.2	4.1	2.8	1.7	2	1.4
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		0.064	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	2.25	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017	<0.017
Calcium (Ca)	ug/L	-		2500	2810	3710	4480	6420	3520	4470	3540	4570	2740	3510	4470	2010	4900	4260	3800	3980	2390
Chromium (Cr)	ug/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	19.7	<1.0	<1.0
Cobalt (Co)	ug/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
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Iron (Fe)	ug/L	300		74	75	90	103	166	116	90	136	103	117	81	132	247	203	**<u>361</u>**	132	135	71
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		394	430	557	650	1510	560	674	598	702	415	524	689	366	665	836	520	627	377
Manganese (Mn)	ug/L	-		17.4	16.4	30.5	119	106	17.8	47.9	122	113	36.3	143	110	365	167	36.5	53.7	63.8	19.6
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	0.014	<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		105	107	<100	106	195	124	116	133	149	157	207	135	<100	175	200	<100	145	132
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1290	1380	1330	1430	1840	1460	1870	1860	1900	1330	1540	1910	1310	2210	1990	1460	2010	1590
Strontium (Sr)	ug/L	-		6.4	8.0	9.9	12.4	18.7	8.5	10.2	8.3	11.1	6.7	9.9	13.2	4.5	10	9.8	8.1	9.2	5.8
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		2.1	<5.0	<2.0	<2.0	<2.0	2.3	<2.0	2.8	<2.0	2.9	2.5	2.9	2.9	2.3	8.2	<2.0	2.6	2.1
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<5.0	<5.0	7.7	<5.0	11.7	<5.0	<5.0	<5.0	<5.0	12.1	<5.0	<5.0	<5.0	<5.0	5.4	<5.0	9.4	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **<u>Bold & Underlined</u>** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-45

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID											
				VL01											
Sampling Date				29-Jul-13	6-Feb-14	25-Jul-14	25-Jan-15	3-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	7-Sep-18	29-Apr-19	5-Aug-19	3-Nov-19
Metals															
Aluminum (Al)	ug/L	Note 5		49.4	69	45	61	32	51	**230**	87	29	100	13	36
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	2.7	1.1	2.8	<1.0	2.3	2.8	**5**	1.2	3.4	1.1	2.1	2.1
Barium (Ba)	ug/L	-		2.3	1.6	1.4	2.4	1.7	1.5	4.1	2	1.3	1.3	1.9	1.4
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.015	<0.010	<0.010	<0.010	<0.010	<0.010
Calcium (Ca)	ug/L	-		3900	3500	4300	5800	4000	3600	4200	3100	4600	2100	7500	4600
Chromium (Cr)	ug/L	-		4.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.1	<1.0	<1.0
Cobalt (Co)	ug/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
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	1.3	0.94	0.52
Iron (Fe)	ug/L	300		116	70	56	<50	65	72	**410**	95	62	**560**	<50	66
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		581	550	630	700	560	540	740	540	670	370	690	720
Manganese (Mn)	ug/L	-		23.4	46	52	110	67	36	310	25	49	36	74	8.9
Mercury (Hg)	ug/L	0.026		0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.1	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	160	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		158	<100	140	110	130	<100	130	160	160	190	290	160
Selenium (Se)	ug/L	1		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.50	<0.50
Silver (Ag)	ug/L	0.25		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Sodium (Na)	ug/L	-		1670	1600	1700	2000	1500	1800	2000	2200	2000	1300	2000	2000
Strontium (Sr)	ug/L	-		11.1	7.7	12	13	11	10	11	8	13	5.1	21	13
Thallium (Tl)	ug/L	0.8		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.3	<2.0	<2.0	2.3	<2.0	<2.0
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<5.0	5.1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(hardness)\}-2.46}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-46

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID FZ01															
Sampling Date				31-Oct-12	26-Nov-12	13-Jan-13	21-Feb-13	27-May-13	30-Jul-13	06-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	10-Feb-18	7-Sep-18	5-Aug-19	3-Nov-19
Metals																			
Aluminum (Al)	ug/L	Note 5		**217**	**145**	70.7	97.3	85.1	**170**	**1400**	**120**	**200**	62	**120**	**180**	**120**	70	**190**	**120**
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	2.0	<1.0	1.3	1.7	<1.0	2.5	**22**	<1.0	**8.8**	<1.0	<1.0	**8.9**	1.0	3.9	**13**	1.5
Barium (Ba)	ug/L	-		4.5	3.5	9.5	2.0	2.3	4.4	35	2.4	9.7	2	2.2	13	3.5	3	11	3.2
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	0.017	0.092	<0.010	0.016	<0.010	<0.010	0.016	<0.010	**0.11**	0.024	<0.010
Calcium (Ca)	ug/L	-		4070	5290	3670	3870	3050	4990	12000	1700	5900	1500	1500	4200	3600	7300	8300	4400
Chromium (Cr)	ug/L	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	41	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	5.5	<0.40	2.2	<0.40	<0.40	0.51	<0.40	<0.40	1.6	<0.40
Copper (Cu)	ug/L	Note 6	300	<2.0	<2.0	2.8	<2.0	<2.0	<2.0	220	<2.0	2.5	<2.0	<2.0	<2.0	<2.0	**2.2**	**5.2**	<0.50
Iron (Fe)	ug/L	300		**468**	201	245	134	116	**632**	**8900**	81	**5600**	<50	70	**1200**	**390**	**560**	**5600**	**290**
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	1.8	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		545	780	546	611	516	608	1500	370	670	340	350	550	500	900	780	620
Manganese (Mn)	ug/L	-		112	14.8	105	63.6	17.5	80.6	3400	14	1300	17	7.5	1600	110	75	1200	22
Mercury (Hg)	ug/L	0.026		<0.013	<0.013	<0.013	<0.013	<0.013	0.013	<0.013	0.022	**0.030**	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	32
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	210	<100	<100	140	<100	<100	<100	<100	**110**	<100
Potassium (K)	ug/L	-		195	411	107	<100	274	<100	640	210	320	210	210	<100	110	290	190	260
Selenium (Se)	ug/L	1		<1.0	<1.0	<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		2300	2380	1920	1920	2070	2090	4900	1700	2600	1600	1700	1800	2600	2800	2500	2500
Strontium (Sr)	ug/L	-		12	33.3	13.2	9.1	7.3	12.8	39	5.4	17	4.8	5.1	15	8.8	18	24	12
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		3.0	5.2	<2.0	2.4	2.6	2.3	15	<2.0	2.4	<2.0	<2.0	2.5	<2.0	4.4	<2.0	<2.0
Uranium (U)	ug/L	15		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Vanadium (V)	ug/L	-		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Zinc (Zn)	ug/L	Note 6	500	8.2	5.2	14.6	8.6	<5.0	<5.0	28	<5.0	8.8	<5.0	<5.0	<5.0	<5.0	17	10	<5.0

Notes:
1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-47 **INORGANIC METALS CHEMISTRY - SURFACE WATER**

Marathon Gold Corp.

Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report

Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID													
				FZ-02													
Sampling Date				31-Oct-12	26-Nov-12	13-Jan-13	21-Feb-13	27-May-13	30-Jul-13	06-Feb-14	25-Jul-14	25-Jan-15	2-Aug-15	17-Jul-16	3-Feb-17	7-Sep-18	5-Aug-19
Metals																	
Aluminum (Al)	ug/L	Note 5		**132**	97.6	**112**	97.9	88.3	**53.7**	**140**	**110**	**320**	61	**100**	**100**	14	19
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	1.0	1.7	<1.0	1.2	1.1	<1.0	**8.2**	<1.0	<1.0	4.7	1.6	1.8
Barium (Ba)	ug/L	-		4.3	3.2	8.5	2.0	2.3	5.5	4.3	2.4	19	2	2.4	7.4	7.8	12
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.017	<0.017	<0.017	<0.017	<0.017	0.016	<0.010	<0.010	0.015	<0.010	<0.010	<0.010	<0.010	<0.010
Calcium (Ca)	ug/L	-		3110	1950	4730	3910	4290	5410	3900	1600	4900	1500	1600	4300	9300	10000
Chromium (Cr)	ug/L	-		<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	1.1	<1.0	1.6
Cobalt (Co)	ug/L	-		<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.87	<0.40	<0.40	<0.40	<0.40	<0.40
Copper (Cu)	ug/L	Note 6	300	2.2	<2.0	2.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<0.50
Iron (Fe)	ug/L	300		294	85	**309**	127	102	203	**400**	150	**3000**	<50	87	**610**	**330**	**310**
Lead (Pb)	ug/L	Note 6	200	<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
Magnesium (Mg)	ug/L	-		457	397	531	615	658	717	580	360	640	340	370	560	1200	1100
Manganese (Mn)	ug/L	-		203	9.7	43.5	62.4	25.3	375	370	16	2300	16	7.5	780	1200	1600
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	150	<100	<100	<100	<100
Potassium (K)	ug/L	-		265	204	118	<100	298	<100	<100	200	<100	220	220	<100	<100	160
Selenium (Se)	ug/L	1		<1.0	<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		2390	1750	2110	1920	2250	1860	1700	1700	1900	1600	1800	1800	2300	2300
Strontium (Sr)	ug/L	-		9.6	6.4	15.9	9.3	9.2	19.4	13	5.5	17	5.2	5.7	16	37	47
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		5.4	2.4	2.0	<2.0	<2.0	<2.0	<2.0	3.1	5.2	<2.0	<2.0	<2.0	<2.0	<2.0
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	8.3	<5.0	13.7	6.4	5.8	<5.0	<5.0	<5.0	5.7	<5.0	<5.0	<5.0	<5.0	<5.0

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{[0.83\log(hardness)]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(hardness)]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(hardness)]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

TABLE D-48

INORGANIC METALS CHEMISTRY - SURFACE WATER
Marathon Gold Corp.
Valentine Lake Project - Baseline Hydrology and Surface Water Quality Monitoring Report
Stantec Consulting Project No. 121416288

Parameter	UNITS	CWQG FAL	MDMER [8]	Sample ID													
				VICRV-01		VIC01SR		VIC01BT		VIC01MD		VAL01SR		VAL01BT		VAL01MD	
Sampling Date				6-Aug-19	4-Nov-19	4-Aug-19	3-Nov-19	4-Aug-19	3-Nov-19	4-Aug-19	3-Nov-19	4-Aug-19	3-Nov-19	4-Aug-19	3-Nov-19	4-Aug-19	3-Nov-19
Metals																	
Aluminum (Al)	ug/L	Note 5		23	**130**	45	48	49	46	46	48	15	11	15	11	22	11
Antimony (Sb)	ug/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
Arsenic (As)	ug/L	5	500	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Barium (Ba)	ug/L	-		2.3	2.9	16	3.4	4.4	5.9	6.5	3	3	2	1.8	1.6	2.5	1.6
Beryllium (Be)	ug/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
Bismuth (Bi)	ug/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
Boron (B)	ug/L	1,500		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	ug/L	Note 6		<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Calcium (Ca)	ug/L	-		3200	4700	1500	1400	1500	1400	1600	1400	2800	2800	2900	2900	2700	2700
Chromium (Cr)	ug/L	-		<1.0	1.4	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	2	<1.0
Cobalt (Co)	ug/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
Copper (Cu)	ug/L	Note 6	300	0.6	0.73	0.76	<0.50	0.83	<0.50	1.1	<0.50	0.67	<0.50	0.77	<0.50	0.92	<0.50
Iron (Fe)	ug/L	300		<50	**310**	76	71	58	57	<50	69	<50	<50	<50	<50	<50	<50
Lead (Pb)	ug/L	Note 6	200	<0.50	<0.50	<0.50	**1.1**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Magnesium (Mg)	ug/L	-		440	860	340	350	320	330	330	340	330	340	330	350	320	330
Manganese (Mn)	ug/L	-		13	100	5.1	13	12	12	4	12	3.5	6.9	5.4	6.7	3.7	6.7
Mercury (Hg)	ug/L	0.026		<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
Molybdenum (Mo)	ug/L	73		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Nickel (Ni)	ug/L	Note 6	500	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)	ug/L	<4 - >100		<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium (K)	ug/L	-		200	200	210	180	220	170	210	190	110	<100	130	<100	110	<100
Selenium (Se)	ug/L	1		<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
Silver (Ag)	ug/L	0.25		<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
Sodium (Na)	ug/L	-		1400	2100	1900	1700	1700	1700	1700	1700	1400	1400	1400	1500	1300	1300
Strontium (Sr)	ug/L	-		7.7	11	5.7	5	5	4.9	5.7	4.8	9.5	9.3	9.6	9.6	9.4	8.9
Thallium (Tl)	ug/L	0.8		<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
Tin (Sn)	ug/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
Titanium (Ti)	ug/L	-		<2.0	4.7	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Uranium (U)	ug/L	15		<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
Vanadium (V)	ug/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
Zinc (Zn)	ug/L	Note 6	500	<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

Notes:

1. ' -' = no standard available; n/a = not applicable
2. <# = parameter concentration below laboratory's reportable detection limit
3. Lab-Dup = laboratory QA/QC duplicate
4. CWQG-FAL = Canadian Council of Ministers of the Environment Canadian Water Quality Guidelines for the Protection of Aquatic Life (1999; last updated 2019); Freshwater aquatic life
5. Aluminum guideline varies depending on pH: 5 µg/L if pH < 6.5 & 100 µg/L if pH ≥ 6.5 (CCME Freshwater Guidelines)
6. Equation based on hardness. Calculated guideline is presented with data in ( ) (CCME Freshwater Guidelines):
   Cadmium guideline = $10^{\{0.83\log(\text{hardness})]-2.46\}}$ µg/L (minimum of 0.04 µg/L regardless of water hardness and maximum of 0.37 µg/L)
   Copper guideline = 0.2 * $e^{\{0.8545[\ln(\text{hardness})]-1.465\}}$ µg/L (minimum of 2 µg/L regardless of water hardness and maximum of 4 µg/L)
   Lead guideline = $e^{\{1.273[\ln(\text{hardness})]-4.705\}}$ µg/L (minimum of 1 µg/L regardless of water hardness and maximum of 7 µg/L)
   Nickel guideline = $e^{\{0.76[\ln(\text{hardness})]+1.06\}}$ µg/L (minimum of 25 µg/L regardless of water hardness and maximum of 150 µg/L)
   Zinc guideline = e{0.947[ln(hardness mg/L-1)]-0.815[pH] + 0.398[ln(DOC mg/L-1)]+4.625} µg/L (The CWQG equation is valid between hardness 23.4 and 399 mg CaCO3·L−1, pH 6.5 and 8.13 and DOC 0.3 to 22.9 mg·L−1)
7. **Bold & Underlined** = parameter concentration exceeds the applicable standard
8. MDMER – Metal and Diamond Mining Effluent Regulations. The Maximum Authorized Monthly Mean Concentration will be the MDMER effluent criteria carried forward in Project effects assessments.

ATTACHMENT 3-D

Hydrogeology Baseline Report (2020) (Gemtec)

GEMTEC

www.gemtec.ca

Hydrogeology Baseline Report
Marathon Valentine Gold Project

Central Newfoundland

GEMTEC Project: 80018.05

experience • knowledge • integrity expérience • connaissance • intégrité

GEMTEC
www.gemtec.ca

Submitted to:

Marathon Gold Corporation
10 King Street East, Suite 501
Toronto, ON
M5C 1C3

Hydrogeology Baseline Report
Marathon Valentine Gold Project

Central Newfoundland

March 18, 2020
GEMTEC Project: 80018.05

experience • knowledge • integrity

GEMTEC Consulting Engineers and Scientists Limited
10 Maverick Place
Paradise, NL, Canada
A1L 0J1

March 18, 2020 File: 80018.05 – R02

Marathon Gold Corporation
10 King Street East, Suite 501
Toronto, ON
M5C 1C3

Submitted via Email: jpowell@marathon-gold.com

Attention: Mr. James Powell
Director of Environment and Stakeholder Engagement

Re: Hydrogeology Baseline Report
Marathon Valentine Gold Project, Central Newfoundland

Please find enclosed the final report presenting the results of a hydrogeology baseline study for Marathon's Valentine Gold Project in Central Newfoundland. We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

Respectfully submitted,

GEMTEC Consulting Engineers and Scientist Limited

<Original signed by>

Carolyn Anstey-Moore, M.Sc., M.A.Sc., P.Geo.
Senior Environmental Geoscientist

Enclosures
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

1.1 Project Description

Marathon Gold Corporation (Marathon) proposes to advance its Valentine Gold Project (“the Project”), a mine development to be situated in the west-central region of the island of Newfoundland. The Project is located approximately 55 km southwest of the town of Millertown, Newfoundland and Labrador (NL), and 45 km south of the community of Buchans (Figure A1, Appendix A).

Disclaimer: The following Project description, as well as references in this report to locations within the Project area, are based on the most current information at time of report writing; however, it should be noted that the scope and details of the Project continue to evolve.

To date, four gold deposits near Valentine Lake have been delineated, including the Leprechaun and Marathon deposits that will be developed as part of the Project, as well as the Sprite and Victory deposits. The Project will employ open-pit mining and conventional milling over a projected 12-year mine life. According to the most recent (January 10, 2020) estimate available at Marathon’s website, Total Mineral Resources comprise: 1.90 M oz (31.69 M t at 1.86 g/t Au) of Measured Mineral Resources; 1.19 M oz (23.17 M t at 1.60 g/t Au) of Indicated Mineral Resources; and 0.96 M oz (16.77 M t at 1.78 g/t Au) of Inferred Mineral Resources.

Open pits will be advanced at the Marathon deposit (to a maximum depth of 400 metres below ground surface (mbgs)), and at the Leprechaun deposit (maximum depth 300 mbgs). Conceptual planning for the Project layout is still in development, but we understand it will include: stockpile areas for waste rock, overburden, and topsoil; a process plant area for crushing/milling, and gold recovery; a tailings storage facility (complete with polishing pond); and an effluent water treatment plant. Other Project infrastructure (e.g., related to water/sewer, power) and buildings (e.g., for maintenance, administration, accommodations, fuel storage) will also be constructed.

1.2 Study Objectives

Marathon has submitted a Project Registration to provincial and federal regulators, and was found to be subject to an environmental assessment (EA) under the Newfoundland and Labrador Environmental Protection Act (2003) and the Canadian Environmental Assessment Act (2012). Both the Newfoundland and Labrador Minister of the Department of Municipal Affairs and Environment (MAE) and the Canadian Environmental Assessment Agency (CEAA) have issued draft guidelines specific to the Project for the preparation of an Environmental Impact Statement (EIS). These draft guidelines were referenced in the preparation of this baseline report. Specifically, groundwater will be considered a valued environmental component (VEC) requiring assessment in the Environmental Impact Statement (EIS), given the likelihood of groundwater interaction with various Project activities such as open pit mining, and the potential interaction of groundwater in the Project area with neighbouring surface water drainage features.

In 2019, when this hydrogeological investigation was initiated, the Project included mining of the Marathon, Leprechaun, and Victory deposits. As a result, the field program focused on those areas (herein referred to as “the Site”). More recently, the scope of the Project has narrowed to the Marathon and Leprechaun deposits, and the Project layout has been revised. As such, references to the hydrogeological test locations with respect to proposed mine components has changed compared to previous reports prepared by GEMTEC Consulting Engineers and Scientists Ltd. (GEMTEC), and other consultants.

The overarching objective of this report is to characterize the hydrogeology baseline conditions (i.e., hydrostratigraphy, hydraulic properties and gradients, groundwater flow directions and velocity, and groundwater quality) at the Site in support of the EA.

1.3 Scope of Work

In the fall of 2019, GEMTEC undertook a combined geotechnical and hydrogeology field program at the Site. The geotechnical findings were previously summarized in a draft factual report issued on December 2, 2019 (GEMTEC, 2019a). A separate letter report summarizing preliminary hydrogeological findings was issued on December 4, 2019 (GEMTEC, 2019b). Since that time a second hydrogeology field program involving groundwater level monitoring and groundwater quality sampling was completed at the Site in February 2020.

The scope of the current study included a review of existing information relating to hydrogeology for the Site, and an analysis of hydrogeological data collected during the field programs. The current report is intended to supersede the 2019 preliminary hydrogeology letter report (GEMTEC, 2019b), as it expands upon previously reported results, and includes more supporting information and detailed results.

Key sources of existing information that were reviewed during this study included the following:

- A 2017 Stantec report (Stantec, 2017a), with a 2019 letter update (Stantec, 2019), detailing the results of preliminary hydrogeological baseline work completed for the Site;
- A 2011 Stantec report (Stantec, 2011) detailing the results of aquifer testing at a new water supply well at the current exploration camp;
- A 2019 geotechnical report prepared by Terrane Geoscience Inc. (in consultation with GEMTEC; Terrane, 2019) in support of pre-feasibility pit design, which included hydraulic conductivity (packer) testing in boreholes completed at the Marathon and Leprechaun deposits;
- Rock Quality Designation (RQD) data for approximately 784 exploration boreholes obtained by Marathon;
- Surficial and bedrock lithological information for Project exploration boreholes obtained by Marathon;

- Site-specific bedrock geology maps and descriptions provided in Tettelaar and Dunsworth (2016), and the Project NI 43-101 Preliminary Economic Assessment (PEA) Report prepared by Lincoln, et al. (2018);
- Publically available surficial and bedrock geology maps;
- Publically available regional groundwater quality data; and,
- Provincial Registry of Water Rights / records of public water supplies.

The hydrogeology baseline field program completed by GEMTEC, which was designed to expand upon previous work by Stantec, comprised two site visits (from September 30 to October 12, 2019; and from February 27 to 29, 2020) to complete the following:

- Diamond drilling of eight vertical hydrogeological boreholes across the Site completed as six shallow monitoring wells (MW1, MW2, MW3, MW4, MW5 and MW7) to depths ranging from 5.64 mbgs to 10.10 mbgs; and two deeper monitoring wells (MW6 and MW8) to approximately 30 m depth that were paired installations with MW3 and MW7, respectively. All new monitoring well locations are shown on Figures A2 and A5 (Appendix A);
- Detailed borehole logging including type and thickness of overburden, type of bedrock, bedrock characteristics (RQD), and occurrence of groundwater in the boreholes;
- Installation and development of 51mm-diameter PVC, screened monitoring wells within each of the eight hydrogeological boreholes;
- Hydraulic conductivity testing comprising rising/falling head hydraulic response (slug) testing in each of the eight monitoring wells;
- Static water level measurements, including within the eight new hydrogeological monitoring wells, as well as within 137 existing, cased, historical exploration boreholes. Static water level monitoring was carried out in the eight new monitoring wells during both the October 2019 and February 2020 site visits;
- Installation of water level data loggers in each of the eight new hydrogeological monitoring wells for long-term monitoring; and,
- Collection of groundwater quality samples in each of the eight new hydrogeological monitoring wells during the October 2019 program, and five of the monitoring wells (those free from ice) during the February 2020 program.

1.4 Organization of this Report

Section 1 presents an introduction, study objectives and scope. An overview of the Site's hydrogeological setting is presented in Section 2.0. Field and analytical methods are explained in Section 3.0, and Section 4.0 presents the results of the hydrogeological baseline characterization, considering previous and current data. Section 5 presents a summary and conclusions.

2.0 SITE SETTING

2.1 Climate

The following is a brief summary of climate for the Site, extracted from Section 4.1 of Stantec (2017b).

July and August are typically the warmest months (daily averages of 16.3 and 16.2°C, respectively), and January and February are the coldest months (daily averages of -8.2 and -8.4°C, respectively). The average annual precipitation in nearby Buchans, where climate normal data is available, is 1,236.2 mm, of which 877 mm falls as rain and 359.3 cm falls as snow (assuming snow melt is 1/10 of snow fall). Typically, August is the rainiest month (123 mm) and January is the snowiest month (88.3 cm).

2.2 Topography and Drainage

Figure A2 (Appendix A) shows the Site along with local topography, watercourses, wetlands, and water bodies in the vicinity of the Site. The Site is dominated by hummocky terrain, and is situated along a northeast-trending ridge with an elevation range from approximately 437 meters above sea level (masl) at the height of land approximately 1 km northeast of the Sprite deposit, down to about 320 to 325 masl at the various surrounding surface water bodies (Valentine Lake, Victoria Lake, and Victoria River).

The ridge represents a divide between three drainage catchment areas. On its northwest side, the ridge slopes towards Valentine Lake; on its southeast side, it slopes towards Victoria Lake to the south and Victoria River to the north. Valentine Lake drains northeast into Victoria River via tributaries located between the Marathon and Victory deposits. Victoria Lake was originally the headwater of Victoria River, which ultimately flows approximately 100 km north into the Exploits River. However, the mouth of Victoria Lake has been strategically dammed to divert water and act as a hydroelectric reservoir for the Newfoundland Hydro Granite Lake power generating station (located 40 km to the southeast). As the Victoria Reservoir Dam has an overflow spillway which is normally dry, the Victoria River now receives very little flow from Victoria Lake.

Depending on the location within the Site, drainage is inferred to be northwest or southeast towards a number of interconnected streams and wetlands identified within or intersecting with the boundaries of the Site. In the vicinity of the Victory deposit as well as the proposed tailings storage facility and process plant, surface water discharges to the Victoria River. In the area of the Marathon pit and associated waste rock piles and stockpiles, surface water discharges either directly into the Victoria River to the southeast, or flows northwest into Valentine Lake, which ultimately discharges into the Victoria River. In the area of the Leprechaun pit and associated stockpiles and waste rock piles, surface water discharges both towards Victoria Lake and Valentine Lake.

The depth to the groundwater table varies spatially, and from first principles we infer it to be a subdued reflection of the regional topography. Topographical highs such as mountains and ridges represent surface water drainage divides, which define surface water catchment areas (watersheds). We infer that, on a regional scale, groundwater catchment areas are approximately coincident with surface water catchment areas at the Site.

2.3 Geology

Figure A3 (Appendix A) presents the surficial geology in the vicinity of the Site. Based on surficial geology mapping (Smith, 2011), glacial till is the dominant overburden material throughout the Site. This till occurs mainly as hummocky and blanket deposits, but also as a thin discontinuous veneer (typically less than 1.5 m thick). The till deposits comprise diamicton (poorly-sorted material containing a mixture of grain-sizes ranging from clay to boulders). Sand and gravel deposits of glacial outwash and fluvial origin are locally present (confined to the Victoria River valley, located along the east side of the Site). In addition to glacial units, a number of areas of organic and peaty soils are present on the Site, overlying either till or bedrock in areas of poor drainage. Areas of high ground along the crest of the ridge (corresponding to the Project deposit areas) are characterized by bedrock outcrop exposed within the till veneer and various other surficial deposits. Bedrock outcrops may be partially or fully concealed by a thin mat of vegetation and/or sparse forest.

Bedrock geology of the Site (Figure A4, Appendix A) is presented in Tettelaar and Dunsworth (2016) and Lincoln, et al. (2018). A summary of these references is provided below, and the text is mainly verbatim from these sources.

Three major lithological units underlie the Site from northwest to southeast, including 1) the Valentine Lake Intrusive Suite (VLIS); 2) the Rogerson Lake Conglomerate (RLC); and 3) mixed sedimentary units and lesser gabbroic and mafic volcanic rocks of the Victoria Lake Group (VLG).

The VLIS is an elongate 22 km long, <4.5 km wide, zoned intrusive body that underlies the northwestern portion of the Site; and is the major host to gold mineralization. Quartz porphyry monzonite and trondhjemite are the dominant lithologies that make up the VLIS, with northwest parts composed of gabbro and diorite. The VLIS is Precambrian age (dated at 563+- 2 Ma), and forms a structural inlier within the younger VLG Cambrian - Ordovician siliciclastic sedimentary rocks. The VLG rocks occur in a small areas along the northern extent of the Site in the vicinity of the Victory WRD, but most significantly occur in the southeast portion of the Site along the southern margin of the RLC.

The RLC occurs as a narrow, elongate, northeast-striking belt in structural contact (fault) with the VLIS along its southern margin. The RLC is Silurian-aged and is host to minor volumes of mineralization proximal to the contact with the VLIS. The conglomerate is laterally extensive and up to 20 m thick, and is composed of polymictic, unsorted, pebble to cobble size conglomerate.

The RLC is locally overturned along its fault contact with the VLIS, and has an unconformable contact with the older rocks of the VLG in the southeastern portion of the Site.

The rocks at the Site have undergone intense deformation associated with Late Ordovician – Silurian Salinic orogenesis, and display a penetrative, steeply-dipping, northeast trending foliation that is sub-parallel to stratigraphy. Deformation is generally brittle in nature in the VLIS; whereas heterogeneous ductile deformation is characteristic of the RLC and VLG rocks. The rocks on the Site are cut by several large-scale faults, the most significant of which is the Valentine Lake Fault (VLF), a major regional structure that strikes northeast and dips between 70° to 90° northwest and displays a reverse fault movement and sinistral shear sense. The VLF runs through the center of the Site and defines the structural contact (fault) between the VLIS and RLC rocks. Second- and third-order extensional shear zones occur at oblique angles to the VLF and provide localized structural control to quartz vein gold mineralization associated with the Project deposits. In addition, the rocks display variable small-scale fractures and joints.

The Project deposit and pit areas are underlain by VLIS and RC rocks in structural contact with the VLF. The waste rock pile for the Leprechaun pit is underlain by rocks of the RLC and VLG; while the waste rock pile for the Marathon deposit is underlain by rocks of the VLIS. The RLC and VLG rocks also underlie the proposed tailings storage facility, process plant, and accommodations camp.

2.4 Existing Groundwater Use

The locations of all Water Rights holders with available GPS coordinates in the Newfoundland and Labrador Registry of Water Rights (i.e., 3,477 of the 3,513 current entries) were viewed to determine if major water users were present within the Site area. Based on a review of the Registry, there are no currently valid water use permits in the vicinity of the Site. Historically, local water (presumably all surface water) has been used exclusively for drilling and mineral exploration. Appendix B contains the relevant pages from the Registry (WRMD, 2019).

The closest public potable water supply is the Buchans surface water supply, which is located approximately 45 km north of Valentine Lake. Given the substantial distance and the number of intervening topographic and hydraulic drainage divides that separate the Buchans Lake catchment area from the site, we conclude that the Site is not hydraulically connected to this public water supply area.

3.0 FIELD METHODS

3.1 Borehole Drilling and Well Installation

A total of eight monitoring wells were installed on the Site between September 30 and October 11, 2019. Drilling was carried out using a skid-mounted Duralite exploration diamond drill rig (provided and operated by Marathon's drilling contractor, RNR Diamond Drilling of Springdale, NL) under the observation of GEMTEC personnel.

Where possible, soil and bedrock conditions were logged continuously in the field, noting grain size classifications and colour, as well as other descriptive characteristics. The rig was equipped with a split-spoon sampler; however, issues with the rig's Standard Penetration Test (SPT) equipment precluded the use of the split-spoon sampler after the first two boreholes (MW2 and MW7). For borehole MW8 overburden characteristics were inferred based on that encountered in the immediately adjacent borehole MW7. For the remainder of the boreholes (MW1, MW3, MW4, MW5, and MW6), local overburden characteristics were inferred based on test pits excavated near each borehole as part of the GEMTEC (2019a) geotechnical program. Because of this, detailed soil descriptions for boreholes without split-spoon samples were limited to the maximum excavation depths of these test pits, which ranged from 1.2 m in test pit TP30 for MW5 to 4.2 m in test pit TP28 for MW1. In all of these cases the boreholes had overburden thickness that extended deeper than could be directly assessed in the corresponding test pits, and as such inferred lithology shown on the borehole logs below the corresponding test pit depths should be regarded with caution.

A continuous photographic record of the drill core was collected, and the cores were left on-site in core boxes for storage by Marathon. Soil samples were collected in sealed plastic bags. Selected samples were sent to GEMTEC's Fredericton, New Brunswick laboratory for gradation and moisture content determination as part of the GEMTEC (2019a) geotechnical program.

The eight boreholes were completed as six shallow monitoring wells and two deeper monitoring wells. The deep wells were situated adjacent to shallow wells to allow calculation of vertical hydraulic gradients through paired well installations. Boreholes for the six shallow monitoring wells (MW1, MW2, MW3, MW4, MW5, and MW7) were advanced to depths ranging from 5.64 mbgs (MW2) to 10.10 mbgs (MW5); while the two deeper monitoring wells were advanced to depths ranging from 30.05 mbgs (MW6) to 31.90 mbgs (MW8). Paired well installations to determine vertical hydraulic gradients were MW3/MW6 and MW7/MW8.

Each borehole was completed as a monitoring well by installing variable lengths of 50 mm diameter, Schedule 40 polyvinyl chloride (PVC) casing and slotted well screen (0.010 inch slot size). The bottom of the screen was capped with a screw-on well point. For shallow wells (MW1, MW2, MW3, MW4, MW5, and MW7) the screened intervals were placed to straddle the anticipated fluctuations in the groundwater table. For deep wells (MW6 and MW8), a 1.52 m length of screen was installed at the bottom of the well. The space between the screened portion of the well and the annulus of the borehole was backfilled with silica sand to no less than of 0.3 m above the top of the well screen and a bentonite seal, ranging in thickness from 0.3 m in MW2 to 1.2 m in MW6, was placed above the top of the sand to prevent surface water from infiltrating the well. Furthermore, deep wells were grouted from the top of the bentonite seal up to surface using a bentonite slurry and tremie pipe.

The Duralite exploration rig used had to be positioned on top of a proposed drill target with drilling down through an opening in the bottom of the rig to advance a borehole. Consequently, it was necessary to advance the borehole, install the underground portion of the well, then physically move off of the drill target in order to then construct the well stick-up and install the protective metal well enclosure. Because the sections of PVC screen/riser are threaded, this required that only *full* pieces (i.e., 5' or 10' lengths) of PVC screen/riser be used below ground surface, so that the stick-up could be properly threaded on once the drill rig was moved out of the way. This made well completion difficult as surface material could fall into the well before completion.

Well installation was further complicated by cave-in material (i.e., slough) within the boreholes. Where that occurred, the monitoring well could not be installed to the full depth of the borehole it was installed in.

It should also be noted that MW5 was originally planned to be a deep (30 m) well, and a borehole was advanced accordingly. However, the well could not be properly installed due to rock cave within the borehole that prevented introduction of the tremie grouting system. The borehole (BH5) was ultimately abandoned after multiple unsuccessful attempts to remedy the issue. MW5 (10.10 m deep) was installed in a new, shallower borehole located approximately 1.5 m from the original borehole.

Following monitoring well installation, each well was developed by purging approximately 60 to 170 L (in the deep wells) of groundwater. Monitoring well development was completed to reduce any sediment that may have been present during installation and to remove any water that may have been introduced during drilling.

Logs for the eight borehole/monitoring wells are included in Appendix C.

3.2 Hydraulic Conductivity

During the October 2019 field program hydraulic response (slug) testing was conducted in each of the eight new monitoring wells, comprising an initial falling head slug test, with a rising head slug test subsequently completed once the well had achieved at least 75% recovery. A cylindrical slug (volume 0.67 L) was used for all slug tests except those conducted at MW5 and MW7, where two slugs were screwed together to form a solid cylindrical unit with a volume of 1.34 L due to rapid recovery at those locations.

The slug was lowered to approximately 0.25 m above the water surface, then allowed to free-fall into the well for approximately 2 m. The slug was then secured to the protective well casing to prevent further slug movement. Water levels were monitored with an electronic Solinst® Levelogger® and a manual Solinst® water level meter until the well had achieved at least 75% recovery. The rising head test was conducted in a similar manner, by removing the slug rapidly from the well and monitoring water levels with a Levelogger® and a manual water level meter.

The slug test water level data was analyzed using AQTESOLV® (HydroSOLVE Inc., 2007) to derive an estimate of hydraulic conductivity for the aquifer materials in the screened intervals of the monitoring wells. The data was analysed using the Bouwer-Rice (1976) unconfined aquifer model, applying Butler's Equation 3.1 (1998) correction for effective casing radius.

3.3 Groundwater Level Monitoring

During the October 2019 field program groundwater levels in the eight new monitoring wells were measured manually with a Solinst® water level meter immediately before slug testing and sampling. After sampling was complete, a Solinst® Levelogger® set to record water levels every 24 hours was installed in each well for long-term monitoring purposes. A Solinst® Barologger® was also placed outdoors at a central location on the Site to allow barometric correction of the long-term Levelogger® data.

Additionally, groundwater levels were manually measured at a number of exploration boreholes at the Site during the October 2019 field program. GEMTEC was provided with the information and coordinates for over 1,000 NQ-size (75 mm-diameter) exploration boreholes drilled at the Site. These boreholes ranged in length from 11 to 1,001 m and were inclined from 64 to 90 degrees down from horizontal. However, many of these boreholes could not be located or were deemed unsuitable for groundwater level measurement (e.g., missing borehole casing, damaged, or open hole obstructed by debris or mud). If multiple boreholes were present within a small area, the water level was measured in only selected boreholes. As a result, GEMTEC's groundwater level survey was limited to 137 exploration boreholes distributed across the Site. The exploration boreholes monitored and used to generate the piezometric contour map are shown on Figure A5 (Appendix A). The manual groundwater depth measurements from the exploration boreholes were adjusted for the inclination of each borehole and were referenced to known collar elevations (provided by Marathon) to determine groundwater elevations.

Groundwater levels were also measured as part of the February 2020 field program immediately before retrieving the level loggers and collecting groundwater samples from monitoring wells MW2, MW3, MW6, MW7, and MW8. During the February 2020 field program, frozen groundwater conditions and considerable ice accumulation that could not be removed (estimated greater that 0.3 m thickness) were encountered in monitoring wells MW1, MW4, and MW5. This prevented collection of groundwater level measurements and groundwater sampling at these locations. Furthermore, the level loggers in monitoring wells MW1, MW4, and MW5 could not be removed to retrieve long-term monitoring data collected at these locations.

3.4 Groundwater Quality Sampling

Two groundwater sampling events were conducted at the site, including a full sampling program in all eight newly installed monitoring wells as part of the October 2019 field program, and a limited sampling program in those monitoring wells not obstructed by ice (MW2, MW3, MW6, MW7, and MW8) as part of the February 2020 field program.

Before sampling, each of the monitoring wells was purged using dedicated polyethylene tubing and a Monsoon® 2” battery-powered submersible pump until field parameters (pH, specific conductance, temperature, dissolved oxygen (DO) and Oxidation-Reduction Potential (ORP)) had stabilized (less than 10% variance) over three consecutive 3-minute interval readings. A YSI Professional Plus multi-parameter meter complete with flow cell was used to monitor water quality during purging. For sampling, the flowrate was set to less than 1 L/min. Groundwater samples were collected for general chemistry parameters, trace metals (including mercury), total suspended solids, strong and weak acid-dissociable cyanide, total phosphorus, and Radium-226. Groundwater samples for metals and mercury analysis were field-filtered using disposable 0.45 µm inline filters (except those collected from MW3 and MW6 during the October 2019 program that, due to field filter issues, were laboratory filtered). All samples were collected in the appropriate laboratory-supplied containers with the necessary preservatives. After sampling, each sample container was tightly capped, labelled and kept cool in coolers with ice and/or in a refrigerator until transported to the laboratory (AGAT Laboratories, in St. John’s, NL).

The following QA/QC measures were employed during the field investigation activities to maintain sample integrity:

- Sampling and monitoring equipment (e.g., the submersible pump) were cleaned between monitoring wells using a mixture of the industrial cleaner Alconox® and potable water followed by a potable water rinse;
- Field personnel wore disposable, nitrile gloves during sampling, and these gloves were replaced between each sampling location;
- Dedicated, new polyethylene (Waterra®) tubing was used at each monitoring well;
- All groundwater samples collected for laboratory analysis were collected in appropriate new sample containers provided by the laboratory;
- Samples were stored in coolers equipped with ice until submission to the laboratory; and,
- Samples submitted to the laboratory were accompanied by a signed and dated Chain of Custody form and were packaged and shipped in cooler(s) containing bags of ice.

QA/QC measures are also performed by the analytical laboratory. QA/QC measures vary by laboratory but typically include all or some of the following: analysis of laboratory duplicate samples, laboratory control samples, matrix spikes, method blanks, internal reference material, surrogate recoveries, and the use of analytical methods in accordance with ISO/IEC 17025:2005 accreditation standards.

A review of the laboratory QA/QC data was performed by GEMTEC upon receipt of the Certificates of Analysis.

4.0 HYDROGEOLOGICAL CHARACTERIZATION

The following sections summarize hydrogeology baseline conditions at the Site based on a desktop assessment of overburden and bedrock information, and hydrogeological data previously collected, and analysis of new data obtained during GEMTEC's hydrogeology baseline field program.

4.1 Hydrostratigraphy

From a regional perspective, the overburden material and the underlying major bedrock groups at the Site can be assigned to identified hydrostratigraphic units in central Newfoundland, as described in AMEC (2013). The till deposits at the Site are included in overburden hydrostratigraphic Unit A (Till Deposits), which predominantly comprises silty sand and clayey silt. The Valentine Lake gold deposits are primarily found in what is referred to as hydrostratigraphic Unit 5, which consists of plutonic rocks, mostly granites, granodiorite, diabase, and diorite intrusions. To the southeast of the VLF, the RLC belt is included within hydrogeological Unit 2, which consists sedimentary strata, mainly siltstone, conglomerate, argillite, and greywacke units, with minor volcanic flows and tuff. The VLG is included within hydrogeological Unit 3, which consists of volcanic strata, mainly basic pillow lava, flows, breccia, and tuff.

Local geology and hydrostratigraphy at the Site was interpreted from borehole data collected as part of the current program, and data from previous investigations (GEMTEC, 2019a; Terrane, 2019), as well as from historical exploration borehole logs provided by Marathon.

The soil and bedrock stratigraphy encountered at the Site as part of the current program is presented in the borehole logs in Appendix C. Bedrock was encountered in all boreholes except MW1, with top of bedrock depths ranging from 1.83 mbgs (in MW5) to greater than 8.23 mbgs (in MW5). MW3 and MW6 consisted of fair to excellent quality granitic intrusive rock interpreted to be trondhjemite of the VLIS. Inferred trondhjemite was also encountered in MW7 and MW8; however, the quality was poor to good. Bedrock in MW2 consisted of excellent quality, fresh granitic rock interpreted to be quartz porphyry monzonite of the VLIS. In MW4 and MW5, bedrock was fresh, sedimentary rock (siltstone) inferred to be part of the VLG, and had variable rock quality. Overall the fracture density was observed to be highest in the upper 5 m of the bedrock stratigraphy, particularly for the trondhjemite and siltstone, and fractures were most commonly horizontal to low angle (<45^{o}) relative to the core axis (further described in Section 4.2).

Bedrock was generally observed to be overlain by a layer of till comprising loose to compact, grey-brown silty sand with gravel, and occasional cobbles/boulders or clay. Also, organic material (rootmat/peat) was present at surface at monitoring well locations MW7 and MW8. Historical exploration borehole logs for over 1,000 exploration boreholes located throughout the Site, as well as overburden data collected as part of the current program and GEMTEC's (2019a) geotechnical program indicate overburden thickness ranging from 0.1 m to 17.1 m, and with an average thickness of 3.8 m across the Site. In the vicinity of the Victory deposit, the till veneer was inferred to be up to 1 m thick, with a thicker blanket of till immediately to the northwest (MW1 was advanced to a depth of 8.23 m without encountering bedrock). Inferred overburden thicknesses in the Leprechaun and Sprite deposit areas ranged from 0.3 to 2.8 m (except in MW3/MW6 and test pit 19TP20, where the overburden was approximately 4 m thick). Around the proposed tailings storage facility and camp, the thickness of the overburden layer was inferred to vary from 2.6 to 4.3 m, with the exception of 19TP25 (0.2 m thickness). In the Marathon deposit area a till blanket at least 4 m thick was inferred in most locations. The thickest accumulations of overburden are associated with the blanket deposits present in the southwestern portion of the proposed Marathon pit and immediately northwest of the Victory deposit. The thinnest accumulations are associated with the till veneer present in the Victory deposit area, the northeastern portion of the proposed Marathon pit, and in the vicinity of the Leprechaun and Sprite deposits.

Based on the hydrogeological data presented in the subsequent sections, GEMTEC infers that the Site is underlain by an unconfined aquifer within the saturated overburden and shallow bedrock units described above, with semi-confined groundwater flow conditions present at depth within the bedrock. The hydraulic conductivity and movement of groundwater through the overburden material is controlled by primary porosity, while groundwater flow within the underlying bedrock is expected to mainly occur within secondary porosity, such as fractures, joints, and will vary depending on the frequency and interconnection of these discontinuities. The estimated hydraulic conductivity determined for the overburden and bedrock hydrostratigraphic units underlying the Site are presented in Section 4.3. The current program and previous investigations determined bulk estimates of hydraulic conductivity over the tested sections of overburden and bedrock that provide reasonable values for general characterization of groundwater flow baseline conditions for Project Registration and anticipated EA purposes. However, it should be noted that additional hydraulic response testing will likely be required to obtain more specific lithology and depth-related hydraulic conductivity estimates to satisfy mine planning and engineering design as Project development advances. In particular various faults, fractures, and shear zones have been mapped at the Site that haven't been tested and are not yet well characterized. Such structures may have substantially higher localized permeability than the surrounding rock mass that could influence groundwater flow at Site.

4.2 Rock Quality Designations (RQDs)

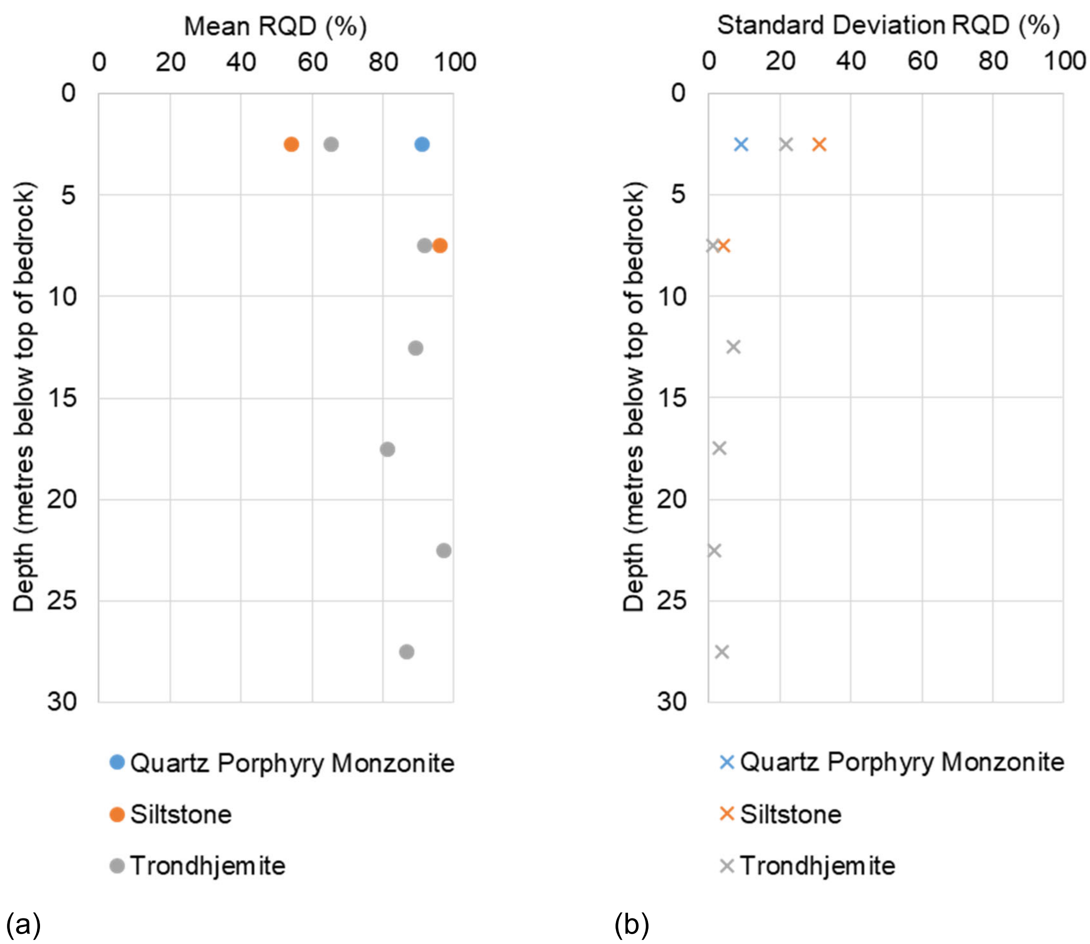
Rock Quality Designation (RQD) is a measure of the intactness of rock core extracted from a borehole. Originally developed for NQ size core, RQD (expressed as %) is the sum length of intact pieces of core over 100 mm (four inches) long divided by the total core run length, multiplied by 100. Natural fractures and joints in the bedrock can result in core pieces less than 100 mm long, reducing RQD values to less than 100%. Highly fractured rock would have few core segments longer than 100 mm, and therefore a low RQD (down to 0%). Typically, highly fractured bedrock with low RQD would tend to have high hydraulic conductivity.

Over 53,000 RQD values from historical exploration borehole logs provided by Marathon were reviewed by GEMTEC, and summary statistics were calculated for 50 to 100 m depth intervals (Appendix D). Generally speaking, RQD tended to be lower in shallower, more weathered bedrock, and in locations with significant structural features such as faults. RQD typically increased slightly with depth at the Site. The standard deviation of the RQD tended to decrease with depth, generally indicating a more uniform rock quality. The mean RQD for the depth interval 0 to 50 m was 85%; at depths greater than 50 m, mean RQDs were over 90%. Terrane (2019) also found that, based on their seven boreholes in the proposed Marathon and Leprechaun pit areas that were advanced to 101 to 401 m depth, rock quality slightly increases with depth.

RQDs from GEMTEC's 2019 drilling program (eight boreholes) were also reviewed, and summary statistics were calculated (Figure 1 (a) mean RQD, and (b) standard deviation RQD). In comparison to historical exploration boreholes, the new monitoring wells were substantially shallower and overburden (not incorporated in RQD values) accounted for a much higher proportion of the borehole depth. Therefore, summary statistics for the new monitoring wells were based on smaller depth intervals of 5 m, where the depth was measured from the top of bedrock rather than depth below ground surface to remove the confounding factor of overburden thickness.

It should be noted that RQD information was only available from one shallow well (MW2) for the quartz porphyry monzonite, and for two shallow wells (MW4 and MW5) for the siltstone. The five remaining monitoring wells, including both deeper wells, were completed in trondhjemite. Based on Figure 1, from 5 to 30 m below top of bedrock, the trondhjemite ranges between good and excellent quality. Lower RQDs within the first 5 m of siltstone and trondhjemite suggest weathering and/or jointing near the bedrock surfaces in those areas. Based on borehole logging, fractures present within the first 5 m of the siltstone and trondhjemite were most commonly horizontal to low angle (<45^{o}) relative to the core axis, and are inferred to represent sub-horizontal unloading joints, which are typically quite open and highly permeable.

Figure 1 RQDs in New Monitoring Wells: Bedrock versus Depth



4.3 Hydraulic Conductivity

Regional Yield Estimates

Based on regional AMEC (2013) data for 46 water wells in overburden hydrostratigraphic Unit A, the till material has a moderate yield (i.e., mean yield of 29 L/m and median yield of 18 L/min) with average associated well depths of 17 m (median 15 m). Based on regional AMEC (2013) data for 688 water wells in bedrock Unit 5, 1,403 wells in Unit 2, and 723 wells in Unit 3, all three bedrock units generally have low to moderate well yields (i.e., with median yields of 7 to 9 L/min and mean yields of 20 to 22 L/min). Well depths in Unit 5 were observed to generally be a few metres shallower than in Units 2 and 3, which had similar average and median depths of approximately 50 – 51 m, and 46 m, respectively. It should be noted that these yield statistics for the regional overburden and bedrock stratigraphic units excluded zero yield wells (approximately 35% of the records for the overburden, and 30% of the records for the bedrock).

Site-Specific Hydraulic Conductivity Estimates – Previous Investigations

Stantec (2017) obtained preliminary bulk estimates of hydraulic conductivity in bedrock at the site from six existing vertical (or near-vertical) exploration boreholes within the proposed Marathon and Leprechaun pit areas. The three boreholes selected from within the Marathon deposit had lengths of 317, 600, and 974 m, while the lengths of the three boreholes within the Leprechaun deposit were 25, 248, and 488 m. Each exploration borehole was pumped at a rate of 10 to 13 L/min for approximately 30 minutes or until the water level had drawn down to the pump intake. The Theis recovery analysis method was then used to estimate the apparent bulk transmissivity (T) of the bedrock. Using the relationship that T = bK, where b is saturated thickness and K is hydraulic conductivity, the average hydraulic conductivities were approximated as T/b (assuming that b was equivalent to the total borehole depth). The calculated hydraulic conductivity values were 3.4×10^{-8} m/s for the Leprechaun pit, and 7.8×10^{-8} m/s for the Marathon pit (Stantec, 2017a). Recognizing that the jointed rock mass below these boreholes is in fact saturated, this approach of limiting b to the borehole depth forces the calculated hydraulic conductivity values to be higher than the actual hydraulic conductivity values. Typical hydraulic conductivity values for fracture plutonic rocks are lower, ranging from 10^{-8} to 10^{-10} m/s.

The historical borehole logs (provided by Marathon) for the six boreholes tested by Stantec were reviewed as part of this program. The primary bedrock type within each of the Leprechaun boreholes was confirmed to be trondhjemite, while the primary bedrock type within each of the Marathon boreholes was quartz-eye porphyry. It should be understood that bulk hydraulic conductivity estimates represent the average response over the depth of the borehole. Hydraulic conductivities may vary widely with depth within a single borehole, depending on the level of weathering and the presence of structural features such as faults.

Terrane (2019) completed a total of ten packer tests in three geotechnical boreholes within the proposed Leprechaun pit and two boreholes within the proposed Marathon pit at depths ranging from 12 to 374 mbgs. The objective of the packer testing was to provide general estimates of hydraulic conductivity for the rock mass in the areas of each proposed pit that could be used for preliminary calculations of pit inflows. Rather than completing a single packer test on the entire borehole to obtain a bulk estimate, particular depth intervals in each borehole were chosen for testing to obtain general estimates of hydraulic conductivity for both the intact and fractured rock mass. Tests conducted within the Leprechaun pit area were all completed within the trondhjemite unit, while tests within the Marathon pit area were limited to one to two tests in each of the three primary bedrock units in that pit (quartz-eye porphyry, conglomerate, and mafic dyke). One packer test was also completed specifically to assess the Valentine Lake thrust fault in the Leprechaun pit.

Terrane's (2019) packer test results for the Leprechaun pit (i.e., primarily for the trondhjemite unit) ranged through four orders of magnitude with a geometric mean of 6×10^{-8} m/s, which is similar to Stantec's (2017) estimate of 3.4×10^{-8} m/s. Results for the various bedrock units within the

Marathon pit also varied widely, with a geometric mean of 5 x 10^{-8} m/s, which was similar to Stantec's (2017) estimate of 7.8 x 10^{-8} m/s. However, it should be noted that the primary bedrock type in the boreholes tested by Stantec was determined to be quartz-eye porphyry, and the (single) Terrane (2019) packer test targeting the quartz-eye porphyry unit yielded a substantially lower estimate for hydraulic conductivity (3.90 x 10^{-10} m/s) by comparison. This may suggest that the hydraulic conductivity within the quartz-eye porphyry is quite variable.

The Stantec (2017) and Terrane (2019) results are limited to the VLIS and RC rocks that make up the pit areas. To date, the only hydraulic conductivity testing that has been completed in the VLG rocks present beneath the Leprechaun waste rock pile, tailings storage facility, process plant, and accommodations camp has been by Stantec (2011). Stantec (2011) completed aquifer testing and estimated transmissivity at 4.5 x 10^{-5} m^2/s for the existing exploration bedrock water well, which equates to a hydraulic conductivity of approximately 7.4 x 10^{-7} m/s assuming a saturated thickness (b) value of 60.8 m. This value is within the range of values determined for the other Site rocks, but GEMTEC considers it to represent an upper limit of hydraulic conductivity for this bedrock unit recognizing that the rock mass below this water well is in fact saturated, and that this approach of limiting b to the borehole depth forces the calculated hydraulic conductivity value to be higher than the actual hydraulic conductivity value.

Site-Specific Hydraulic Conductivity Estimates – Current Hydrogeology Baseline Program

Plots of water level versus time for the slug tests conducted in the eight new monitoring wells by GEMTEC in October 2019 are provided in Appendix E. AQTESOLV® analytical plots are presented in Appendix F. Results of the slug tests analyses are presented in Table 1 below.

The slug tests completed at monitoring wells MW1 to MW5, and MW7, which were screened across overburden and varying thicknesses of shallow bedrock (with the screened interval in bedrock ranging from zero percent bedrock in MW1 up to 64 percent bedrock in MW2), resulted in hydraulic conductivity estimates ranging from 5 x 10^{-7} m/s (MW4) to 1 x 10^{-4} m/s (MW5) with a geometric mean of 5 x 10^{-6} m/s. Slug test results for MW1, which was screened fully within the overburden material, returned an individual hydraulic conductivity value of 1 x 10^{-6} m/s that was similar to the geometric mean for the combined overburden/shallow bedrock dataset, suggesting that shallow bedrock within the screened test intervals down to a maximum of 10 m (MW5) also has a similar individual hydraulic conductivity value of 1 x 10^{-6} m/s.

The slug tests completed for MW6 and MW8, screened at approximately 30 m depth within bedrock, returned a geometric mean result of 6 x 10^{-7} m/s, which was approximately one order of magnitude lower than geometric mean value determined for the combined overburden/shallow bedrock dataset. This result fits the higher RQD values (more intact rock), and lower fracture density measured as part of the GEMTEC (2019a) geotechnical program below five metres, which would be expected to result in correspondingly lower hydraulic conductivity values.

Based on the bedrock hydraulic conductivity estimates determined as part of the current program, and those determined by previous studies (e.g., Stantec, 2017; Terrane, 2019), a trend of decreasing hydraulic conductivity with depth is apparent in the Site bedrock hydraulic conductivity data set that is attributed to decreasing bedrock weathering and fracturing as depth increases, as also observed in the RQD dataset. The data available do not show a relation between hydraulic conductivity and bedrock type, confirming secondary porosity (faults and fractures) likely controls permeability. It should be noted that various faults, fractures, and shear zones have been mapped at the Site that have not been tested and are not yet well characterized. Such structures may have substantially higher localized permeability than the surrounding rock mass that could influence groundwater flow at the Site.

The current Site hydraulic conductivity data set is not sufficient for GEMTEC to confidently define separate hydraulic conductivity estimates based on bedrock type and depth at the Site. Limited data are also available to differentiate the hydraulic conductivity of overburden and bedrock. Based on the range of values determined through the various studies discussed, we assumed for the purposes of the groundwater velocity calculations below that the hydraulic conductivity of the overburden was in the order of 10^{-6} m/s, and that a reasonable bulk hydraulic conductivity for the bedrock, including within the proposed pit depths (i.e., 300 to 400 m), was in the order of 10^{-8} m/s.

In general, the hydraulic conductively values determined for overburden and bedrock at the Site were within the typical range of values in the literature for similar unconsolidated deposit and fractured/unfractured bedrock types (e.g., Freeze & Cherry, 1979).

Table 1 Summary of Slug Test Analyses Results

Well ID	Hydro-stratigraphic Unit (% screened section)	Test No.	Test Type	Test Date	Estimated Hydraulic Conductivity (m/sec)	Geometric Mean Hydraulic Conductivity (m/sec)
MW1	Overburden	1	Slug (Falling Head)	October 7, 2019	1.27E-6	1.34E-6
		2	Slug (Rising Head)		1.42E-6	
MW2	Overburden (36%) Shallow bedrock (64%)	1	Slug (Falling Head)	October 5, 2019	8.19E-6	1.51E-5
		2	Slug (Rising Head)		2.79E-5	
MW3	Overburden (61%) Shallow bedrock (39%)	1	Slug (Falling Head)	October 11, 2019	8.94E-7	7.94E-7
		2	Slug (Rising Head)		7.05E-7	
MW4	Overburden (62%) Shallow bedrock (38%)	1	Slug (Falling Head)	October 8, 2019	5.14E-6	1.54E-6
		2	Slug (Rising Head)		4.59E-7	
MW5	Bedrock (to 10 m)	1	Slug (Falling Head)	October 10, 2019	7.43E-5	8.59E-5
		2	Slug (Rising Head)		9.93E-5	
MW6	Bedrock (at ~ 30 m)	1	Slug (Falling Head)	October 11, 2019	3.61E-7	8.79E-7
		2	Slug (Rising Head)		2.14E-6	
MW7	Overburden (65%) Shallow bedrock (35%)	1	Slug (Falling Head)	October 6, 2019	3.40E-6	4.74E-6
		2	Slug (Rising Head)		6.61E-6	
MW8	Bedrock (at ~ 30 m)	1	Slug (Falling Head)	October 7, 2019	4.70E-8	3.69E-7
		2	Slug (Rising Head)		2.89E-6	
Geometric Mean – Overburden/Shallow Bedrock (MW1 to MW5, and MW7)						4.65E-06
Geometric Mean – Bedrock (30 m depth) (MW6 and MW8)						5.70E-07

4.4 Groundwater Levels

4.4.1 Piezometric Contours

Based on groundwater level measurements collected in October 2019 from the eight new monitoring wells and 137 accessible exploration boreholes, groundwater (piezometric) contours were developed for the Site (Figure A5 in Appendix A). Groundwater levels collected from the monitoring wells during the October 2019 event used to develop the groundwater contour map, are summarized in Table 2, and are included in the monitoring well logs in Appendix C. The groundwater levels collected during the February 2020 monitoring event are also provided in Table 2. Groundwater levels measured in the exploration boreholes are tabulated in Appendix G.

Table 2 Summary of Manual Groundwater Level Measurements

Well ID	Surface Elevation (masl)	October 2019		February 2020	
		Groundwater Level (mbgs)	Groundwater Elevation (masl)	Groundwater Level (mbgs)	Groundwater Elevation (masl)
MW1	310.83	-0.23	311.06	-	-
MW2	419.22	1.17	418.05	2.01	417.21
MW3	386.38	1.85	384.53	2.56	383.82
MW4	364.49	-0.04	364.53	-	-
MW5	363.32	0.26	363.06	-	-
MW6	386.46	7.42	379.04	9.30	377.16
MW7	342.27	0.68	341.60	0.77	341.5
MW8	342.37	0.24	342.14	0.43	341.94

The groundwater elevation data and contours are generally consistent with that determined by Stantec (2017). The developed potentiometric map is inferred to represent regional groundwater flow conditions across the Site, and generally mimics surface topography, with higher groundwater elevations observed in upland areas along the prominent northeast-trending ridge running through the center of the Site, and lower groundwater elevations observed in adjacent lowland areas.

The groundwater levels in February 2020 were systematically lower than those in October 2019. This is expectable due to gradual groundwater recession during winter conditions with no further infiltration and groundwater recharge.

4.4.2 Long-term Monitoring

Time-series plots of groundwater levels from October 12, 2019 to February 28, 2020 at five of the new monitoring wells (MW2, MW3, MW6, MW7, and MW8) are shown in Appendix H. These are accompanied by daily precipitation measurements from the nearest weather station with available data for the monitoring period (i.e., at the Millerstown Reference Climate Station (RCS), 55 km from the Site). Summary statistics for this period are presented in Table 3.

Table 3 Summary of Groundwater Level Monitoring (Oct. 12, 2019 – Feb. 28, 2020)

Well ID	Lowest Observed Groundwater Elevation			Highest Observed Groundwater Elevation			Mean Groundwater Elevation		Observed Groundwater Elevation Variability (m)
	Depth (mbgs)	Elevation (masl)	Date	Depth (mbgs)	Elevation (masl)	Date	Depth (mbgs)	Elevation (masl)	
MW2	2.06	416.68	Feb 19, 2020	-0.34	419.08	Nov 14, 2019	0.70	418.04	2.40
MW3	2.74	383.48	Dec 11, 2019	0.01	386.21	Nov 13, 2019	1.57	384.65	2.73
MW6	9.05	377.00	Feb 19, 2020	6.92	379.13	Nov 14, 2019	7.92	378.13	2.13
MW7	1.16	340.93	Feb 2, 2020	0.14	341.95	Feb 8, 2020	0.64	341.45	1.02
MW8	0.54	341.47	Feb 2, 2020	-0.03	342.04	Feb 8, 2020	0.27	341.74	0.57

Over the monitoring period, the depth to shallow groundwater as recorded in MW2, MW3, and MW7 ranged from -0.34 mbgs (MW2) to 2.74 mbgs (MW3). In the two deeper wells (MW6 and MW8), the static water level ranged from -0.03 mbgs (very slightly artesian; at MW8) to 9.05 mbgs (MW6). The shallow, above ground surface water level readings recorded in MW2 from November 1 to December 20, 2019 (50 days) is not thought to represent artesian conditions but rather reflect near surface water table conditions, and possibly be due to level logger/barologger sensitivity. Groundwater levels in MW2 and paired well system MW3 and MW6 were relatively stable for the first approximately 3 weeks of monitoring, and then rose sharply to peak shallow groundwater conditions (i.e., highest groundwater elevations) at about November 1, 2019, followed by a general trend to lower levels (i.e., the depth to groundwater increased) for the remainder of the approximately four month monitoring period. The groundwater level profiles for MW2, and paired well system MW3 and MW6 appear to coincide with rainfall estimates over the monitoring period (Appendix D), and support the concept that the overburden and shallow bedrock aquifer at these locations is unconfined, and situated within an area of groundwater recharge, as inferred based on the calculated vertical gradients for paired well system MW3/MW6 (as discussed in Section 4.5) Information provided in Stantec (2019) indicates that annual groundwater level fluctuations typically vary by less than 0.8 m, and do not appear to show a strong correlation with precipitation. However, Stantec measured water levels in existing exploration wells. One of these exploration wells was 25 m deep; the other five wells ranged from 112 to 974 m deep. Typically deeper wells experience delayed precipitation effects or none at all due to the water-bearing fractures' decreased connectivity with the surface.

Over the monitoring period, groundwater levels in paired wells MW7 and MW8 remained relatively stable; showing very little correlation to rainfall measurements. This relationship is expected given the paired well system's location in a low-lying area inferred to be an area of groundwater discharge, inferred based on calculated vertical gradients (as discussed in Section 4.5).

Day-to-day variability in groundwater levels are also observed at all long-term monitoring well locations that appear coincidence of individual rainfall events (Appendix D). It should be noted that the monitoring period may not have captured the full range of seasonal groundwater level fluctuations at these locations at the Site. A longer-term (e.g., at least a full year) water level monitoring program would be required to confirm the extent of seasonal variability over an entire year.

The well with the highest observed mean groundwater elevation during the monitoring period was MW2 (418.04 masl), while the lowest was observed at MW7 (341.45 masl). The presented elevations are based on a well elevation and location survey (provided by Marathon), and manually measured casing stick-up heights.

4.5 Groundwater Flow Direction and Hydraulic Gradients

Based on the piezometric contours in Figure A5 (Appendix A), GEMTEC interprets that the Site is situated along a groundwater divide and an area of groundwater recharge that corresponds to the surface water divide crest of the topographic ridge (shown as a dark blue dashed line on Figure A5 in Appendix A). Overall, the direction of groundwater flow on the Site is assumed to follow topography and surface water flow, which, depending on the specific location on the Site, would be to the northwest towards Valentine Lake or to the southeast towards the Victoria River and Victoria Lake drainage systems. These bordering drainage features to the northwest and southeast of the Site are expected to be areas of regional groundwater flow discharge.

The current hydrogeological data set is not of sufficient detail to evaluate whether local groundwater flow systems are present on the Site within the regional groundwater flow system described. It is possible that hilly topography, present particularly in the areas of the Victory Deposit, the Leprechaun pit and its waste rock pile and other associated stockpiles, and the processing plant and tailing storage facility areas, may influence local shallow groundwater flow and direct discharge to nearby topographic lows instead of to the regional discharge areas.

An estimate of horizontal hydraulic gradients for shallow groundwater was calculated by dividing the total difference in hydraulic head between two known points (e.g., the change in head between two monitoring wells) by the horizontal distance between those wells. Inferred horizontal groundwater gradients range from 8 percent (0.08 m/m) along the steepest portion of the Site near the Sprite deposit to approximately 1 percent (0.009 m/m) along the low-lying area along the northwest side of the Marathon pit and adjacent waste rock pile. Similar horizontal gradients of 3 to 5 percent occur in other areas of the Site including in the vicinity of the Leprechaun pit and adjacent waste rock pile and stockpile areas, tailings storage facility, and Victory deposit.

The vertical component of hydraulic gradient was evaluated at the two locations were a paired well system was installed (i.e., MW3/MW6 northeast of the Leprechaun pit, and MW7/MW8 in the Marathon waste rock pile and stockpile areas). Vertical hydraulic gradient was calculated by dividing the change in hydraulic head between the paired monitoring wells by the vertical distance between the midpoints of each well's screened interval. If the head of the deeper point was higher than the head of the shallower point, the gradient is upward. If the deeper head is lower than that of the shallower point, the gradient is downward.

Groundwater flow was determined to be upward in the relatively low-lying area at MW7/MW8 well pair location, with October 2019 and February 2020 monitoring results indicating flow at a slight vertical gradient from the bedrock to the overburden material of 2.5 percent (0.025 m/m) and 1 percent (0.01 m/m), respectively. Conversely, groundwater flow was determined to be downward in the relatively high-ground area at MW3/MW6 well pair location, flowing at a moderate vertical gradient from the overburden material to the bedrock of 22 percent (0.22 m/m) measured during the October 2019 event, and 27 percent (0.27 m/m) during the February 2020 event. Based on topography and observed water levels in the exploration boreholes and hydrogeology monitoring wells in other areas of the Site, a downward vertical hydraulic gradient from overburden to bedrock is expected in the groundwater divide/recharge areas, and an upward vertical hydraulic gradient is expected in the regional discharge areas along the shorelines of the surrounding surface water bodies.

Stantec (2011) reported artesian conditions in the water well located at the existing exploration camp along the shoreline of Victoria Lake confirming an area of groundwater discharge in this area. Note while artesian conditions, reflecting upward vertical gradients, were observed in a number of exploration boreholes along the crest of the topographic ridge (recharge area), GEMTEC infers that these artesian flows represent localized, confined conditions that are geologically-controlled (possibly by a structural feature at depth), and do not reflect the inferred overall regional groundwater flow regime of the Site.

4.6 Groundwater Velocity

Hydraulic conductivity represents the permeability of a material and, when multiplied by hydraulic gradient, gives a value known as Darcy Flux, analogous to the average velocity of water in a pipe. However, part of the area that groundwater passes through in earth materials is occupied by impermeable soil particles. To achieve the same average velocity (flux), the groundwater velocity through the void spaces between the soil particles must be substantially higher.

The average linear groundwater velocity is calculated by dividing the Darcy Flux by porosity, or:

$$v = Ki/n$$

where:

v = average linear groundwater velocity (m/s)
K = hydraulic conductivity (m/s)
i = hydraulic gradient (m/m), and
n = effective porosity (fractional value, from 0 to 1).

Based on the average values for overburden and bedrock hydraulic conductivity (10^{-6} and 10^{-8} m/s, respectively) determined in Section 4.3, and assuming a typical horizontal groundwater gradient across the Site of 0.04 and an effective porosity of 0.1 ((typical of a relatively unfractured volcanic rock; Earle, 2019), the average linear groundwater flow velocity is estimated to range from 0.126 m/year to 12.6 1 m/year. Linear groundwater flow velocities may be higher than that estimated in steeper areas of the Site (i.e., near the Sprite deposit where hydraulic gradient is likely higher) and lower in flatter areas of the Site (i.e., the low-lying area along the northwest side of the Marathon pit and waste rock pile where hydraulic gradient is likely lower). Furthermore, linear groundwater flow velocities may be higher than estimated in areas with higher porosity and/or higher hydraulic conductivity than those assumed.

4.7 Groundwater Quality

4.7.1 Previous Groundwater Quality Data

An understanding of groundwater chemistry is required in order to assess the potential effects of mine-related seepages/run-off on nearby surface water bodies, and the potential for the development of on-site water supply wells. Publically available regional data and previous Site-specific data are compared below.

AMEC's regional water quality classification of the above-noted hydrogeological Units is based on a total of 122 chemical analyses (nine analyses from one source water in McCallum for Unit 5, 47 analyses from nine sources in Unit 2, and 66 analyses from 13 sources in Unit 3). Based on their results, the source waters are classified as either sodium-bicarbonate type (Unit 5), or no dominant type (Units 2 and 3). From a potability perspective, potential water quality concerns common to all three units included turbidity, colour, iron, lead, and manganese. Other parameters of potential concern included pH, total dissolved solids, sodium, chloride, arsenic, cadmium, and uranium. Overall, water quality in Unit 5 was considered to be fair to good, and water quality in Units 2 and 3 was very good to excellent (AMEC, 2013). It should be noted that none of these water samples were collected near the Site; the nearest sample collection point was in Millertown (Unit 3), approximately 65 km to the northeast.

Stantec (2017a) collected a total of six water quality samples in November 2017 from existing vertical (or near-vertical) exploration boreholes within the Leprechaun and Marathon deposit areas. The three boreholes selected from within the Marathon deposit had lengths of 317, 600, and 974 m, while the lengths of the three boreholes within the Leprechaun deposit were 25, 248, and 488 m. Water samples were analyzed for general chemistry, dissolved metals (including mercury), weak and strong acid-dissociable cyanide, and radium-226.

A review of the analytical results obtained by Stantec (2017a) indicate that the groundwater in the four shallowest boreholes (the three in the Leprechaun deposit area and one in the Marathon deposit area) was calcium-bicarbonate type; while the two other samples (collected from boreholes 600 and 974 m deep) at the Marathon deposit were classified as calcium-sulfate type. Groundwater was slightly alkaline (basic), with pH ranging from 7.46 to 7.76. Hardness ranged from moderately hard to very hard, with the highest hardnesses, conductivities, and total dissolved solids (predictably) observed in the two deepest boreholes. Langelier Saturation Indices for the six samples indicate that the groundwater is neither strongly scale-forming nor corrosive with respect to calcium carbonate. Phosphorus, nitrate, nitrite, radium-226, strong and weak acid-dissociative cyanide, mercury, and lead results were all below or near the laboratory detection limits. Iron and manganese were noted to exceed the current Guidelines for Canadian Drinking Water Quality (GCDWQ). Other metals concentrations were generally relatively low, with the exception of strontium, which had concentrations above the guideline value in the two deeper Marathon boreholes.

All six of Stantec's sample locations were theoretically located within AMEC's hydrogeological Unit 5. Overall, it appears that the regional dataset is not a particularly good indicator of groundwater chemistry at the Site. This is likely partially attributable to the depths of the boreholes that Stantec sampled (which are substantially deeper than a typical potable water well), and the fact that none of the samples used to characterize Unit 5 are located near the Site.

No other previous groundwater quality data are available specifically for the Site.

4.7.2 Field Measurements and Analytical Results

GEMTEC's baseline field program included groundwater quality sampling (general chemistry and dissolved metals) of the eight new monitoring wells. It should be noted that during the February 2020 event, frozen groundwater conditions were present in three of the monitoring wells (MW1, MW4, and MW5), and groundwater sampling was limited to monitoring wells MW2, MW3, MW6, MW7, and MW8. Field measurements and analytical results for groundwater samples were compared to the Water Quality Guidelines for the Protection of Aquatic Life (freshwater, long-term) (CCME, 1999 and updates), and the Guidelines for Canadian Drinking Water Quality (GCDWQ) for the protection of human health (Health Canada, 2019).

Field parameters measured during the October 2019 and February 2020 sampling programs are presented in Table 4. Analytical results for inorganic parameters and dissolved metals in groundwater samples collected from monitoring wells are presented in Tables I.1 and I.2 in Appendix I. Laboratory certificates of analysis (which include laboratory QA/QC data) are included in Appendix J. Due to weather/temperature-related equipment issues, field parameters are only available for MW3 for the February 2020 sampling event.

Table 4 Measured Field Parameters

Well ID	Date	Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	pH (unitless)	ORP (mV)
Guideline	CCME FAL[1]	–	>6 [3]	–	6.5-9.0	–
	GCDWQ[2]	<15 AO	–	–	7.0-10.5 OG	–
MW1	7-Oct-2019	7.8	**1.81**	142.1	7.76	-226.7
MW2	6-Oct-2019	6.7	12.15	-	**6.20**	102.2
MW3	11-Oct-2019	8.3	8.02	166.2	7.70	26.5
	28-Feb-2020	4.3	**5.59**	72.5	6.59	47.2
MW4	8-Oct-2019	6.9	6.60	120.9	7.50	141.7
MW5	9-Oct-2019	9.1	**1.27**	172.4	7.55	-50.0
MW6	11-Oct-2019	6.4	**0.64**	185.2	8.05	109.9
MW7	6-Oct-2019	7.4	**1.09**	127.0	**6.37**	-125.7
MW8	7-Oct-2019	6.7	**0.62**	174.8	8.24	155.7

[1] Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Aquatic Life (freshwater, long-term) (1999 and updates)
[2] Health Canada Guidelines for Canadian Drinking Water Quality (June 2019)
[3] Most conservative value for warm water biota (early life; other life stages require 5.5 mg/L
°C = Degrees Celsius
mg/L = milligrams per litre
µS/cm = microsiemens per centimeter
mV = millivolts

Results that exceed the CCME guideline or a health-based GCDWQ are bolded and shaded

Results that exceed a GCDWQ Aesthetic Objective (AO) are shaded

Field measurements indicate that dissolved oxygen is often below the recommended guideline for the protection of freshwater aquatic life; however, dissolved oxygen would be expected to increase once the groundwater discharges to a surface water body that is exposed to atmospheric conditions. Lower dissolved oxygen concentrations are common in groundwater because they tend to decrease with residence time and depth (i.e., the longer the water remains underground without exposure to the atmosphere and greater evolution of groundwater along its flowpath).

Field measurements and analytical results both indicate that pH in MW2 and MW7 is below the GCDWQ operational guideline. However, pH tends to increase with residence time and depth, and these shallow monitoring wells are not planned to be used as potable water supplies. Therefore, the low pH in these wells is not necessarily a concern for the potential operational issues. Similar to dissolved oxygen, pH would also be expected to change once the groundwater is exposed to atmospheric conditions; therefore, the FAL pH guideline is not strictly applicable to groundwater.

Turbidity exceeded the GCDWQ in all collected samples, and true color exceeded the aesthetics-based GCDWQ in MW7 (October 2019 and February 2020) and MW8 (February 2020 only). Turbidity and true color are associated with suspended sediment; elevated levels are common in new wells. It should also be noted that the guidelines for turbidity and true color are operational/aesthetic guidelines.

Several dissolved metal exceedances of the CCME FAL guidelines and GCDWQ were noted during this baseline study:

- Aluminum exceeded the pH-dependant FAL guideline in MW7 in both October 2019 and February 2020.
- Arsenic exceeded the FAL guideline and GCDWQ in MW5. In MW7, the arsenic concentration in October 2019 exceeded both the FAL guideline and GCDWQ, and exceeded the FAL guideline only in February 2020.
- Copper exceeded the calculated FAL guidelines and GCDWQ for MW2 and MW3 in both October 2019 and February 2020.
- Iron exceeded the FAL guideline and aesthetics-based GCDWQ in MW3 in February 2020 and MW7 in both October 2019 and February 2020.
- Manganese exceeded the aesthetics-based GCDWQ in all collected samples except for those from MW6, with concentrations up to 1,070 µg/L. The health-based GCDWQ of 120 µg/L was exceeded in MW1, MW2 (October 2019 only), MW3, MW5, MW7, and MW8 (February 2020 only). The FAL guidelines was also exceeded in MW1, MW2 (October 2019 only), MW3 (February 2020 only), MW5, MW7, and MW8 (February 2020 only).

Overall, MW7 had the highest number of exceedances of the eight monitoring wells.

It should be noted the FAL guidelines are intended to be applied to unfiltered surface water samples. Similarly, the GCDWQ are intended to be applied to potable water samples, which are typically either applied to a raw water sample to determine treatment requirements, or to a treated sample to confirm the treatment has been effective. Groundwater samples collected as part of the current program cannot be directly compared to the CCME Guideline or the GCDWQ since the groundwater samples were filtered. However, these guidelines can nonetheless be used for relative comparison purposes to characterize groundwater quality at the Site. The groundwater sampling data collected as part of the current program will be used to detect any changes in groundwater quality over time as the Project progresses through development, operational and closure phases.

4.7.3 Groundwater Classification

In general it was found that the groundwater comprised a calcium-bicarbonate type water (Appendix K). The groundwater samples are neutral to slightly basic with values ranging from 7.01 to 8.07, with the exception of MW2 and MW7 which showed slightly acidic conditions ranging from 6.42 to 6.71. Total alkalinity (as CaCO3) ranged from 24 mg/L to 138 mg/L, and hardness (as CaCO3) values range from 15.3 mg/L (soft) to 126 mg/L (hard). Electrical conductivity values for samples collected range from 50 μmho/cm to 325 μmho/cm (fresh conditions), total dissolved solids ranged from 24 mg/L to 164 mg/L, turbidity measurements ranged from 10.4 NTU to 2780 NTU, and color measurements ranged from non-detect (<5 TCU) to 177 TCU. The water type, relatively low total dissolved solids and electrical conductivity results indicate that the groundwater on the Site is principally meteoric water that has infiltrated and flowed in shallow, short flow paths to the wells. This is consistent with the setting of the Site on a topographic ridge.

5.0 SUMMARY AND CONCLUSIONS

Based on the results of the hydrogeology baseline field program, GEMTEC presents the following conclusions:

- Boreholes for the six shallow monitoring wells (MW1, MW2, MW3, MW4, MW5, and MW7) were advanced to depths ranging from 5.64 mbgs (MW2) to 10.10 mbgs (MW5); while the two deeper monitoring wells were advanced to depths ranging from 30.05 mbgs (MW6) to 31.90 mbgs (MW8). Paired well installations were installed to determine vertical hydraulic gradients at MW3/MW6 and MW7/MW8.

- Bedrock was encountered in all monitoring wells except MW1; with inferred trondhjemite (VLIS) in MW3, MW6, MW7, and MW8; quartz porphyry monzonite (VLIS) in MW2; and siltstone (VLG) in MW4 and MW5. Based on the historical exploration borehole database, as well as overburden data collected as part of the current program and the GEMTEC (2019a) geotechnical program, overburden thickness ranging from 0.1 m to 17.1 m, and with an average thickness of 3.8 m are present across the Site. The thickest accumulations of overburden are associated with the blanket deposits present in the southwestern portion of the proposed Marathon pit and immediately northwest of the Victory deposit (with maximum thickness greater than 8.23 m). The thinnest accumulations are associated with the till veneer present in the Victory deposit area, the northeastern portion of the proposed Marathon pit, and in the vicinity of the Leprechaun and Sprite deposits, ranging from 0.1 to 2.8 m. The overburden generally consists of a silty sand with gravel, with occasional cobbles/boulders or clay.

- A trend of decreasing hydraulic conductivity with depth is apparent in the Site data sets that is attributed to decreasing bedrock weathering and fracturing as depth increases, as also observed in the RQD dataset. The data available do not show a relation between hydraulic conductivity and bedrock type, indicating that secondary porosity (faults and fractures) likely controls permeability.

- Based on the results of hydraulic (slug) testing completed as part of the current hydrogeology baseline program, and review of previous hydrogeological studies, representative average values of 10^{-6} m/s and 10^{-8} m/s were estimated for overburden and bedrock, respectively. The bedrock value may be on the high side based on the methods and assumptions used. The data set is not considered sufficient to confidently define separate hydraulic conductivity estimates based on bedrock type and depth at the Site. Structural features such as the VLF may also have substantially higher localized permeability than the surrounding rock mass that could influence groundwater flow at the Site; therefore, additional hydraulic response testing will likely be required to satisfy more specific lithology and depth-related hydraulic conductivity estimates to satisfy mine planning and engineering design as Project development advances.

- GEMTEC infers that the Site is underlain by an unconfined aquifer contained within the saturated overburden and shallow bedrock units, with semi-confined groundwater flow conditions present at depth within the bedrock. The overall direction of groundwater flow within the unconfined aquifer system, based on groundwater (piezometric) contours derived from the October 2019 program, follows topography and surface water flow, which, depending on the specific location on the Site, would be to the northwest towards Valentine Lake or to the southeast towards the Victoria River and Victoria Lake drainage systems. Typical horizontal hydraulic gradients range from 8 percent near the Sprite deposit to 1 percent to the northwest of the Marathon deposit. Elsewhere, horizontal hydraulic gradients are approximately 3 to 5 percent. It should be noted that the current hydrogeological data set is not of sufficient detail to evaluate whether local groundwater flow systems are present in the on the Site within the regional groundwater flow system described. It is possible that hilly topography, present particularly in the areas of the Victory Deposit, Leprechaun pit and its waste rock pile and other associated stockpiles, the processing plant and tailing storage facility areas, may influence shallow groundwater flow and direct discharge to nearby topographic lows instead of to the regional discharge areas.

- Groundwater flow was found to be upward in the relatively low-lying area at MW7/MW8 well pair location flowing at a slight vertical hydraulic gradient ranging from 1 percent (0.01 m/m) to 2.5 percent (0.025 m/m) from the bedrock to the overburden material; and downward in the relatively high-ground area at MW3/MW6 well pair location, flowing at a moderate gradient of 22 percent (0.22 m/m) to 27 percent (0.27 m/m) from the overburden material to the bedrock. While artesian conditions, reflecting upward vertical gradients, were observed in a number of exploration boreholes along the crest of the topographic ridge (recharge area), these artesian flows are considered to represent localized, confined conditions that are geologically-controlled (possibly by a structural feature at depth), and do not reflect the inferred overall regional groundwater flow regime of the Site.

- Based on the determined hydraulic conductivities and gradients, the average linear groundwater velocity is estimated to range between 0.126 m/year to 12.6 1 m/year. The average linear velocity will vary throughout the Site (i.e. may be substantially higher in some areas) based on the local hydraulic conductivity, hydraulic gradient, and porosity.

- Groundwater quality samples collected from the eight monitoring wells were classified as being calcium-carbonate type, likely of meteoric origin. Hardness varied from soft to hard. In MW2 and MW7, groundwater was slightly acidic; in other wells, it was near-neutral to slightly basic. Several exceedances of the FAL guidelines and GCDWQ were noted in at least one sample for the following parameters: pH, dissolved oxygen, turbidity, true color, aluminum, arsenic, copper, iron, and manganese. MW7 was noted to have the highest number of exceedances.

- It should be noted that the groundwater quality results presented in this report represent baseline conditions, and are intended to be compared to future analytical results to detect any changes in water quality over time as the Project progresses through the development, operational and closure phases. Groundwater samples collected as part of the current program cannot be directly compared to the CCME Guideline or the GCDWQ since the groundwater samples were filtered. However, these guidelines can nonetheless be used for relative comparison purposes to characterize groundwater quality at the Site.

6.0 CLOSURE

This report has been prepared for the sole benefit of our client, Marathon Gold Corporation. The report may not be relied upon by any other person or entity without the express written consent of GEMTEC Consulting Engineers and Scientist Limited and our client, Marathon Gold Corporation.

Any use that a third party makes of this report, or any reliance or decisions made based on it, is the responsibility of such third parties. GEMTEC Consulting Engineers and Scientist Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The conclusions presented represent the best technical judgment of GEMTEC Consulting Engineers and Scientist Limited based on current engineering and scientific practices and environmental standards at the time the work was performed. The conclusions are based on the site conditions encountered at the time the work was performed at the sampling/testing locations, and can only be extrapolated to an undefined limited area around these locations. In addition, analysis was only performed for a limited number of chemical parameters, and it should not be inferred that other chemical compounds are not present on the Site. Due to the nature of the investigation and to the limited data available, GEMTEC Consulting Engineers and Scientist Limited cannot warrant against undiscovered environmental liabilities.

Should additional information become available, GEMTEC Consulting Engineers and Scientist Limited requests that this information be brought to our attention so that we may re-assess the conclusions presented herein.

This report was prepared by Christine Chase, M.Eng., P.Eng., and was reviewed by Carolyn Anstey-Moore, M.Sc., M.A.Sc., P.Geo. of GEMTEC Consulting Engineers and Scientists Ltd.; along with independent, senior review by H. Scott Schillereff, Ph.D., P.Geo. of Tetra Tech Canada Inc. We trust that this report meets your present requirements. If you have any questions or require additional information, please contact our office at your convenience.

Respectfully submitted,

GEMTEC Consulting Engineers and Scientist Limited

<Original signed by>

Carolyn Anstey-Moore, M.Sc., M.A.Sc., P.Geo.

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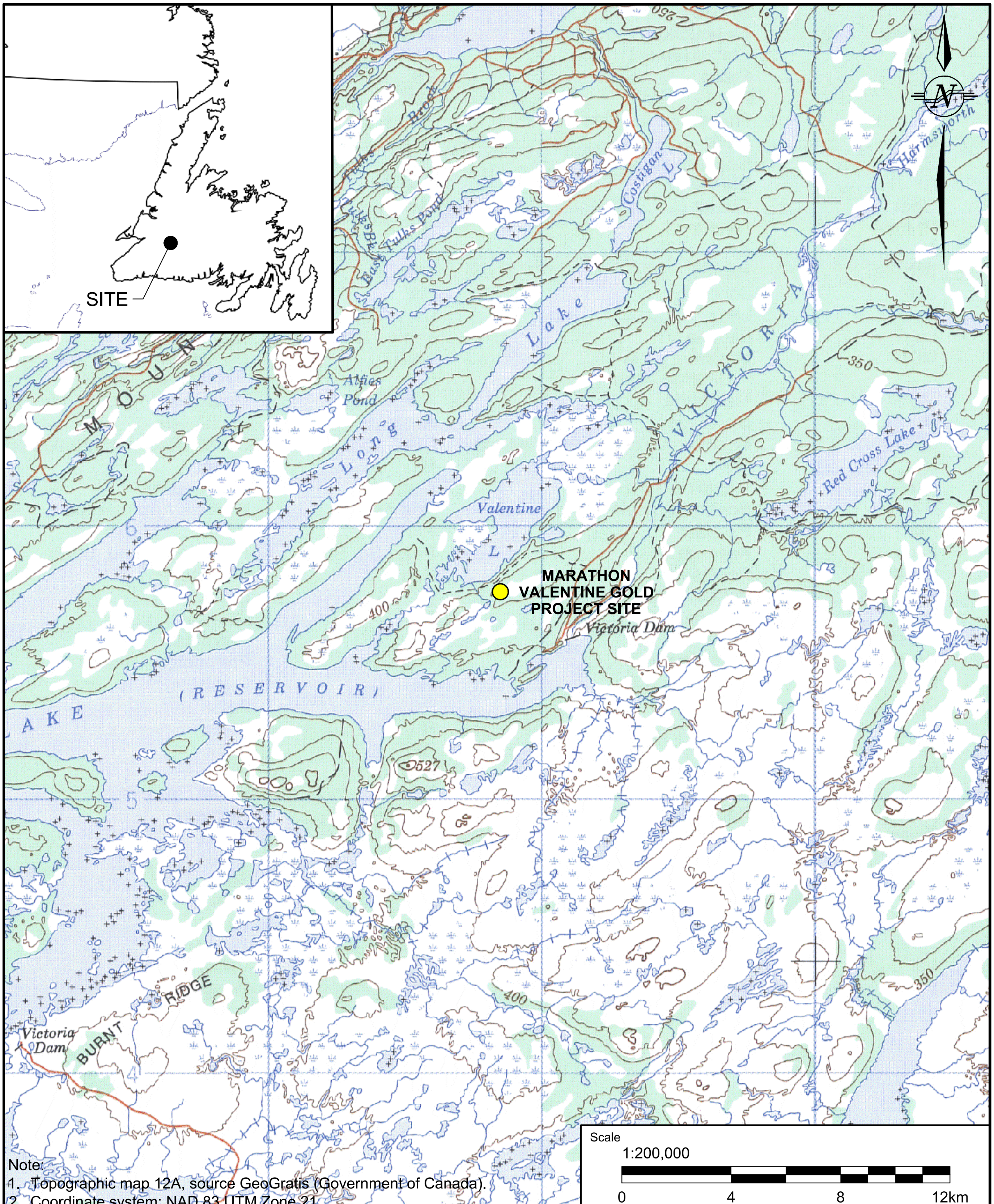
APPENDIX A

Figures



Note:
1. Topographic map 12A, source GeoGratis (Government of Canada).
2. Coordinate system: NAD 83 UTM Zone 21.

Project			Drawing	
Hydrogeology Baseline Report, Marathon Valentine Gold Project, Central Newfoundland			Site Location Map Overview	
Drawn By CHG	Date March 2020	File No. 80018.05	Drawing No. Figure 1	Revision No. 0

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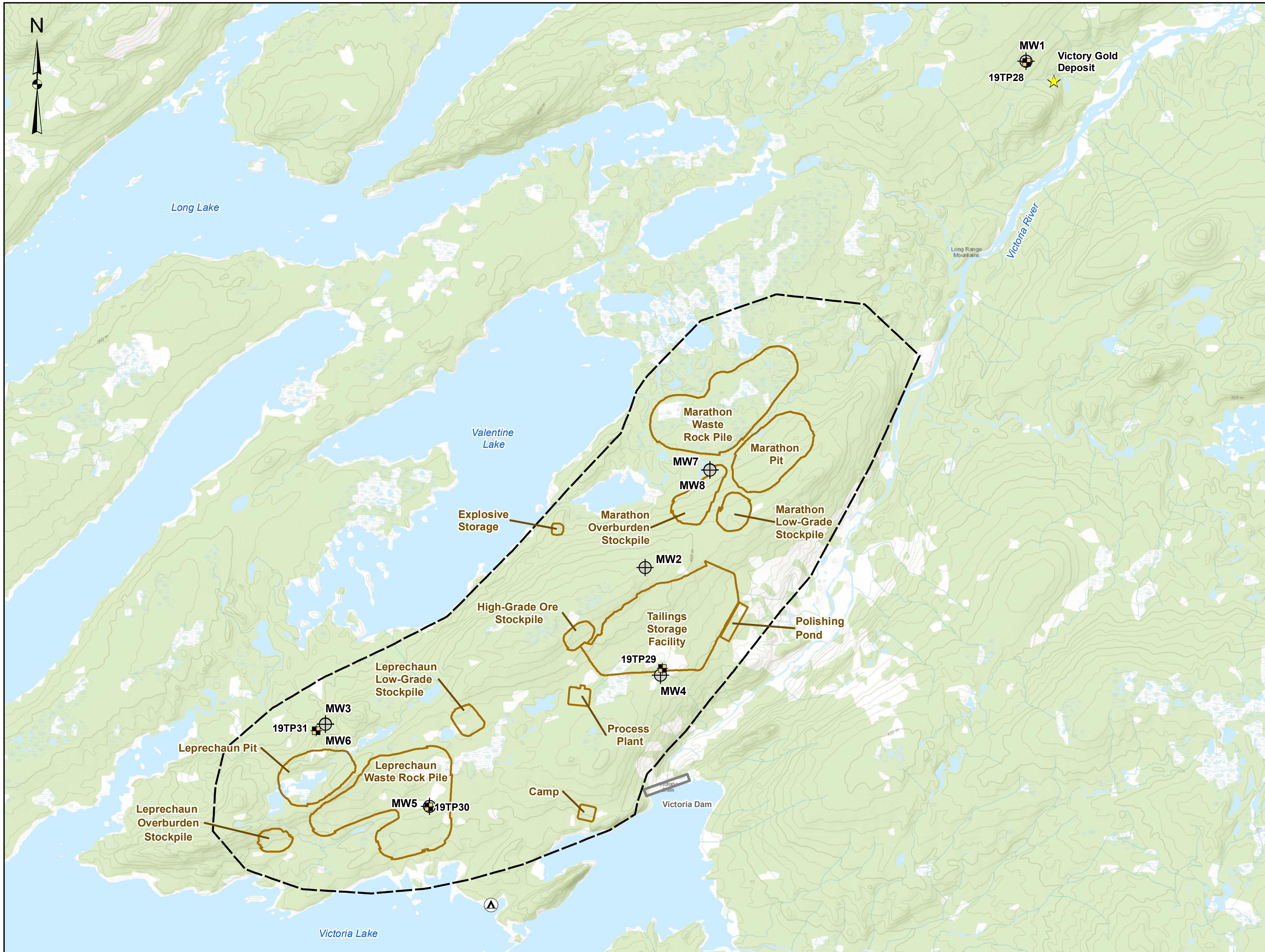

GEMTEC 2019 Monitoring Well
GEMTEC 2019 Geotechnical Test Pit
Mine Site
Proposed Mine Site Infrastructure
Gold Deposit
Existing Exploration Camp

Note
1. This drawing is a schematic representation. Sizes, locations and dimensions are approximate.
2. Coordinate system: NAD83 CSRS UTM Zone 21 North.
3. Mine site layout provided by Marathon Gold Corporation.
4. Basemap: ESRI ArcGIS Online basemaps.

Drawn By	MC	Checked By	CAM
Date	March 2020		

Project
Hydrogeology Baseline Report, Marathon Valentine Gold Project, Central Newfoundland

Drawing
Proposed Mine Site Layout & Test Location Plan

Scale
1:50,000
0 1,250 2,500
(meters)
NAD83/ UTM Zone 21N

File No.	80018.05	Drawing	Figure 2

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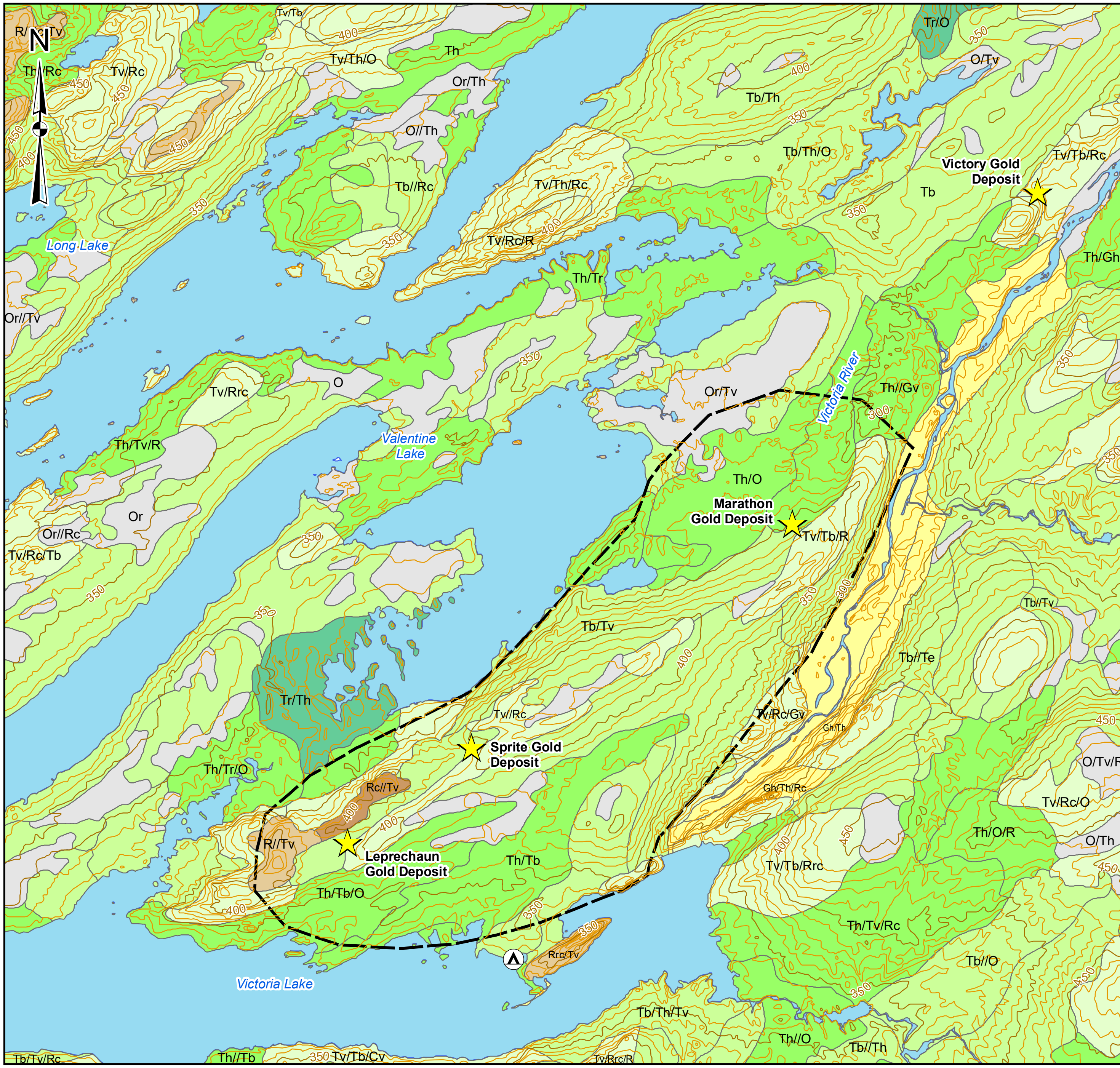
Consulting Engineers and Scientists



Surficial Geology Units:

- Fluvial Plain (Fp)
- Glaciofluvial Blanket/ Hummock/ Ridge/ Veneer (Gb/Gh/Gr/Gv)
- Organic/ Organic Ridge (O/Or)
- Rock (R)
- Rock Concealed By Vegetation (Rc)
- Rock Ridge (Rrc)
- Glacial Blanket (Tb)
- Glacial Hummock (Th)
- Glacial Ridge (Tr)
- Glacial Veneer (Tv)
- Water Body
- Mine Site
- Contour - 10 m
- Existing Exploration Camp
- Gold Deposit

1. This drawing is a schematic representation. Sizes, locations and dimensions are approximate
2. Coordinate System: NAD83 CSRS UTM Zone 21 North.
3. Topographic Data acquired from GeoGratis (Government of Canada)
4. Surficial geology data acquired from Government of Newfoundland and Labrador Geoscience Online

Drawn By	MC	Checked By	CAM
Date	March 2020		

Project
Hydrogeology Baseline Report, Marathon Valentine Gold Project Central Newfoundland

Drawing
Surficial Geology in the Vicinity of the Site

Scale
1:80,000
0 1,250 2,500
(meters)
NAD83/ UTM Zone 21N

File No.	80018.05	Drawing	Figure 3

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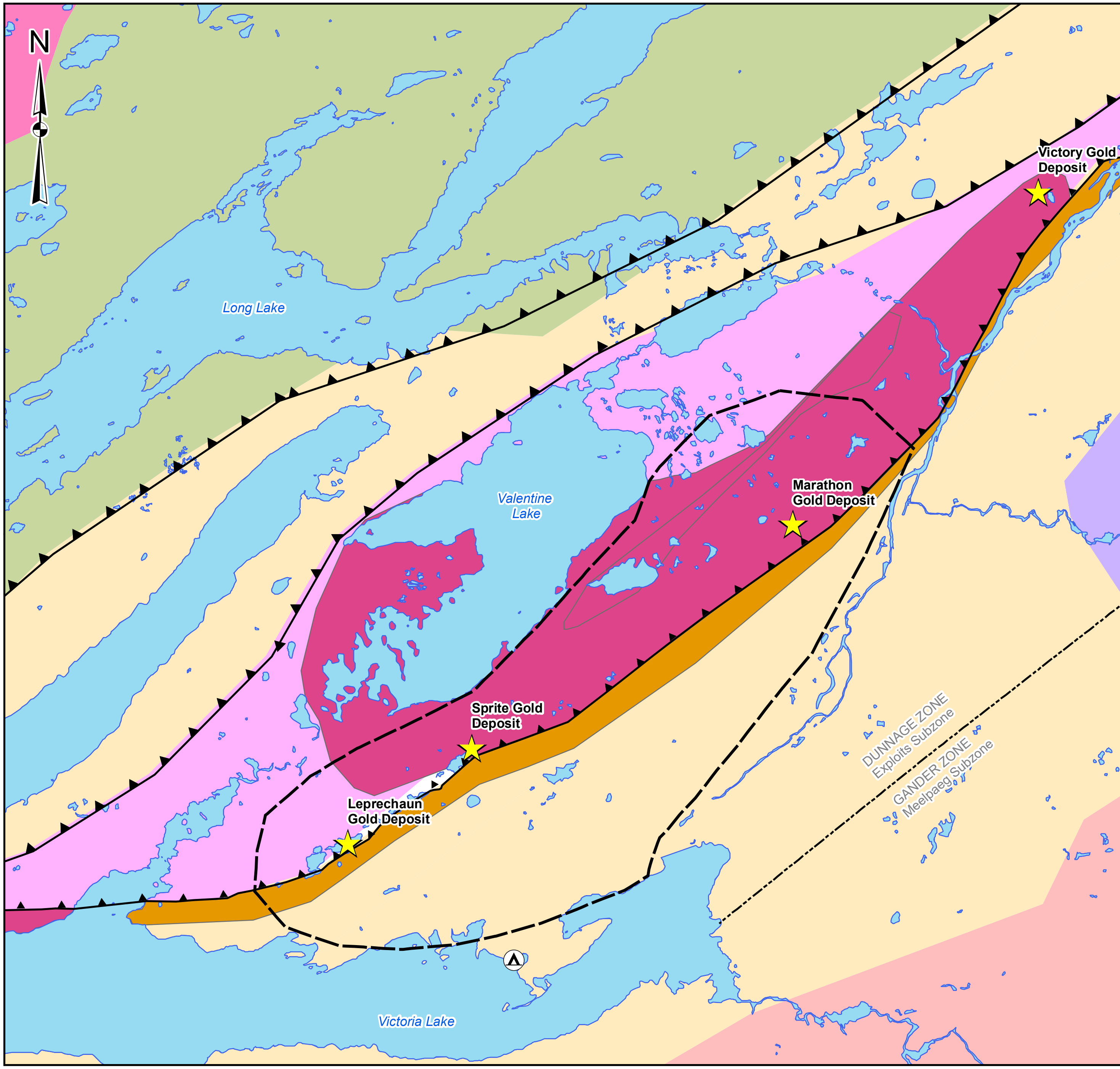

Bedrock Geology Units:

- Silurian-Devonian Mafic Intrusive
- Silurian-Devonian Granitoids
- Silurian Rogerson Lake Conglomerate
- Cambrian-Ordovician Siliclastic Sediments
- Cambrian-Ordovician Mafic-Felsic Submarine Volcanics
- Cambrian-Ordovician Granitoids

Precambrian Valentine Lake Intrusive Suite

- Trondhjemite
- Quartz Porphyry, minor Gabbro
- Water Body
- Victoria Lake Shear Zone
- Thrust Fault
- Mine Site
- Gold Deposit
- Existing Exploration Camp

1. This drawing is a schematic representation. Sizes, locations and dimensions are approximate
2. Coordinate System: NAD83 CSRS UTM Zone 21 North.
3. Topographic Data acquired from GeoGraits (Government of Canada).
4. Regional geology data modified from Tettelaar & Dunsworth (2016)

Drawn By	MC	Checked By	CAM
Date	March 2020		

Project

Hydrogeology Baseline Report,
Marathon Valentine Gold Project
Central Newfoundland

Drawing

Bedrock Geology in the Vicinity of the Site

Scale 1:80,000

0 1,250 2,500

(meters)

NAD83/ UTM Zone 21N

File No.	Drawing
80018.05	Figure 4

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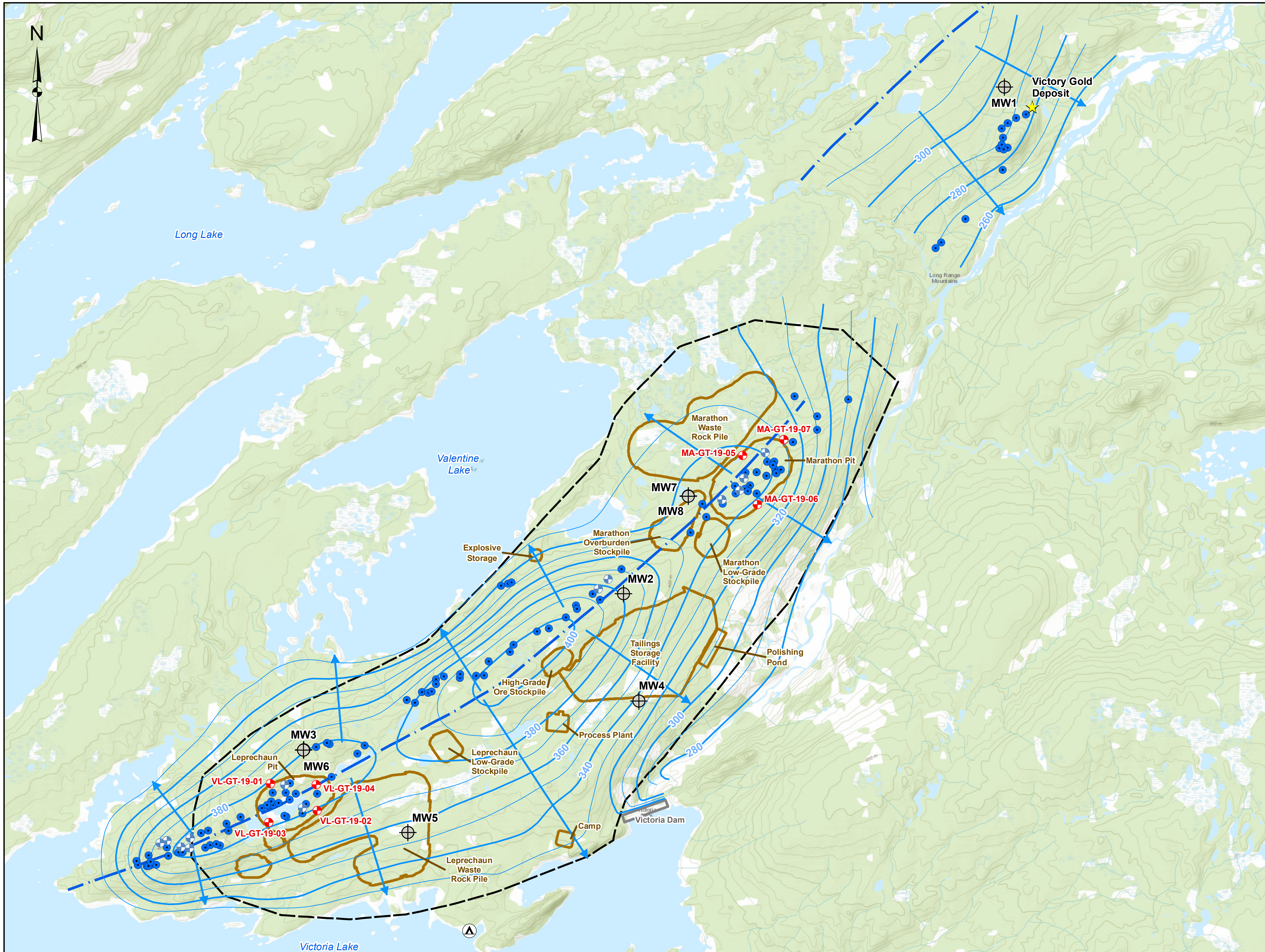

GEMTEC 2019 Monitoring Well

Groundwater Survey Observation Point (Exploration BH)

Exploration BH (Artesian)

Terrane Geotechnical Boreholes

Groundwater Flow Directional Arrow

Groundwater Flow Divide

Interpreted Groundwater Contour - 10 m

Mine Site

Proposed Mine Site Infrastructure

Gold Deposit

Existing Exploration Camp

Note

1. This drawing is a schematic representation. Sizes, locations and dimensions are approximate.
2. Coordinate system: NAD83 CSRS UTM Zone 21 North.
3. Mine site layout provided by Marathon Gold Corporation.
4. Basemap: ESRI ArcGIS Online basemaps.

Drawn By	MC	Checked By	CAM
Date	March 2020		

Project

Hydrogeology Baseline Report, Marathon Valentine Gold Project, Central Newfoundland

Drawing

Project Site Plan With Piezometric Contours and Groundwater Flow Directions

Scale

1:50,000

0 1,250 2,500

(meters)

NAD83/ UTM Zone 21N

File No.	80018.05	Drawing	Figure 5

GEMTEC

Consulting Engineers and Scientists

APPENDIX B

Excerpts from the
Newfoundland and Labrador Registry of Water Rights

Newfoundland and Labrador Registry of Water Rights

[IMPORTANT NOTICE]: Any non-domestic water user in the Province, must obtain Water Use Licence under the Water Resources Act or register its valid water rights

R	File No.	Document No.	Holder or Licensee's Name	Body of Water Used or Diverted	Main Purpose	Designated Purpose	Use Type	Source of Rights	Amendment	Expiry Date	Latitude			Longtiude			Status
C	515	05-030	Crosshair Exploration and Mining Corp.	Unnamed near Paul's Pond	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	48	40	9	55	7	32	Expired
C	515	05-031	Crosshair Exploration and Mining Corp.	Unnamed near Gander Bay	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	19	6	54	35	10	Expired
C	515	05-032	Crosshair Exploration and Mining Corp.	Unnamed near Glenwood	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	5	50	54	55	10	Expired
C	515	05-033	Altius Resources Inc.	Unnamed near Rambler - Location # 1	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	55	28	56	3	43	Expired
C	515	05-033	Altius Resources Inc.	Unnamed near Rambler - Location # 2	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	55	27	56	5	9	Expired
C	515	05-033	Altius Resources Inc.	Unnamed near Rambler - Location # 3	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	54	45	56	4	10	Expired
C	515	05-034	Altius Resources Inc.	Unnamed near Twilick Pond - Location # 1	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	48	9	40	55	35	17	Expired
C	515	05-034	Altius Resources Inc.	Unnamed near Twilick Pond - Location # 2	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	48	8	53	55	34	22	Expired
C	515	05-034	Altius Resources Inc.	Unnamed near Twilick Pond - Location # 3	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	48	6	36	55	34	35	Expired
C	515	05-035	Cornerstone Resources Inc.	Unnamed, known as VooDoo Brook near Mic Mac Lake - Location # 1	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	36	46	56	25	25	Expired
C	515	05-035	Cornerstone Resources Inc.	Unnamed, known as VooDoo Brook near Mic Mac Lake - Location # 2	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	36	50	56	24	55	Expired
C	515	05-035	Cornerstone Resources Inc.	Unnamed, known as VooDoo Brook near Mic Mac Lake - Location # 3	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	37	0	56	24	34	Expired
C	515	05-037	Buchans River Ltd.	Unnamed near Buchans	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	48	48	51	56	51	35	Expired
L	517	05-039	LabMag Services Inc.	Unnamed near Rosemary and Elross Lakes	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	54	53	48	67	14	15	Expired
C	515	05-041	Richmont Mines Inc.	Unnamed near Victoria Lake	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	48	21	20	57	11	0	Expired
L	517	05-042	Northstar Exploration Ltd.	Pasty Lake	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	57	1	25	61	26	30	Expired
C	515	05-043	Ice Water Marine Farms Ltd.	East Bay near Victoria Cove, Northern Arm, Bay D'Espoir	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	44	37	55	6	0	Expired
C	515	05-044	Ice Water Marine Farms Ltd.	East Bay near Stone Point, Northern Arm, Bay D'Espoir	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	45	6	55	6	10	Expired
C	515	05-045	Ice Water Marine Farms Ltd.	East Bay, Northern Arm, Bay D'Espoir	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	45	53	55	5	3	Expired
C	515	05-046	Vulcan Minerals Inc.	Unnamed near Flat Bay Brook and Noel's Pond (Flat Bay Test Hole # 2)	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	48	23	5	58	33	10	Expired
C	515	05-047	Vulcan Minerals Inc.	Unnamed near Goose Pond and Dribble Brook (Storm # 1)	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	14-Oct-05	48	25	6	58	26	23	Expired
E	516	05-050	Bulundon's Personal Care Home Ltd.	Unnamed in Hickman's Harbour	Commercial	Commercial-Institutional	Consumptive	WR Act	No	31-Dec-15	48	6	30	53	44	42	Expired
C	515	05-051	Aur Resources Inc.	Tally Pond near Noel Paul's Brook	Industrial	Mineral Exploration	Consumptive	WR Act	No	1-Jun-06	48	38	14	56	28	56	Cancelled
C	515	05-052	Thwart Island Mussel Farm Inc.	St. John's Harbour (South) near Thwart Island, Notre Dame Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	49	18	36	55	8	19	Cancelled
C	515	05-053	Vinland Resources Limited	Unnamed near Red Indian Lake	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	48	52	20	56	34	4	Expired
E	516	05-054	Canadian Iceberg Vodka Corporation	Unnamed (Iceberg)	Commercial	Commercial (Bottling)	Consumptive	WR Act	No	31-Dec-10	47	55	26	53	45	0	Expired
C	515	05-055	Peter M. Dimmell	Unnamed near Baie Verte	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-05	49	51	35	56	3	8	Expired
E	516	05-057	Lindo & Laurie Pitcher	Heart's Content Harbour, Trinity Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	47	52	5	53	22	58	Expired
C	515	05-058	Richmont Mines Inc.	Long Pond near Tilt Cove	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	52	46	55	38	50	Expired
W	514	05-059	Cornerstone Resources Inc.	Unnamed near Isle Aux Morts River	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	47	44	22	58	57	34	Expired
L	517	05-060	GeoScott Exploration Consultants Inc.	Unnamed near Nain	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	56	35	0	62	47	30	Expired
C	515	05-061	Brook Enterprises Inc.	Upper Salmon power canal	Industrial	Industrial (Rock Washing)	Consumptive	WR Act	No	30-Sept.-05	48	8	55	56	19	36	Expired
L	517	05-062	Altius Resources Inc.	Unnamed near Postville (Jacques Lake)	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Jul-06	54	42	55	59	35	53	Expired
L	517	05-063	Altius Resources Inc.	Unnamed near Postville (Michelin)	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Jul-06	54	34	55	59	59	11	Expired
L	517	05-064	Altius Resources Inc.	Unnamed near Postville (Post Hill)	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Jul-06	54	55	28	59	34	40	Expired
L	517	05-065	Altius Resources Inc.	Unnamed near Postville (Otter Lake)	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Jul-06	54	38	30	59	36	58	Expired
L	517	05-066	Altius Resources Inc.	Unnamed near Postville (Melody Hill)	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Jul-06	54	40	0	60	0	0	Expired
W	514	05-067	Altius Resources Inc.	Unnamed Pond near Humber River - Site # 1	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	24	15	57	4	54	Expired
W	514	05-067	Altius Resources Inc.	Wigwam Brook near Humber River - Site # 2	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	25	0	57	4	58	Expired
W	514	05-067	Altius Resources Inc.	Wigwam Brook near Humber River - Site # 3	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	24	48	57	4	4	Expired
W	514	05-067	Altius Resources Inc.	Unnamed Pond near Humber River - Site # 4	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	25	24	57	4	11	Expired
W	514	05-067	Altius Resources Inc.	Unnamed Brook near Humber River - Site # 5	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	26	48	57	2	20	Expired
W	514	05-067	Altius Resources Inc.	Unnamed Pond near Humber River - Site # 6	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	27	29	57	2	48	Expired

R	File No.	Document No.	Holder or Licensee's Name	Body of Water Used or Diverted	Main Purpose	Designated Purpose	Use Type	Source of Rights	Amendment	Expiry Date	Latitude			Longtiude			Status
L	517	05-104	Santoy Resources Ltd.	Unnamed near Postville (Mustang Lake)	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	30-Sep-06	54	37	30	60	53	0	Expired
L	517	05-105	Santoy Resources Ltd.	Unnamed near Postville Anomaly 7 Lake)	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	30-Sep-06	54	31	0	61	8	0	Expired
E	516	05-106	Shells & Fins Inc.	Northwest Arm, Trinity Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	48	23	23	53	22	11	Cancelled
C	515	05-107	Cornerstone Resources Inc.	Unnamed, known as Veneer Brook near Loon Pond	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Oct-07	48	30	26	56	36	1	Expired
L	517	05-108	LabMag Services Inc.	Rosemary and Elross Lakes	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	54	53	48	67	14	15	Expired
W	514	05-109	Kermode Resources Ltd.	Unnamed near Jackson's Arm	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	49	54	37	56	48	31	Expired
C	515	05-110	Rubicon Minerals Corporation	Unnamed near Exploits River (Golden Promise Property)	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-05	48	56	5	55	53	6	Expired
C	515	05-111	Long Island Resources Ltd.	Long Pond near Hermitage Road	Commercial	Aquaculture	Non-Consumptive	WR Act	No	31-Oct-06	47	35	36	55	48	28	Expired
C	515	05-112	Falconbridge Limited	Unnamed near Red Cross Lake	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-05	48	22	45	56	59	53	Expired
L	517	05-113	Town Council of Hopedale	Unnamed Ponds near Hopedale	Municipal	Municipal	Consumptive	WR Act	No	31-Dec-30	55	27	30	60	15	15	Valid
C	515	05-114	Long Island Resources Ltd.	Muddy Hole, Bay D'Espoir	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	47	48	53	55	51	21	Expired
E	516	05-115	Ervin Locke and Sons Ltd.	Unnamed near Port Rexton, Trinity Bay	Commercial	Aquaculture/Hatchery	Non-Consumptive	WR Act	No	31-Oct-10	49	27	0	55	47	25	Expired
E	516	05-116	Ervin Locke & Sons Ltd.	World Pond near Port Rexton, Trinity Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	31-Oct-07	48	26	28	53	19	8	Expired
C	515	05-117	B & B Forest Products Ltd.	Winter Tickle, Bay of Exploits, Notre Dame Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	49	22	42	55	13	23	Expired
C	515	05-117A	Rubicon Minerals Corporation	Unnamed Pond near Seal Bay	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Oct-06	49	24	11	55	35	11	Expired
C	515	05-117A	Rubicon Minerals Corporation	Unnamed Pond, known as "Northwest Arm Pond" near Seal Bay	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Oct-06	49	24	56	55	35	59	Expired
C	515	05-117A	Rubicon Minerals Corporation	Seal Bay	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Oct-06	49	22	8	55	34	43	Expired
E	516	05-118	Lloyd J. Phillips	Traytown Harbour at Ireland's Eye Island, Trinity Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	48	12	29	53	30	2	Expired
E	516	05-119	William Broderick	Hayward's Cove, Bonavista Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	48	52	19	53	38	28	Expired
E	516	05-120	Olonzo Bailey	Smith Sound near Old Bonaventure, Trinity Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	48	16	57	52	25	20	Expired
C	515	05-121	Aur Resources Inc.	Tally Pond near Noel Paul's Brook	Industrial	Industrial	Consumptive	WR Act	Yes	31-Dec-10	48	37	46	56	29	5	Expired
E	516	05-122	Canada Ice Enterprises Inc.	Unnamed	Commercial	Commercial (Bottling)	Consumptive	WR Act	No	31-Dec-10	S	S	S	S	S	S	Expired
E	516	05-123	Joseph Pevie and Christopher Pearson	Placentia Bay near Woody Island	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	22	22	54	42	20	Expired
E	516	05-124	Claude Seaward	Ship Cove, Hearts Ease Inlet, Trinity Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	48	1	14	53	39	14	Cancelled
E	516	05-125	Green Seafoods Ltd.	Peter's Cove near Bunyan's Cove, Clode Sound, Bonavista Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	48	24	15	54	1	37	Expired
E	516	05-126	Shells & Fins Inc.	Cap Cove, Northwest Arm, Trinity Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	48	22	48	53	22	32	Cancelled
E	516	05-127	Town Council of Norman's Cove-Long Cove	Water Use for Municipal Water Supply from John Newhook's Pond	Municipal	Municipal	Consumptive	WR Act	No	31-Dec-30	47	32	50	53	42	35	Valid
L	517	05-128	Iron Ore Company of Canada	Unnamed stream draining into Dumbell Lake - Location # 1	industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-10	52	59	13	66	56	13	Expired
L	517	05-128	Iron Ore Company of Canada	Unnamed pond draining into Leg Lake - Location # 2	industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-10	52	59	5	66	56	56	Expired
L	517	05-128	Iron Ore Company of Canada	Unnamed pond draining into Leg Lake - Location # 3	industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-10	52	58	38	66	57	25	Expired
L	517	05-128	Iron Ore Company of Canada	Unnamed pond near Leg Lake - Location # 4	industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-10	52	58	32	66	56	42	Expired
L	517	05-128	Iron Ore Company of Canada	Unnamed pond near Leg Lake - Location # 5	industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-10	52	57	55	66	57	40	Expired
E	516	05-129	Newfoundland Power Inc.	Water Use for Cape Broyle and Horse Chops Hydroelectric Power Generating Plants	Water Power Rental (Generation)	Water Power Generation	Non-Consumptive	WR Act	No	31-Dec-30	47	5	45	52	56	15	Valid
C	515	05-130	VVC Exploration Corporation	Unnamed near Northwest Gander River	Industrial	Industrial (Drilling)	Consumptive	WR Act	No	30-Jun-06	48	42	25	55	12	18	Expired
L	517	05-131	Crosshair Exploration and Mining Corp.	Unnamed - Moran Lake	industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Jul-06	54	27	30	61	0	0	Cancelled
L	517	05-132	Aurora Energy Inc.	Unnamed - White Bear	industrial	Industrial (Drilling)	Consumptive	WR Act	No	31-Dec-06	54	38	30	59	44	5	Expired
L	517	05-133	Department of Natural Resources (Agrifoods Branch)	Chruchill River near Happy Valley-Goose Bay	Agricultural	Irrigation	Consumptive	WR Act	No	31-Dec-09	53	16	48	60	23	39	Expired
L	517	06-001	LabMag Services Inc.	Unnamed streams and Rosemary and Elross Lakes	industrial	Industrial/Drilling	Consumptive	WR Act	No	31-Dec-07	54	53	11	67	13	11	Expired
C	515	06-002	Aur Resources Inc.	Unnamed - Location A1	Industrial	Mineral Exploration	Consumptive	WR Act	Yes	31-Mar-07	48	38	35	56	26	4	Expired
C	515	06-002	Aur Resources Inc.	Unnamed - Location A2	Industrial	Mineral Exploration	Consumptive	WR Act	Yes	31-Mar-07	48	39	2	56	26	44	Expired
C	515	06-002	Aur Resources Inc.	Unnamed - Location B	Industrial	Mineral Exploration	Consumptive	WR Act	Yes	31-Mar-07	48	39	29	56	26	22	Expired
C	515	06-002	Aur Resources Inc.	Tally Pond - Location C	Industrial	Mineral Exploration	Consumptive	WR Act	Yes	31-Mar-07	48	37	43	56	29	27	Expired

Newfoundland and Labrador Registry of Water Rights

[IMPORTANT NOTICE]: Any non-domestic water user in the Province, must obtain Water Use Licence under the Water Resources Act or register its valid water rights

R	File No.	Document No.	Holder or Licensee's Name	Body of Water Used or Diverted	Main Purpose	Designated Purpose	Use Type	Source of Rights	Amendment	Expiry Date	Latitude			Longtiude			Status
E	516	06-035	Walter Sweetapple et al	Unnamed near Hare Bay Location # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-06	48	50	43	53	59	46	Expired
E	516	06-036	Graham C. Feltham	Unnamed near Eastport	Commercial	Commercial	Consumptive	WR Act	No	31-Jul-16	48	38	56	53	46	0	Expired
L	517	06-037	Crosshair Exploration and Mining Corp.	Unnamed - Moran Lake	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-07	54	27	30	61	0	0	Expired
W	514	06-038	AggMapR Inc.	Unnamed near Victors Brook and Harry Brook Group # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	35	8	59	1	56	Expired
E	516	06-039	Atlantic Clam Farms Ltd.	Pinchard's Bight, Cape Freels	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	49	13	0	53	30	59	Expired
L	517	06-040	Crosshair Exploration and Mining Corp.	Unnamed - Moran Lake	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-07	54	31	26	60	56	54	Expired
L	517	06-041	Crosshair Exploration and Mining Corp.	Unnamed - Moran Lake	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-07	54	31	38	60	53	27	Expired
L	517	06-042	Crosshair Exploration and Mining Corp.	Unnamed - Moran Lake Location # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-07	54	29	39	60	54	19	Expired
L	517	06-042	Crosshair Exploration and Mining Corp.	Unnamed - Moran Lake Location # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-07	54	29	17	60	54	47	Expired
L	517	06-043	Crosshair Exploration and Mining Corp.	Unnamed - Moran Lake	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-07	54	28	2	60	58	22	Expired
C	515	06-044	Crosshair Exploration and Mining Corp.	Unnamed near Exploits River	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-07	48	48	43	56	24	29	Expired
C	515	06-045	Crosshair Exploration and Mining Corp.	Victoria Lake and Unnamed near Victoria Lake	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-07	48	22	49	57	19	51	Expired
W	514	06-046	Vulcan Minerals Inc.	Unnamed near Flat Bay Brook and Noel's Pond (Flat Bay # 4)	Industrial	Industrial/Oil Exploration	Consumptive	WR Act	No	31-Jul-07	48	23	5	58	33	10	Expired
W	514	06-047	Vulcan Minerals Inc.	Unnamed near Jeffery's and Robinson's (Jeffery's # 1)	Industrial	Industrial/Oil Exploration	Consumptive	WR Act	No	31-Jul-07	48	13	16	58	49	39	Expired
W	514	06-048	Vulcan Minerals Inc.	Unnamed near Robinson's (Red Brook # 1)	Industrial	Industrial/Oil Exploration	Consumptive	WR Act	No	31-Jul-07	48	16	5	58	45	1	Expired
L	517	06-049	Aurora Energy Inc.	Unnamed - Witchdoctor Lake	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	54	33	39	59	59	49	Expired
W	514	06-050	51190 Newfoundland & Labrador Ltd.	Unnamed near Three Corner Pond (Rambler)	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	49	55	40	56	4	12	Expired
L	517	06-051	Celtic Minerals Ltd.	Unnamed - Five Locations (Voisey Bay West)	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	56	15	15	56	14	35	Expired
C	515	06-052	Continental Stone Limited	Unnamed near Belleoram	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-07	47	32	8	55	25	43	Expired
C	515	06-053	Richmont Mines Inc.	Unnamed flowing into First Pond	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-07	49	10	57	54	30	29	Expired
C	515	06-054	Aur Resources Inc.	Red Indian Lake near Millertown	Industrial	Industrial (Dust Control)	Consumptive	WR Act	No	31-Dec-06	48	48	43	56	32	45	Expired
C	515	06-055	Badger Bay Mussel Farms Ltd.	near Hayward's Gull Island, Notre Dame Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	49	29	39	55	46	18	Expired
C	515	06-056	Badger Bay Mussel Farms Ltd.	Beaver Bight, Badger Bay, Notre Dame Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	49	24	50	55	41	41	Cancelled
L	517	06-057	Inco Technical Services Limited	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	56	2	10	61	49	21	Cancelled
C	515	06-058	Silver Spruce Resources Inc.	Unnamed near Corbin	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	46	56	31	55	16	13	Expired
C	515	06-059	Mountain Lake Resources Inc.	Unnamed near Bobby's Pond	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	39	45	56	47	23	Expired
C	515	06-060	Mountain Lake Resources Inc.	Unnamed near Valentine Lake Location # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	21	23	57	11	1	Expired
C	515	06-060	Mountain Lake Resources Inc.	Unnamed near Victoria River Location # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	26	15	57	3	3	Expired
E	516	06-061	Goobies Irving Big Stop c/o Calvin Drodge	Unnamed near TCH and Goobies	Commercial	Commercial	Consumptive	WR Act	No	31-Jul-16	47	56	47	53	56	59	Expired
C	515	06-062	Natures Sea Farms Inc.	Water of Bay D'Espoir Generating Stataion	Commercial	Aquaculture	Consumptive	WR Act	No	31-Dec-11	47	59	46	55	48	36	Cancelled
C	515	06-063	Natures Sea Farms Inc.	Southeast Cove, Roti Bay, Bay D'Espoir	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	47	39	55	51	44	Cancelled
C	515	06-064	Natures Sea Farms Inc.	Man of War Cove, Bay D'Espoir	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	52	3	55	49	43	Cancelled
C	515	06-065	Natures Sea Farms Inc.	Strickland Cove, Little Passage, Bay D'Espoir	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	39	35	55	56	19	Cancelled
C	515	06-066	Natures Sea Farms Inc.	Lou Cove near Culett Head, Bay D'Espoir	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	52	15	55	48	43	Cancelled
C	515	06-067	Natures Sea Farms Inc.	Ship Cove near St. Alban's Govt' Wharf, Bay D'Espoir	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	47	51	48	55	50	12	Cancelled
C	515	06-068	Natures Sea Farms Inc.	Blackfish Cove, Little Passage, Bay D'Espoir	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	39	59	55	55	52	Cancelled
C	515	06-069	Natures Sea Farms Inc.	Seal Nest Cove, Little Passage, Bay D'Espoir	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	39	12	55	55	36	Cancelled
C	515	06-070	Natures Sea Farms Inc.	Spyglass Cove, Cinq Islands Bay, Belle Bay, Fortune Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	37	35	55	28	15	Cancelled
C	515	06-071	Natures Sea Farms Inc.	Cinq Islands Bay, Belle Bay, Fortune Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	38	5	55	27	40	Cancelled
C	515	06-072	Natures Sea Farms Inc.	Northwest Cove, East Bay, Northern Arm, Bay D'Espoir	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	47	18	56	4	18	Expired
C	515	06-073	Natures Sea Farms Inc.	The White Horse, North Bay, Bay D'Espoir	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	47	22	56	8	0	Expired
C	515	06-074	Natures Sea Farms Inc.	Woody Bight, North Bay, Bay D'Espoir	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	46	52	56	7	48	Expired
C	515	06-075	Natures Sea Farms Inc.	Cinq Islands Bay, Belle Bay, Fortune Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	38	36	55	27	6	Cancelled

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R	File No.	Document No.	Holder or Licensee's Name	Body of Water Used or Diverted	Main Purpose	Designated Purpose	Use Type	Source of Rights	Amendment	Expiry Date	Latitude			Longtiude			Status
C	515	06-076	Rubicon Minerals Corporation	Unnamed Site # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	26	30	55	36	6	Expired
C	515	06-076	Rubicon Minerals Corporation	Unnamed Site # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	26	35	55	35	33	Expired
C	515	06-076	Rubicon Minerals Corporation	Gander River Site # 3	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	27	27	55	37	25	Expired
C	515	06-076	Rubicon Minerals Corporation	Gander River Site # 4	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	27	53	55	35	43	Expired
C	515	06-077	Rubicon Minerals Corporation	Unnamed near Joe Batts Pond and Joe Batts Brook Site # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	58	58	54	46	15	Expired
C	515	06-077	Rubicon Minerals Corporation	Unnamed near Joe Batts Pond and Joe Batts Brook Site # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	49	0	24	54	44	51	Expired
C	515	06-077	Rubicon Minerals Corporation	Unnamed near Joe Batts Pond and Joe Batts Brook Site # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	49	1	14	54	44	2	Expired
C	515	06-078	Peter Dimmell/Krinor Resources Inc.	Unnamed near Rambler Brook & South Brook Site # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	49	52	2	56	5	38	Expired
C	515	06-078	Peter Dimmell/Krinor Resources Inc.	Unnamed near Rambler Brook & South Brook Site # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	49	51	18	56	3	20	Expired
C	515	06-078	Peter Dimmell/Krinor Resources Inc.	Unnamed near Rambler Brook & South Brook Site # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	49	50	50	56	0	50	Expired
C	515	06-079	Prominex Resource Corp.	Unnamed near Tulks Brook Site # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	30	46	57	12	31	Expired
C	515	06-079	Prominex Resource Corp.	Unnamed near Tulks Brook Site # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	31	7	57	11	52	Expired
C	515	06-080	Cornerstone Resources Inc.	Unnamed near Long Lake Site # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	24	7	57	13	29	Expired
C	515	06-080	Cornerstone Resources Inc.	Unnamed near Long Lake Site # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	23	56	57	13	33	Expired
C	515	06-080	Cornerstone Resources Inc.	Unnamed near Long Lake Site # 3	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	24	5	57	13	59	Expired
C	515	06-081	Vinland Resources Limited	Unnamed near Millertown Site # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	53	52	56	30	23	Expired
C	515	06-081	Vinland Resources Limited	Unnamed near Millertown Site # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	51	36	56	30	30	Expired
C	515	06-081	Vinland Resources Limited	Unnamed near Millertown Site # 3	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	50	8	56	33	48	Expired
C	515	06-082	Kat Exploration Inc.	Unnamed near Colliers River	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	47	26	33	53	14	20	Expired
C	515	06-083	Crosshair Exploration and Mining Corp.	Unnamed near Exlpoits River Location # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	46	7	56	28	33	Expired
C	515	06-083	Crosshair Exploration and Mining Corp.	Unnamed near Exlpoits River Location # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	45	7	56	30	18	Expired
C	515	06-083	Crosshair Exploration and Mining Corp.	Unnamed near Exlpoits River Location # 3	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	43	51	56	32	2	Expired
C	515	06-083	Crosshair Exploration and Mining Corp.	Unnamed near Exlpoits River Location # 4	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	43	12	56	32	51	Expired
C	515	06-083	Crosshair Exploration and Mining Corp.	Unnamed near Exlpoits River Location # 5	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	42	52	56	33	38	Expired
L	517	06-084	Voisey's Bay Nickle Company Limited	Otter Pond Brook	Industrial	Industrial	Consumptive	WR Act	No	31-Aug-09	56	20	17	62	2	40	Expired
W	514	06-085	Kermode Resources Ltd.	Unnamed near Jackson's Arm Pond, Ratlle Brook Pond and Great Coney Arm Site # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	49	52	2	56	51	3	Cancelled
W	514	06-085	Kermode Resources Ltd.	Unnamed near Jackson's Arm Pond, Ratlle Brook Pond and Great Coney Arm Site # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	49	52	53	56	50	32	Cancelled
W	514	06-085	Kermode Resources Ltd.	Unnamed near Jackson's Arm Pond, Ratlle Brook Pond and Great Coney Arm Site # 3	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	49	53	33	56	49	55	Cancelled
W	514	06-085	Kermode Resources Ltd.	Unnamed near Jackson's Arm Pond, Ratlle Brook Pond and Great Coney Arm Site # 4	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	49	54	51	56	49	35	Cancelled
C	515	06-086	North Range Resources Ltd.	Unnamed near Victoria and Lloyds Lakes Site # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	23	27	57	28	12	Cancelled
C	515	06-086	North Range Resources Ltd.	Unnamed near Victoria and Lloyds Lakes Site # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	23	39	57	28	18	Cancelled
C	515	06-086	North Range Resources Ltd.	Unnamed near Victoria and Lloyds Lakes Site # 3	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	23	21	57	26	58	Cancelled
W	514	06-087	North Range Resources Ltd.	Unnamed near Flat Bay Brook Site # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	22	29	58	19	18	Cancelled
W	514	06-087	North Range Resources Ltd.	Unnamed near Flat Bay Brook Site # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	22	29	58	19	5	Cancelled
W	514	06-087	North Range Resources Ltd.	Unnamed near Flat Bay Brook Site # 3	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	48	22	29	58	18	25	Cancelled
L	517	06-088	Inco Technical Services Limited	Unnamed Site # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	56	2	10	61	49	21	Expired
L	517	06-088	Inco Technical Services Limited	Unnamed Site # 2	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	56	1	37	61	48	15	Expired
L	517	06-088	Inco Technical Services Limited	Unnamed Site # 3	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	56	2	38	61	44	34	Expired
L	517	06-088	Inco Technical Services Limited	Unnamed Site # 4	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	56	6	2	61	45	43	Expired
L	517	06-088	Inco Technical Services Limited	Unnamed Site # 5	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	56	6	43	62	14	48	Expired
L	517	06-088	Inco Technical Services Limited	Unnamed Site # 6	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	56	9	45	62	25	32	Expired
L	517	06-089	Iron Ore Company of Canada Inc.	Unnamed Site # 1	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-07	52	56	55	67	0	56	Expired

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W	514	09-092	Vulcan Minerals Inc.	Unnamed - Three Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-10	48	16	43	58	44	40	Expired
W	514	09-093	Aspect Canada Mining Company	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-09	49	4	3	57	12	27	Expired
C	515	09-094	Altius Resources Inc.	Unnamed - Two Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-10	47	24	46	55	35	33	Expired
L	517	09-095	Vale Inco Newfoundland and Labrador Limited	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-10	56	18	50	62	4	11	Expired
E	516	09-096	Pennecon ATCON LP for Vale Inco NL Limited	Rattling Brook	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	47	25	14	53	48	48	Expired
W	514	09-097	Corner Brook Pulp and Paper Ltd.	Unnamed - Two Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-10	49	2	54	57	52	30	Expired
C	515	09-098	Nova Fish Farms Inc.	Arron Cove, Bay D'Espoir	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	47	47	52	55	48	52	Cancelled
C	515	09-099	Nova Fish Farms Inc.	Hardy Cove, Bay D'Espoir	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	47	47	48	55	50	42	Cancelled
C	515	09-100	Atlantic Ocean Farms Ltd.	Northwest Arm, Fortune Harbour, Notre Dame Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	49	31	18	55	15	54	Cancelled
C	515	09-101	Atlantic Ocean Farms Ltd.	Saltwater Pond, Winter Tickle, Bay of Exploits	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	49	24	24	55	12	53	Cancelled
E	516	09-102	Claude Seaward	Heart's Ease Inlet (Square Cliff), Trinity Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	48	1	30	53	38	35	Cancelled
E	516	09-103	Paul, Wilson, and Everett Watton	Aspen Cove, Trinity Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	48	9	34	53	44	55	Expired
C	515	09-104	Allister Roberts	Gull Island Tickle, Badger Bay, Notre Dame Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	49	25	42	55	40	30	Cancelled
C	515	09-105	Norsk Salmon Inc.	Herring Cove, Bonne Bay, Hermatige Cove	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	47	39	40	56	13	24	Expired
C	515	09-106	Norsk Salmon Inc.	North of Killbuck, Bonne Bay, Hermitage Bay	Commercial	Commercial	Non-Consumptive	WR Act	No	Conditional	47	39	1	56	13	18	Cancelled
C	515	09-107	Norsk Salmon Inc.	Wild Cove, Bonne Bay, Hermitage Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	39	3	56	12	25	Cancelled
L	517	10-001	Nalcor Energy	Tailrace at Menihek Hydro Development	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-19	54	28	17	66	36	55	Expired
C	515	10-002	TECK Resources Ltd. (Duck Pond Operations)	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	48	40	21	56	26	43	Expired
C	515	10-003	Paragon Minerals Corporation	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	48	34	52	56	41	37	Expired
L	517	10-004	Vale Inco Newfoundland and Labrador Limited	Otter Pond Brook	Industrial	Industrial	Consumptive	WR Act	No	31-Dec-13	56	20	17	62	2	40	Expired
L	517	10-005	Vale Inco Newfoundland and Labrador Limited	Camp Pond	Industrial	Industrial	Consumptive	WR Act	No	31-Dec-13	56	20	13	62	5	25	Expired
L	517	10-006	Vale Inco Newfoundland and Labrador Limited	Unnamed near Nain	Industrial	Industrial&Fire Fighting	Consumptive	WR Act	No	31-Dec-13	56	24	39	62	4	35	Expired
C	515	10-007	Cold Ocean Salmon Inc.	near Ingram Point, Bay D'Espoir	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	Yes	Conditional	47	45	40	55	50	45	Cancelled
C	515	10-008	Cold Ocean Salmon Inc.	near Taylor Island, Bay D'Espoir	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	Yes	Conditional	47	44	11	55	51	21	Cancelled
W	514	10-009	1314175 Alberta Ltd.	Unnamed (Little Lobster Harbour Property)	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	50	1	53	56	16	55	Expired
C	515	10-010	59758 Newfoundland and Labrador Ltd.	Water of Bay D'Espoir Generating Stataion	Commercial	Aquaculture/Hatchery	Consumptive	WR Act	No	31-Dec-14	47	59	46	55	48	36	Expired
C	515	10-011	Crosshair Exploration and Mining Corp.	Unnamed near Exploits River	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	48	54	29	56	9	3	Expired
C	515	10-012	TECK Resources Ltd. (Duck Pond Operations)	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	48	39	29	56	26	21	Expired
C	515	10-013	Paragon Minerals Corporation	Winter Pond	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	47	39	44	55	36	21	Expired
L	517	10-014	Iron Ore Company of Canada	Unnamed, Luce Lake and White Lake	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	53	2	41	66	57	44	Cancelled
W	514	10-015	Marathon PGM Corporation	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	48	21	23	57	11	1	Expired
W	514	10-015	Marathon PGM Corporation	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	48	20	33	57	8	59	Expired
W	514	10-016	Nalcor Energy	Moulting Pond and Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	Yes	31-Dec-10	50	1	5	57	42	49	Expired
W	514	10-016	Nalcor Energy	Moulting Pond and Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	Yes	30-Jun-11	49	58	40	57	43	17	Expired
L	517	10-017	Champion Minerals Inc.	Unnamed - Four Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	54	58	53	66	43	17	Expired
W	514	10-018	Thundermin Resources Inc.	Unnamed near Deer Pond	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	49	35	4	56	1	24	Expired
W	514	10-018	Thundermin Resources Inc.	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	49	35	1	56	1	52	Expired
W	514	10-018	Thundermin Resources Inc.	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	49	35	4	56	1	4	Expired
L	517	10-019	Vale Inco Newfoundland and Labrador Limited	Unnamed - Twelve Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	56	19	22	62	4	11	Expired
C	515	10-020	Paragon Minerals Corporation	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	49	35	4	56	1	24	Expired
W	514	10-021	Deer Lake Oil & Gas Inc.	Unnamed flowing into Junction Brook	Industrial	Industrial	Consumptive	WR Act	No	31-Jul-11	49	19	6	57	12	21	Expired
C	515	10-022	Manson Creek Resources Ltd.	Unnamed - Two Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	49	31	9	54	46	48	Expired
C	515	10-022	Manson Creek Resources Ltd.	Unnamed - Two Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	49	29	44	54	48	51	Expired
W	514	10-023	1289839 Alberta Ltd.	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-10	49	45	25	57	8	23	Expired

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C	515	11-002	Paragon Minerals Corporation	Unnamed - Several Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-11	48	34	59	56	41	16	Expired
E	516	11-003	Vale Inco Newfoundland and Labrador Limited	Rattling Brook Big Pond	Industrial	Industrial	Consumptive	WR Act	No	31-Dec-13	47	24	4	53	47	36	Expired
E	516	11-004	Vale Inco Newfoundland and Labrador Limited	Long Harbour	Industrial	Industrial	Consumptive	WR Act	No	31-Dec-15	47	25	18	53	49	27	Expired
C	515	11-005	Garland L. Smith	Unnamed near Grand Falls	Agricultural	Irrigation	Consumptive	WR Act	No	31-Dec-20	49	1	49	55	35	6	Valid
L	517	11-006	Vale Inco Newfoundland and Labrador Limited	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	56	19	23	62	6	59	Cancelled
L	517	11-006	Vale Inco Newfoundland and Labrador Limited	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	56	19	17	62	6	31	Cancelled
L	517	11-006	Vale Inco Newfoundland and Labrador Limited	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	56	19	19	62	4	7	Cancelled
L	517	11-006	Vale Inco Newfoundland and Labrador Limited	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	56	19	2	62	7	8	Cancelled
L	517	11-006	Vale Inco Newfoundland and Labrador Limited	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	56	23	29	62	5	47	Cancelled
L	517	11-006	Vale Inco Newfoundland and Labrador Limited	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	56	23	34	62	5	6	Cancelled
L	517	11-006	Vale Inco Newfoundland and Labrador Limited	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	56	22	57	62	4	36	Cancelled
L	517	11-006	Vale Inco Newfoundland and Labrador Limited	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	56	22	56	62	5	33	Cancelled
L	517	11-006	Vale Inco Newfoundland and Labrador Limited	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	56	22	27	62	2	37	Cancelled
L	517	11-006	Vale Inco Newfoundland and Labrador Limited	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	56	22	0	62	4	16	Cancelled
E	516	11-007	The Wilds c/o Gerry Bishop	Unnamed near St. Catherine's	Commercial	Commercial	Consumptive	WR Act	No	31-Dec-15	47	13	19	53	20	1	Expired
L	517	11-008	Playfair Mining Ltd.	Seal Lake Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	54	17	40	61	42	32	Expired
L	517	11-008	Playfair Mining Ltd.	Seal Lake Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	54	17	44	61	39	55	Expired
L	517	11-008	Playfair Mining Ltd.	Seal Lake Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	54	17	54	61	37	6	Expired
L	517	11-008	Playfair Mining Ltd.	Seal Lake Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	54	17	40	62	2	7	Expired
L	517	11-008	Playfair Mining Ltd.	Seal Lake Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	54	17	40	62	2	7	Expired
L	517	11-008	Playfair Mining Ltd.	Seal Lake Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	54	18	28	61	55	10	Expired
L	517	11-009	Alderon Resource Corp.	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	52	50	6	67	2	11	Expired
C	515	11-010	Marathon Gold Corporation	Unnamed - Three Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	48	26	11	57	3	36	Expired
C	515	11-010	Marathon Gold Corporation	Unnamed - Three Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	48	21	24	57	11	11	Expired
C	515	11-010	Marathon Gold Corporation	Unnamed - Three Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	48	20	31	57	8	57	Expired
W	514	11-011	Cornerstone Resources Inc.	Unnamed - Several Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	49	36	45	56	25	20	Expired
L	514	11-011	Cornerstone Resources Inc.	Unnamed - Several Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	49	36	31	56	25	55	Expired
W	514	11-011	Cornerstone Resources Inc.	Unnamed - Several Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	49	36	46	56	24	30	Expired
W	514	11-011	Cornerstone Resources Inc.	Unnamed - Several Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	49	36	13	56	25	24	Expired
L	517	11-012	Mega Uranium Ltd.	Mustang Lake - Two Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	54	37	22	59	51	22	Expired
L	517	11-012	Mega Uranium Ltd.	Mustang Lake - Two Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	54	37	57	59	51	34	Expired
E	516	11-013	Mountain Lake Resources Inc.	Unnamed - Two Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	47	56	32	55	29	50	Expired
E	516	11-013	Mountain Lake Resources Inc.	Unnamed - Two Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	47	49	27	55	42	15	Expired
L	517	11-014	Iron Ore Company of Canada	Several Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	52	59	16	66	56	7	Expired
C	515	11-015	Benton Resources Corporation	Unnamed - Four Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	49	4	56	54	45	43	Expired
C	515	11-015	Benton Resources Corporation	Unnamed - Four Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	49	5	31	54	42	8	Expired
C	515	11-015	Benton Resources Corporation	Unnamed - Four Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	49	4	27	54	45	43	Expired
C	515	11-015	Benton Resources Corporation	Unnamed - Four Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	49	2	54	54	48	51	Expired
E	516	11-016	Town of Bay Bulls	Unnamed	Municipal	Municipal	Consumptive	WR Act	No	31-Dec-20	47	19	16	52	49	16	Valid
E	516	11-017	Town of Conception Harbour	Unnamed - Several Sites	Municipal	Municipal	Consumptive	WR Act	No	31-Dec-35	47	29	25	53	9	53	Valid
W	514	11-018	Cyntech Services	Gulf of St. Lawrence	Industrial	Industrial (Testing Purposes)	Consumptive	WR Act	No	30-Jun-11	48	57	51	58	0	56	Expired
L	517	11-019	Vale Newfoundland and Labrador Limited	Unnamed - Several Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	56	19	58	62	8	19	Expired
L	517	11-019	Vale Newfoundland and Labrador Limited	Unnamed - Several Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	56	20	49	62	0	51	Cancelled
L	517	11-019	Vale Newfoundland and Labrador Limited	Unnamed - Several Sites	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-11	56	19	35	62	2	39	Cancelled

Newfoundland and Labrador Registry of Water Rights

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R	File No.	Document No.	Holder or Licensee's Name	Body of Water Used or Diverted	Main Purpose	Designated Purpose	Use Type	Source of Rights	Amendment	Expiry Date	Latitude			Longtude			Status
C	515	12-148	Puddle Pond Resources Inc.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-13	46	55	23	55	52	3	Expired
E	516	12-149	Stantec Consulting Ltd.	Bulls Arm	Institutional	Institutional	Consumptive	WR Act	No	30-Jun-13	47	49	25	53	52	0	Expired
W	514	12-151	Benton Resources Corporation	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-12	47	49	27	58	48	19	Expired
W	514	12-152	Anaconda Mining Inc.	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-12	49	57	42	56	7	48	Expired
L	517	12-153	Alderon Iron Ore Corp.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-12	52	50	17	66	59	50	Expired
C	515	12-154	Newfoundland Aqua Services Limited	Mill Pond	Commercial	Commercial Purpose	Consumptive	WR Act	No	31-Dec-17	47	56	0	55	42	0	Expired
W	514	12-155	Anaconda Mining Inc.	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-13	49	57	42	56	7	48	Expired
C	515	12-156	Playfair Mining Ltd.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-13	47	36	13	57	5	39	Expired
E	516	12-157	Husky Energy	Argentia Harbour	Industrial	Industrial	Consumptive	WR Act	No	30-Jun-13	47	18	32	53	58	22	Expired
W	514	12-158	Four Corners Mining Corporation	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-12	48	29	8	58	7	2	Expired
L	517	12-159	Century Iron Mines Corp.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-12	53	25	8	66	29	42	Expired
E	516	12-160	KBAC Constructors	Rattling Brook Big Pond	Industrial	Industrial	Consumptive	WR Act	No	31-Dec-15	47	24	5	53	47	37	Expired
E	516	12-161	Mr. Ward George	Trinity Bay near New Harbour	Commercial	Commercial Purpose	Consumptive	WR Act	No	31-Dec-17	47	34	54	53	33	44	Expired
L	517	12-162	Century Iron Mines Corp.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-13	53	25	8	66	29	42	Expired
L	517	12-163	Century Iron Mines Corp.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-13	54	48	32	66	58	47	Expired
W	514	12-164	Tawsho Mining Inc.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-13	50	1	24	56	9	12	Cancelled
L	517	12-165	Nalcor Energy	Churchill River near Happy Valley-Goose Bay	Industrial	Industrial	Consumptive	WR Act	No	31-Dec-13	53	15	18	60	46	15	Expired
C	515	12-166	NSP Maritime Link Inc.	Unnamed	Industrial	Industrial	Consumptive	WR Act	No	31-Dec-13	48	11	35	56	49	16	Expired
W	514	12-167	NSP Maritime Link Inc.	First Pond	Industrial	Industrial	Consumptive	WR Act	No	31-Dec-13	48	31	27	58	15	27	Expired
W	514	12-168	NSP Maritime Link Inc.	Unnamed	Industrial	Industrial	Consumptive	WR Act	No	31-Dec-13	47	38	48	59	17	47	Expired
C	515	12-170	Kelly Cove Salmon Ltd.	Unnamed	Commercial	Aquaculture/Hatchery	Consumptive	WR Act	Yes	31-Dec-17	47	53	13.99	55	50	17.99	Expired
E	516	12-171	Vale Newfoundland and Labrador Limited	Rattling Brook Big Pond	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-17	47	24	5	53	47	37	Expired
C	515	12-172	Northern Harvest Sea Farms Newfoundland Ltd.	The Hobby, Mal Bay, Fortune Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	47	38	36	55	8	56	Cancelled
E	516	12-173	KBAC Constructors	Rattling Brook Big Pond	Industrial (Hydrostatic Testing)	Industrial (Hydrostatic Testing)	Consumptive	WR Act	No	31-Dec-15	47	24	49	53	45	30	Expired
L	517	12-174	Tata Steel Minerals Canada Ltd.	Timmins 2 groundwater well	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-17	54	53	56	67	5	33	Expired
C	515	12-175	Buchans Mineral Corporation (for 7980736 Canada Inc.)	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Jul-13	48	49	15	56	51	54	Expired
L	517	12-176	CIP Magnetite Ltd.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-13	65	52	58	54	39	33	Expired
L	517	12-178	Iron Ore Company of Canada	Bodies of Water	Industrial (Drilling & Dewatering)	Industrial (Drilling & Dewatering)	Consumptive	WR Act	No	31-Mar-13							Expired
L	517	12-179	Nalcor Energy	Unnamed near Happy Valley-Goose Bay	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-18	53	14	5	60	44	17	Expired
L	517	12-180	Nalcor Energy	Groundwater Well #1 and #2 near Happy Valley-Goose Bay	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-18	53	13	20	60	36	44	Expired
L	517	12-181	Nalcor Energy	Four Groundwater Wells near Happy Valley-Goose Bay	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-18	53	13	10	60	36	21	Expired
C	515	12-182	Canstar Resources Inc.	Red Indian Lake	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Mar-13	48	49	50	56	31	53	Expired
W	514	12-183	Anaconda Mining Inc.	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-13	49	58	32	56	3	42	Expired
W	514	12-184	Newfoundland Power Inc.	Water Use for Lookout Brook Hydroelectric Power Generating Plant	Water Power Rental (Generation)	Water Power Generation	Non-Consumptive	WR Act	No	31-Dec-37							Valid
C	515	13-001	Newfoundland and Labrador Hydro	Bear Brook	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-22	47	58	47	55	48	3	Valid
W/C	514/515	WRL/P-13-001	NSP Maritime Link Inc.	Bodies of Water	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-18	N/A	N/A	N/A	N/A	N/A	N/A	Expired
L	517	13-002	Vale Newfoundland and Labrador Limited	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	56	22	2	62	4	14	Expired
C	515	13-003	Marathon Gold Corporation	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	48	26	5	57	3	38	Expired
C	515	13-004	Notre Dame Poultry Farm Ltd.	unnamed	Agricultural	Irrigation	Consumptive	WR Act	No	31-Dec-22	49	12	50	55	2	55	Expired
C	515	13-005	Tenajon Resources Corporation	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-13	47	36	34	57	6	23	Expired
E	516	13-006	Community Centre	Unnamed in Ship Harbour	Municipal	Municipal	Consumptive	WR Act	No	31-Dec-37	47	21	45	53	53	55	Valid
W	514	13-007	Paragon Minerals Corporation	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	48	31	35	56	42	57	Expired
L	517	13-008	Aurora Energy Ltd.	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	54	35	39	59	56	6	Expired

R	File No.	Document No.	Holder or Licensee's Name	Body of Water Used or Diverted	Main Purpose	Designated Purpose	Use Type	Source of Rights	Amendment	Expiry Date	Latitude			Longtiude			Status
W	514	13-009	Anaconda Mining Inc.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	49	58	7	56	4	35	Cancelled
C	515	13-010	Marilyn Quinlan	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-13	49	11	48	54	49	41	Expired
E	516	13-011	College of North Atlantic	Atlantic Ocean near Lord's Cove	Commercial	Commercial Purpose	Non-Consumptive	WR Act	No	31-Dec-18	46	52	6	55	39	43	Expired
W	514	13-012	Castillian Resources Corp.	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	47	44	17	58	5	39	Expired
L	517	13-013	Iron Ore Company of Canada	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	53	0	42	66	58	19	Expired
W	514	13-014	Thomas Resources Inc.	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	48	51	13	57	49	44	Expired
L	517	13-015	Century Iron Mines Corp.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	Conditional to M	54	42	38	66	50	35	Cancelled
L	517	13-016	Nothern Star Minerals Ltd.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	Conditional to M	54	35	23	66	14	6	Cancelled
L	517	13-017	Golden Dory Resources Corp.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	Conditional to M	53	39	43	65	27	42	Valid
W	514	13-018	Messina Minerals Inc.	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	49	2	42	58	18	47	Cancelled
C	515	13-019	Canada Fluorspar (NL) Inc.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	46	54	26	55	28	4	Expired
C	515	13-020	TECK Resources Ltd. (Duck Pond Operations)	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	48	37	44	56	29	9	Cancelled
W	514	13-021	Messina Minerals Inc.	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	48	32	4	57	7	52	Cancelled
C	515	13-022	Messina Minerals Inc.	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	48	26	44	57	20	12	Expired
C	515	13-023	Cold Ocean Salmon Inc.	Unnamed (Long Pond Site # 1)	Commercial	Aquaculture/Freshwater	Non-Consumptive	WR Act	Yes	31-Dec-17	47	35	36	55	48	28	Expired
C	515	13-024	Cold Ocean Salmon Inc.	North of Herring Cove, Bonne Bay, Hermitage Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	Yes	Conditional	47	39	40	56	13	24	Cancelled
C	515	13-026	Gray Aqua Group Ltd.	Wallace Cove, Facheux Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	42	56	56	19	1	Cancelled
C	515	13-027	Gray Aqua Group Ltd.	Indian Tea Point, Facheux Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	43	56	56	19	41	Cancelled
C	515	13-028	Gray Aqua Group Ltd.	Near Tickle Point, Facheux Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	45	3	56	19	41	Cancelled
C	515	13-029	Beaver Brook Antimony Mine Inc.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	48	42	31	55	11	51	Expired
L	517	13-030	IKC-ONE for Nalcor Energy	Churchill River near Happy Valley-Goose Bay	Industrial	Industrial	Consumptive	WR Act	No	30-Jun-14	53	14	11	60	44	35	Expired
W	514	13-031	Red Moon Potash Inc.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-14	48	24	43	58	30	42	Expired
L	517	13-032	Labrador Iron Mines	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	Conditional to M	54	55	0	67	10	7	Valid
L	517	13-033	New Millennium Iron Corp.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	Conditional to M	54	23	28	66	39	57	Cancelled
W	514	13-034	Altius Resources Inc.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-14	48	56	4	57	4	12	Expired
L	517	13-035	Labec Century Iron Ore Inc.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	Conditional to M	54	53	34	66	30	54	Cancelled
W	514	13-036	Troy Gordon	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-14	49	4	2	57	12	40	Expired
W	514	13-037	Four Corners Mining Corp.	Unnamed	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-17	48	29	3	58	1	15	Expired
C	515	13-038	Nothern Harvest Sea Farms Newfoundland Ltd.	Northwest Cove, East Bay, Northern Arm, Bay D'Espoir	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	47	18	56	4	18	Expired
C	515	13-039	Northern Harvest Sea Farms Newfoundland Ltd.	Benny's Cove (Mal Bay, Fortune Bay)	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	47	40	40	55	7	49	Cancelled
C	515	13-040	Northern Harvest Sea Farms Newfoundland Ltd.	Foshie's Cove (Mal Bay, Fortune Bay)	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	47	39	41	55	8	12	Cancelled
C	515	13-041	Northern Harvest Sea Farms Newfoundland Ltd.	Belle Bay near Iornskull Point, Fortune Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	47	34	6	55	24	10	Cancelled
C	515	13-042	Northern Harvest Sea Farms Newfoundland Ltd.	Magrath Cove South, Belle Bay, Fortune Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	47	39	34	55	22	11	Cancelled
C	515	13-043	Northern Harvest Sea Farms Newfoundland Ltd.	Magrath Cove North, Belle Bay, Fortune Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	47	39	50	55	22	46	Cancelled
C	515	13-044	Northern Harvest Sea Farms Newfoundland Ltd.	Belle Bay near Belle Island, Fortune Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	Conditional	47	38	1	55	21	14	Cancelled
C	515	13-045	Lester Farms Inc.	Unnamed	Commercial	Aquaculture/Hatchery	Consumptive	WR Act	No	31-Dec-17	47	30	27	52	46	37	Expired
C	515	13-046	Cold Ocean Salmon Inc.	Mooring Cove, Dragon Bay	Commercial	Aquaculture	Non-Consumptive	WR Act	No	Conditional	47	37	41	56	21	8	Expired
C	515	13-047	0840559 BC Ltd.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	30-Jun-14	49	12	12	54	26	37	Expired
L	517	13-048	Kami General Partner Ltd.	Bodies of Water near Wabush	Industrial	Industrial	Consumptive	WR Act	No	30-Jun-15							Expired
C	515	13-049	Marathon Gold Corporation	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-18	48	26	12	57	3	38	Expired
C	515	13-050	Marathon Gold Corporation	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-18	47	57	24	58	17	27	Cancelled
L	517	13-051	Nalcor Energy (For Its Contractors)	Bodies of Water near Happy Valley-Goose Bay	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-18							Expired
C	515	13-052	Tawsho Mining Inc.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-18	50	1	24	56	9	12	Expired
C	515	13-053	Mountain Lake Minerals Inc.	Bodies of Water	Industrial	Mineral Exploration	Consumptive	WR Act	No	31-Dec-18	47	51	31	55	40	19	Expired

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R	File No.	Document No.	Holder or Licensee's Name	Body of Water Used or Diverted	Main Purpose	Designated Purpose	Use Type	Source of Rights	Amendment	Expiry Date	Latitude			Longtiude			Status
C	515	18-9942	Allister Roberts	Gull Island, Badger Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	28-Sep-23	49	25	44	55	40	18	Valid
C	515	18-9953	Altius Resources Inc.	Buchans-Mary March Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	3-Oct-19	48	52	16.32	56	33	10.08	Cancelled
C	515/AQ18	18-9954	Marine Harvest Atlantic Canada Inc.	North Bob Locke Cove, Hare Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	4-Oct-23	47	38	39.56	56	31	7.8	Valid
C	515/AQ18	18-9955	Marine Harvest Atlantic Canada Inc.	Mare Cove South, Hare Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	4-Oct-23	47	39	42.69	56	31	10.69	Valid
C	515/AQ18	18-9956	Marine Harvest Atlantic Canada Inc.	Indian Tea Point, Facheux Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	4-Oct-23	47	43	56	56	19	24.24	Valid
C	515/AQ18	18-9957	Marine Harvest Atlantic Canada Inc.	Wild Cove, Facheux Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	4-Oct-23	47	38	47.78	56	19	8.62	Valid
C	515/AQ18	18-9958	Marine Harvest Atlantic Canada Inc.	Butter Cove, Bay d'Espoir	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	4-Oct-23	47	40	35.33	56	3	24.54	Valid
C	515/AQ18	18-9959	Marine Harvest Atlantic Canada Inc.	Jervis Island, Bay d'Espoir	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	4-Oct-23	47	39	20.42	56	8	10.4	Valid
C	515/AQ18	18-9960	Marine Harvest Atlantic Canada Inc.	Pass My Can, Bay d'Espoir	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	9-Oct-23	47	40	5.39	56	9	6.18	Valid
C	515/AQ18	18-9962	Marine Harvest Atlantic Canada Inc.	Goblin Bay, Bay d'Espoir	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	9-Oct-23	47	42	20.61	56	6	46.09	Valid
C	515/AQ18	18-9964	Marine Harvest Atlantic Canada Inc.	Devil Bay, Rencontre West	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	9-Oct-23	47	38	39.43	56	31	7.56	Valid
C	515/AQ18	18-9966	Marine Harvest Atlantic Canada Inc.	Little Bay, Rencontre West	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	9-Oct-23	47	37	43.22	56	39	57.54	Valid
C	515/AQ18	18-9967	Marine Harvest Atlantic Canada Inc.	Rencontre Bay, Rencontre West	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	9-Oct-23	47	37	23.26	56	40	56.15	Valid
C	515	18-9971	RJK Exploration Ltd	Rolling Pond Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	3-Oct-19	48	40	9.91	55	29	32.46	Expired
W	514	18-9973	Anaconda Mining Inc	Corkscrew Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	5-Oct-19	49	59	0.56	56	6	47.96	Expired
W	514	18-10003	Quadro Resources Limited	Staghorn Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	6-Nov-19	48	14	39.85	57	37	27.86	Expired
W	514	18-10004	Maritime Resources Corp.	Whisker Valley Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	4-Oct-19	49	37	23.5	56	20	30.66	Expired
L	517	18-10012	Muskrat Falls Corporation	groundwater well near Happy Valley-Goose Bay	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-23	53	14	4.98	60	44	16.56	Valid
L	517	18-10013	Muskrat Falls Corporation	Two groundwater wells near Happy Valley-Goose Bay	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-23	53	13	19.8	60	36	44.27	Valid
L	517	18-10014	Muskrat Falls Corporation	Four groundwater wells near Happy Valley-Goose Bay	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-23	53	13	9.72	60	36	21.16	Valid
L	517	18-10015	Muskrat Falls Corporation	Bodies of Water near Happy Valley-Goose Bay	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-23							Valid
C	515	18-10020	Champion Iron Mines Ltd.	Powderhorn Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	5-Oct-19	49	6	52.51	56	6	40.12	Expired
C	515	18-10032	Department of Transportation and Works	Water Withdrawal from Exploits River for Test of Lagoons of former Abitibi Mill	Temporary	Temporary	Consumptive	WR Act	No	31-Mar-19	48	55	41.05	55	40	1.96	Expired
C	515	18-10038	Avidian Gold Corp	Black Raven Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	14-Nov-19	49	34	24.1	54	52	34.04	Expired
E	516	18-10040	Bonavista Resources Corp	Hickey's Pond Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	19-Nov-19	47	47	26.05	54	19	30.96	Expired
L	517	18-10054	Vale Newfoundland and Labrador Limited	Water Withdrawal and Use from Camp Pond, Voisey's Bay	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-23	56	20	12.83	62	5	26.43	Valid
L	517	18-10055	Vale Newfoundland and Labrador Limited	Water Withdrawal and Use for Anaktalak Bay Construction Camp	Industrial	Industrial (General Purpose)	Consumptive	WR Act	No	31-Dec-23	56	24	39.11	62	4	35.05	Valid
C	515	18-10068	Sunrise Fish Farms Inc.	Flat Rock Tickle and Raft Tickle, Notre Dame Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	31-Dec-23	49	28	58.08	55	43	58.08	Valid
W	514	19-10073	Marathon Gold Corporation	Valentine Lake Property	Industrial	Mineral Exploration	Non-Consumptive	WR Act	No	7-Dec-19	48	21	57.18	57	8	7.83	Expired
L	517	19-10082	Iron Ore Company of Canada	In-Pit Drilling Property	Industrial	Mineral Exploration	Non-Consumptive	WR Act	No	31-Dec-19	53	3	22.96	66	56	18.21	Expired
C	515	19-10101	Badger Bay Mussel Farms Ltd.	Northern Arm, North of Sop's Head, Notre Dame Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	5-Feb-19	49	28	26	55	45	28	Expired
C	515	19-10104	Badger Bay Mussel Farms Ltd.	West Arm, Great Trinton Harbour, Notre Dame Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	5-Feb-19	49	31	30	55	37	55	Expired
C	515	19-10105	Gilbert Simms	Shoal Harbour, Little Bay Arm, Notre Dame Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	5-Feb-19	49	34	24	55	58	4	Expired
C	515	19-10106	Badger Bay Mussel Farms Ltd.	Side Harbour, Seal Bay, Notre Dame Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	5-Feb-19	49	24	54	55	35	48	Expired
C	515	19-10107	Connaigre Fish Farms Inc.	The Pocket, Connaigre Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	5-Feb-19	47	33	53	55	49	9	Expired
W/C/E	514/515/516	19-10119	Berg Water	Water Use from Harvesting Icebergs	Commercial	Water Bottling	Consumptive	WR Act	No	8-Feb-24	N/A	N/A	N/A	N/A	N/A	N/A	Valid
L	517	19-10121	Iron Ore Company of Canada	Lorraine 4 and Knight Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	4-Feb-20	52	54	50.32	67	3	48.72	Valid
C	515	19-10125	Altius Resources Inc.	Buchans-Mary March Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	23-Nov-19	48	47	52.2	56	39	35.87	Cancelled
L	517	19-10136	Vale Newfoundland and Labrador Limited	Voisey's Main Block Property	Industrial	Mineral Exploration	Consumptive	WR Act	No	1-Feb-20	56	17	59.08	62	9	0.78	Valid
C	515/AQ959	19-10138	Badger Bay Mussel Farms Ltd.	Little Northwest Arm, New Bay, Notre Dame Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	5-Mar-24	49	27	35	55	20	26	Valid
C	515/AQ109	19-10140	Badger Bay Mussel Farms Ltd.	Hussey's Cove, Sop's Arm, Badger Bay, Notre Dame Bay	Commercial	Aquaculture/Marine	Non-Consumptive	WR Act	No	5-Mar-24	49	27	18	55	45	35	Valid

APPENDIX C

Borehole Logs

Report to: Marathon Gold Corporation
GEMTEC Project: 80018.05 (March 18, 2020)

ABBREVIATIONS AND TERMINOLOGY USED ON RECORDS OF BOREHOLES AND TEST PITS

SAMPLE TYPES	
AS	Auger sample
CA	Casing sample
CS	Chunk sample
BS	Borros piston sample
GS	Grab sample
MS	Manual sample
RC	Rock core
SS	Split spoon sampler
ST	Slotted tube
TO	Thin-walled open shelby tube
TP	Thin-walled piston shelby tube
WS	Wash sample

SOIL TESTS	
w	Water content
PL, w_p	Plastic limit
LL, w_L	Liquid limit
C	Consolidation (oedometer) test
D_R	Relative density
DS	Direct shear test
G_S	Specific gravity
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	Organic content test
UC	Unconfined compression test
γ	Unit weight

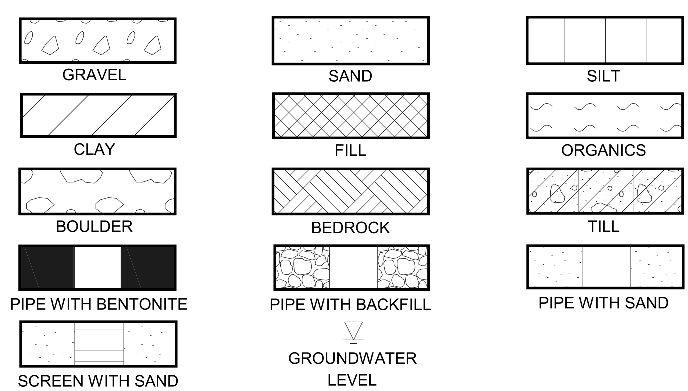
PENETRATION RESISTANCE

Standard Penetration Resistance, N
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 millimetres (30 in.) required to drive a 50 mm split spoon sampler for a distance of 300 mm (12 in.). For split spoon samples where less than 300 mm of penetration was achieved, the number of blows is reported over the sampler penetration in mm.

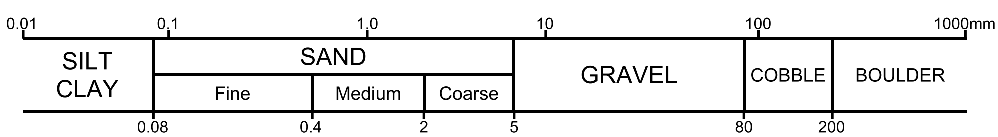
Dynamic Penetration Resistance
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive a 50 mm (2 in.) diameter 60° cone attached to 'A' size drill rods for a distance of 300 mm (12 in.).

WH	Sampler advanced by static weight of hammer and drill rods
WR	Sampler advanced by static weight of drill rods
PH	Sampler advanced by hydraulic pressure from drill rig
PM	Sampler advanced by manual pressure

COHESIONLESS SOIL Compactness		COHESIVE SOIL Consistency	
SPT N-Values	Description	Cu, kPa	Description
0-4	Very Loose	0-12	Very Soft
4-10	Loose	12-25	Soft
10-30	Compact	25-50	Firm
30-50	Dense	50-100	Stiff
>50	Very Dense	100-200	Very Stiff
		>200	Hard



GRAIN SIZE



DESCRIPTIVE TERMINOLOGY
(Based on the CANFEM 4th Edition)

0 – 10	10 – 20	20 – 35	35 –
TRACE	SOME	ADJECTIVE	noun > 35% and main fraction
trace clay, etc	some gravel, etc.	silty, etc.	sand and gravel, etc.

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERING STATE	
Fresh	No visible sign of rock material weathering
Faintly weathered	Weathering limited to the surface of major discontinuities
Slightly weathered	Penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material
Moderately weathered	Weathering extends throughout the rock mass but the rock material is not friable
Completely weathered	Rock is wholly decomposed and in a friable condition but the rock and structure are preserved

CORE CONDITION
Total Core Recovery (TCR) The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run
Solid Core Recovery (SCR) The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.
Rock Quality Designation (RQD) The percentage of solid drill core, greater than 100 mm length, as measured along the centerline axis of the core, relative to the length of the total core run. RQD varies from 0% for completed broken core to 100% for core in solid segments.

BEDDING THICKNESS	
Description	**Thickness**
Thinly laminated	< 6 mm
Laminated	6 - 20 mm
Very thinly bedded	20 - 60 mm
Thinly bedded	60 - 200 mm
Medium bedded	200 - 600 mm
Thickly bedded	600 - 2000 mm
Very thickly bedded	2000 - 6000 mm

DISCONTINUITY SPACING	
Description	**Spacing**
Very close	20 - 60 mm
Close	60 - 200 mm
Moderate	200 - 600 mm
Wide	600 -2000 mm
Very wide	2000 - 6000 mm

ROCK QUALITY	
RQD	**Overall Quality**
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

ROCK COMPRESSIVE STRENGTH	
Comp. Strength, MPa	**Description**
1 - 5	Very weak
5 - 25	Weak
25 - 50	Moderate
50 - 100	Strong
100 - 250	Very strong

RECORD OF BOREHOLE

CLIENT: Marathon Gold Corporation
PROJECT: Hydrogeology Baseline Report, Valentine Gold Project, Central NFLD
JOB#: 80018.05
LOCATION: Valentine Lake Property, NL

BORING DATES: Oct 5, 2019 to Oct 6, 2019
TOTAL DEPTH: 8.2 m
ELEVATION: 309.88 m
COORDINATES: **N** 5365302.0 **E** 495790.3 (UTM NAD83)

DRILL HOLE ID: MW1

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY (mm) or TCR (%)	BLOWS/0.3m or RQD (%)	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED); WATER CONTENT, % (W_P, W, W_L) 10 20 30 40 50 60 70 80 90	ADDITIONAL LAB. TESTING	PIEZOMETER OR MONITOR WELL INSTALLATION
0		Ground Surface		309.88							Stickup = 1.125m
0–8.2	Wash Casing HW (114mm OD)	OVERBURDEN: NO SAMPLING Inferred from lithology based on adjacent test pit 19-TP-28: Brown, silty SAND with gravel (SM); some cobbles and boulders, trace orange staining throughout, damp to wet. Note: 19-TP-28 was terminated at 4.2 m depth; inferred lithology below this depth in the borehole should be regarded with caution.									50mm dia. Solid PVC Riser Pipe in Bentonite Pellet Seal 50mm dia. Solid PVC Riser Pipe in No.3 Silica Sand Pack 50mm dia. No.10 Slot PVC Screen in No.3 Silica Sand Pack End Cap Sand Backfill
8.2		End of Borehole - Borehole terminated at 8.2 m below ground surface in overburden. Bedrock not encountered. - Groundwater level measured at 0.2 m above ground surface after well installation, indicating artesian pressure present. Monitoring Well Construction Elevations: - Top of Well Stickup = 311.01 m - Top of Screen = 308.36 m - Bottom of Screen = 303.78 m		301.65 8.23							

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
19/10/07	-0.2	311.0

GEMTEC
Consulting Engineers and Scientists

SHEET: 1 OF 1

LOGGED: LMS
CHECKED: CAM

RECORD OF BOREHOLE

CLIENT: Marathon Gold Corporation
PROJECT: Hydrogeology Baseline Report, Valentine Gold Project, Central NFLD
JOB#: 80018.05
LOCATION: Valentine Lake Property, NL

BORING DATES: Sept 30, 2019 to Oct 1, 2019
TOTAL DEPTH: 5.6 m
ELEVATION: 418.74 m
COORDINATES: **N** 5358751.3 **E** 490868.4 (UTM NAD83)

DRILL HOLE ID: MW2

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY (mm) or TCR (%)	BLOWS/0.3m or RQD (%)
0		Ground Surface	418.74				
0–2.69	Power Auger, Hollow Stem Auger (210mm OD)	Loose to compact, brown, silty SAND with gravel (SM), occasional cobbles and boulders: TILL - Trace orange staining and organics observed in upper 0.6 m.		1	SS	533	8
				2	SS	381	15
				3	SS	406	55
				4	SS	279	18
			416.05 / 2.69	5	SS	152	65/330
2.69–5.64	Diamond Rotary Core, HQ (96mm OD)	Excellent quality, grey with pink quartz veining, fresh, strong: BEDROCK - Granitic Rock (Quartz Porphyry Monzonite?)		6	RC	96%	100%
		- Encountered 0.5 m of weathered, brown stained, poor quality rock from approximately 4.1 m depth to 4.6 m depth.	413.10 / 5.64	7	RC	42%	82%

End of Borehole
- Borehole terminated at 5.6 m below ground surface in bedrock.
- Groundwater level observed at approximately 1.0 m below ground surface during drilling. Water level measured at 1.2 m below ground surface after well installation.

Monitoring Well Construction Elevations:
- Top of Well Stickup = 419.55 m
- Top of Screen = 417.83 m
- Bottom of Screen = 413.10 m

PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED; WATER CONTENT, % W_P W W_L; 10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR MONITOR WELL INSTALLATION
Stickup = 0.81m
Sand Backfill
50mm dia. Solid PVC Riser Pipe in Bentonite Pellet Seal
50mm dia. Solid PVC Riser Pipe in No.3 Silica Sand Pack
50mm dia. No.10 Slot PVC Screen in No.3 Silica Sand Pack
End Cap

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
19/09/30	1.0 ▽	418.2
19/10/05	1.2 ▼	418.0

GEMTEC Consulting Engineers and Scientists

SHEET: 1 OF 1

LOGGED: LMS
CHECKED: CAM

GEO - BOREHOLE LOG 8001805.GPJ GEMTEC 2018.GDT 19/10/31

RECORD OF BOREHOLE

CLIENT: Marathon Gold Corporation
PROJECT: Hydrogeology Baseline Report, Valentine Gold Project, Central NFLD
JOB#: 80018.05
LOCATION: Valentine Lake Property, NL

BORING DATES: Oct 11, 2019
TOTAL DEPTH: 6.9 m
ELEVATION: 386.22 m
COORDINATES: N 5356723.7 E 486729.7 (UTM NAD83)

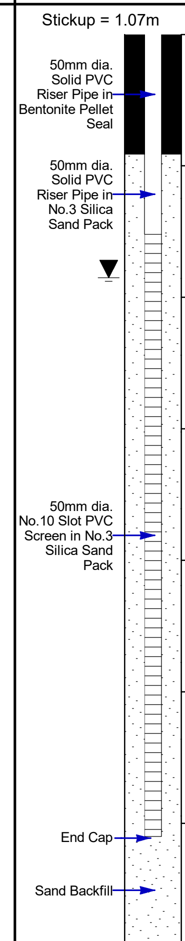
DRILL HOLE ID: MW3

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY (mm) or TCR (%)	BLOWS/0.3m or RQD (%)
0		Ground Surface		386.22				
0–4.45	Wash Casing HW (114mm OD)	OVERBURDEN: NO SAMPLING Inferred from lithology based on adjacent test pit 19-TP-31: Grey, silty SAND with gravel (SM); some cobbles and boulders, damp to wet. Note: 19-TP-31 was terminated at 1.9 m depth; inferred lithology below this depth in the borehole should be regarded with caution.						
4.45	Diamond Rotary Core HQ (96mm OD)	Fair quality, grey, fresh, strong: BEDROCK - Granitic Rock (Trondhjemite?) - Quartz vein observed at approximately 4.8 m depth, approximately 120mm wide.		381.77 4.45				
5.06		Fair to good quality, white and pink, trace weathering at fractures, very strong: BEDROCK - Granitic Rock (Trondhjemite?)		381.16 5.06	1	RC	73%	60%
6.92		End of Borehole - Borehole terminated at 6.9 m below ground surface in bedrock. - Groundwater level measured at 1.9 m below ground surface after well installation. Monitoring Well Construction Elevations: - Top of Well Stickup = 387.29 m - Top of Screen = 384.70 m - Bottom of Screen = 380.12 m		379.30 6.92				

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P W W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR MONITOR WELL INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
19/10/11	1.9	384.6

GEMTEC Consulting Engineers and Scientists

SHEET: 1 OF 1

LOGGED: LMS
CHECKED: CAM

GEO - BOREHOLE LOG 8001805.GPJ GEMTEC 2018.GDT 19/10/31

RECORD OF BOREHOLE

CLIENT: Marathon Gold Corporation
PROJECT: Hydrogeology Baseline Report, Valentine Gold Project, Central NFLD
JOB#: 80018.05
LOCATION: Valentine Lake Property, NL

BORING DATES: Oct 7, 2019
TOTAL DEPTH: 7.5 m
ELEVATION: 364.08 m
COORDINATES: **N** 5357353.4 **E** 491064.5 (UTM NAD83)

DRILL HOLE ID: MW4

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY (mm) or TCR (%)	BLOWS/0.3m or RQD (%)	ADDITIONAL LAB. TESTING	PIEZOMETER OR MONITOR WELL INSTALLATION (Stickup = 0.91m)
0		Ground Surface		364.08						
0–4.27	Wash Casing HW (114mm OD)	OVERBURDEN: NO SAMPLING Inferred from lithology based on adjacent test pit 19-TP-29: Blue-grey to brown, silty SAND with gravel (SM); some cobbles and boulders, damp. Note: 19-TP-29 was terminated at 2.6 m depth; inferred lithology below this depth in the borehole should be regarded with caution.		359.81 4.27						50mm dia. Solid PVC Riser Pipe in Bentonite Pellet Seal 50mm dia. Solid PVC Riser Pipe in No.3 Silica Sand Pack 50mm dia. No.10 Slot PVC Screen in No.3 Silica Sand Pack
4.27–7.49	Diamond Rotary Core HQ (96mm OD)	Fair to excellent quality, grey, fresh, strong: BEDROCK - Sediment (Siltstone)		356.59 7.49	1	RC	76%	71%		End Cap
					2	RC	100%	100%		Sand Backfill
7.49		End of Borehole - Borehole terminated at 7.5 m below ground surface in bedrock. - Groundwater level measured at 0.04 m above ground surface after well installation, indicating artesian pressure present. Monitoring Well Construction Elevations: - Top of Well Stickup = 364.99 m - Top of Screen = 362.56 m - Bottom of Screen = 357.98 m								

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

PENETRATION RESISTANCE (N), BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
19/10/07	0.0	364.5

GEO - BOREHOLE LOG 8001805.GPJ GEMTEC 2018.GDT 19/10/31

GEMTEC Consulting Engineers and Scientists

SHEET: 1 OF 1

LOGGED: LMS

CHECKED: CAM

RECORD OF BOREHOLE

CLIENT: Marathon Gold Corporation
PROJECT: Hydrogeology Baseline Report, Valentine Gold Project, Central NFLD
JOB#: 80018.05
LOCATION: Valentine Lake Property, NL

BORING DATES: Oct 9, 2019
TOTAL DEPTH: 10.1 m
ELEVATION: 362.76 m
COORDINATES: **N** 5355658.0 **E** 488068.4 (UTM NAD83)

DRILL HOLE ID: MW5

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY (mm) or TCR (%)	BLOWS/0.3m or RQD (%)
0		Ground Surface	362.76				
0–1.83	Wash Casing HW (114mm OD)	OVERBURDEN: NO SAMPLING Inferred from lithology based on adjacent test pit 19-TP-30: Dark grey to brown, silty SAND with gravel (SM); occasional cobbles and boulders, dry to damp. Note: 19-TP-30 was terminated at 1.2 m depth; inferred lithology below this depth in the borehole should be regarded with caution.	360.93 1.83				
1.83–10.10	Diamond Rotary Core HQ (96mm OD)	Very poor to fair, grey with white quartz veins, fresh, weak: BEDROCK - Sediment (Siltstone) - Excellent quality rock beyond 4.5 m depth.	352.66 10.10	1	RC	100%	58%
				2	RC	55%	9%
				3	RC	62%	33%
				4	RC	98%	92%
				5	RC	100%	100%
10.10		End of Borehole - Borehole terminated at 10.1 m below ground surface in bedrock. - Groundwater level measured at 0.09 m below ground surface after well installation. Monitoring Well Construction Elevations: - Top of Well Stickup = 363.69 m - Top of Screen = 359.71 m - Bottom of Screen = 353.66 m					

Chart headings: PENETRATION RESISTANCE (N), BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; WATER CONTENT, % W_P W W_L; 10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR MONITOR WELL INSTALLATION

Stickup = 0.925m

- 50mm dia. Solid PVC Riser Pipe in Bentonite Pellet Seal
- 50mm dia. Solid PVC Riser Pipe in No.3 Silica Sand Pack
- 50mm dia. No.10 Slot PVC Screen in No.3 Silica Sand Pack
- End Cap
- Sand Backfill

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
19/10/19	0.3	363.0

GEMTEC Consulting Engineers and Scientists

SHEET: 1 OF 1

LOGGED: LMS
CHECKED: CAM

GEO - BOREHOLE LOG 8001805.GPJ GEMTEC 2018.GDT 19/10/31

RECORD OF BOREHOLE

CLIENT: Marathon Gold Corporation
PROJECT: Hydrogeology Baseline Report, Valentine Gold Project, Central NFLD
JOB#: 80018.05
LOCATION: Valentine Lake Property, NL

BORING DATES: Oct 9, 2019 to Oct 10, 2019
TOTAL DEPTH: 30.05 m
ELEVATION: 386.05 m
COORDINATES: **N** 5356722.6 **E** 486725.5 (UTM NAD83)

DRILL HOLE ID: MW6

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY (mm) or TCR (%)	BLOWS/0.3m or RQD (%)	PIEZOMETER OR MONITOR WELL INSTALLATION
0		Ground Surface	386.05					Stickup = 1.425m
0–3.58	Wash Casing HW (114mm OD)	OVERBURDEN: NO SAMPLING Inferred from lithology based on adjacent test pit 19-TP-31: Grey, silty SAND with gravel (SM); some cobbles and boulders, damp to wet. Note: 19-TP-31 was terminated at 1.9 m depth; inferred lithology below this depth in the borehole should be regarded with caution.						
3.58		Fair to excellent quality, white with pink and grey, slightly weathered to fresh, very strong: BEDROCK - Granitic Rock (Trondhjemite?) - Observed trace clay (alteration) at fractures. - Color changes from predominantly white to pink to grey throughout.	382.47 3.58					
				1	RC	68%	33%	
				2	RC	84%	68%	50mm dia. Solid PVC Riser in Bentonite Grout Backfill
				3	RC	100%	90%	
				4	RC	100%	93%	

PENETRATION RESISTANCE (N), BLOWS/0.3m — SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED — DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m — WATER CONTENT, % W_P W W_L — 10 20 30 40 50 60 70 80 90 — ADDITIONAL LAB. TESTING

GEO - BOREHOLE LOG 8001805.GPJ GEMTEC 2018.GDT 19/10/31

GEMTEC Consulting Engineers and Scientists

SHEET: 1 OF 3

LOGGED: LMS
CHECKED: CAM

RECORD OF BOREHOLE

CLIENT: Marathon Gold Corporation
PROJECT: Hydrogeology Baseline Report, Valentine Gold Project, Central NFLD
JOB#: 80018.05
LOCATION: Valentine Lake Property, NL

BORING DATES: Oct 9, 2019 to Oct 10, 2019
TOTAL DEPTH: 30.05 m
ELEVATION: 386.50 m
COORDINATES: **N** 5356720.7 **E** 486724.5 (UTM NAD83)

DRILL HOLE ID: MW6

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY (mm) or TCR (%)	BLOWS/0.3m or RQD (%)	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED; WATER CONTENT, % W_P W W_L (10 20 30 40 50 60 70 80 90)	ADDITIONAL LAB. TESTING	PIEZOMETER OR MONITOR WELL INSTALLATION
12	Diamond Rotary Core HQ (96mm OD)										
13					5	RC	98%	79%			
14											
15											
16					6	RC	100%	88%			
17											50mm dia. Solid PVC Riser in Bentonite Grout Backfill
18											
19					7	RC	98%	88%			
20											
21											
22					8	RC	100%	95%			
23											

RECORD OF BOREHOLE

CLIENT: Marathon Gold Corporation
PROJECT: Hydrogeology Baseline Report, Valentine Gold Project, Central NFLD
JOB#: 80018.05
LOCATION: Valentine Lake Property, NL

BORING DATES: Oct 9, 2019 to Oct 10, 2019
TOTAL DEPTH: 30.05 m
ELEVATION: 386.50 m
COORDINATES: **N** 5356720.7 **E** 486724.5 (UTM NAD83)

DRILL HOLE ID: MW6

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY (mm) or TCR (%)	BLOWS/0.3m or RQD (%)	PENETRATION RESISTANCE (N), BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; WATER CONTENT, % W_P W W_L (10 20 30 40 50 60 70 80 90)	ADDITIONAL LAB. TESTING	PIEZOMETER OR MONITOR WELL INSTALLATION
23											
24											50mm dia. Solid PVC Riser in Bentonite Grout Backfill
25					9	RC	100%	98%			
26		- Joins observed in core, weather staining in joins.									
27											50mm dia. Solid PVC Riser Pipe in Bentonite Pellet Seal
28					10	RC	100%	83%			50mm dia. Solid PVC Riser Pipe in No.3 Silica Sand Pack
29											50mm dia. No.10 Slot PVC Screen in No.3 Silica Sand Pack
30		End of Borehole - Borehole terminated at 30.1 m below ground surface in bedrock. - Groundwater level measured at 7.4 m below ground surface after well installation. Monitoring Well Construction Elevations: - Top of Well Stickup = 387.48 m - Top of Screen = 357.55 m - Bottom of Screen = 356.05 m		356.00 30.05							End Cap
31											
32											
33											
34											

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
19/10/11	7.4	379.1

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

LOGGED: LMS
CHECKED: CAM

RECORD OF BOREHOLE

CLIENT: Marathon Gold Corporation
PROJECT: Hydrogeology Baseline Report, Valentine Gold Project, Central NFLD
JOB#: 80018.05
LOCATION: Valentine Lake Property, NL

BORING DATES: Oct 2, 2019 to Oct 3, 2019
TOTAL DEPTH: 7.6 m
ELEVATION: 342.09 m
COORDINATES: **N** 5360014.9 **E** 491700.8 (UTM NAD83)

DRILL HOLE ID: MW7

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY (mm) or TCR (%)	BLOWS/0.3m or RQD (%)	PENETRATION RESISTANCE (N), BLOWS/0.3m
0		Ground Surface	342.09					
0–2.3	Power Auger, Hollow Stem Auger (210mm OD)	BOG/PEAT - No sample recovery, assumed bog/peat based on very low blow counts and observation of surrounding areas.		1	SS	25	1	●
				2	SS	0	1	●
				3	SS	0	2	●
2.3–4.42	Power Auger, Hollow Stem Auger (210mm OD)	Compact, grey, sandy SILT (ML) to silty SAND with gravel (SM); occasional cobbles and boulders, wet: TILL	339.79 2.30	4	SS	356	10	●
				5	SS	152	19	●
				6	SS	305	25	●
4.42–7.62	Diamond Rotary Core, HQ (96mm OD)	Good quality, green grey, fresh, strong: BEDROCK - Granitic Rock (Trondhjemite?)	337.67 4.42	8	RC	100%	82%	
				9	RC	75%	88%	
7.62		End of Borehole - Borehole terminated at 7.6 m below ground surface in bedrock. - Groundwater level measured at 0.4 m below ground surface immediately following well installation and at 0.7 m below ground surface greater than 24 hours after well installation. Monitoring Well Construction Elevations: - Top of Well Stickup = 343.14 m - Top of Screen = 340.57 m - Bottom of Screen = 336.09 m	334.47 7.62					

SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR MONITOR WELL INSTALLATION

Stickup = 1.05m
50mm dia. Solid PVC Riser Pipe in Bentonite Pellet Seal
50mm dia. Solid PVC Riser Pipe in No.3 Silica Sand Pack
50mm dia. No.10 Slot PVC Screen in No.3 Silica Sand Pack
End Cap
Sand Backfill

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
19/10/06	0.4 ▽	341.9
19/10/07	0.7 ▼	341.6

GEMTEC
CONSULTING ENGINEERS AND SCIENTISTS

SHEET: 1 OF 1

LOGGED: LMS
CHECKED: CAM

GEO - BOREHOLE LOG 8001805.GPJ GEMTEC 2018.GDT 19/10/31

RECORD OF BOREHOLE

CLIENT: Marathon Gold Corporation
PROJECT: Hydrogeology Baseline Report, Valentine Gold Project, Central NFLD
JOB#: 80018.05
LOCATION: Valentine Lake Property, NL

BORING DATES: Oct 3, 2019 to Oct 5, 2019
TOTAL DEPTH: 31.9 m
ELEVATION: 342.01 m
COORDINATES: **N** 5360010.4 **E** 491702.4 (UTM NAD83)

DRILL HOLE ID: MW8

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY (mm) or TCR (%)	BLOWS/0.3m or RQD (%)	ADDITIONAL LAB. TESTING	PIEZOMETER OR MONITOR WELL INSTALLATION
		Ground Surface		342.01						Stickup = 0.84m
0	Wash Casing HW (114mm OD)	OVERBURDEN: NO SAMPLING Inferred from lithology based on adjacent borehole BH7: BOG overlying compact, grey, sandy SILT (ML) to silty SAND with gravel (SM); occasional cobbles and boulders, wet.								50mm dia. Solid PVC Riser Pipe in Bentonite Pellet Backfill
4		Poor quality, green grey to grey with white quartz veins, fresh, strong to very strong: BEDROCK - Granitic Rock (Trondhjemite?)		337.82 4.19						
5					1	RC	83%	37%		
6										50mm dia. Solid PVC Riser in Bentonite Grout Backfill
7					2	RC	93%	90%		
10					3	RC	100%	92%		

Chart legend: ● PENETRATION RESISTANCE (N), BLOWS/0.3m; ▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED; WATER CONTENT, % W_P — W — W_L; 10 20 30 40 50 60 70 80 90

RECORD OF BOREHOLE

CLIENT: Marathon Gold Corporation
PROJECT: Hydrogeology Baseline Report, Valentine Gold Project, Central NFLD
JOB#: 80018.05
LOCATION: Valentine Lake Property, NL

BORING DATES: Oct 3, 2019 to Oct 5, 2019
TOTAL DEPTH: 31.9 m
ELEVATION: 342.4 m
COORDINATES: **N** 5360009.8 **E** 491702.2 (UTM NAD83)

DRILL HOLE ID: MW8

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES – NUMBER	TYPE	RECOVERY (mm) or TCR (%)	BLOWS/0.3m or RQD (%)	PENETRATION RESISTANCE (N), BLOWS/0.3m; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA + NATURAL ⊕ REMOULDED; WATER CONTENT, % W_P W W_L (10 20 30 40 50 60 70 80 90)	ADDITIONAL LAB. TESTING	PIEZOMETER OR MONITOR WELL INSTALLATION
12–14	Diamond Rotary Core HQ (96mm OD)	- Observed clay (alteration) seams, grey quartz veins.			4	RC	99%	92%			
15–17					5	RC	100%	98%			50mm dia. Solid PVC Riser in Bentonite Grout Backfill
18–20		- 1.5 m long section of very hard, white and pink and grey quartz veining?			6	RC	98%	82%			
21–23					7	RC	98%	74%			

GEMTEC Consulting Engineers and Scientists

SHEET: 2 OF 3

LOGGED: LMS
CHECKED: CAM

GEO - BOREHOLE LOG 8001805.GPJ GEMTEC 2018.GDT 19/10/31

RECORD OF BOREHOLE

CLIENT: Marathon Gold Corporation
PROJECT: Hydrogeology Baseline Report, Valentine Gold Project, Central NFLD
JOB#: 80018.05
LOCATION: Valentine Lake Property, NL

BORING DATES: Oct 3, 2019 to Oct 5, 2019
TOTAL DEPTH: 31.9 m
ELEVATION: 342.4 m
COORDINATES: N 5360009.8 E 491702.2 (UTM NAD83)

DRILL HOLE ID: MW8

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY (mm) or TCR (%)	BLOWS/0.3m or RQD (%)
23–24								
24–27		- 0.5 m long section of very hard, white and pink and grey quartz veining?			8	RC	100%	98%
27–30					9	RC	100%	85%
30–31.9				310.11 / 31.90	10	RC	92%	92%
32		End of Borehole - Borehole terminated at 31.9 m below ground surface in bedrock. - Groundwater level measured at 0.2 m below ground surface after well installation. Monitoring Well Construction Elevations: - Top of Well Stickup = 342.85 m - Top of Screen = 313.51 m - Bottom of Screen = 312.01 m						

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR MONITOR WELL INSTALLATION

- 50mm dia. Solid PVC Riser in Bentonite Grout Backfill
- 50mm dia. Solid PVC Riser Pipe in Bentonite Pellet Seal
- 50mm dia. Solid PVC Riser Pipe in No.3 Silica Sand Pack
- 50mm dia. No.10 Slot PVC Screen in No.3 Silica Sand Pack
- End Cap
- Sand Backfill

GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
19/10/07	0.2	342.2

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SHEET: 3 OF 3

LOGGED: LMS
CHECKED: CAM

APPENDIX D

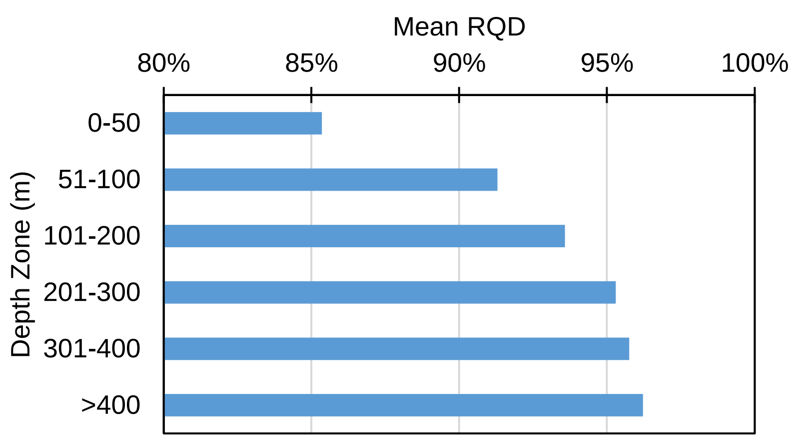
Summary of Rock Quality Designations in Existing Exploration Boreholes

Report to: Marathon Gold Corporation
GEMTEC Project: 80018.05 (March 18, 2020)

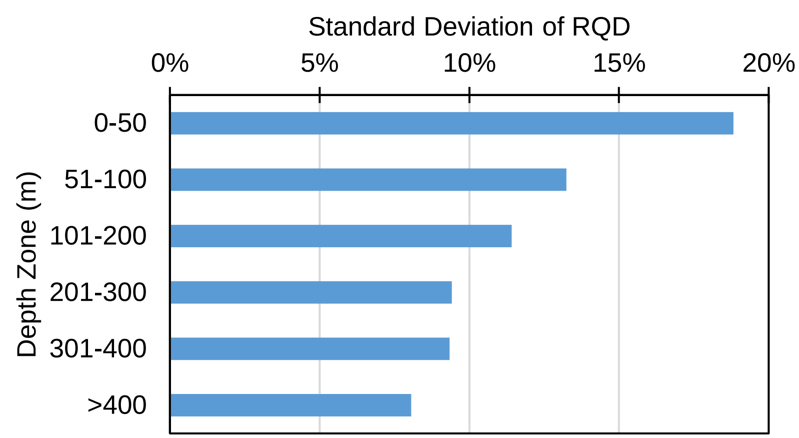
Table F1: Summary Statistics on Exploration Borehole Rock Quality Designations within Project

Summary Statistic	Depth Range					
	0-50	51-100	101-200	201-300	301-400	>400
Minimum	0%	0%	0%	0%	0%	0%
Mean	85%	91%	94%	95%	96%	96%
Maximum	100%	100%	100%	100%	100%	100%
Standard Deviation	19%	13%	11%	9%	9%	8%
# entries	**12152**	**11144**	**14705**	**7260**	**4223**	**3642**
					Total entries:	**53126**

RQD by Depth Zone



Standard Deviation of RQD by Depth Zone



APPENDIX E

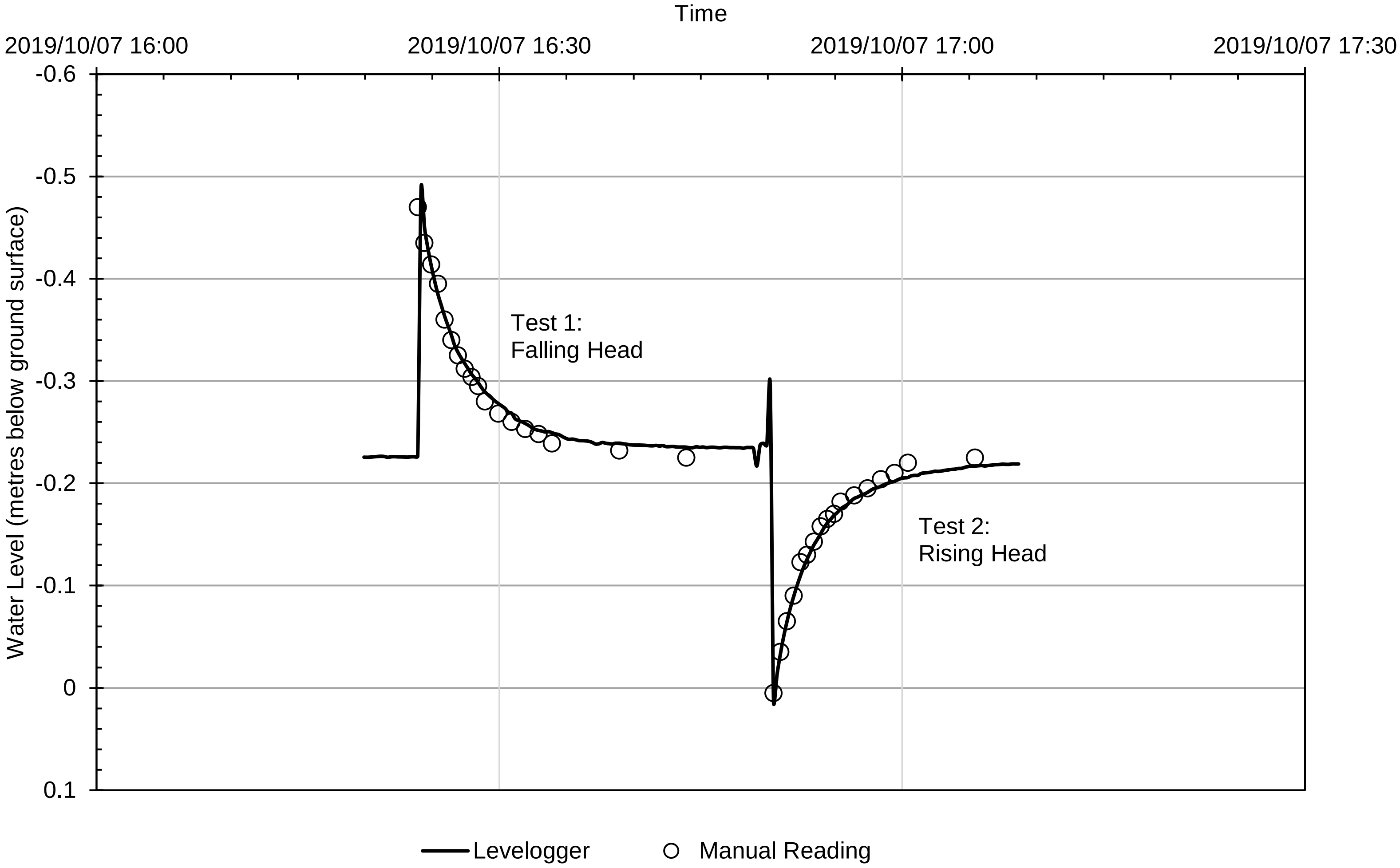
Water Level versus Time Plots for Slug Tests

Report to: Marathon Gold Corporation
GEMTEC Project: 80018.05 (March 18, 2020)

Title: **MW1 Slug Test (Falling Head and Rising Head) Water Level Data**

Project: Hydrogeology Baseline Report

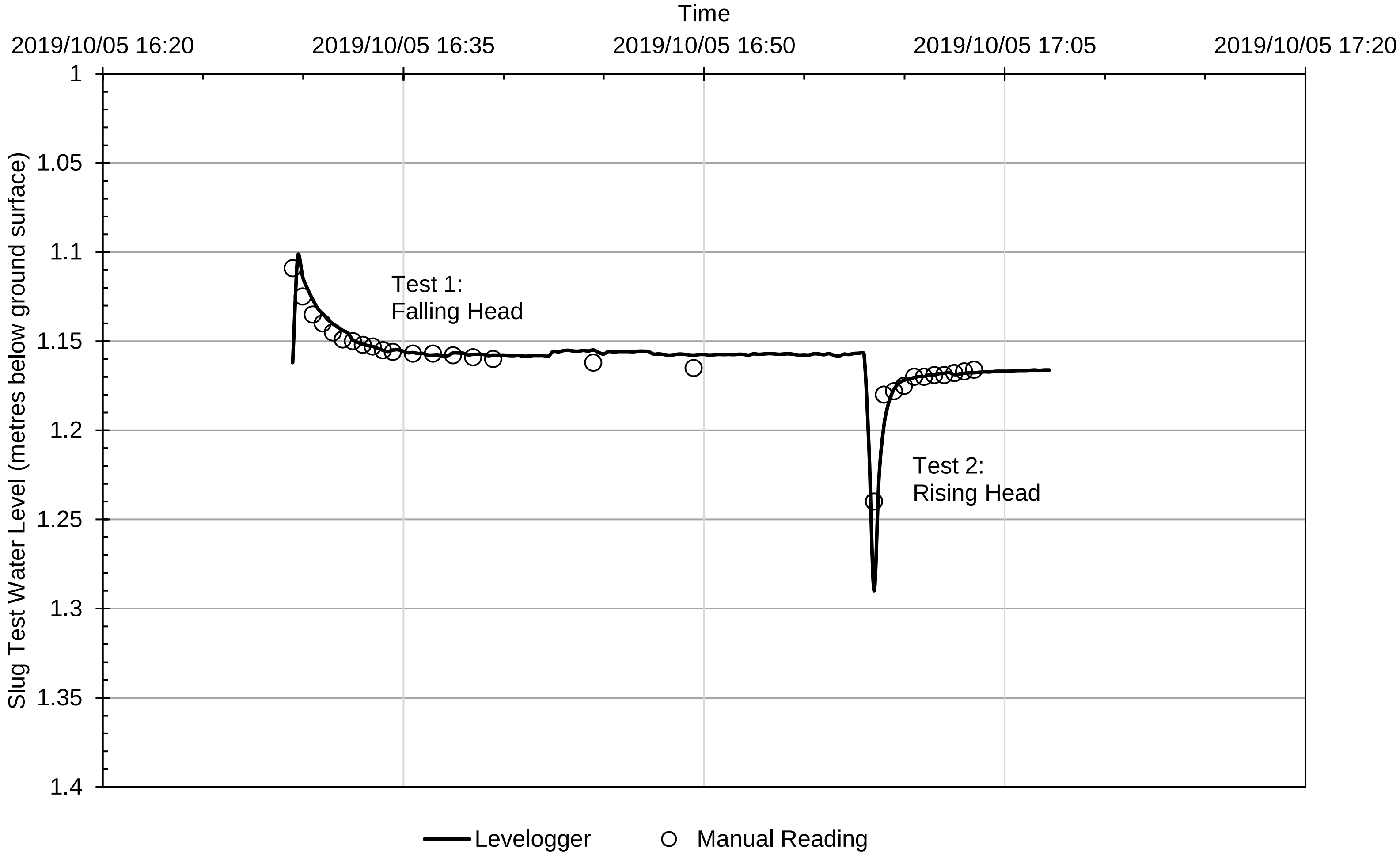
Marathon Valentine Gold Project, Central Newfoundland



Title: **MW2 Slug Test (Falling Head and Rising Head) Water Level Data**

Project: Hydrogeology Baseline Report

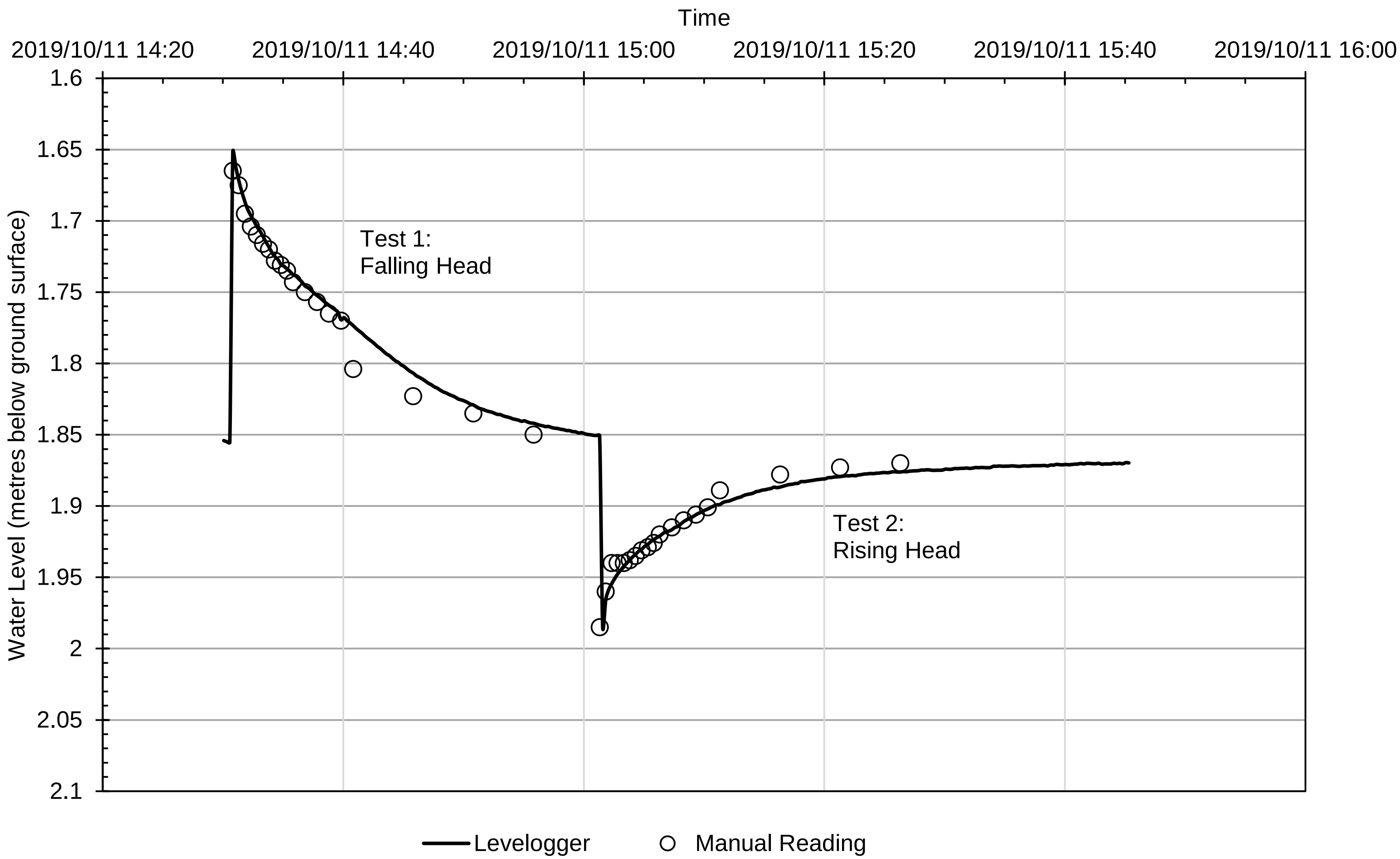
Marathon Valentine Gold Project, Central Newfoundland



Title: **MW3 Slug Test (Falling Head and Rising Head) Water Level Data**

Project: Hydrogeology Baseline Report

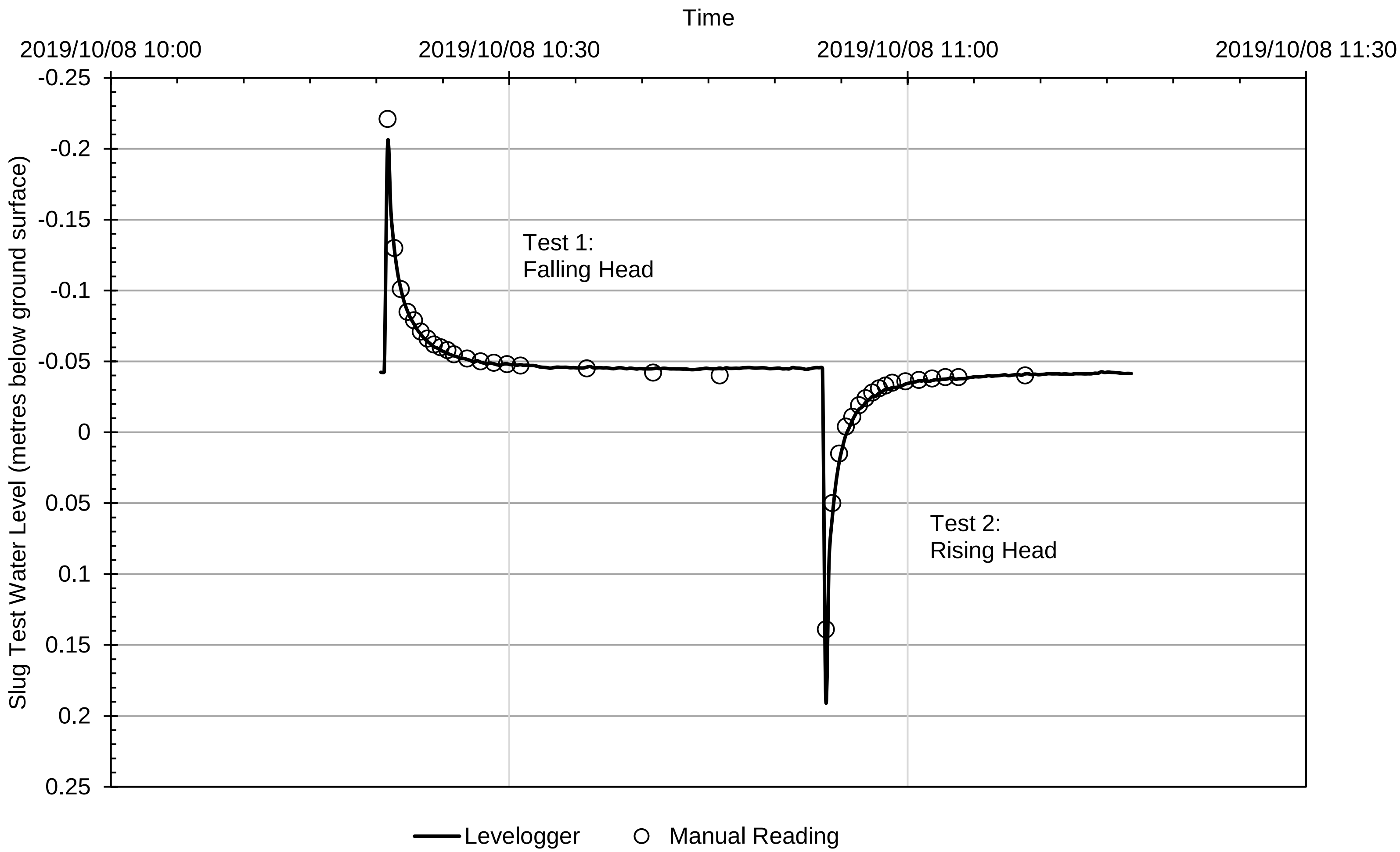
Marathon Valentine Gold Project, Central Newfoundland



Title: **MW4 Slug Test (Falling Head and Rising Head) Water Level Data**

Project: Hydrogeology Baseline Report

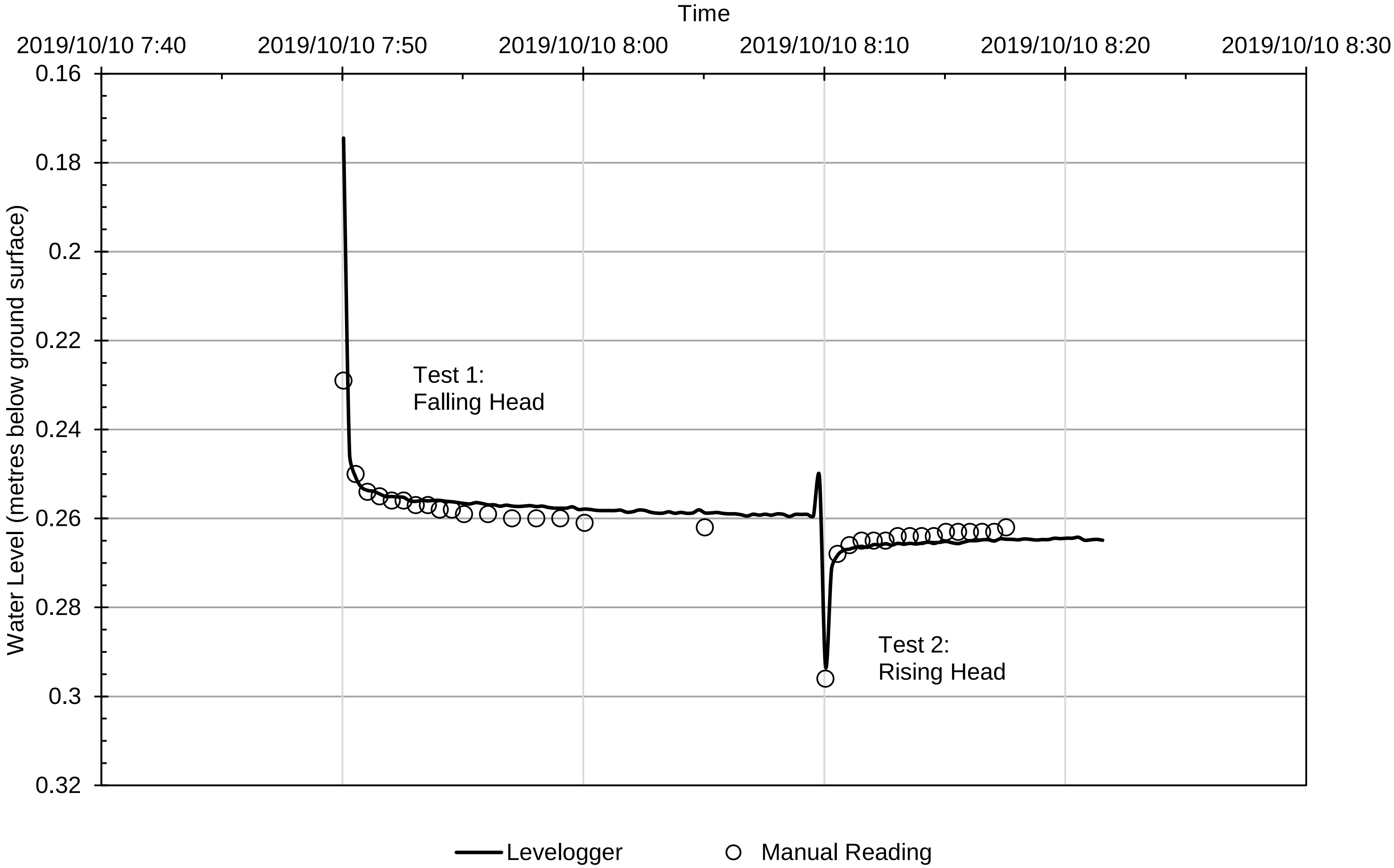
Marathon Valentine Gold Project, Central Newfoundland



Title: **MW5 Slug Test (Falling Head and Rising Head) Water Level Data**

Project: Hydrogeology Baseline Report

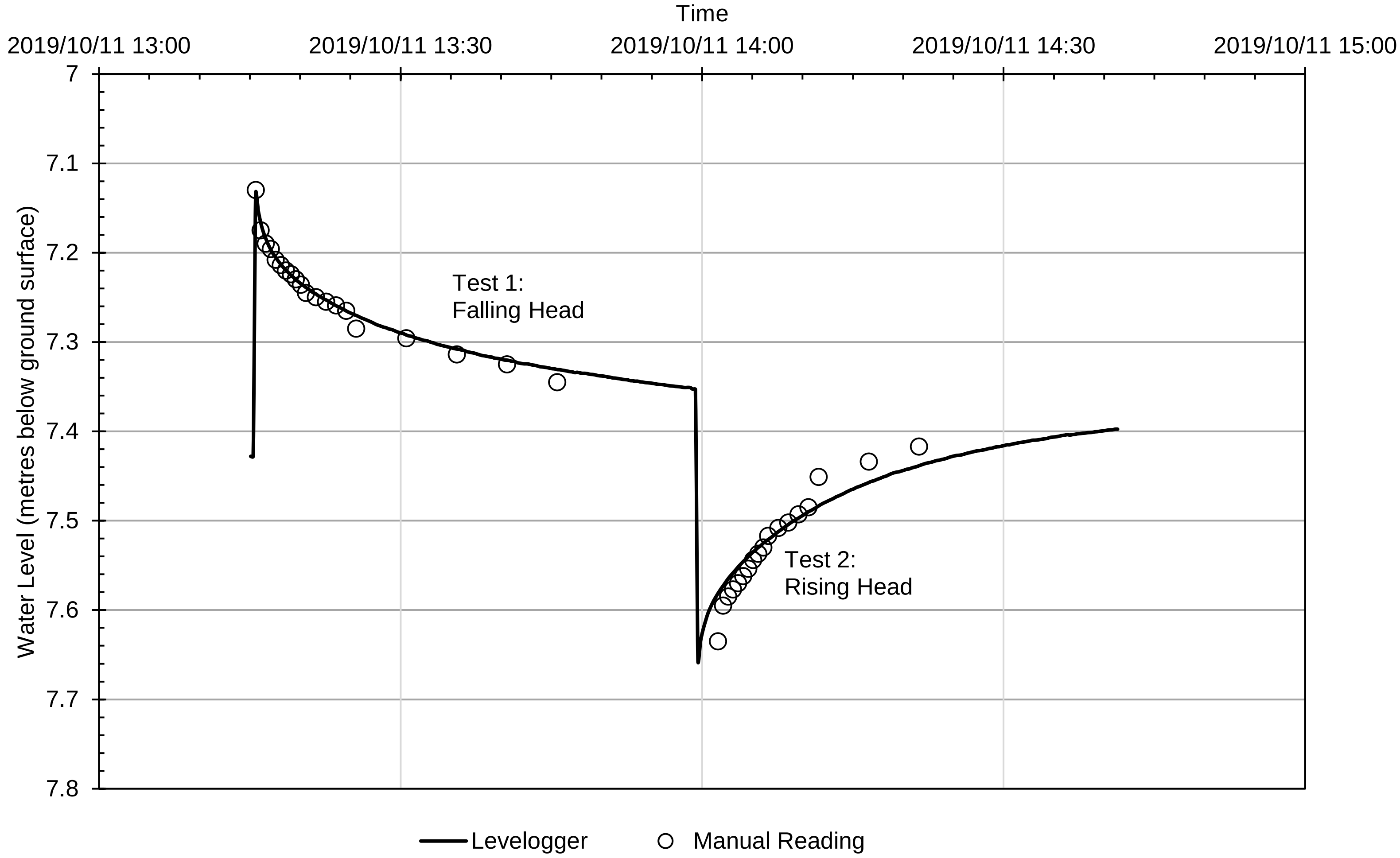
Marathon Valentine Gold Project, Central Newfoundland



Title: **MW6 Slug Test (Falling Head and Rising Head) Water Level Data**

Project: Hydrogeology Baseline Report

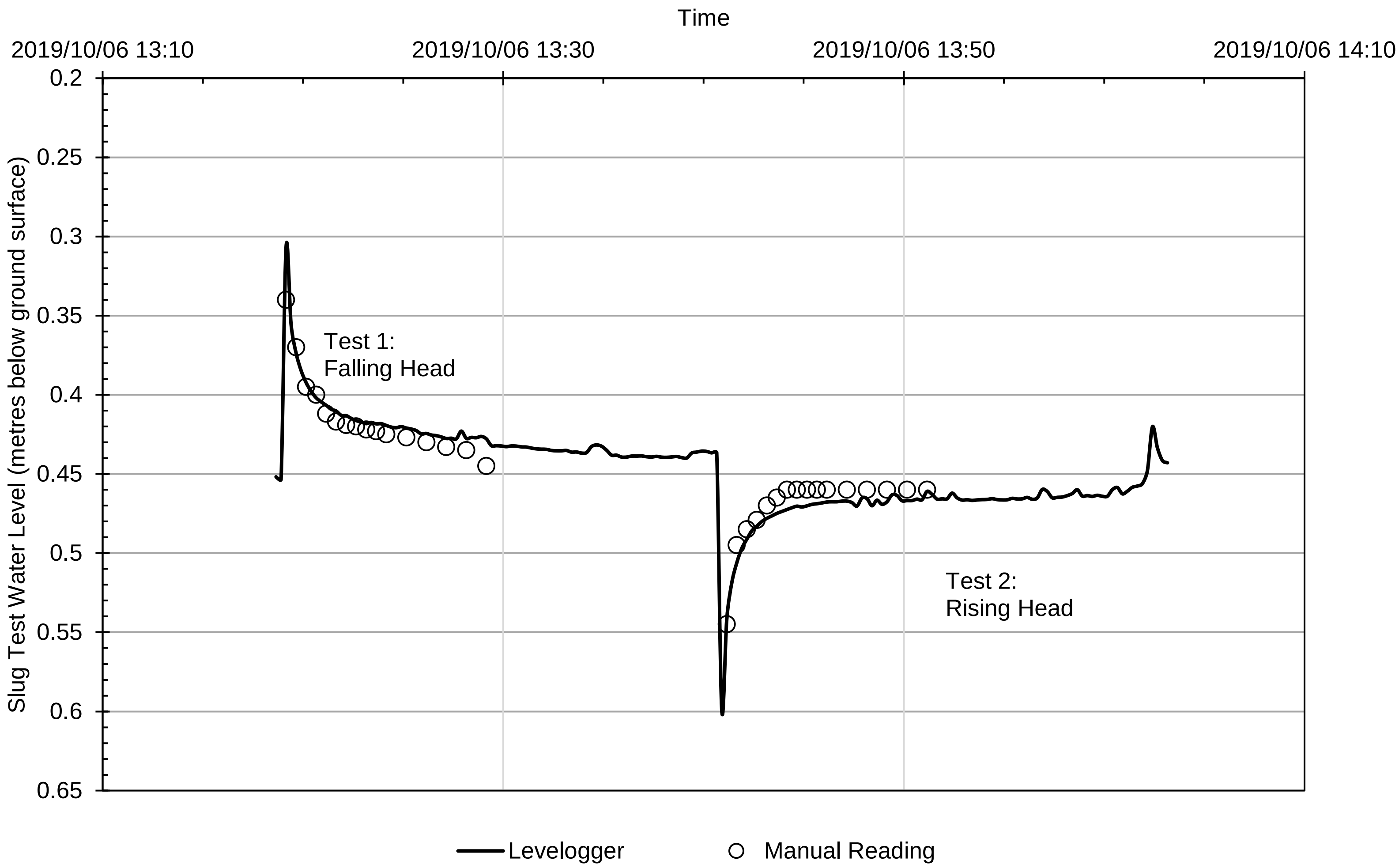
Marathon Valentine Gold Project, Central Newfoundland



Title: **MW7 Slug Test (Falling Head and Rising Head) Water Level Data**

Project: Hydrogeology Baseline Report

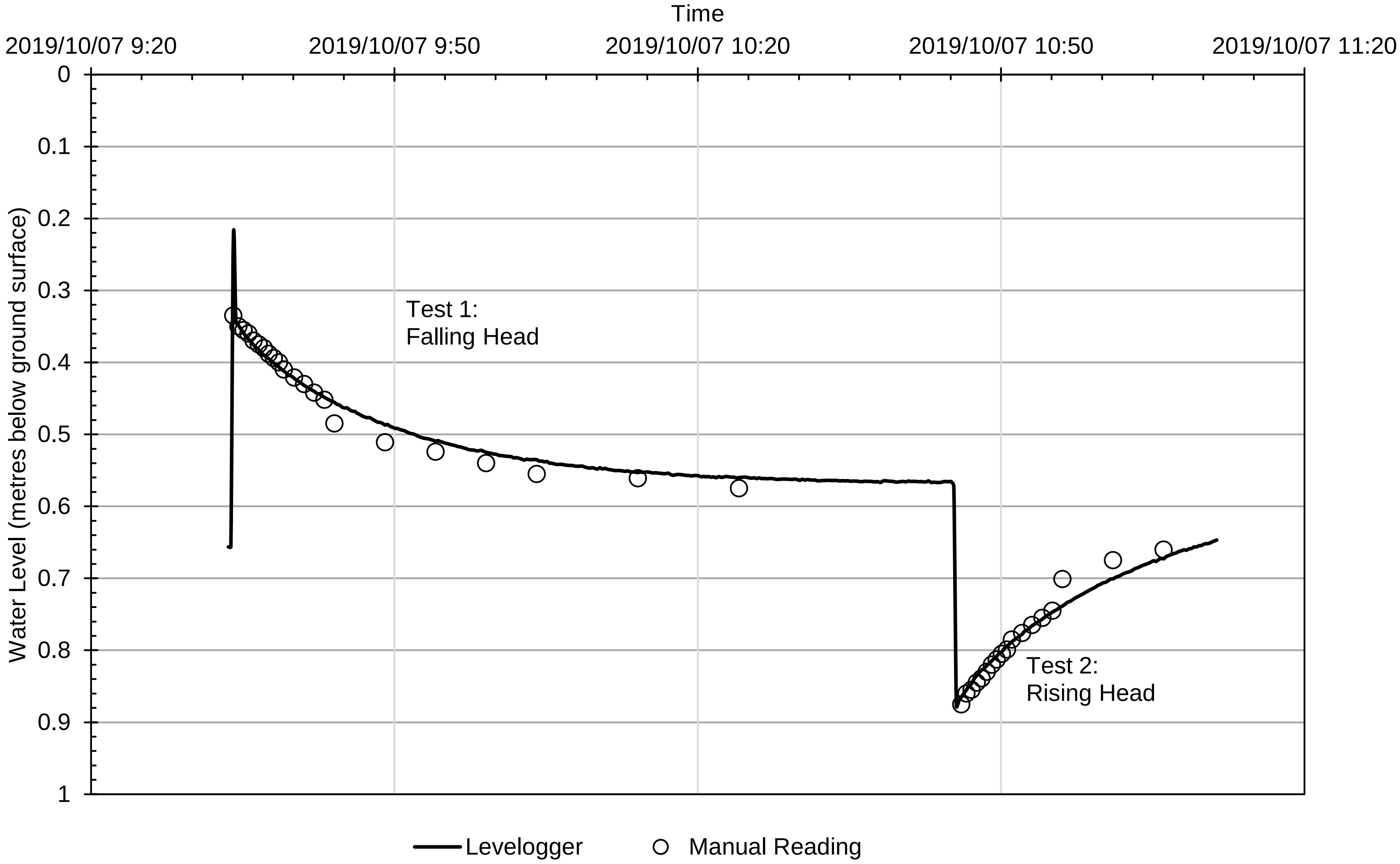
Marathon Valentine Gold Project, Central Newfoundland



Title: **MW8 Slug Test (Falling Head and Rising Head) Water Level Data**

Project: Hydrogeology Baseline Report

Marathon Valentine Gold Project, Central Newfoundland



APPENDIX F

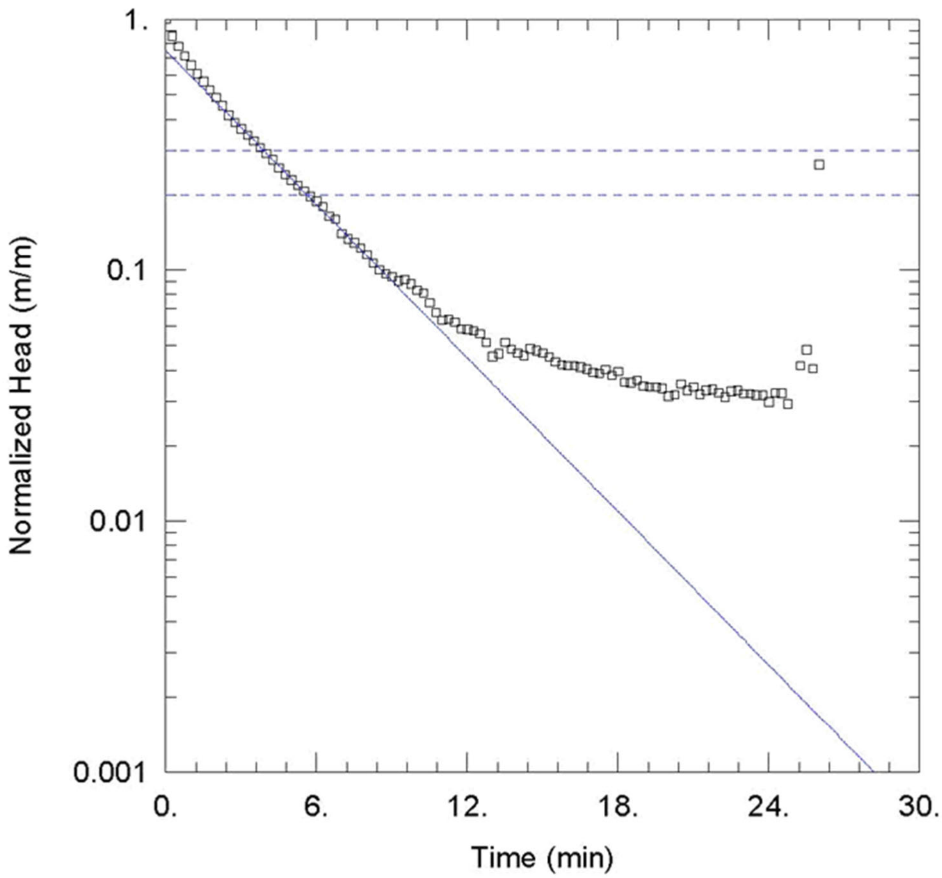
AQTESOLV® Analytical Plots for Slug Tests

Report to: Marathon Gold Corporation
GEMTEC Project: 80018.05 (March 18, 2020)

Title: **MW1 Test 1 (Falling Head) Analysis**

Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 1 slug, volume 0.00067 m^3; H(0)* = 0.3306 for effective casing radius correction (Butler, 1998 – Equation 3.1).

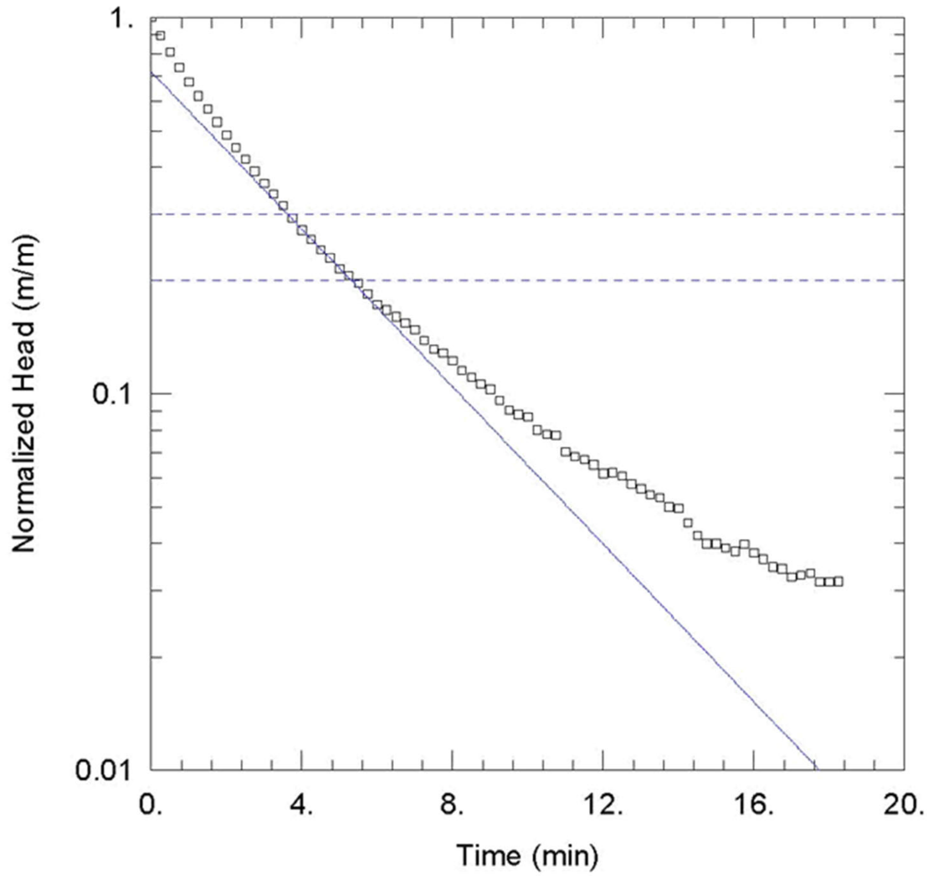


Data Set: \...\8001805_MW1 Test 1.aqt	
Date: 10/30/19	Time: 14:08:24
AQUIFER DATA	
Saturated Thickness: 6.1 m	Anisotropy Ratio (Kz/Kr): 1.
WELL DATA (MW1 Test 1: Falling Head)	
Initial Displacement: 0.2614 m	Static Water Column Height: 6.325 m
Total Well Penetration Depth: 6.1 m	Screen Length: 4.58 m
Casing Radius: 0.0254 m	Well Radius: 0.051 m
	Gravel Pack Porosity: 0.
SOLUTION	
Aquifer Model: Unconfined	Solution Method: Bouwer-Rice
K = 1.27E-6 m/sec	y0 = 0.196 m

Title: **MW1 Test 2 (Rising Head) Analysis**

Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 1 slug, volume 0.00067 m^3; H(0)* = 0.3306 for effective casing radius correction (Butler, 1998 – Equation 3.1).



Data Set: N:\files\80000\80018.05\Field_Program\AQTESOLV\8001805_MW1 Test 2.aqt
Date: 10/30/19 Time: 14:28:14

AQUIFER DATA

Saturated Thickness: 6.1 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW1 Test 2: Rising Head)

Initial Displacement: 0.2399 m
Total Well Penetration Depth: 6.1 m
Casing Radius: 0.0254 m
Static Water Column Height: 6.325 m
Screen Length: 4.58 m
Well Radius: 0.051 m
Gravel Pack Porosity: 0.

SOLUTION

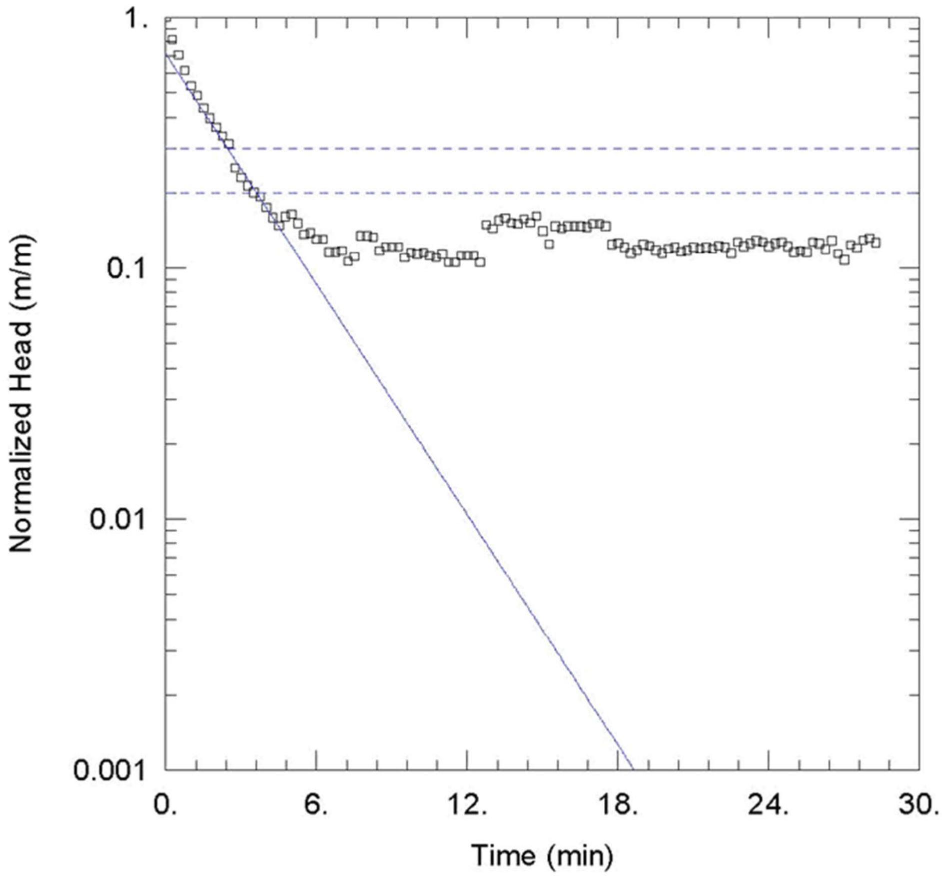
Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.42E-6 m/sec y0 = 0.172 m

Title: **MW2 Test 1 (Falling Head) Analysis**

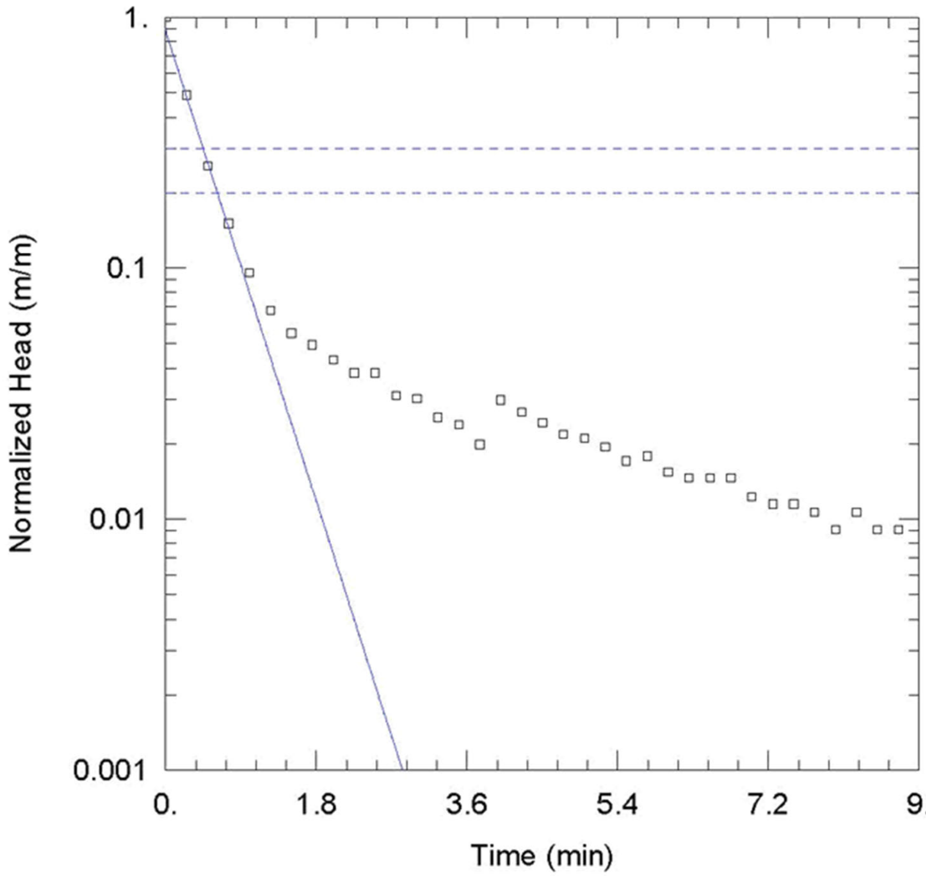
Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 1 slug, volume 0.00067 m^3; H(0)*=0.3306 m for effective casing radius correction (Butler, 1998 – Equation 3.1).



Data Set: N:\files\80000\80018.05\Field_Program\AQTESOLV\8001805_MW2 Test 1.aqt	
Date: 10/30/19	Time: 14:31:20
AQUIFER DATA	
Saturated Thickness: 4.374 m	Anisotropy Ratio (Kz/Kr): 1.
WELL DATA (MW2 Test 1: Falling Head)	
Initial Displacement: 0.06252 m	Static Water Column Height: 4.374 m
Total Well Penetration Depth: 5.54 m	Screen Length: 4.63 m
Casing Radius: 0.0254 m	Well Radius: 0.051 m
	Gravel Pack Porosity: 0.
SOLUTION	
Aquifer Model: Unconfined	Solution Method: Bouwer-Rice
K = 8.19E-6 m/sec	y0 = 0.0448 m

Title:	**MW2 Test 2 (Rising Head) Analysis**
Project:	Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador
Details:	1 slug, volume 0.00067 m^3; H(0)*=0.3306 m for effective casing radius correction (Butler, 1998 – Equation 3.1).



Data Set: N:\files\80000\80018.05\Field_Program\AQTESOLV\8001805_MW2 Test 2.aqt
Date: 10/30/19 Time: 14:33:37

AQUIFER DATA

Saturated Thickness: 4.374 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW2 Test 2: Rising Head)

Initial Displacement: 0.1249 m
Total Well Penetration Depth: 5.54 m
Casing Radius: 0.0254 m
Static Water Column Height: 4.374 m
Screen Length: 4.63 m
Well Radius: 0.051 m
Gravel Pack Porosity: 0.

SOLUTION

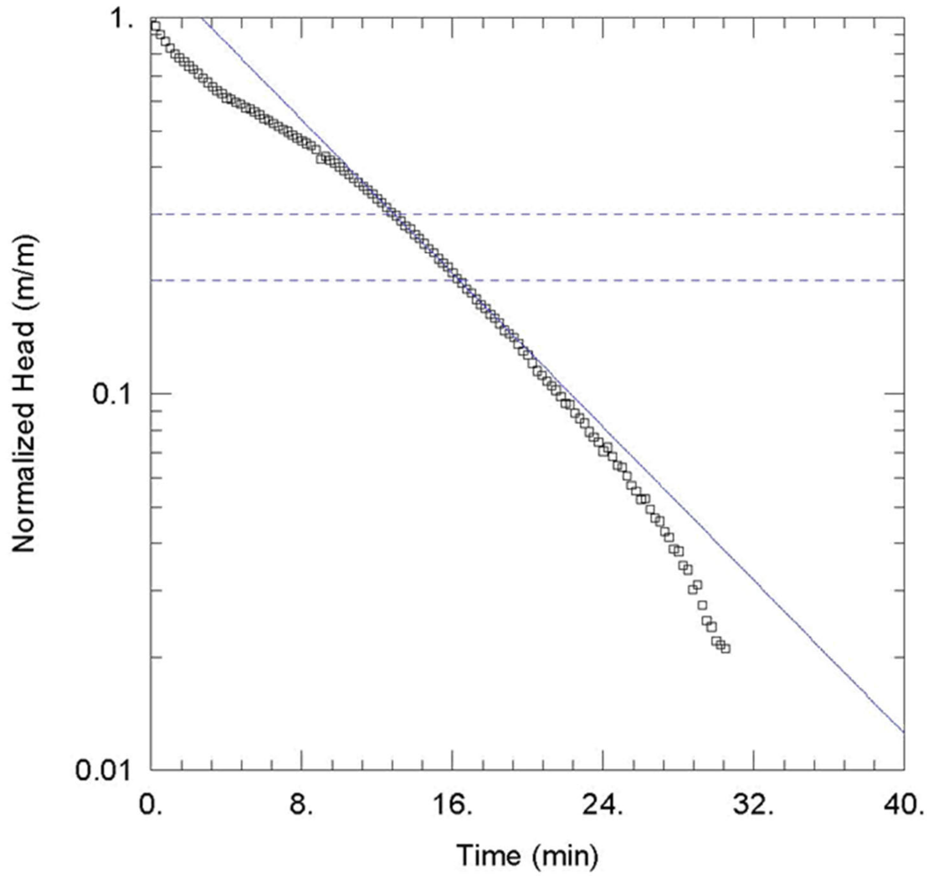
Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 2.79E-5 m/sec y0 = 0.11 m

Title: **MW3 Test 1 (Falling Head) Analysis**

Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 1 slug, volume 0.00067 m^3; H(0)*=0.3306 m for effective casing radius correction (Butler, 1998 – Equation 3.1).

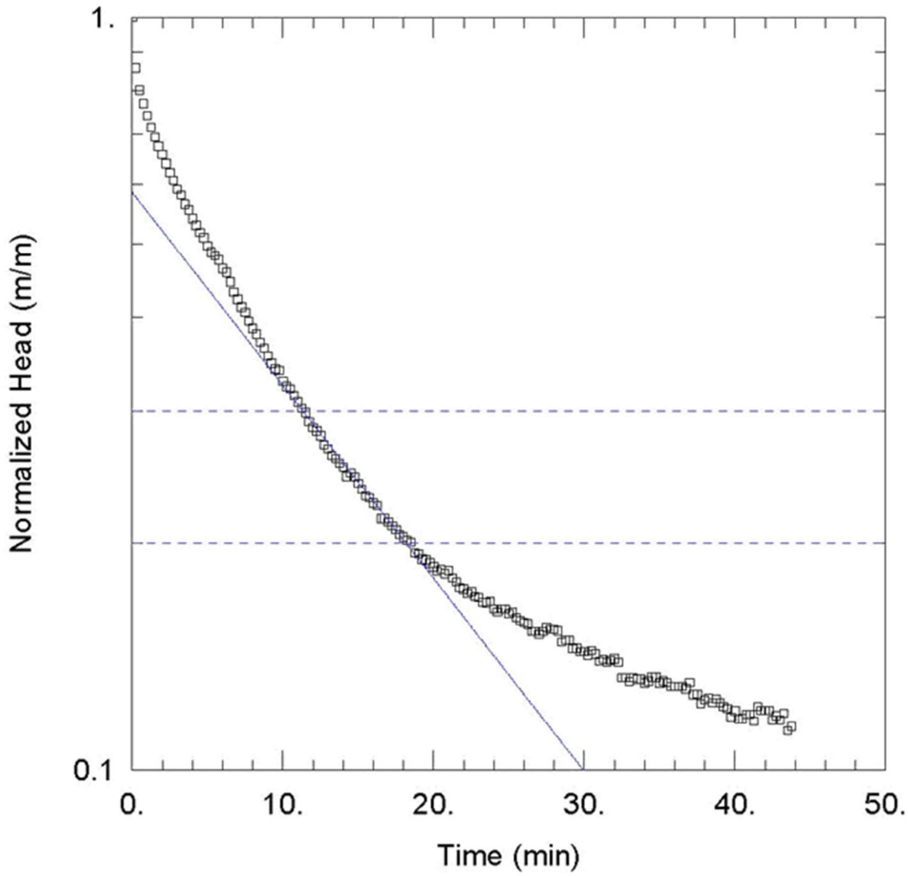


Data Set: N:\files\80000\80018.05\Field_Program\AQTESOLV\8001805_MW3 Test 1.aqt	
Date: 10/30/19	Time: 14:36:33
AQUIFER DATA	
Saturated Thickness: 4.15 m	Anisotropy Ratio (Kz/Kr): 1.
WELL DATA (MW3 Test 1: Falling Head)	
Initial Displacement: 0.2032 m	Static Water Column Height: 4.15 m
Total Well Penetration Depth: 6. m	Screen Length: 4.48 m
Casing Radius: 0.0254 m	Well Radius: 0.051 m
	Gravel Pack Porosity: 0.
SOLUTION	
Aquifer Model: Unconfined	Solution Method: Bouwer-Rice
K = 8.94E-7 m/sec	y0 = 0.277 m

Title: **MW3 Test 2 (Rising Head) Analysis**

Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 1 slug, volume 0.00067 m^3; H(0)*=0.3306 m for effective casing radius correction (Butler, 1998 – Equation 3.1).

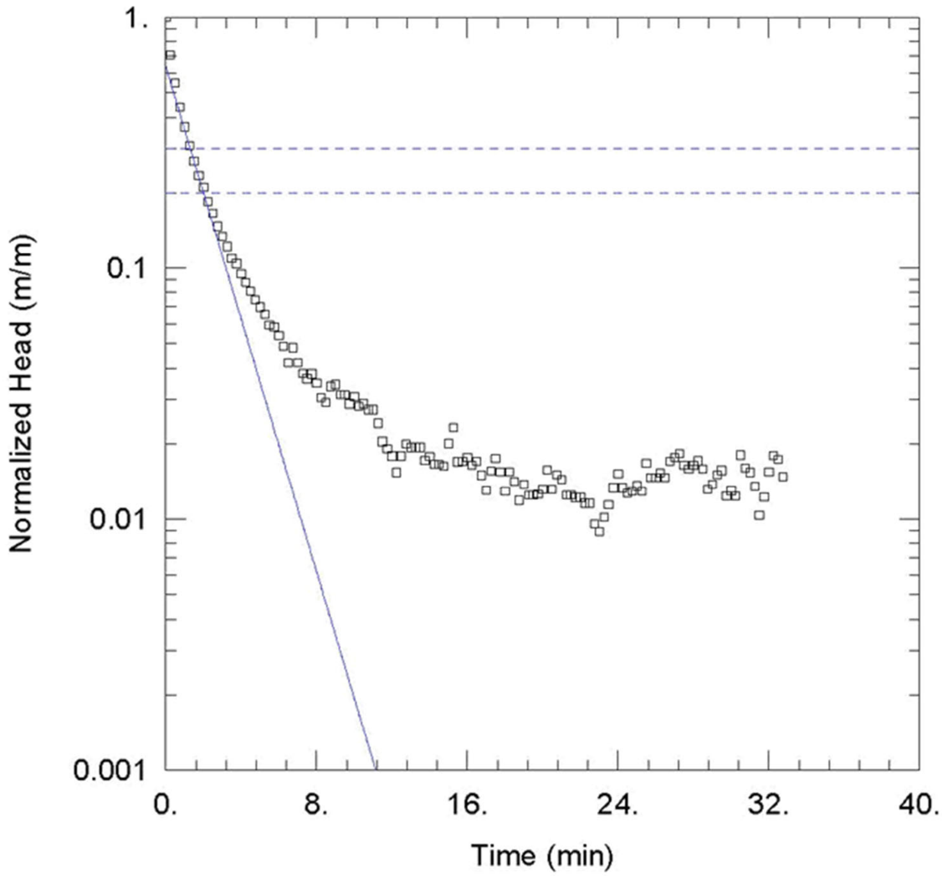


Data Set: N:\files\80000\80018.05\Field_Program\AQTESOLV\8001805_MW3 Test 2.aqt	
Date: 10/30/19	Time: 14:39:00
AQUIFER DATA	
Saturated Thickness: 4.15 m	Anisotropy Ratio (Kz/Kr): 1.
WELL DATA (MW3 Test 2: Rising Head)	
Initial Displacement: 0.1297 m	Static Water Column Height: 4.15 m
Total Well Penetration Depth: 6. m	Screen Length: 4.48 m
Casing Radius: 0.0254 m	Well Radius: 0.051 m
	Gravel Pack Porosity: 0.
SOLUTION	
Aquifer Model: Unconfined	Solution Method: Bouwer-Rice
K = 7.05E-7 m/sec	y0 = 0.076 m

Title: **MW4 Test 1 (Falling Head) Analysis**

Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 1 slug, volume 0.00067 m^3; H(0)* = 0.3306 for effective casing radius correction (Butler, 1998 – Equation 3.1).

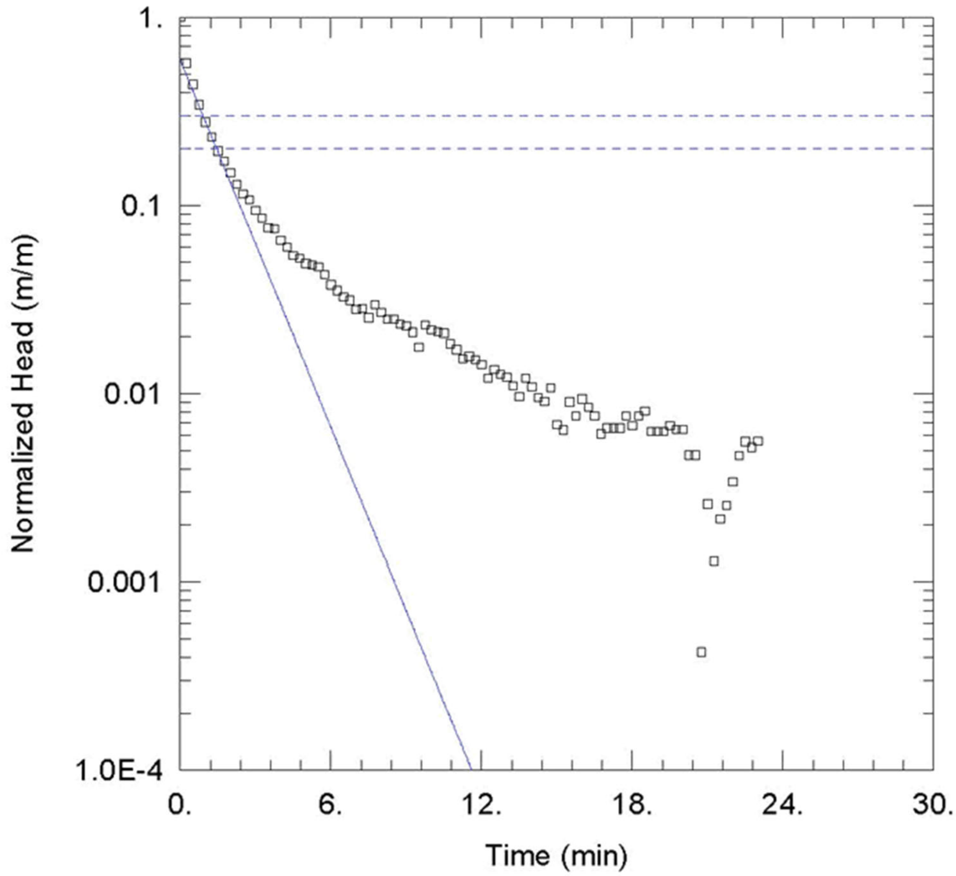


Data Set: \...\8001805_MW4 Test 1.aqt	
Date: 10/30/19	Time: 15:20:12
AQUIFER DATA	
Saturated Thickness: 6.1 m	Anisotropy Ratio (Kz/Kr): 1.
WELL DATA (MW4 Test 1: Falling Head)	
Initial Displacement: 0.1596 m	Static Water Column Height: 6.14 m
Total Well Penetration Depth: 6.1 m	Screen Length: 4.58 m
Casing Radius: 0.0254 m	Well Radius: 0.051 m
	Gravel Pack Porosity: 0.
SOLUTION	
Aquifer Model: Unconfined	Solution Method: Bouwer-Rice
K = 5.14E-6 m/sec	y0 = 0.102 m

Title: **MW4 Test 2 (Rising Head) Analysis**

Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 1 slug, volume 0.00067 m^3; H(0)* = 0.3306 for effective casing radius correction (Butler, 1998 – Equation 3.1).

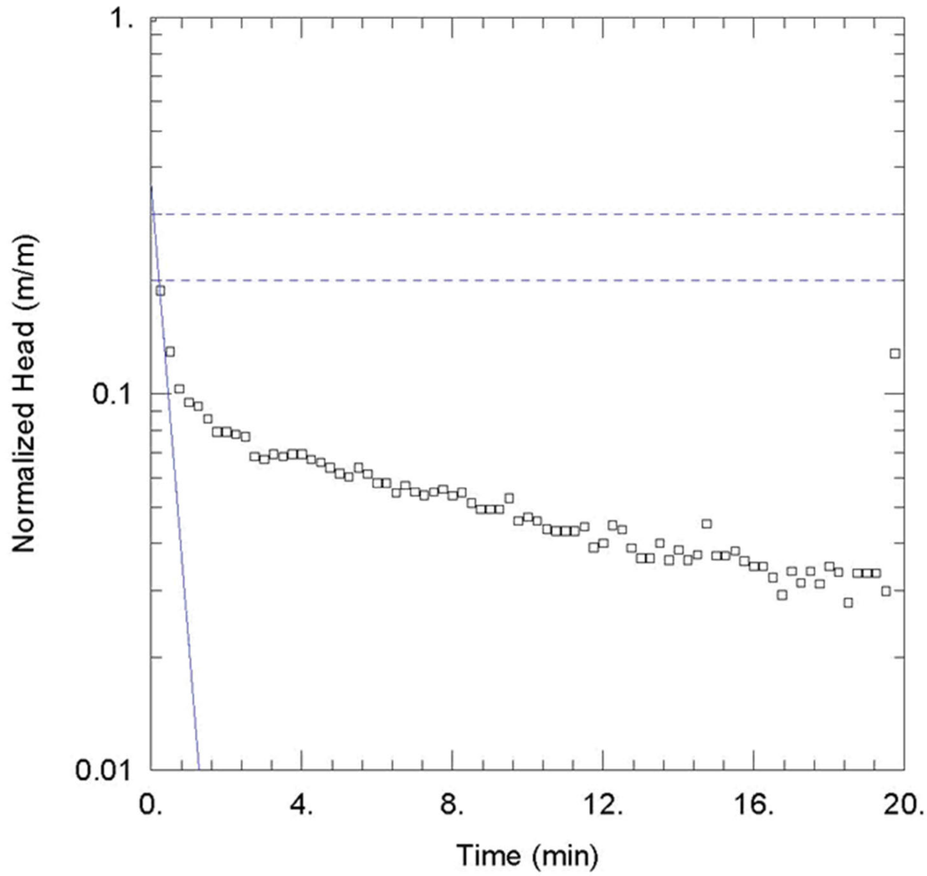


Data Set: N:\files\80000\80018.05\Field_Program\AQTESOLV\8001805_MW4 Test 2.aqt	
Date: 10/30/19	Time: 14:45:11
AQUIFER DATA	
Saturated Thickness: 6.1 m	Anisotropy Ratio (Kz/Kr): 1.
WELL DATA (MW4 Test 2: Rising Head)	
Initial Displacement: 0.2305 m	Static Water Column Height: 6.14 m
Total Well Penetration Depth: 6.1 m	Screen Length: 4.58 m
Casing Radius: 0.0254 m	Well Radius: 0.051 m
	Gravel Pack Porosity: 0.
SOLUTION	
Aquifer Model: Unconfined	Solution Method: Bouwer-Rice
K = 4.59E-7 m/sec	y0 = 0.137 m

Title: **MW5 Test 1 (Falling Head) Analysis**

Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 2 slugs, total volume 0.00134 m^3; H(0)*=0.6611 m for effective casing radius correction (Butler, 1998 – Equation 3.1).

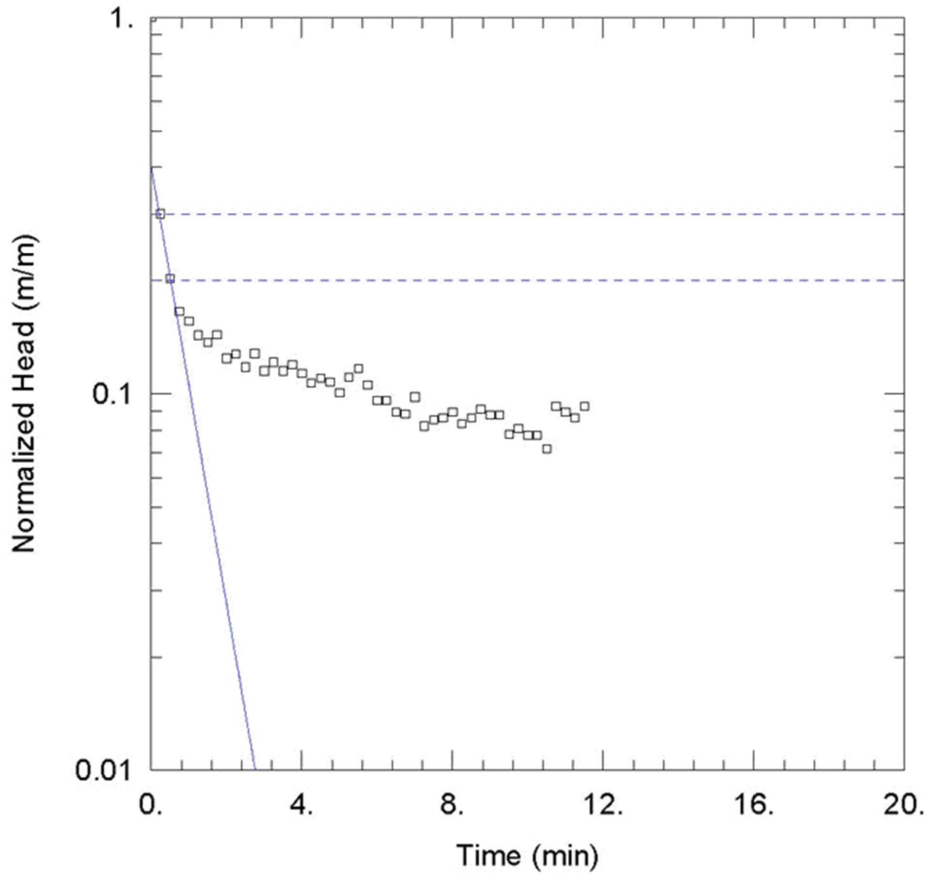


Data Set: \...\8001805_MW5 Test 1.aqt	
Date: 10/30/19	Time: 15:47:10
AQUIFER DATA	
Saturated Thickness: 8.838 m	Anisotropy Ratio (Kz/Kr): 1.
WELL DATA (MW5 Test 1: Falling Head)	
Initial Displacement: 0.08754 m	Static Water Column Height: 8.838 m
Total Well Penetration Depth: 9.1 m	Screen Length: 6.05 m
Casing Radius: 0.0254 m	Well Radius: 0.051 m
	Gravel Pack Porosity: 0.
SOLUTION	
Aquifer Model: Unconfined	Solution Method: Bouwer-Rice
K = 7.43E-5 m/sec	y0 = 0.0312 m

Title: **MW5 Test 2 (Rising Head) Analysis**

Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 2 slugs, total volume 0.00134 m3; H(0)*=0.6611 m for effective casing radius correction (Butler, 1998 – Equation 3.1).

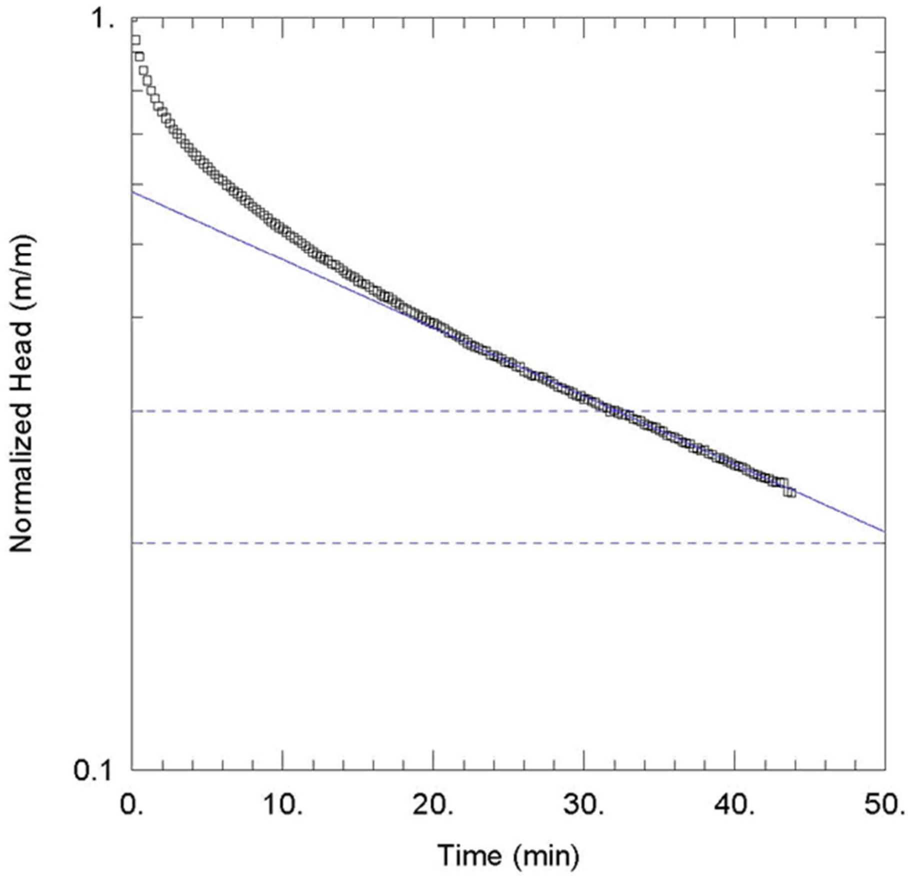


Data Set: N:\files\80000\80018.05\Field_Program\AQTESOLV\8001805_MW5 Test 2.aqt	
Date: 10/30/19	Time: 15:48:05
AQUIFER DATA	
Saturated Thickness: 8.838 m	Anisotropy Ratio (Kz/Kr): 1.
WELL DATA (MW5 Test 2: Rising Head)	
Initial Displacement: 0.03119 m	Static Water Column Height: 8.838 m
Total Well Penetration Depth: 9.1 m	Screen Length: 6.05 m
Casing Radius: 0.0254 m	Well Radius: 0.051 m
	Gravel Pack Porosity: 0.
SOLUTION	
Aquifer Model: Unconfined	Solution Method: Bouwer-Rice
K = 9.93E-5 m/sec	y0 = 0.0125 m

Title: **MW6 Test 1 (Falling Head) Analysis**

Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 1 slug, volume 0.00067 m^3; H(0)* = 0.3306 for effective casing radius correction (Butler, 1998 – Equation 3.1).

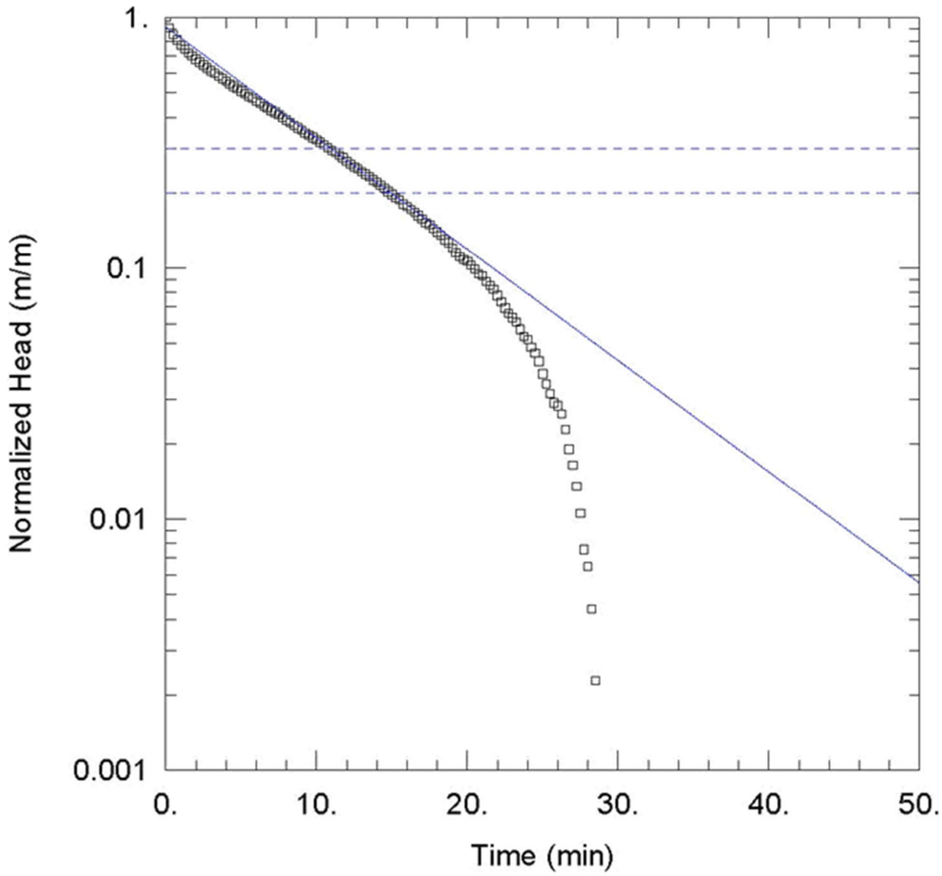


Data Set: N:\files\80000\80018.05\Field_Program\AQTESOLV\8001805_MW6 Test 1.aqt	
Date: 10/30/19	Time: 14:55:20
AQUIFER DATA	
Saturated Thickness: 22.58 m	Anisotropy Ratio (Kz/Kr): 1.
WELL DATA (MW6 Test 1: Falling Head)	
Initial Displacement: 0.2864 m	Static Water Column Height: 22.58 m
Total Well Penetration Depth: 30. m	Screen Length: 1.5 m
Casing Radius: 0.0254 m	Well Radius: 0.051 m
	Gravel Pack Porosity: 0.
SOLUTION	
Aquifer Model: Unconfined	Solution Method: Bouwer-Rice
K = 3.61E-7 m/sec	y0 = 0.168 m

Title: **MW6 Test 2 (Rising Head) Analysis**

Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 1 slug, volume 0.00067 m^3; H(0)* = 0.3306 for effective casing radius correction (Butler, 1998 – Equation 3.1).

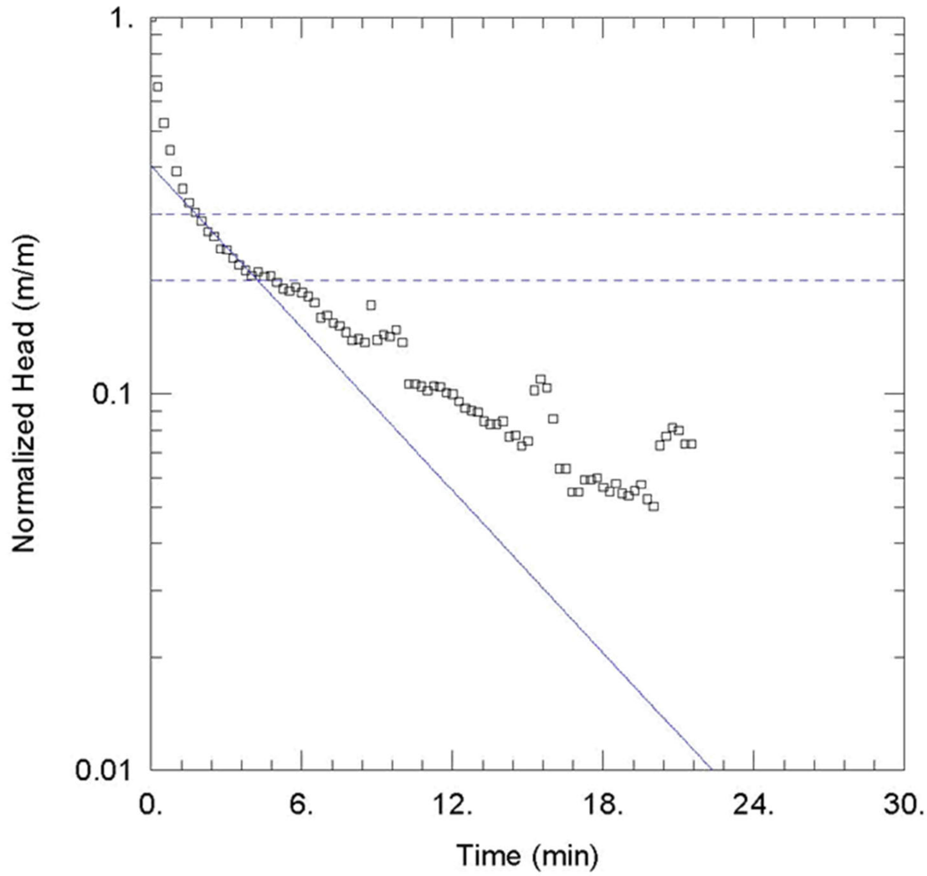


Data Set: N:\files\80000\80018.05\Field_Program\AQTESOLV\8001805_MW6 Test 2.aqt	
Date: 10/30/19	Time: 14:57:41
AQUIFER DATA	
Saturated Thickness: 22.58 m	Anisotropy Ratio (Kz/Kr): 1.
WELL DATA (MW6 Test 2: Rising Head)	
Initial Displacement: 0.2367 m	Static Water Column Height: 22.58 m
Total Well Penetration Depth: 30. m	Screen Length: 1.5 m
Casing Radius: 0.0254 m	Well Radius: 0.051 m
	Gravel Pack Porosity: 0.
SOLUTION	
Aquifer Model: Unconfined	Solution Method: Bouwer-Rice
K = 2.14E-6 m/sec	y0 = 0.217 m

Title: **MW7 Test 1 (Falling Head) Analysis**

Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 2 slugs, total volume 0.00134 m^3; H(0)* = 0.6611 for effective casing radius correction (Butler, 1998 – Equation 3.1).

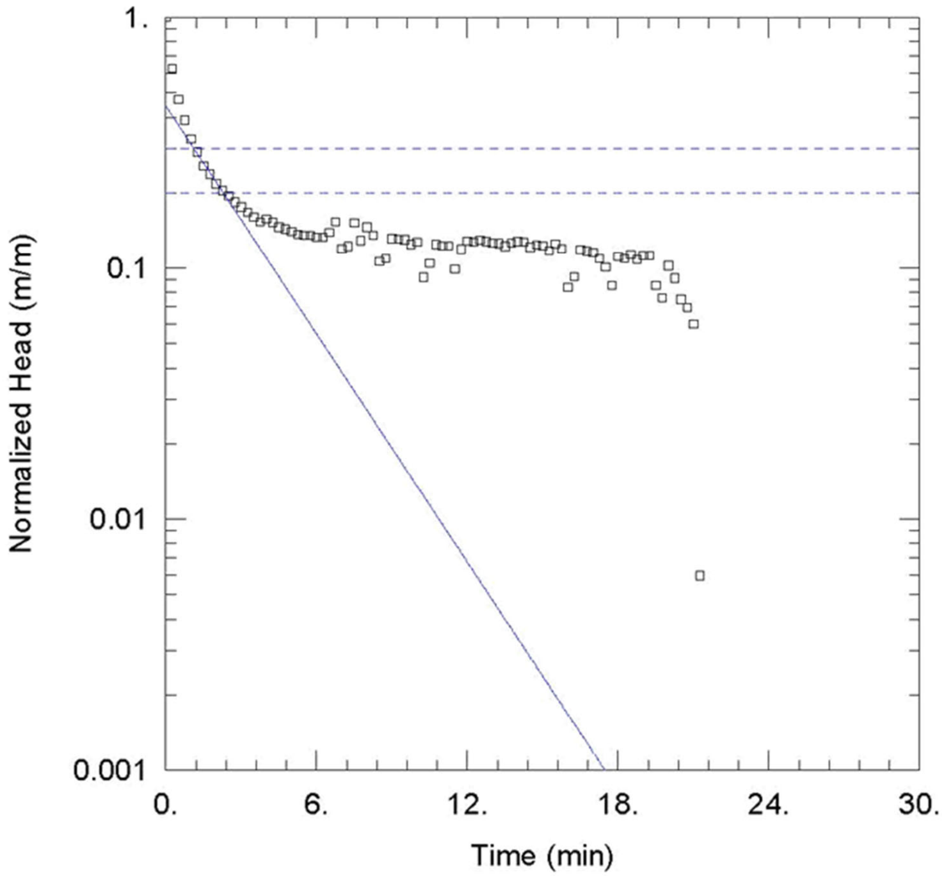


Data Set: N:\files\80000\80018.05\Field_Program\AQTESOLV\8001805_MW7 Test 1.aqt Date: 10/30/19 Time: 15:01:30
AQUIFER DATA Saturated Thickness: 5.325 m Anisotropy Ratio (Kz/Kr): 1.
WELL DATA (MW7 Test 1: Falling Head) Initial Displacement: 0.1402 m Static Water Column Height: 5.325 m Total Well Penetration Depth: 6. m Screen Length: 4.48 m Casing Radius: 0.0254 m Well Radius: 0.051 m Gravel Pack Porosity: 0.
SOLUTION Aquifer Model: Unconfined Solution Method: Bouwer-Rice K = 3.4E-6 m/sec y0 = 0.0566 m

Title: **MW7 Test 2 (Rising Head) Analysis**

Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 2 slugs, total volume 0.00134 m^3; H(0)* = 0.6611 for effective casing radius correction (Butler, 1998 – Equation 3.1).

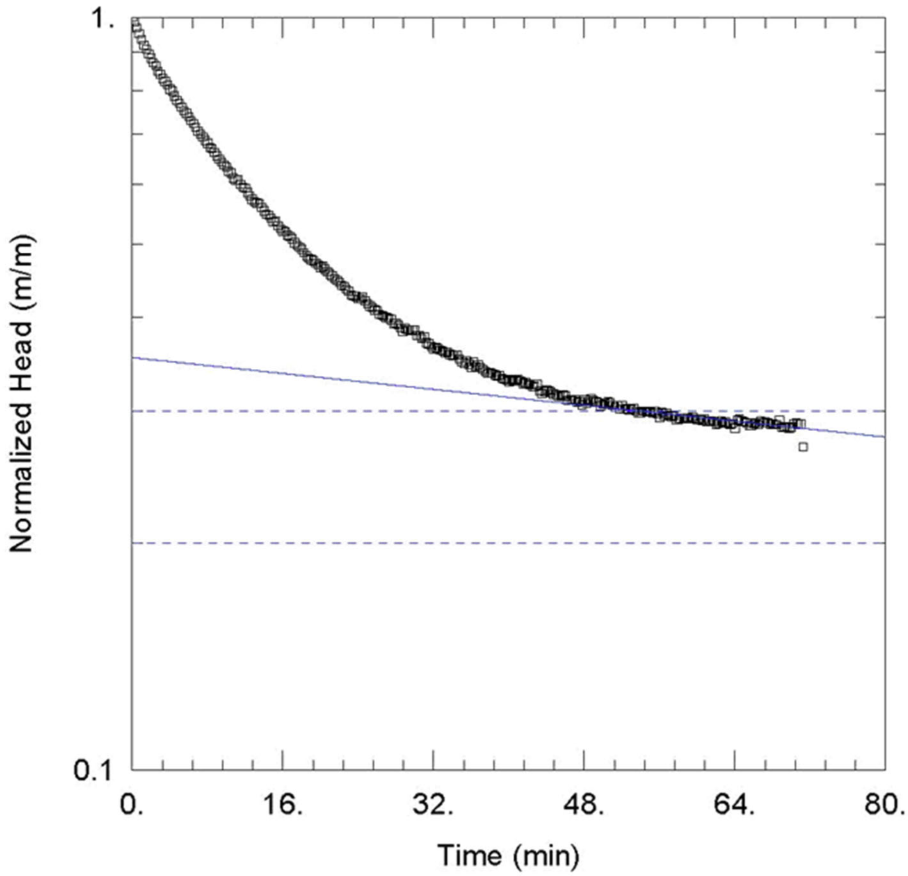


Data Set: N:\files\80000\80018.05\Field_Program\AQTESOLV\8001805_MW7 Test 2.aqt	
Date: 10/30/19	Time: 15:03:52
AQUIFER DATA	
Saturated Thickness: 5.325 m	Anisotropy Ratio (Kz/Kr): 1.
WELL DATA (MW7 Test 2: Rising Head)	
Initial Displacement: 0.152 m	Static Water Column Height: 5.325 m
Total Well Penetration Depth: 6. m	Screen Length: 4.48 m
Casing Radius: 0.0254 m	Well Radius: 0.051 m
	Gravel Pack Porosity: 0.
SOLUTION	
Aquifer Model: Unconfined	Solution Method: Bouwer-Rice
K = 6.61E-6 m/sec	y0 = 0.0676 m

Title: **MW8 Test 1 (Falling Head) Analysis**

Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 1 slug, volume 0.00067 m^3; H(0)* = 0.3306 for effective casing radius correction (Butler, 1998 – Equation 3.1).

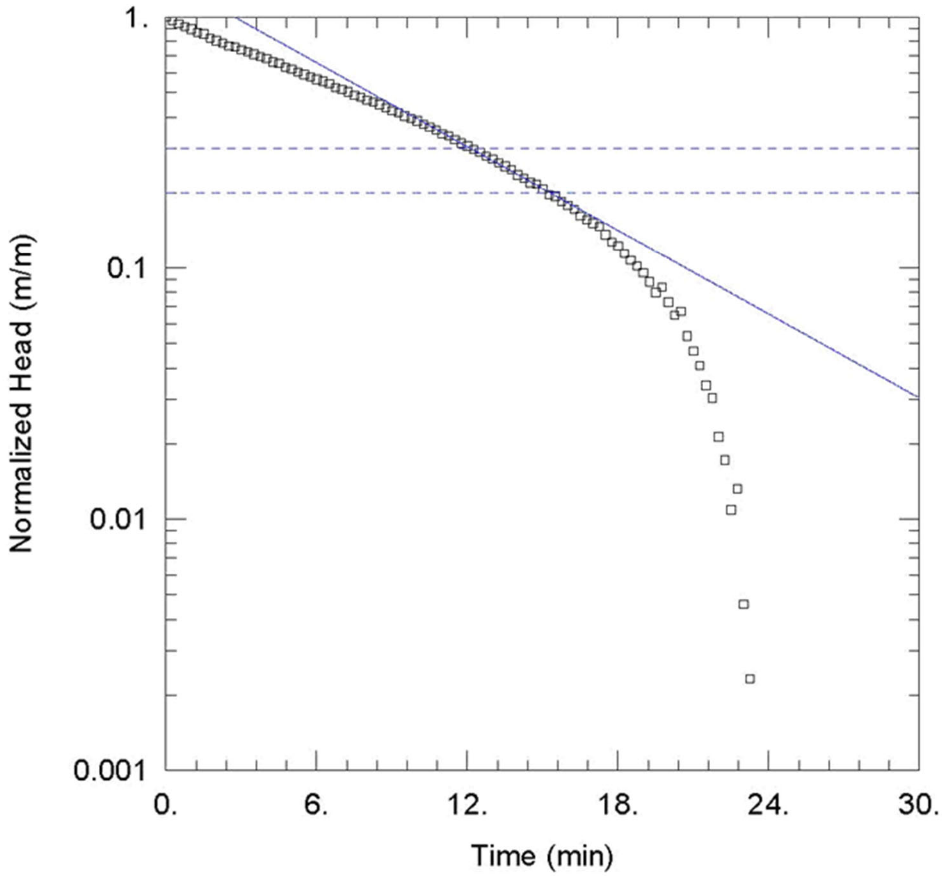


Data Set: N:\files\80000\80018.05\Field_Program\AQTESOLV\8001805_MW8 Test 1.aqt	
Date: 10/30/19	Time: 15:06:55
AQUIFER DATA	
Saturated Thickness: 29.77 m	Anisotropy Ratio (Kz/Kr): 1.
WELL DATA (MW8 Test 1: Falling Head)	
Initial Displacement: 0.32 m	Static Water Column Height: 29.77 m
Total Well Penetration Depth: 30. m	Screen Length: 1.5 m
Casing Radius: 0.0254 m	Well Radius: 0.051 m
	Gravel Pack Porosity: 0.
SOLUTION	
Aquifer Model: Unconfined	Solution Method: Bouwer-Rice
K = 4.7E-8 m/sec	y0 = 0.113 m

Title: **MW8 Test 2 (Rising Head) Analysis**

Project: Hydrogeological Study, Valentine Gold Project, Newfoundland and Labrador

Details: 1 slug, volume 0.00067 m^3; H(0)* = 0.3306 for effective casing radius correction (Butler, 1998 – Equation 3.1).



Data Set: N:\files\80000\80018.05\Field_Program\AQTESOLV\8001805_MW8 Test 2.aqt	
Date: 10/30/19	Time: 15:08:59
AQUIFER DATA	
Saturated Thickness: 29.77 m	Anisotropy Ratio (Kz/Kr): 1.
WELL DATA (MW8 Test 2: Rising Head)	
Initial Displacement: 0.2199 m	Static Water Column Height: 29.77 m
Total Well Penetration Depth: 30. m	Screen Length: 1.5 m
Casing Radius: 0.0254 m	Well Radius: 0.051 m
	Gravel Pack Porosity: 0.
SOLUTION	
Aquifer Model: Unconfined	Solution Method: Bouwer-Rice
K = 2.89E-6 m/sec	y0 = 0.312 m

APPENDIX G

Water Level Survey Data for Existing Exploration Boreholes

Report to: Marathon Gold Corporation
GEMTEC Project: 80018.05 (March 18, 2020)

Title: **Water Level Survey Data for Existing Exploration Boreholes**

Project: Hydrogeology Baseline Report
Marathon Valentine Gold Project, Central Newfoundland

Well ID	Easting (NAD83Z21N)	Northing (NAD83Z21N)	Surface Elevation (m)	Plunge Dip (°)	BH Depth (mbgs)	Water Level Date	Water Level (along hole, m)	Water Level (vertical, mbgs)	GW Elevation (m)
VL-12-475	484740.31	5355229.6	401.14	45	71	01-Oct-19	5.964	3.907	397.23
VL-12-485	484581.76	5355233.49	375.09	60	36	01-Oct-19	0.921	0.598	374.49
VL-12-484	484563.9	5355286.74	366.86	45	82	01-Oct-19	2.278	1.381	365.48
VL-12-482	484693.94	5355217.89	387.78	45	46	01-Oct-19	0.834	0.210	387.57
VL-12-476	484716.89	5355219.41	399.62	45	91	01-Oct-19	5.654	3.818	395.80
VL-12-473	484722.29	5355360.24	392.4	60	90	01-Oct-19	2.376	1.898	390.50
VL-12-479	484816.4	5355237.96	410.52	45	71	01-Oct-19	2.265	1.542	408.98
VL-12-470	484746.22	5355275.16	408.48	65	94	01-Oct-19	17.700	15.742	392.74
VL-12-498	484974.58	5355352.15	418.17	85	86	01-Oct-19	5.125	4.875	413.29
VL-12-459	484956.54	5355462.92	404.55	71	175	01-Oct-19	5.972	5.437	399.11
VL-12-496	485103.84	5355395.64	408.58	85	98	01-Oct-19	3.276	3.064	405.52
VL-12-499	485159.31	5355398.31	408.84	85	92	01-Oct-19	3.890	3.775	405.06
VL-11-366	485454.57	5355458.76	405.85	80	93	01-Oct-19	3.311	3.211	402.64
VL-11-369	485517.05	5355490.18	402.94	75	93	01-Oct-19	1.494	1.133	401.81
VL-11-371	485641.40	5355487.83	401.61	75	65	01-Oct-19	2.639	2.169	399.44
VL-11-370	485597.78	5355503.47	404.05	75	96	01-Oct-19	3.743	3.445	400.60
VL-12-433	485396.51	5355646.86	401.45	60	207	01-Oct-19	1.000	0.116	401.33
VL-12-428	485491.25	5355681.01	416.24	50	192	01-Oct-19	14.997	11.308	404.93
VL-12-420	485753.80	5355677.80	402.50	45	129	01-Oct-19	5.711	3.368	399.13
VL-12-425	485725.81	5355770.10	407.66	55	230	01-Oct-19	0.430	0.022	407.64
VL-12-432	485908.42	5355856.96	392.91	55	235	01-Oct-19	4.892	3.367	389.54
VL-17-624	486262.761	5355997.321	388.326	70.1	315	01-Oct-19	3.962	3.425	384.90
VL-17-642	486330.9	5356012.318	386.116	74	305	01-Oct-19	1.015	0.886	385.23

Title: **Water Level Survey Data for Existing Exploration Boreholes**

Project: Hydrogeology Baseline Report
Marathon Valentine Gold Project, Central Newfoundland

Well ID	Easting (NAD83Z21N)	Northing (NAD83Z21N)	Surface Elevation (m)	Plunge Dip (°)	BH Depth (mbgs)	Water Level Date	Water Level (along hole, m)	Water Level (vertical, mbgs)	GW Elevation (m)
VL-17-651	486306.54	5356057.82	388.17	84.12	384	01-Oct-19	1.270	0.973	387.19
VL-11-314	486402.38	5356035.29	386.10	57	211	01-Oct-19	2.668	2.058	384.04
VL-17-649	486324.99	5356168.98	405.24	80.67	490	01-Oct-19	8.376	8.085	397.15
VL-13-524	486549.23	5356288.89	403.93	67	408	01-Oct-19	5.600	5.075	398.86
VL-19-695	486503.58	5355858.51	384.67	62.88	349	01-Oct-19	1.073	0.605	384.06
VL-10-137	486477.74	5355873.34	384.26	60	45	01-Oct-19	0.895	0.115	384.14
VL-12-421	486186.10	5355969.49	384.07	55	225	03-Oct-19	1.129	0.405	383.67
VL-12-438	486252.15	5356013.15	389.51	65	290	03-Oct-19	4.539	3.974	385.54
VL-12-410	486492.85	5356166.56	397.73	54	269	03-Oct-19	1.775	1.076	396.65
VL-11-336	486545.41	5356079.75	386.40	57	190	03-Oct-19	1.685	1.173	385.23
VL-12-378	486627.04	5356154.92	391.79	57	224	03-Oct-19	3.810	3.035	388.75
VL-11-271	486901.12	5356155.62	396.34	45	37	03-Oct-19	5.071	3.316	393.02
VL-11-283	486757.74	5356023.32	387.08	65	34	03-Oct-19	1.889	1.352	385.73
VL-14-583	487063.19	5356798.50	426.42	38.6	57	03-Oct-19	14.550	8.977	417.44
VL-14-584	487026.40	5356816.01	429.33	54.6	114	03-Oct-19	1.624	1.314	428.02
VL-14-588	486887.23	5356758.88	406.28	59.2	69	03-Oct-19	17.705	14.988	391.29
VL-99-9	487087.78	5356376.78	389.75	45	42	03-Oct-19	0.417	0.075	389.68
VL-13-510	487422.06	5356675.75	390.15	44.2	81	03-Oct-19	0.350	-0.036	390.19
VL-11-272	487516.21	5356781.16	397.86	45	86	03-Oct-19	6.826	4.397	393.46
VL-14-550	488165.46	5357331.59	388.73	69.2	114	03-Oct-19	2.700	1.684	387.05
VL-14-560	488059.09	5357372.28	385.75	69.2	128	03-Oct-19	1.085	1.014	384.74
VL-14-546	488255.72	5357472.14	401.09	69.9	115	03-Oct-19	2.832	2.290	398.80
VL-14-600	488334.37	5357462.51	400.46	75.4	98	03-Oct-19	1.060	0.776	399.68

Title: **Water Level Survey Data for Existing Exploration Boreholes**

Project: Hydrogeology Baseline Report
Marathon Valentine Gold Project, Central Newfoundland

Well ID	Easting (NAD83Z21N)	Northing (NAD83Z21N)	Surface Elevation (m)	Plunge Dip (°)	BH Depth (mbgs)	Water Level Date	Water Level (along hole, m)	Water Level (vertical, mbgs)	GW Elevation (m)
VL-14-552	488381.31	5357481.43	404.98	69.5	145	03-Oct-19	5.040	3.931	401.05
VL-14-595	488438.11	5357636.97	411.71	80.8	156	03-Oct-19	1.575	1.495	410.22
VL-14-598	488435.97	5357574.02	415.17	75.4	77	03-Oct-19	2.775	2.405	412.76
VL-14-572	488540.74	5357677.12	410.9	44.3	68	03-Oct-19	1.295	0.824	410.08
VL-14-601	488746.94	5357652.35	421.26	81.9	118	03-Oct-19	1.231	0.899	420.36
VL-14-577	488752.33	5357703.99	424.09	33.9	41	03-Oct-19	1.860	1.037	423.05
VL-14-603	488956.60	5357685.29	428.63	80.6	156	04-Oct-19	2.567	2.283	426.35
VL-15-606	489059.59	5357689.96	426.66	59.6	92	04-Oct-19	0.605	0.372	426.29
VL-15-610	489120.46	5357869.24	430.64	44.6	65	04-Oct-19	0.740	0.250	430.39
VL-18-664	489439.89	5358086.45	436.141	44.67	155	04-Oct-19	6.603	4.372	431.77
VL-18-676	489395.19	5357994.41	432.48	74.55	288	04-Oct-19	2.160	1.982	430.50
VL-18-668	489743.71	5358256.94	433.57	44.61	147	04-Oct-19	2.245	1.307	432.26
VL-18-670	489897.58	5358298.50	433.46	43.64	105	04-Oct-19	1.099	0.458	433.00
VL-18-658	490118.10	5358435.59	432.09	59.84	170	04-Oct-19	1.560	0.799	431.29
VL-18-660	490248.05	5358594.67	425.53	59.48	227	04-Oct-19	0.315	-0.089	425.61
VL-18-659	490261.62	5358547.41	426.79	44.82	116	04-Oct-19	0.753	0.221	426.57
VL-18-674	490463.88	5358740.09	418.44	45.03	116	04-Oct-19	0.029	-0.199	418.63
VL-18-673	490559.94	5358666.08	422.46	75.66	246	04-Oct-19	4.775	4.416	418.04
VL-17-630	489367.84	5358871.37	371.41	45.63	119	04-Oct-19	8.890	6.145	365.27
VL-17-627	489280.734	5358849.235	362.035	46.48	73	04-Oct-19	11.765	8.381	353.65
VL-17-638	489413.853	5358892.292	367.815	43.5	70	04-Oct-19	1.068	0.275	367.54
MA-18-293	490835.929	5359065.206	400.104	45	17	04-Oct-19	0.450	0.068	400.04
MA-16-086	491733.072	5359536.811	375.209	44.8	148	04-Oct-19	10.560	7.211	368.00

Title: **Water Level Survey Data for Existing Exploration Boreholes**

Project: Hydrogeology Baseline Report
Marathon Valentine Gold Project, Central Newfoundland

Well ID	Easting (NAD83Z21N)	Northing (NAD83Z21N)	Surface Elevation (m)	Plunge Dip (°)	BH Depth (mbgs)	Water Level Date	Water Level (along hole, m)	Water Level (vertical, mbgs)	GW Elevation (m)
MA-18-287	491935.236	5359739.082	361.045	54.45	204	04-Oct-19	8.872	7.048	354.00
MA-18-346	491885.3	5359905.435	350.819	64.6	316	04-Oct-19	2.695	2.294	348.52
MA-18-331	492145.811	5359908.794	357.454	79.66	158	04-Oct-19	2.790	2.285	355.17
MA-16-115	492585.626	5360043.447	367.131	54.5	229	04-Oct-19	3.340	2.519	364.61
MA-17-260	492440.911	5360311.893	347.928	80.74	588	04-Oct-19	0.685	0.576	347.35
MA-18-324	492500.95	5360149.384	355.511	74.27	513	04-Oct-19	3.100	2.684	352.83
MA-16-106	492314.791	5360039.909	354.204	44.1	106	04-Oct-19	6.190	4.138	350.07
MA-18-272	492825.969	5360352.086	358.03	70.17	643	04-Oct-19	3.020	2.351	355.68
MA-17-161	492719.735	5360450.453	349.73	81.7	422	04-Oct-19	2.565	2.388	347.34
MA-18-263	492815.26	5360455.27	353.32	81.85	468	04-Oct-19	3.970	3.600	349.72
MA-18-281	492900.12	5360349.07	363.28	54.22	488	04-Oct-19	10.660	8.098	355.18
MA-15-076	493368.1	5360868.1	334.29	44.2	66	04-Oct-19	10.550	7.275	327.01
MA-15-074	493076.63	5361297.72	313.84	46	55	04-Oct-19	2.240	1.291	312.55
MA-15-072	493367.48	5361040.40	317.34	43.4	55	04-Oct-19	3.390	2.099	315.24
MA-15-057	493771.09	5361262.21	323.04	44.5	75	04-Oct-19	9.149	6.333	316.71
VSW-15-003	494901.51	5363217.86	274.07	43.2	55	04-Oct-19	1.405	0.712	273.36
VSW-15-001	494973.98	5363287.35	272.59	45.1	72	04-Oct-19	0.726	0.314	272.28
VGD-18-048	495285.24	5363595.11	273.74	64.9	91	04-Oct-19	8.881	7.842	265.90
VGD-18-053	495727.78	5364512.56	327.79	49.38	77	04-Oct-19	32.915	24.674	303.11
VGD-14-030	495941.51	5364904.00	303.83	43.5	70	04-Oct-19	1.650	0.866	302.96
VGD-14-034	495758.65	5364767.97	315.64	49.3	79	04-Oct-19	5.200	3.882	311.76
VE-13-010	495774.67	5364646.57	326.69	64.9	86	04-Oct-19	19.460	17.322	309.37
VGD-18-057	495833.007	5364516.195	322.499	80.39	100	04-Oct-19	24.259	23.659	298.84

Title: **Water Level Survey Data for Existing Exploration Boreholes**

Project: Hydrogeology Baseline Report
Marathon Valentine Gold Project, Central Newfoundland

Well ID	Easting (NAD83Z21N)	Northing (NAD83Z21N)	Surface Elevation (m)	Plunge Dip (°)	BH Depth (mbgs)	Water Level Date	Water Level (along hole, m)	Water Level (vertical, mbgs)	GW Elevation (m)
VGD-18-055	495780.796	5364494.561	319.797	74.39	186	04-Oct-19	13.300	12.629	307.17
VGD-18-050	495770.397	5364230.552	266.151	65.13	181	04-Oct-19	0.332	0.001	266.15
VE-13-019	495755.79	5364559.59	328.42	53.1	62	04-Oct-19	35.960	28.227	300.19
VGD-14-031	495832.78	5364835.57	312.02	44.3	78	04-Oct-19	7.825	5.195	306.82
MA-18-344	492472.938	5360070.925	358.832	77.24	441	11-Oct-19	5.415	4.891	353.94
MA-15-077	493054.1	5360706.77	339.2	44.2	83	08-Oct-19	1.691	1.179	338.02
MA-15-038	492797.87	5360408.71	355.74	49.3	186	08-Oct-19	1.490	0.510	355.23
MA-17-181	492840.527	5360304.263	362.366	55	410	08-Oct-19	6.269	4.895	357.47
MA-18-282	492713.157	5360272.501	357.029	75.55	795	08-Oct-19	3.475	2.965	354.06
MA-19-352	492586.264	5360315.012	349.874	82.67	207	08-Oct-19	0.499	0.195	349.68
VGD-14-035	496071.26	5364950.56	290.29	44	85	08-Oct-19	31.140	21.632	268.66
MA-15-077	493054.10	5360706.77	339.20	44.2	83	08-Oct-19	1.691	1.179	338.02
MA-15-038	492797.87	5360408.71	355.74	49.3	186	08-Oct-19	1.490	0.510	355.23
MA-17-181	492840.527	5360304.263	362.37	55	410	08-Oct-19	6.269	4.895	357.47
MA-18-282	492713.16	5360272.50	357.029	75.55	795	08-Oct-19	3.475	2.965	354.06
MA-19-352	492586.26	5360315.01	349.87	82.67	207	08-Oct-19	0.499	0.195	349.68
VGD-14-035	496071.26	5364950.56	290.29	44	85	08-Oct-19	31.140	21.632	268.66
MA-17-257	492432.63	5360099.67	355.30	59.94	391	11-Oct-19	3.326	2.619	352.68
MA-18-344	492472.94	5360070.93	358.83	77.24	441	11-Oct-19	5.975	5.437	353.39
VL-12-458	484955.74	5355550.73	379.61	55	186	03-Oct-19	0.000	-0.040	379.65
VL-12-490	484867.08	5355521.92	372.12	45	74	03-Oct-19	0.000	-0.400	372.52
VL-12-429	485138.76	5355463.58	398.68	55	112	03-Oct-19	0.000	-0.490	399.17
VL-19	485250.94	5355450.92	402.81	45	42	03-Oct-19	0.000	-0.720	403.53

Title: **Water Level Survey Data for Existing Exploration Boreholes**

Project: Hydrogeology Baseline Report
Marathon Valentine Gold Project, Central Newfoundland

Well ID	Easting (NAD83Z21N)	Northing (NAD83Z21N)	Surface Elevation (m)	Plunge Dip (°)	BH Depth (mbgs)	Water Level Date	Water Level (along hole, m)	Water Level (vertical, mbgs)	GW Elevation (m)
VL-12-426	485258.78	5355585.98	392.49	60	220	03-Oct-19	0.000	-0.650	393.14
VL-19-701	486482.24	5356270.36	397.49	74.58	453	04-Oct-19	0.000	-0.290	397.78
VL-17-655	486708.49	5355900.17	384.06	55.03	456	04-Oct-19	0.000	-0.100	384.16
VL-18-667	490538.55	5358805.20	417.80	45.27	123	04-Oct-19	0.000	-0.320	418.12
VL-18-675	490665.99	5358932.94	405.39	45.21	127	04-Oct-19	0.000	-0.040	405.43
MA-17-201	492696.83	5360569.28	342.00	84.37	599	04-Oct-19	0.000	-0.330	342.33
MA-18-316	492422.14	5360242.67	349.96	64.39	207	04-Oct-19	0.000	-0.300	350.26
MA-18-316	492422.14	5360242.67	349.96	64.39	207	04-Oct-19	0.000	-0.340	350.30
MA-18-345	492305.44	5360139.42	348.80	69.8	333	04-Oct-19	0.000	-0.160	348.96
VL-19-704	486615.00	5356209.00	499.00	76.27087	N/A	04-Oct-19	7.715	7.495	491.51
VL-13-538	486787.00	5356440.00	509.00	58.41366	94	04-Oct-19	14.295	12.177	496.82
VL-19-731	486418.00	5355834.00	445.00	64.99217	N/A	04-Oct-19	0.847	0.768	444.23
VL-GT-19-03	486274.00	5355786.00	445.00	55.69885	N/A	04-Oct-19	2.747	2.269	442.73
VL-19-742	486318.00	5355896.00	442.00	52.13635	N/A	04-Oct-19	1.120	0.884	441.12
VL-19-723	486913.00	5356125.00	451.00	44.90087	N/A	04-Oct-19	8.560	6.042	444.96
VL-19-727	486953.00	5356162.00	455.00	56.44269	N/A	04-Oct-19	8.550	7.125	447.88
VL-16-616	486788	5356494	459.00	47.16657	N/A	04-Oct-19	3.475	2.548	456.45
VL-GT-19-02	486905.00	5355940.00	458	45	N/A	04-Oct-19	11.001	7.779	450.22
MA-19-464	492064.00	5359837.00	398.00	40.83222	N/A	04-Oct-19	7.445	4.868	393.13
MA-19-468	492139.00	5359961.00	393.00	73.40216	N/A	04-Oct-19	-0.230	-0.230	393.23
MA-19-419	492253.00	5359937.00	399.00	73.04257	N/A	04-Oct-19	4.550	4.352	394.65
VGD-16-039	496502.00	5365187.00	287.00	44.82292	N/A	04-Oct-19	2.374	1.673	285.33

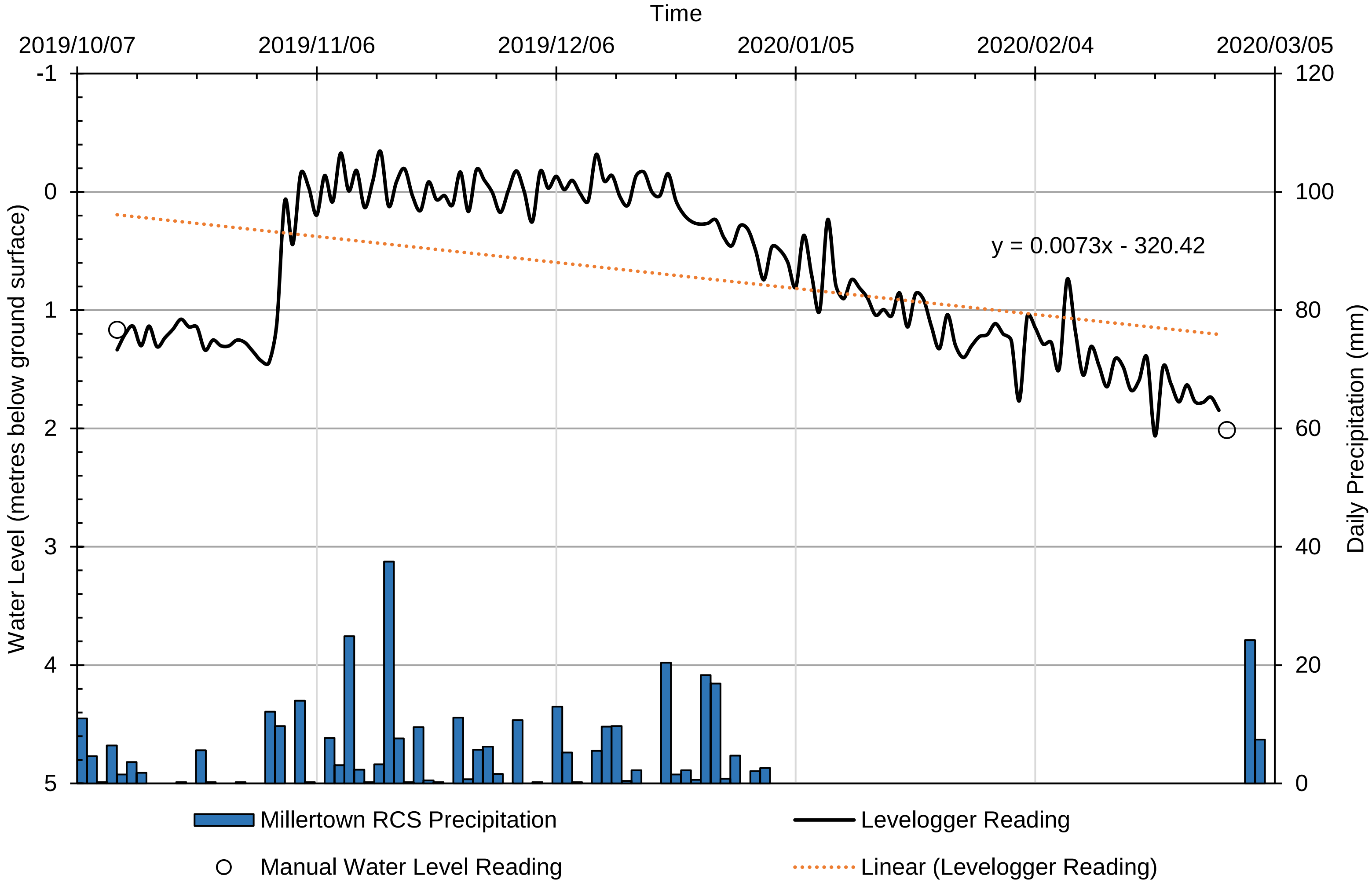
APPENDIX H

Long-Term Plots of Water Level versus Time in Monitoring Wells

Report to: Marathon Gold Corporation
GEMTEC Project: 80018.05 (March 18, 2020)

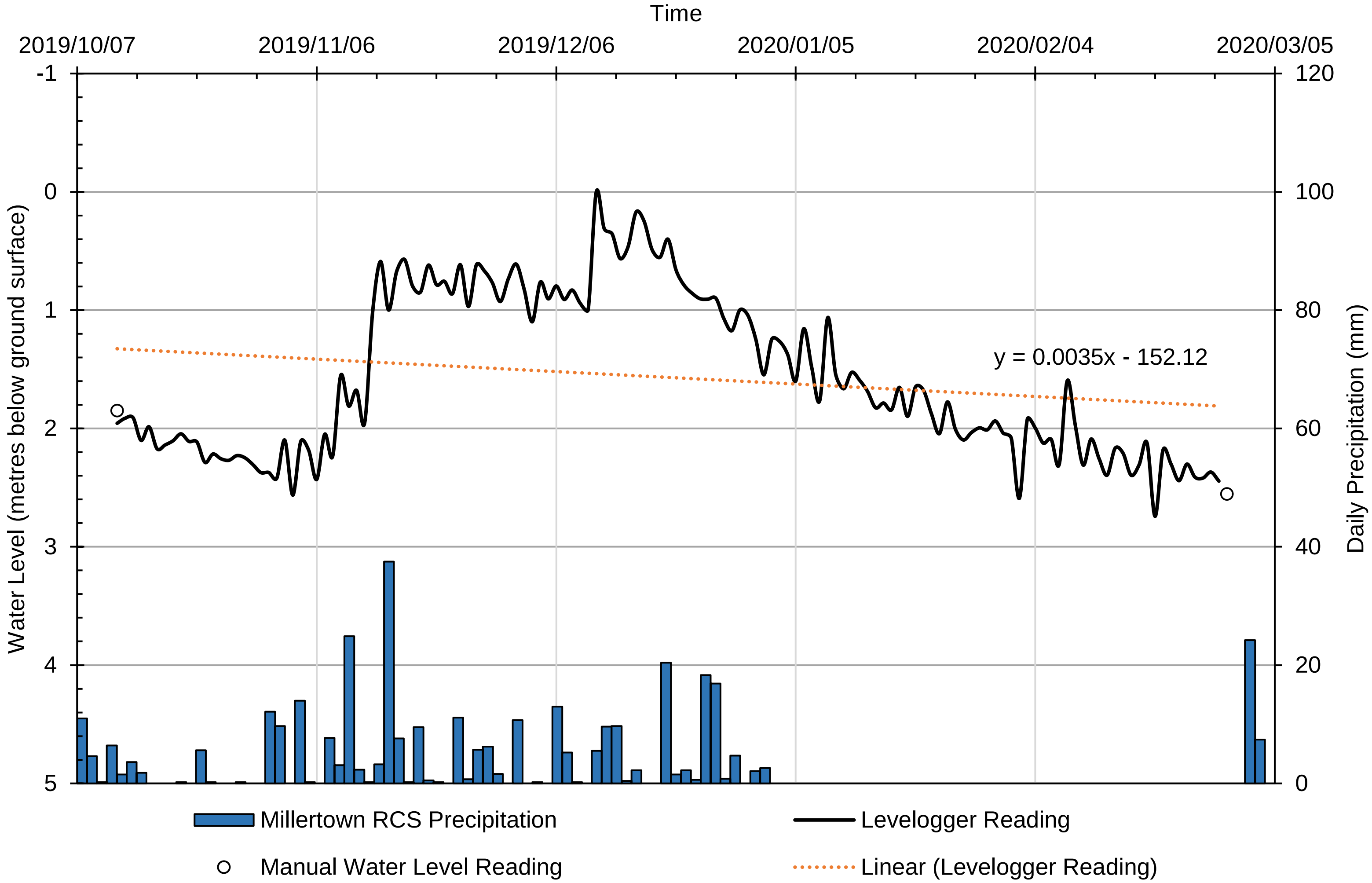
Title: **MW2 Long-Term Water Level Data**

Project: Hydrogeology Baseline Report
Marathon Valentine Gold Project, Central Newfoundland



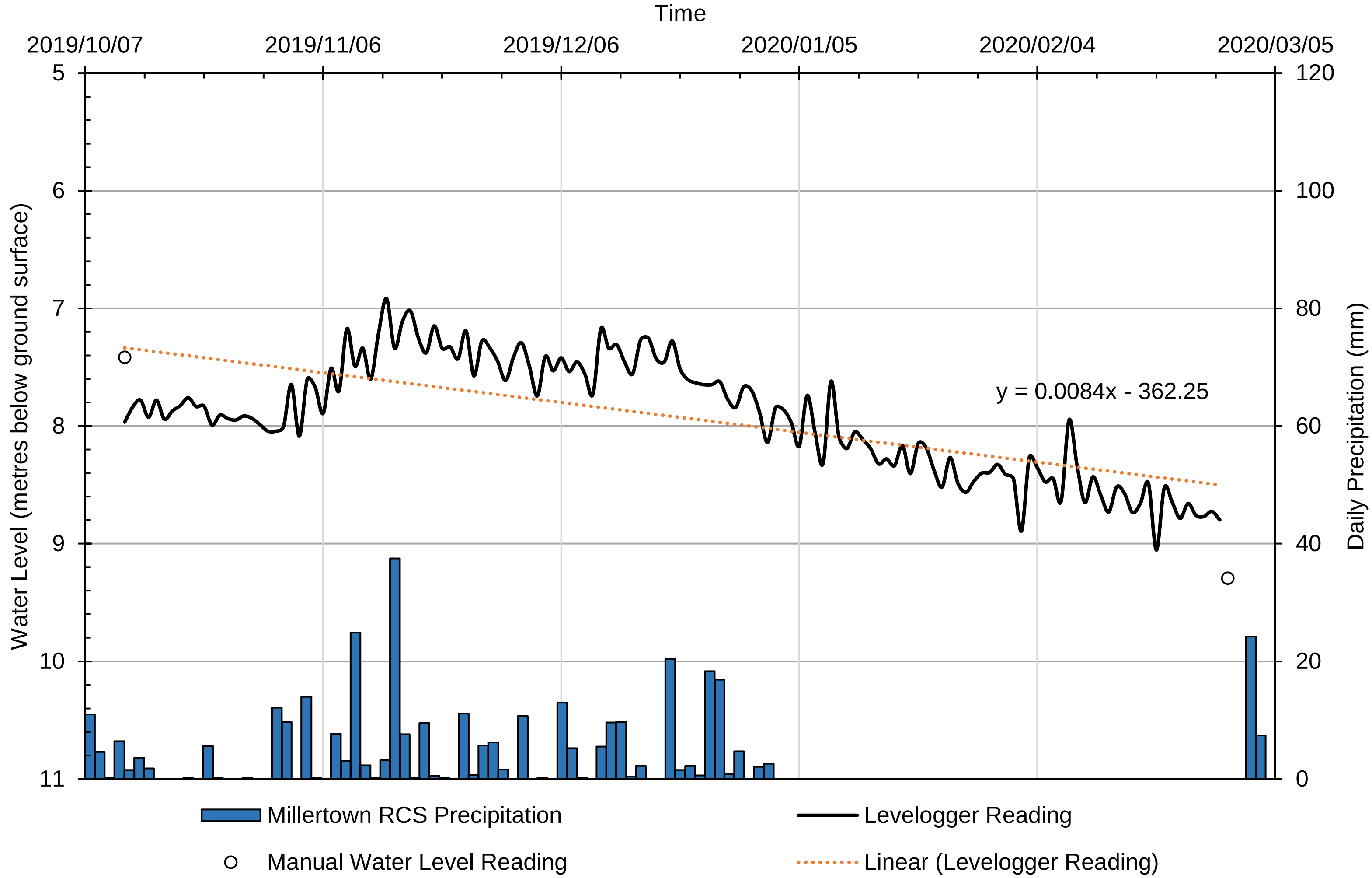
Title: **MW3 Long-Term Water Level Data**

Project: Hydrogeology Baseline Report
Marathon Valentine Gold Project, Central Newfoundland



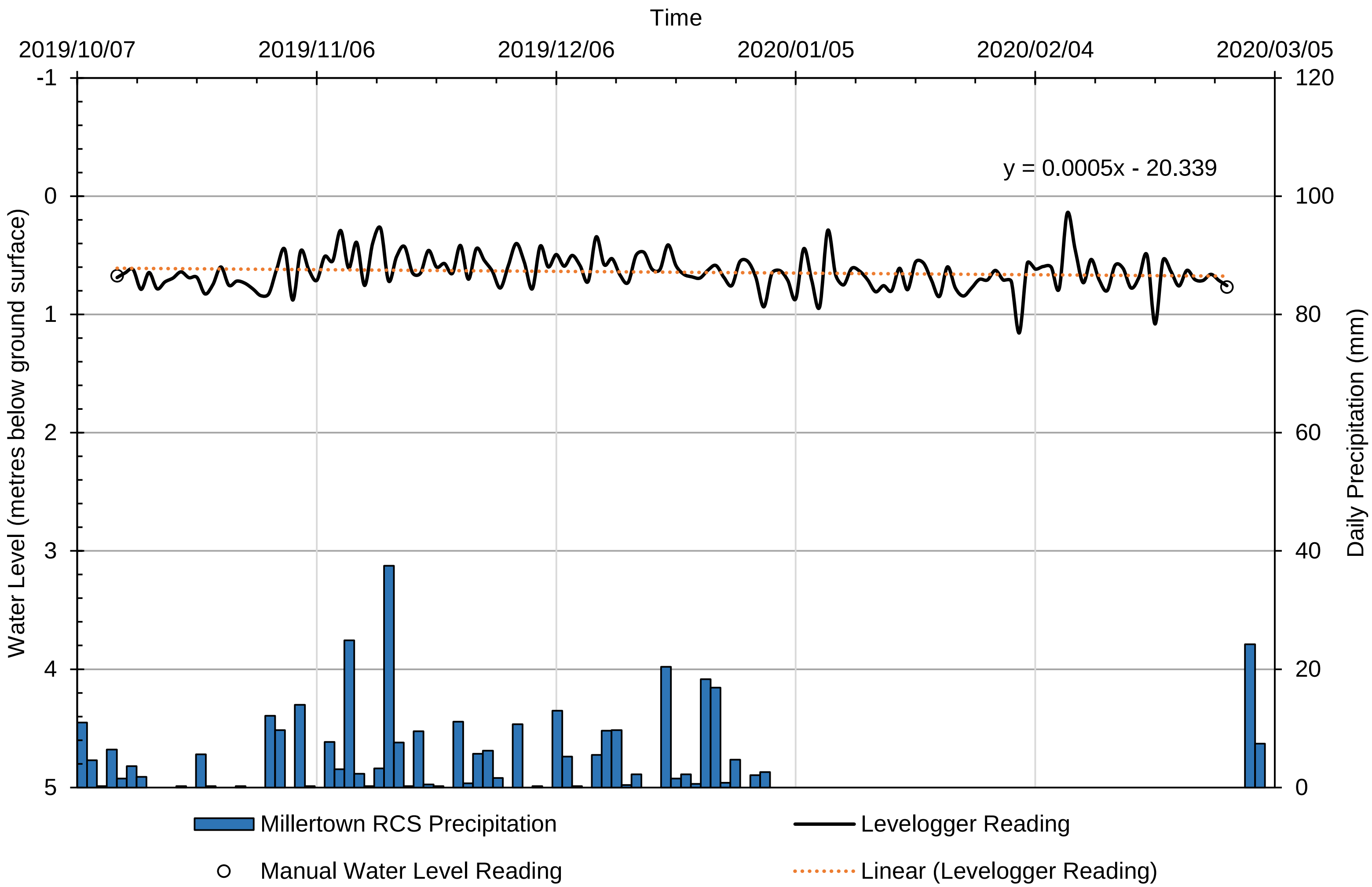
Title: **MW6 Long-Term Water Level Data**

Project: Hydrogeology Baseline Report
Marathon Valentine Gold Project, Central Newfoundland



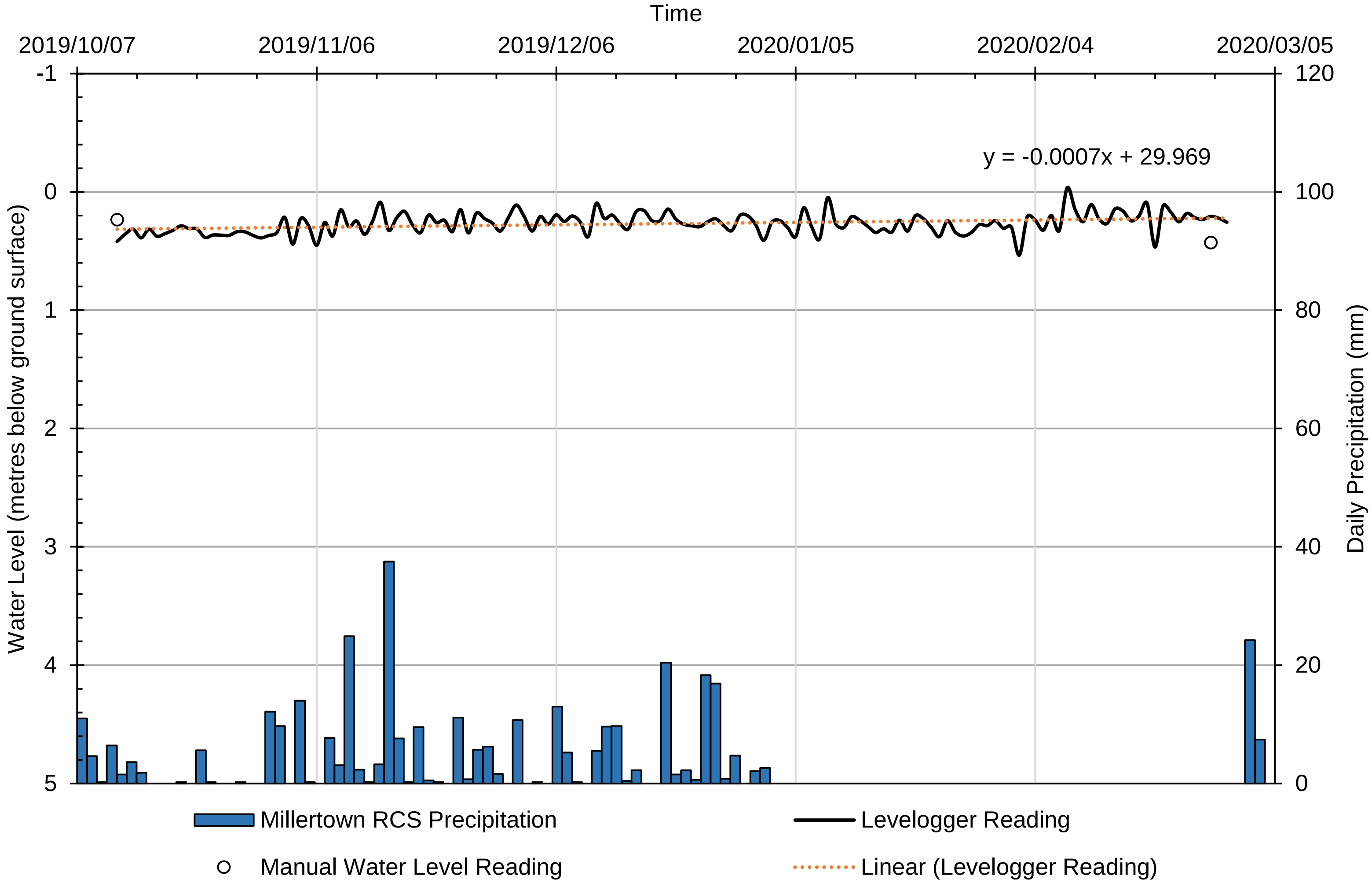
Title: **MW7 Long-Term Water Level Data**

Project: Hydrogeology Baseline Report
Marathon Valentine Gold Project, Central Newfoundland



Title: **MW8 Long-Term Water Level Data**

Project: Hydrogeology Baseline Report
Marathon Valentine Gold Project, Central Newfoundland



APPENDIX I

Groundwater Quality Analytical Results

Table I1: Analytical Results for Inorganic Parameters in Groundwater

Sample Location:	Units	Guideline		RDL	MW1	MW2		MW3		MW4	MW5	MW6		MW7		MW8	
Date Sampled:		CCME FAL[1]	GCDWQ[2]		2019-Oct-07	2019-Oct-06	2020-Feb-28	2019-Oct-11	2020-Feb-28	2019-Oct-08	2019-Oct-09	2019-Oct-11	2020-Feb-28	2019-Oct-06	2020-Feb-28	2019-Oct-07	2020-Feb-28
Field-measured pH					7.76	6.20	-	7.70	6.59	7.50	7.55	8.05	-	6.37	-	8.24	-
Field-measured Temperature (°C)					7.8	6.7	-	8.3	4.3	6.9	9.1	6.4	-	7.4	-	6.7	-
CCME calculated ammonia guideline (mg/L as N)					0.9	26.6	8.5	0.9	12.6	2.7	0.9	0.3	0.3	26.6	26.6	0.3	0.9
Inorganics																	
pH	-	6.5-9.0	7.0-10.5 OG	NA	7.83	6.71	6.67	7.47	7.01	7.87	7.94	8.07	8.01	6.54	**6.42**	8.07	7.94
Reactive Silica as SiO2	mg/L	–	–	0.5	6.2	8.8	6.3	7.1	6.6	7.9	13.3	12.8	8.3	10.6	6.4	13.6	12.2
Chloride	mg/L	120	250 AO	1	8	2	2	7	3	4	4	4	3	2	2	2	4
Fluoride	mg/L	0.12	1.5	0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12
Sulphate	mg/L	–	500 AO	2	5	<2	<2	21	<2	5	6	9	7	10	<2	12	14
Alkalinity	mg/L	–	–	5	92	24	24	105	52	78	114	130	138	58	35	116	133
True Color	TCU	–	15 AO	5	15	11	<5	<5	7	<5	8	<5	<5	177	116	12	19
Turbidity	NTU	–	1 OG	0.1	122	174	1510	21.9	44.6	12.3	657	10.4	15.9	1740	2780	29.3	16.3
Electrical Conductivity	umho/cm	–	–	1	210	64	50	223	122	142	200	234	298	166	84	270	325
Nitrate as N	mg/L	3	10	0.05	<0.05	<0.05	<0.05	0.09	0.14	0.05	<0.05	0.05	0.06	<0.05	<0.05	<0.05	<0.05
Nitrite as N	mg/L	0.06	1	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
Ammonia as N	mg/L	Calculated[3]	–	0.03	0.14	0.08	<0.03	0.16	0.04	0.08	0.27	0.09	0.04	0.62	0.51	0.12	0.04
Total Organic Carbon	mg/L	–	–	0.5	8.0	0.9	5.6	21.8	<0.5	2.6	6.1	1.4	<0.5	62.1	29.4	4.4	20.6
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	0.02	<0.01	<0.01	0.01
Total Phosphorous as P	mg/L	–	–	0.03	0.18	0.28	2.76	0.19	0.07	0.16	0.78	0.14	0.11	1.20	3.18	0.05	0.30
Cyanide (SAD)	mg/L	–	0.2	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cyanide (WAD)	mg/L	–	–	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Radium-226	Bq/L	-	1	0.005	<0.005	0.008	0.05	<0.005	<0.005	0.005	0.04	<0.005	<0.005	0.18	0.16	<0.005	<0.005
Calculated Parameters																	
Nitrate + Nitrite as N	mg/L	–	–	0.05	<0.05	<0.05	<0.05	0.09	0.14	0.05	<0.05	0.05	0.06	<0.05	<0.05	<0.05	<0.05
Bicarb. Alkalinity (as CaCO3)	mg/L	–	–	5	92	24	24	105	52	78	114	130	138	58	35	116	133
Carb. Alkalinity (as CaCO3)	mg/L	–	–	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Hydroxide	mg/L	–	–	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Calculated TDS	mg/L	–	500 AO	1	116	27	24	141	58	86	126	140	145	90	43	144	164
Hardness	mg/L	–	–	NA	108	20.9	15.3	100	48.6	66.3	80.3	116	126	65.0	27.4	122	101
Langelier Index (@20C)	NA	–	–	NA	-0.24	-2.57	-2.75	-0.61	-1.68	-0.45	-0.13	0.17	0.18	-1.93	-2.60	0.10	-0.08
Langelier Index (@ 4C)	NA	–	–	NA	-0.56	-2.89	-3.07	-0.93	-2.00	-0.77	-0.45	-0.15	-0.14	-2.25	-2.92	-0.22	-0.40
Saturation pH (@ 20C)	NA	–	–	NA	8.07	9.28	9.42	8.08	8.69	8.32	8.07	7.90	7.83	8.47	9.02	7.97	8.02
Saturation pH (@ 4C)	NA	–	–	NA	8.39	9.60	9.74	8.40	9.01	8.64	8.39	8.22	8.15	8.79	9.34	8.29	8.34
Anion Sum	me/L	–	–	NA	2.17	0.54	0.54	2.74	1.13	1.78	2.52	2.90	2.99	1.42	0.76	2.63	3.06
Cation sum	me/L	–	–	NA	2.45	0.55	0.40	2.57	1.19	1.51	2.27	2.56	2.71	2.09	0.94	3.11	3.30
% Difference/ Ion Balance	%	–	–	NA	6.1	1.2	14.8	3.3	2.4	8.1	5.2	6.4	5.0	18.9	10.9	8.4	3.7
Total Suspended Solids (TSS)	mg/L	–	–	5	82	344	1200	46	32	9	532	22	32	468	2860	104	41

Notes:

1 = Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Aquatic Life (freshwater, long-term; 1999 and updates)

2 = Health Canada Guidelines for Canadian Drinking Water Quality (June 2019).

3 = The guideline for Ammonia decreases as pH and temperature increase. Field pH and field temperature were used to select the guideline value; if field parameters were not available, laboratory-measured pH and a conservative assumption of 10 degrees calsius was assumed. Tabulated values were multipled by 0.8224 to convert from mg/L as NH_3 to mg/L as N.

"-" = None established

RDL = Reported Detection Limit.

NA = Not applicable

Results that exceed the CCME guideline or a health-based GCDWQ are bolded and shaded.

Results that exceed a GCDWQ Aesthetic Objective (AO) or Operational Guideline (OG) are shaded.

Table I2: Analytical Results for Dissolved Metals in Groundwater

Sample Location:	Units	Guideline		RDL	MW1	MW2		MW3		MW4	MW5	MW6		MW7		MW8	
Date Sampled:		CCME FAL[1]	GCDWQ[2]		2019-Oct-07	2019-Oct-06	2020-Feb-28	2019-Oct-11	2020-Feb-28	2019-Oct-08	2019-Oct-09	2019-Oct-11	2020-Feb-28	2019-Oct-06	2020-Feb-28	2019-Oct-07	2020-Feb-28
pH					7.83	6.71	6.67	7.47	7.01	7.87	7.94	8.07	8.01	6.54	6.42	8.07	7.94
Hardness (mg/L as CaCO3)					108	20.9	15.3	100	48.6	66.3	80.3	116	126	65.0	27.4	122	101
CCME calculated Aluminum guideline (ug/L)					100	100	100	100	100	100	100	100	100	100	5	100	100
CCME calculated Cadmium guideline (ug/L)					0.17	0.04	0.04	0.16	0.35	0.11	0.13	0.18	0.49	0.11	0.28	0.19	0.45
CCME calculated Copper guideline (ug/L)					2.53	2	2	2.36	2	2	2	2.68	2.88	2	2	2.8	2.38
CCME calculated Lead guideline (ug/L)					3.51	1	1	3.18	1	1.89	2.39	3.84	4.27	1.84	1	4.1	3.22
CCME calculated Manganese guideline (ug/L)					370	230	230	530	380	320	350	250	390	460	310	250	370
CCME calculated Nickel guideline					101.33	25	25	95.58	25	69.94	80.67	106.99	63.43	68.89	25	111.17	52.60
Dissolved Aluminum (Al)	ug/L	Calculated [3]	-	5	40	8	7	11	<5	6	17	6	<5	**533**	**278**	13	8
Dissolved Antimony (Sb)	ug/L	–	6	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dissolved Arsenic (As)	ug/L	5	10	2	2	<2	<2	<2	<2	<2	**14**	<2	<2	**44**	**8**	3	4
Dissolved Barium (Ba)	ug/L	–	1000	5	16	6	5	109	187	11	51	55	14	24	13	38	77
Dissolved Beryllium (Be)	ug/L	–	–	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dissolved Bismuth (Bi)	ug/L	–	–	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dissolved Boron (B)	ug/L	1500	5000	5	5	<5	<5	7	<5	<5	<5	<5	<5	7	<5	6	11
Dissolved Cadmium (Cd)	ug/L	Calculated [4]	5	0.017	0.031	0.032	0.024	0.029	0.040	<0.017	0.045	0.051	<0.017	<0.017	<0.017	0.042	0.047
Dissolved Calcium (Ca)	ug/L	–	–	100	36500	7400	5	31600	15	23400	29500	39100	43	22400	10	37300	29
Dissolved Chromium (Cr)	ug/L	–	50	1	2	1	1	2	2	2	1	3	2	3	2	2	2
Dissolved Cobalt (Co)	ug/L	–	–	1	<1	2	<1	1	3	<1	<1	<1	<1	2	1	<1	1
Dissolved Copper (Cu)	ug/L	Calculated [5]	2000, 1000 [AO]	2	<2	4	5	3	4	<2	<2	<2	<2	<2	<2	2	<2
Dissolved Iron (Fe)	ug/L	300	300 [AO]	50	<50	<50	<50	<50	**1100**	<50	244	<50	<50	**7600**	**6800**	<50	<50
Dissolved Lead (Pb)	ug/L	Calculated [6]	5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5
Dissolved Magnesium (Mg)	ug/L	–	–	100	4000	600	0.5	5200	3	1900	1600	4500	4.7	2200	0.7	7000	6.7
Dissolved Manganese (Mn)	ug/L	Calculated [7]	120, 20 [AO]	2	**985**	**362**	94	**470**	**1070**	26	**751**	9	4	**647**	**457**	42	**532**
Dissolved Mercury (Hg)	ug/L	0.026	1	0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026	<0.026
Dissolved Molybdenum (Mo)	ug/L	73	–	2	5	<2	<2	8	4	<2	<2	23	3	<2	<2	25	34
Dissolved Nickel (Ni)	ug/L	Calculated [8]	–	2	2	5	3	9	9	3	3	4	<2	6	2	2	<2
Dissolved Phosphorus (P)	ug/L	–	–	20	<20	<20	<0.02	<20	<0.02	<20	<20	<20	<0.02	280	0.07	<20	0.09
Dissolved Potassium (K)	ug/L	–	–	100	1500	200	<0.1	900	0.3	2000	3700	300	0.2	800	0.3	800	1
Dissolved Selenium (Se)	ug/L	1	50	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Silver (Ag)	ug/L	0.25	–	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	–	200 000 [AO]	100	4800	2400	2	11700	3	3000	11800	5000	4.2	8400	1.3	14600	28.5
Dissolved Strontium (Sr)	ug/L	–	7000	5	80	19	14	60	21	40	87	55	63	47	19	156	176
Dissolved Thallium (Tl)	ug/L	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
Dissolved Tin (Sn)	ug/L	–	–	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dissolved Titanium (Ti)	ug/L	–	–	2	4	<2	<2	<2	<2	<2	<2	<2	<2	6	4	<2	<2
Dissolved Uranium (U)	ug/L	15	20	0.1	1.6	<0.1	<0.1	0.1	<0.1	0.1	0.8	0.6	0.6	0.4	0.2	1.3	1.4
Dissolved Vanadium (V)	ug/L	–	–	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	7	<2	<2	<2
Dissolved Zinc (Zn)	ug/L	–	5000 [AO]	5	<5	12	7	<5	12	<5	<5	<5	<5	77	38	<5	<5

Notes:

1 = Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Aquatic Life (freshwater, long-term; 1999 and updates).

2 = Health Canada Guidelines for Canadian Drinking Water Quality (June 2019).

3 = Aluminum guideline = 5 μg/L at pH<6.5, or 100 μg/L at pH>=6.5

4 = Cadmium guideline [μg/L] = $10^{0.83[\log(\text{hardness})]-2.46}$, for water hardness between 17 and 280 mg/L as CaCO3; For water hardness<17, guideline =0.04; For water hardness>280, guideline =0.37; For unknown water hardness, guideline = 0.04

5 = Copper guideline [μg/L] = 0.2 * $e^{0.8545[\ln(\text{hardness})]-1.465}$, for water hardness between 82 and 180 mg/L as $CaCO_3$; If water hardness is <82, guideline = 2; If water hardness is >180, guideline = 4; If water hardness is unknown, guideline = 2

6 = Lead guideline [μg/L] = $e^{1.273[\ln(\text{hardness})]-4.705}$, for water hardness between 60 and 180 mg/L as $CaCO_3$; If water hardness is less than 60, guideline = 1; If water hardness is greater than 180, guideline = 7; If water hardness is unknown, guideline = 1

7 = Manganese guideline [ug/L] is calculated using the CWQG calculator in Appendix B of the Scientific Criteria Document for the Development of the Canadian Water Quality Guidelines for the Protection of Aquatic Life: Manganese.

8 = Nickel guideline [μg/L] = $e^{0.76[\ln(\text{hardness})]+1.06}$; for water hardness between <60 to 180 mg/L as CaCO3. If water hardness <60 mg/L, guideline = 25 ug/L; For water hardness >180 mg/L, guideline = 150 ug/L. If hardness is unknown, guideline is 25 ug/L.

"-" = None established or guideline not applicable

RDL = Reported Detection Limit.

Results that exceed an applicable CCME guideline or health-based GCDWQ are bolded and shaded.

Results that exceed a GCDWQ Aesthetic Objective (AO) or Operational Guideline (OG) are shaded.

APPENDIX J

Laboratory Certificates of Analysis

57 Old Pennywell Road, Unit I
St. John's, NL
CANADA A1E 6A8
TEL (709)747-8573
FAX (709 747-2139
http://www.agatlabs.com

CLIENT NAME: GEMTEC LIMITED
10 Maverick Place
Paradise, NL A1L 1Y8
709722-2275

ATTENTION TO: Carolyn Anstey-Moore

PROJECT: 80002.08

AGAT WORK ORDER: 19K530329

MISCELLANEOUS ANALYSIS REVIEWED BY: Michelle Hildebrand, Inorganics Analyst, B.Sc, P.Chem

WATER ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganics Supervisor

DATE REPORTED: Oct 30, 2019

PAGES (INCLUDING COVER): 15

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (709)747-8573

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

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Certificate of Analysis

AGAT WORK ORDER: 19K530329
PROJECT: 80002.08

CLIENT NAME: GEMTEC LIMITED **ATTENTION TO: Carolyn Anstey-Moore**
SAMPLING SITE: **SAMPLED BY:**

Subcontracted Data Received

DATE RECEIVED: 2019-10-15 **DATE REPORTED: 2019-10-30**

			SAMPLE DESCRIPTION:	MW3	MW6
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2019-10-11	2019-10-11
Parameter	**Unit**	**G / S**	**RDL**	**616085**	**616099**
Subcontracted Data				Y	Y

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Halifax (unless marked by *)

<Original signed by>

Certified By:

Certificate of Analysis

AGAT WORK ORDER: 19K530329
PROJECT: 80002.08

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CLIENT NAME: GEMTEC LIMITED **ATTENTION TO: Carolyn Anstey-Moore**
SAMPLING SITE: **SAMPLED BY:**

Cyanide, Strong and Weak Acid Dissociable (SAD and WAD)

DATE RECEIVED: 2019-10-15 **DATE REPORTED: 2019-10-30**

			SAMPLE DESCRIPTION:	MW3	MW6
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2019-10-11	2019-10-11
Parameter	Unit	G / S	RDL	616085	616099
Cyanide (SAD)	mg/L		0.002	<0.002	<0.002
Cyanide (WAD)	mg/L		0.002	<0.002	<0.002

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Vancouver (unless marked by *)

<Original signed by>

Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 19K530329
PROJECT: 80002.08

CLIENT NAME: GEMTEC LIMITED
ATTENTION TO: Carolyn Anstey-Moore
SAMPLING SITE:
SAMPLED BY:

Mercury in Water (Dissolved) - CCME FWAL

DATE RECEIVED: 2019-10-15 **DATE REPORTED: 2019-10-30**

			SAMPLE DESCRIPTION:	MW3	MW6
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2019-10-11	2019-10-11
Parameter	**Unit**	**G / S**	**RDL**	**616085**	**616099**
Dissolved Mercury	µg/L		0.026	<0.026	<0.026

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Toronto (unless marked by *)

<Original signed by>

Certified By:

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AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 19K530329
PROJECT: 80002.08

CLIENT NAME: GEMTEC LIMITED **ATTENTION TO: Carolyn Anstey-Moore**
SAMPLING SITE: **SAMPLED BY:**

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2019-10-15 **DATE REPORTED: 2019-10-30**

			SAMPLE DESCRIPTION:	MW3	MW6
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2019-10-11	2019-10-11
Parameter	**Unit**	**G / S**	**RDL**	**616085**	**616099**
pH				7.47	8.07
Reactive Silica as SiO2	mg/L		0.5	7.1	12.8
Chloride	mg/L		1	7	4
Fluoride	mg/L		0.12	<0.12	<0.12
Sulphate	mg/L		2	21	9
Alkalinity	mg/L		5	105	130
True Color	TCU		5	<5	<5
Turbidity	NTU		0.1	21.9	10.4
Electrical Conductivity	umho/cm		1	223	234
Nitrate + Nitrite as N	mg/L		0.05	0.09	0.05
Nitrate as N	mg/L		0.05	0.09	0.05
Nitrite as N	mg/L		0.05	<0.05	<0.05
Ammonia as N	mg/L		0.03	0.16	0.09
Total Organic Carbon	mg/L		0.5	21.8	1.4
Ortho-Phosphate as P	mg/L		0.01	0.01	0.01
Dissolved Sodium	mg/L		0.1	11.7	5.0
Dissolved Potassium	mg/L		0.1	0.9	0.3
Dissolved Calcium	mg/L		0.1	31.6	39.1
Dissolved Magnesium	mg/L		0.1	5.2	4.5
Bicarb. Alkalinity (as CaCO3)	mg/L		5	105	130
Carb. Alkalinity (as CaCO3)	mg/L		10	<10	<10
Hydroxide	mg/L		5	<5	<5
Calculated TDS	mg/L		1	141	140
Hardness	mg/L			100	116
Langelier Index (@20C)	NA			-0.61	0.17
Langelier Index (@ 4C)	NA			-0.93	-0.15
Saturation pH (@ 20C)	NA			8.08	7.90
Saturation pH (@ 4C)	NA			8.40	8.22
Anion Sum	me/L			2.74	2.90
Cation sum	me/L			2.57	2.56

<Original signed by>

Certified By:

Results relate only to the items tested. Results apply to samples as received.

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Certificate of Analysis

AGAT WORK ORDER: 19K530329

PROJECT: 80002.08

CLIENT NAME: GEMTEC LIMITED

ATTENTION TO: Carolyn Anstey-Moore

SAMPLING SITE:

SAMPLED BY:

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2019-10-15

DATE REPORTED: 2019-10-30

			SAMPLE DESCRIPTION:	MW3	MW6
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2019-10-11	2019-10-11
Parameter	Unit	G / S	RDL	616085	616099
% Difference/ Ion Balance	%			3.3	6.4
Dissolved Aluminum	ug/L		5	11	6
Dissolved Antimony	ug/L		2	<2	<2
Dissolved Arsenic	ug/L		2	<2	<2
Dissolved Barium	ug/L		5	109	55
Dissolved Beryllium	ug/L		2	<2	<2
Dissolved Bismuth	ug/L		2	<2	<2
Dissolved Boron	ug/L		5	7	<5
Dissolved Cadmium	ug/L		0.017	0.029	0.051
Dissolved Chromium	ug/L		1	2	3
Dissolved Cobalt	ug/L		1	1	<1
Dissolved Copper	ug/L		2	3	<2
Dissolved Iron	ug/L		50	<50	<50
Dissolved Lead	ug/L		0.5	<0.5	<0.5
Dissolved Manganese	ug/L		2	470	9
Dissolved Molybdenum	ug/L		2	8	23
Dissolved Nickel	ug/L		2	9	4
Dissolved Phosphorus	mg/L		0.02	<0.02	<0.02
Dissolved Selenium	ug/L		1	<1	<1
Dissolved Silver	ug/L		0.1	<0.1	<0.1
Dissolved Strontium	ug/L		5	60	55
Dissolved Thallium	ug/L		0.1	<0.1	<0.1
Dissolved Tin	ug/L		2	<2	<2
Dissolved Titanium	ug/L		2	<2	<2
Dissolved Uranium	ug/L		0.1	0.1	0.6
Dissolved Vanadium	ug/L		2	<2	<2
Dissolved Zinc	ug/L		5	<5	<5

<Original signed by>

Certified By: ______________________

Results relate only to the items tested. Results apply to samples as received.

Certificate of Analysis

AGAT WORK ORDER: 19K530329
PROJECT: 80002.08

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CLIENT NAME: GEMTEC LIMITED **ATTENTION TO: Carolyn Anstey-Moore**

SAMPLING SITE: **SAMPLED BY:**

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2019-10-15 **DATE REPORTED: 2019-10-30**

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

616085-616099 Metals analysis completed on a filtered sample.

Analysis performed at AGAT Halifax (unless marked by *)

<Original signed by>

Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 19K530329
PROJECT: 80002.08

CLIENT NAME: GEMTEC LIMITED
ATTENTION TO: Carolyn Anstey-Moore
SAMPLING SITE:
SAMPLED BY:

TSS

DATE RECEIVED: 2019-10-15
DATE REPORTED: 2019-10-30

			SAMPLE DESCRIPTION:	MW3	MW6
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2019-10-11	2019-10-11
Parameter	**Unit**	**G / S**	**RDL**	**616085**	**616099**
Total Suspended Solids	mg/L		5	46	22

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT St John's (unless marked by *)

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Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 19K530329

PROJECT: 80002.08

CLIENT NAME: GEMTEC LIMITED

ATTENTION TO: Carolyn Anstey-Moore

SAMPLING SITE:

SAMPLED BY:

Total Phosphorus

DATE RECEIVED: 2019-10-15 **DATE REPORTED: 2019-10-30**

			SAMPLE DESCRIPTION:	MW3	MW6
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2019-10-11	2019-10-11
Parameter	Unit	G / S	RDL	616085	616099
Total Phosphorous as P	mg/L		0.03	0.19	0.14

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Halifax (unless marked by *)

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Certified By:

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Quality Assurance

CLIENT NAME: GEMTEC LIMITED | **AGAT WORK ORDER: 19K530329**

PROJECT: 80002.08 | **ATTENTION TO: Carolyn Anstey-Moore**

SAMPLING SITE: | **SAMPLED BY:**

Water Analysis

RPT Date: Oct 30, 2019			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
TSS															
Total Suspended Solids	610472		194	182	6.4%	< 5	101%	80%	120%				107%	80%	120%
Standard Water Analysis + Dissolved Metals															
pH	616259		7.48	7.49	0.1%	<	102%	80%	120%	NA	80%	120%	NA	80%	120%
Reactive Silica as SiO2	616230		4.7	5.0	6.2%	< 0.5	111%	80%	120%	113%	80%	120%	102%	80%	120%
Chloride	616033		108	113	4.5%	< 1	102%	80%	120%	NA	80%	120%	NA	80%	120%
Fluoride	616033		<0.12	<0.12	NA	< 0.12	111%	80%	120%	NA	80%	120%	100%	80%	120%
Sulphate	616033		17	16	5.1%	< 2	117%	80%	120%	NA	80%	120%	NA	80%	120%
Alkalinity	616259		17	17	NA	< 5	87%	80%	120%	NA	80%	120%	NA	80%	120%
True Color	611461		5	<5	NA	< 5	95%	80%	120%	NA			NA		
Turbidity	611461		0.7	0.8	8.1%	< 0.1	95%	80%	120%	NA			NA		
Electrical Conductivity	616137		29	28	3.5%	< 1	108%	80%	120%	NA	80%	120%	NA	80%	120%
Nitrate as N	616033		1.08	1.15	5.6%	< 0.05	108%	80%	120%	NA	80%	120%	NA	80%	120%
Nitrite as N	616033		<0.05	<0.05	NA	< 0.05	98%	80%	120%	NA	80%	120%	113%	80%	120%
Ammonia as N	616768		0.10	0.10	NA	< 0.03	106%	80%	120%	102%	80%	120%	104%	80%	120%
Total Organic Carbon	607890		4.5	5.2	14.1%	< 0.5	101%	80%	120%	NA	80%	120%	87%	80%	120%
Ortho-Phosphate as P	616230		<0.01	0.01	NA	< 0.01	99%	80%	120%	99%	80%	120%	96%	80%	120%
Dissolved Sodium	616345		1.4	1.7	19.4%	< 0.1	103%	80%	120%	103%	80%	120%	NA	70%	130%
Dissolved Potassium	616345		0.2	0.2	NA	< 0.1	104%	80%	120%	100%	80%	120%	99%	70%	130%
Dissolved Calcium	616345		2.1	2.1	1.4%	< 0.1	101%	80%	120%	100%	80%	120%	NA	70%	130%
Dissolved Magnesium	616345		0.5	0.5	NA	< 0.1	103%	80%	120%	102%	80%	120%	109%	70%	130%
Bicarb. Alkalinity (as CaCO3)	616259		17	17	NA	< 5	NA	80%	120%	NA	80%	120%	NA	80%	120%
Carb. Alkalinity (as CaCO3)	616259		<10	<10	NA	< 10	NA	80%	120%	NA	80%	120%	NA	80%	120%
Hydroxide	616259		<5	<5	NA	< 5	NA	80%	120%	NA	80%	120%	NA	80%	120%
Dissolved Aluminum	616345		10	10	NA	< 5	101%	80%	120%	102%	80%	120%	98%	70%	130%
Dissolved Antimony	616345		< 2	< 2	0.0%	< 2	80%	80%	120%	115%	80%	120%	111%	70%	130%
Dissolved Arsenic	616345		< 2	< 2	0.0%	< 2	96%	80%	120%	93%	80%	120%	101%	70%	130%
Dissolved Barium	616345		< 5	< 5	0.0%	< 5	99%	80%	120%	94%	80%	120%	98%	70%	130%
Dissolved Beryllium	616345		< 2	< 2	0.0%	< 2	102%	80%	120%	106%	80%	120%	116%	70%	130%
Dissolved Bismuth	616345		< 2	< 2	0.0%	< 2	97%	80%	120%	101%	80%	120%	NA	70%	130%
Dissolved Boron	616345		< 5	< 5	0.0%	< 5	102%	80%	120%	109%	80%	120%	105%	70%	130%
Dissolved Cadmium	616345		< 0.017	< 0.017	0.0%	< 0.017	95%	80%	120%	93%	80%	120%	102%	70%	130%
Dissolved Chromium	616345		< 1	< 1	0.0%	< 1	94%	80%	120%	93%	80%	120%	82%	70%	130%
Dissolved Cobalt	616345		< 1	< 1	0.0%	< 1	91%	80%	120%	91%	80%	120%	89%	70%	130%
Dissolved Copper	616345		3	2	NA	< 2	92%	80%	120%	93%	80%	120%	97%	70%	130%
Dissolved Iron	616345		< 50	< 50	0.0%	< 50	103%	80%	120%	104%	80%	120%	70%	70%	130%
Dissolved Lead	616345		< 0.5	< 0.5	0.0%	< 0.5	102%	80%	120%	100%	80%	120%	96%	70%	130%
Dissolved Manganese	616345		4	3	NA	< 2	99%	80%	120%	99%	80%	120%	101%	70%	130%
Dissolved Molybdenum	616345		< 2	< 2	0.0%	< 2	99%	80%	120%	97%	80%	120%	70%	70%	130%

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Quality Assurance

CLIENT NAME: GEMTEC LIMITED | **AGAT WORK ORDER: 19K530329**
PROJECT: 80002.08 | **ATTENTION TO: Carolyn Anstey-Moore**
SAMPLING SITE: | **SAMPLED BY:**

Water Analysis (Continued)

RPT Date: Oct 30, 2019			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Dissolved Nickel	616345		3	<2	NA	< 2	93%	80%	120%	92%	80%	120%	99%	70%	130%
Dissolved Phosphorus	616345		< 0.02	< 0.02	0.0%	< 0.02	80%	80%	120%	80%	80%	120%	NA	70%	130%
Dissolved Selenium	616345		< 1	< 1	0.0%	< 1	96%	80%	120%	92%	80%	120%	111%	70%	130%
Dissolved Silver	616345		< 0.1	< 0.1	0.0%	< 0.1	110%	80%	120%	103%	80%	120%	102%	70%	130%
Dissolved Strontium	616345		16	13	NA	< 5	99%	80%	120%	96%	80%	120%	98%	70%	130%
Dissolved Thallium	616345		< 0.1	< 0.1	0.0%	< 0.1	98%	80%	120%	95%	80%	120%	93%	70%	130%
Dissolved Tin	616345		< 2	< 2	0.0%	< 2	91%	80%	120%	94%	80%	120%	72%	70%	130%
Dissolved Titanium	616345		< 2	< 2	0.0%	< 2	102%	80%	120%	101%	80%	120%	90%	70%	130%
Dissolved Uranium	616345		< 0.1	< 0.1	0.0%	< 0.1	97%	80%	120%	95%	80%	120%	88%	70%	130%
Dissolved Vanadium	616345		< 2	< 2	0.0%	< 2	104%	80%	120%	104%	80%	120%	98%	70%	130%
Dissolved Zinc	616345		< 5	< 5	0.0%	< 5	104%	80%	120%	104%	80%	120%	112%	70%	130%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Total Phosphorus

PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Lower	Upper	Recovery	Lower	Upper	Recovery	Lower	Upper
Total Phosphorous as P	607890		0.19	0.20	6.6%	< 0.03	91%	80%	120%	NA	80%	120%	104%	80%	120%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Mercury in Water (Dissolved) - CCME FWAL

PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Lower	Upper	Recovery	Lower	Upper	Recovery	Lower	Upper
Dissolved Mercury	616545		<0.026	<0.026	NA	< 0.026	105%	90%	110%	99%	80%	120%	101%	80%	120%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Cyanide, Strong and Weak Acid Dissociable (SAD and WAD)

PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Lower	Upper	Recovery	Lower	Upper	Recovery	Lower	Upper
Cyanide (SAD)	616541		<0.002	<0.002	NA	< 0.002				95%	90%	110%	97%	80%	120%
Cyanide (WAD)	616541		<0.002	<0.002	NA	< 0.002	106%	70%	130%	102%	90%	110%	108%	80%	120%

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

<Original signed by>

Certified By: ______________________

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Method Summary

CLIENT NAME: GEMTEC LIMITED | **AGAT WORK ORDER: 19K530329**

PROJECT: 80002.08 | **ATTENTION TO: Carolyn Anstey-Moore**

SAMPLING SITE: | **SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Miscellaneous Analysis			
Subcontracted Data			

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Method Summary

CLIENT NAME: GEMTEC LIMITED **AGAT WORK ORDER: 19K530329**
PROJECT: 80002.08 **ATTENTION TO: Carolyn Anstey-Moore**
SAMPLING SITE: **SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Cyanide (SAD)	INOR-181-6010	EPA 335.3	CONTINUOUS FLOW ANALYZER
Cyanide (WAD)	INOR-181-6010	EPA 335.3	CONTINUOUS FLOW ANALYZER
Dissolved Mercury	MET-93-6100	EPA SW 846 7470 & 245.1	CVAAS
pH	INOR-121-6001	SM 4500 H+B	PC TITRATE
Reactive Silica as SiO2	INOR-121-6027	SM 4500-SiO2 F	COLORIMETER
Chloride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Alkalinity	INOR-121-6001	SM 2320 B	
True Color	INOR-121-6014	SM 2120 C	NEPHELOMETER
Turbidity	INOR-121-6022	SM 2130 B	NEPHELOMETER
Electrical Conductivity	INOR-121-6001	SM 2510 B	PC TITRATE
Nitrate + Nitrite as N	INORG-121-6005	SM 4110 B	CALCULATION
Nitrate as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-121-6047	SM 4500-NH3 H	COLORIMETER
Total Organic Carbon	INOR-121-6026	SM 5310 B	TOC ANALYZER
Ortho-Phosphate as P	INOR-121-6012	SM 4500-P G	COLORIMETER
Dissolved Sodium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Potassium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Calcium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Magnesium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Bicarb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Carb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Hydroxide	INORG-121-6001	SM 2320 B	PC-TITRATE
Calculated TDS	CALCULATION	SM 1030E	CALCULATION
Hardness	CALCULATION	SM 2340B	CALCULATION
Langelier Index (@20C)	CALCULATION	CALCULATION	CALCULATION
Langelier Index (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 20C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Anion Sum	CALCULATION	SM 1030E	CALCULATION
Cation sum	CALCULATION	SM 1030E	CALCULATION
% Difference/ Ion Balance	CALCULATION	SM 1030E	CALCULATION
Dissolved Aluminum	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Antimony	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Arsenic	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Barium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Beryllium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Bismuth	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS

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Method Summary

CLIENT NAME: GEMTEC LIMITED **AGAT WORK ORDER: 19K530329**

PROJECT: 80002.08 **ATTENTION TO: Carolyn Anstey-Moore**

SAMPLING SITE: **SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Dissolved Boron	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Cadmium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Chromium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Cobalt	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Copper	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Iron	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Lead	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Manganese	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Molybdenum	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Nickel	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Phosphorus	MET-121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Selenium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Silver	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Strontium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Thallium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Tin	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Titanium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Uranium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Vanadium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Zinc	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Suspended Solids	INOR-123-6006	Based on SM 2540D	GRAVIMETRIC
Total Phosphorous as P	INOR-121-6046	SM 4500-P H, EPA 365.4	COLORIMETER

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AGAT Laboratories

Chain of Custody Record

P: 709.747.8573 • F: 709.747.2139

Laboratory Use Only

Arrival Condition: ☒ Good ☐ Poor (see notes)
Arrival Temperature: 1.3, 0.5, 2.8
Hold Time:
AGAT Job Number: 19K530329
Notes:

Report Information

Company: GEMTEC Consulting Engineers and Scientists Ltd.
Contact: Carolyn Anstey-Moore
Address: 10 Maverick Place
St. John's, NL A1L 0J1
Phone: 709-693-9171 Fax:
Client Project #: 80002.08
AGAT Quotation: GEMTEC SOA #205862
Please Note: If quotation number is not provided client will be billed full price for analysis.

Report Information (Please print):

1. Name: Carolyn Anstey-Moore
   Email: carolyn.anstey-moore@gemtec.ca
2. Name:
   Email:

Report Format

☐ Single Sample per page
☐ Multiple Samples per page
☐ Excel Format Included

Turnaround Time Required (TAT)

Regular TAT ☐ 5 to 7 working days
Rush TAT ☐ Same day ☐ 1 day ☐ 2 days ☐ 3 days
Date Required:

Regulatory Requirements (Check):

☐ List Guidelines on Report ☒ Do not list Guidelines on Report
☐ PIRI
☐ Tier 1 ☐ Res ☐ Pot ☐ Coarse
☐ Tier 2 ☐ Com ☐ N/Pot ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Industrial ☐ Other
☐ Commercial
☐ Res/Park
☐ Agricultural
☐ FWAL
☐ Sediment

Drinking Water Sample: ☐ Yes ☐ No Salt Water: ☐ Yes ☐ No
Reg. No.:

Invoice To

Same Yes ☐ / No ☐

Company: GEMTEC Consulting Engineers and Scientist Ltd.
Contact:
Address:
Phone: Fax:
PO/Credit Card#:

Sample Identification	Date/Time Sampled	Sample Matrix	# Containers	Comments – Site/Sample Info. Sample Containment	Field Filtered/Preserved	Standard Water Analysis	Metals: ☐ Total ☒ Diss ☐ Available	Mercury (Dissolved)	☐ BOD ☐ CBOD	pH	☒ TSS ☐ TDS ☐ VSS	TKN	Total Phosphorus	Phenols	Tier 1: TPH/BTEX (PIRI) ☐ low level	Tier 2: TPH/BTEX Fractionation	CCME-CWS TPH/BTEX	VOC	THM	HAA	PAH	PCB	TC + EC ☐ P/A ☐ MPN ☐ MF	☐ HPC ☐ Pseudomonas	Fecal Coliform ☐ MPN ☐ MF	Other: Cyanide (Strong + weak acid)	Other: Radium 226	Hazardous (Y/N)
MW3	Oct 11/19	Water	7	Metals Require Filt		X	X	X			X		X													X	X	
MW 6	Oct 11/19	water	7	" " "		X	X	X			X		X													X	X	

Samples Relinquished By (Print Name):	Date/Time	Samples Received By:	Date/Time		
<Original signed by>		<Original signed by>	Oct 15/19	Pink Copy - Client	Page ☐ of ☐
<Original signed by>	Oct 15/19.	<Original signed by>	9:40	Yellow Copy - AGAT	Nº:
				White Copy- AGAT	

Document ID: DIV-158-1502

Date revised: January 11, 2016

SASKATCHEWAN RESEARCH COUNCIL
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E: analytical@src.sk.ca
www.src.sk.ca/analytical

SRC Group # 2019-14995

Oct 28, 2019

AGAT Laboratories
122-11 Morris Drive
Dartmouth, NS B3B 1M2
Attn:

Date Samples Received: Oct-17-2019 Client P.O.: 136203

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 4 authorized by Vicky Snook, Supervisor

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

SASKATCHEWAN RESEARCH COUNCIL

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www.src.sk.ca/analytical

SRC Group # 2019-14995

Oct 28, 2019

AGAT Laboratories

122-11 Morris Drive
Dartmouth, NS B3B 1M2
Attn:

Date Samples Received: Oct-17-2019

Client P.O.: 136203

60369 **10/11/2019 19K530329-616085 *WATER***
60370 **10/11/2019 19K530329-616099 *WATER***

Analyte	Units	60369	60370
Lab Section 4			
Radium-226	Bq/L	<0.005	<0.005

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 8.8 °C upon receipt.

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CLIENT NAME: GEMTEC LIMITED
10 Maverick Place
Paradise, NL A1L 1Y8
709722-2275

ATTENTION TO: Carolyn Anstey-Moore

PROJECT: 80018.05

AGAT WORK ORDER: 19K528418

MISCELLANEOUS ANALYSIS REVIEWED BY: Michelle Hildebrand, Inorganics Analyst, B.Sc, P.Chem

WATER ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganics Supervisor

DATE REPORTED: Oct 29, 2019

PAGES (INCLUDING COVER): 15

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (709)747-8573

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

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Certificate of Analysis

AGAT WORK ORDER: 19K528418
PROJECT: 80018.05

CLIENT NAME: GEMTEC LIMITED
ATTENTION TO: Carolyn Anstey-Moore
SAMPLING SITE:
SAMPLED BY:

Subcontracted Data Received

DATE RECEIVED: 2019-10-09
DATE REPORTED: 2019-10-29

			SAMPLE DESCRIPTION:	MW1	MW2	MW7	MW8
			SAMPLE TYPE:	Water	Water	Water	Water
			DATE SAMPLED:	2019-10-07	2019-10-06	2019-10-06	2019-10-07
Parameter	Unit	G / S	RDL	602458	602463	602464	602465
Subcontracted Data				Y	Y	Y	Y

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Halifax (unless marked by *)

<Original signed by>

Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 19K528418
PROJECT: 80018.05

CLIENT NAME: GEMTEC LIMITED
ATTENTION TO: Carolyn Anstey-Moore
SAMPLING SITE:
SAMPLED BY:

Cyanide, Strong and Weak Acid Dissociable (SAD and WAD)

DATE RECEIVED: 2019-10-09
DATE REPORTED: 2019-10-29

			SAMPLE DESCRIPTION:	MW1	MW2	MW7	MW8
			SAMPLE TYPE:	Water	Water	Water	Water
			DATE SAMPLED:	2019-10-07	2019-10-06	2019-10-06	2019-10-07
Parameter	Unit	G / S	RDL	602458	602463	602464	602465
Cyanide (SAD)	mg/L		0.002	<0.002	<0.002	<0.002	<0.002
Cyanide (WAD)	mg/L		0.002	<0.002	<0.002	<0.002	<0.002

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Vancouver (unless marked by *)

<Original signed by>

Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 19K528418

PROJECT: 80018.05

CLIENT NAME: GEMTEC LIMITED

ATTENTION TO: Carolyn Anstey-Moore

SAMPLING SITE:

SAMPLED BY:

Mercury in Water (Dissolved) - CCME FWAL

DATE RECEIVED: 2019-10-09

DATE REPORTED: 2019-10-29

			SAMPLE DESCRIPTION:	MW1	MW2	MW7	MW8
			SAMPLE TYPE:	Water	Water	Water	Water
			DATE SAMPLED:	2019-10-07	2019-10-06	2019-10-06	2019-10-07
Parameter	Unit	G / S	RDL	602458	602463	602464	602465
Dissolved Mercury	µg/L		0.026	<0.026	<0.026	<0.026	<0.026

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Toronto (unless marked by *)

<Original signed by>

Certified By:

AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 19K528418

PROJECT: 80018.05

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http://www.agatlabs.com

CLIENT NAME: GEMTEC LIMITED

ATTENTION TO: Carolyn Anstey-Moore

SAMPLING SITE:

SAMPLED BY:

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2019-10-09

DATE REPORTED: 2019-10-29

Parameter	Unit	G / S	RDL	MW1	MW2	MW7	MW8
			SAMPLE TYPE:	Water	Water	Water	Water
			DATE SAMPLED:	2019-10-07	2019-10-06	2019-10-06	2019-10-07
				602458	602463	602464	602465
pH				7.83	6.71	6.54	8.07
Reactive Silica as SiO2	mg/L		0.5	6.2	8.8	10.6	13.6
Chloride	mg/L		1	8	2	2	2
Fluoride	mg/L		0.12	<0.12	<0.12	<0.12	<0.12
Sulphate	mg/L		2	5	<2	10	12
Alkalinity	mg/L		5	92	24	58	116
True Color	TCU		5	15	11	177	12
Turbidity	NTU		0.1	122	174	1740	29.3
Electrical Conductivity	umho/cm		1	210	64	166	270
Nitrate + Nitrite as N	mg/L		0.05	<0.05	<0.05	<0.05	<0.05
Nitrate as N	mg/L		0.05	<0.05	<0.05	<0.05	<0.05
Nitrite as N	mg/L		0.05	<0.05	<0.05	<0.05	<0.05
Ammonia as N	mg/L		0.03	0.14	0.08	0.62	0.12
Total Organic Carbon	mg/L		0.5	8.0	0.9	62.1	4.4
Ortho-Phosphate as P	mg/L		0.01	<0.01	<0.01	0.02	<0.01
Dissolved Sodium	mg/L		0.1	4.8	2.4	8.4	14.6
Dissolved Potassium	mg/L		0.1	1.5	0.2	0.8	0.8
Dissolved Calcium	mg/L		0.1	36.5	7.4	22.4	37.3
Dissolved Magnesium	mg/L		0.1	4.0	0.6	2.2	7.0
Bicarb. Alkalinity (as CaCO3)	mg/L		5	92	24	58	116
Carb. Alkalinity (as CaCO3)	mg/L		10	<10	<10	<10	<10
Hydroxide	mg/L		5	<5	<5	<5	<5
Calculated TDS	mg/L		1	116	27	90	144
Hardness	mg/L			108	20.9	65.0	122
Langelier Index (@20C)	NA			-0.24	-2.57	-1.93	0.10
Langelier Index (@ 4C)	NA			-0.56	-2.89	-2.25	-0.22
Saturation pH (@ 20C)	NA			8.07	9.28	8.47	7.97
Saturation pH (@ 4C)	NA			8.39	9.60	8.79	8.29
Anion Sum	me/L			2.17	0.54	1.42	2.63
Cation sum	me/L			2.45	0.55	2.09	3.11

<Original signed by>

Certified By: ______________________

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Certificate of Analysis

AGAT WORK ORDER: 19K528418
PROJECT: 80018.05

CLIENT NAME: GEMTEC LIMITED
ATTENTION TO: Carolyn Anstey-Moore
SAMPLING SITE:
SAMPLED BY:

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2019-10-09
DATE REPORTED: 2019-10-29

			SAMPLE DESCRIPTION:	MW1	MW2	MW7	MW8
			SAMPLE TYPE:	Water	Water	Water	Water
			DATE SAMPLED:	2019-10-07	2019-10-06	2019-10-06	2019-10-07
Parameter	Unit	G / S	RDL	602458	602463	602464	602465
% Difference/ Ion Balance	%			6.1	1.2	18.9	8.4
Dissolved Aluminum	ug/L		5	40	8	533	13
Dissolved Antimony	ug/L		2	<2	<2	<2	<2
Dissolved Arsenic	ug/L		2	2	<2	44	3
Dissolved Barium	ug/L		5	16	6	24	38
Dissolved Beryllium	ug/L		2	<2	<2	<2	<2
Dissolved Bismuth	ug/L		2	<2	<2	<2	<2
Dissolved Boron	ug/L		5	5	<5	7	6
Dissolved Cadmium	ug/L		0.017	0.031	0.032	<0.017	0.042
Dissolved Chromium	ug/L		1	2	1	3	2
Dissolved Cobalt	ug/L		1	<1	2	2	<1
Dissolved Copper	ug/L		2	<2	4	<2	2
Dissolved Iron	ug/L		50	<50	<50	7600	<50
Dissolved Lead	ug/L		0.5	<0.5	<0.5	0.6	<0.5
Dissolved Manganese	ug/L		2	985	362	647	42
Dissolved Molybdenum	ug/L		2	5	<2	<2	25
Dissolved Nickel	ug/L		2	2	5	6	2
Dissolved Phosphorus	mg/L		0.02	<0.02	<0.02	0.28	<0.02
Dissolved Selenium	ug/L		1	<1	<1	<1	<1
Dissolved Silver	ug/L		0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Strontium	ug/L		5	80	19	47	156
Dissolved Thallium	ug/L		0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Tin	ug/L		2	<2	<2	<2	<2
Dissolved Titanium	ug/L		2	4	<2	6	<2
Dissolved Uranium	ug/L		0.1	1.6	<0.1	0.4	1.3
Dissolved Vanadium	ug/L		2	<2	<2	7	<2
Dissolved Zinc	ug/L		5	<5	12	77	<5

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Certificate of Analysis

AGAT WORK ORDER: 19K528418
PROJECT: 80018.05

CLIENT NAME: GEMTEC LIMITED
SAMPLING SITE:

ATTENTION TO: Carolyn Anstey-Moore
SAMPLED BY:

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2019-10-09

DATE REPORTED: 2019-10-29

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
602458-602465 Metals analysis completed on a filtered sample.
Analysis performed at AGAT Halifax (unless marked by *)

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Certificate of Analysis

AGAT WORK ORDER: 19K528418

PROJECT: 80018.05

CLIENT NAME: GEMTEC LIMITED

ATTENTION TO: Carolyn Anstey-Moore

SAMPLING SITE:

SAMPLED BY:

TSS

DATE RECEIVED: 2019-10-09

DATE REPORTED: 2019-10-29

			SAMPLE DESCRIPTION:	MW1	MW2	MW7	MW8
			SAMPLE TYPE:	Water	Water	Water	Water
			DATE SAMPLED:	2019-10-07	2019-10-06	2019-10-06	2019-10-07
Parameter	Unit	G / S	RDL	602458	602463	602464	602465
Total Suspended Solids	mg/L		5	82	344	468	104

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT St John's (unless marked by *)

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Certified By:

AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 19K528418

PROJECT: 80018.05

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CLIENT NAME: GEMTEC LIMITED

ATTENTION TO: Carolyn Anstey-Moore

SAMPLING SITE:

SAMPLED BY:

Total Phosphorus

DATE RECEIVED: 2019-10-09

DATE REPORTED: 2019-10-29

			SAMPLE DESCRIPTION:	MW1	MW2	MW7	MW8
			SAMPLE TYPE:	Water	Water	Water	Water
			DATE SAMPLED:	2019-10-07	2019-10-06	2019-10-06	2019-10-07
Parameter	Unit	G / S	RDL	602458	602463	602464	602465
Total Phosphorous as P	mg/L		0.03	0.18	0.28	1.20	0.05

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Halifax (unless marked by *)

<Original signed by>

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Quality Assurance

CLIENT NAME: GEMTEC LIMITED
PROJECT: 80018.05
SAMPLING SITE:

AGAT WORK ORDER: 19K528418
ATTENTION TO: Carolyn Anstey-Moore
SAMPLED BY:

Water Analysis

RPT Date: Oct 29, 2019			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
TSS															
Total Suspended Solids	602326		4.8	4.6	4.3%	< 5	101%	80%	120%				105%	80%	120%
Standard Water Analysis + Dissolved Metals															
pH	603809		7.93	7.82	1.4%	<	101%	80%	120%	NA	80%	120%	NA	80%	120%
Reactive Silica as SiO2	592987		4.6	5.0	8.8%	< 0.5	102%	80%	120%	99%	80%	120%	102%	80%	120%
Chloride	600052		11	11	1.5%	< 1	88%	80%	120%	NA	80%	120%	NA	80%	120%
Fluoride	600052		<0.12	<0.12	NA	< 0.12	99%	80%	120%	NA	80%	120%	84%	80%	120%
Sulphate	600052		4	4	NA	< 2	90%	80%	120%	NA	80%	120%	87%	80%	120%
Alkalinity	603809		76	78	2.7%	< 5	86%	80%	120%	NA	80%	120%	NA	80%	120%
True Color	599179		20	18	NA	< 5	95%	80%	120%	NA			NA		
Turbidity	599179		0.6	0.7	7.8%	< 0.1	95%	80%	120%	NA			NA		
Electrical Conductivity	603809		272	274	0.8%	< 1	103%	80%	120%	NA	80%	120%	NA	80%	120%
Nitrate as N	600052		<0.05	<0.05	NA	< 0.05	93%	80%	120%	NA	80%	120%	92%	80%	120%
Nitrite as N	600052		<0.05	<0.05	NA	< 0.05	89%	80%	120%	NA	80%	120%	116%	80%	120%
Ammonia as N	606769		0.04	<0.03	NA	< 0.03	107%	80%	120%	105%	80%	120%	103%	80%	120%
Total Organic Carbon	609892		1.6	1.7	NA	< 0.5	99%	80%	120%	NA	80%	120%	97%	80%	120%
Ortho-Phosphate as P	592987		<0.01	<0.01	NA	< 0.01	99%	80%	120%	97%	80%	120%	100%	80%	120%
Dissolved Sodium	606810		34.8	35.3	1.6%	< 0.1	105%	80%	120%	101%	80%	120%	NA	70%	130%
Dissolved Potassium	606810		1.3	1.2	4.5%	< 0.1	107%	80%	120%	101%	80%	120%	NA	70%	130%
Dissolved Calcium	606810		37.2	36.0	3.3%	< 0.1	104%	80%	120%	98%	80%	120%	NA	70%	130%
Dissolved Magnesium	606810		4.4	4.4	0.9%	< 0.1	106%	80%	120%	99%	80%	120%	NA	70%	130%
Bicarb. Alkalinity (as CaCO3)	603809		76	78	2.7%	< 5	NA	80%	120%	NA	80%	120%	NA	80%	120%
Carb. Alkalinity (as CaCO3)	603809		<10	<10	NA	< 10	NA	80%	120%	NA	80%	120%	NA	80%	120%
Hydroxide	603809		<5	<5	NA	< 5	NA	80%	120%	NA	80%	120%	NA	80%	120%
Dissolved Aluminum	606810		<5	<5	NA	< 5	107%	80%	120%	100%	80%	120%	101%	70%	130%
Dissolved Antimony	606810		<2	<2	NA	< 2	80%	80%	120%	113%	80%	120%	108%	70%	130%
Dissolved Arsenic	606810		4	4	NA	< 2	99%	80%	120%	101%	80%	120%	115%	70%	130%
Dissolved Barium	606810		11	10	NA	< 5	99%	80%	120%	95%	80%	120%	99%	70%	130%
Dissolved Beryllium	606810		<2	<2	NA	< 2	94%	80%	120%	93%	80%	120%	104%	70%	130%
Dissolved Bismuth	606810		<2	<2	NA	< 2	100%	80%	120%	102%	80%	120%	NA	70%	130%
Dissolved Boron	606810		48	45	6.4%	< 5	98%	80%	120%	99%	80%	120%	NA	70%	130%
Dissolved Cadmium	606810		<0.017	<0.017	NA	< 0.017	94%	80%	120%	92%	80%	120%	99%	70%	130%
Dissolved Chromium	606810		<1	<1	NA	< 1	89%	80%	120%	84%	80%	120%	81%	70%	130%
Dissolved Cobalt	606810		<1	<1	NA	< 1	95%	80%	120%	93%	80%	120%	83%	70%	130%
Dissolved Copper	606810		<2	<2	NA	< 2	102%	80%	120%	99%	80%	120%	83%	70%	130%
Dissolved Iron	606810		<50	<50	NA	< 50	91%	80%	120%	88%	80%	120%	77%	70%	130%
Dissolved Lead	606810		<0.5	<0.5	NA	< 0.5	109%	80%	120%	103%	80%	120%	95%	70%	130%
Dissolved Manganese	606810		<2	<2	NA	< 2	95%	80%	120%	92%	80%	120%	84%	70%	130%
Dissolved Molybdenum	606810		5	5	NA	< 2	90%	80%	120%	88%	80%	120%	92%	70%	130%

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Quality Assurance

CLIENT NAME: GEMTEC LIMITED
PROJECT: 80018.05
SAMPLING SITE:

AGAT WORK ORDER: 19K528418
ATTENTION TO: Carolyn Anstey-Moore
SAMPLED BY:

Water Analysis (Continued)

RPT Date: Oct 29, 2019			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
Dissolved Nickel	606810		<2	<2	NA	< 2	92%	80%	120%	93%	80%	120%	82%	70%	130%
Dissolved Phosphorus	606810		<0.02	<0.02	NA	< 0.02	102%	80%	120%	112%	80%	120%	86%	70%	130%
Dissolved Selenium	606810		1	1	NA	< 1	104%	80%	120%	99%	80%	120%	117%	70%	130%
Dissolved Silver	606810		<0.1	<0.1	NA	< 0.1	99%	80%	120%	92%	80%	120%	97%	70%	130%
Dissolved Strontium	606810		103	100	2.6%	< 5	97%	80%	120%	94%	80%	120%	NA	70%	130%
Dissolved Thallium	606810		<0.1	<0.1	NA	< 0.1	104%	80%	120%	98%	80%	120%	92%	70%	130%
Dissolved Tin	606810		<2	<2	NA	< 2	92%	80%	120%	91%	80%	120%	84%	70%	130%
Dissolved Titanium	606810		<2	<2	NA	< 2	99%	80%	120%	96%	80%	120%	90%	70%	130%
Dissolved Uranium	606810		0.7	0.7	3.8%	< 0.1	103%	80%	120%	99%	80%	120%	97%	70%	130%
Dissolved Vanadium	606810		<2	<2	NA	< 2	92%	80%	120%	89%	80%	120%	86%	70%	130%
Dissolved Zinc	606810		<5	<5	NA	< 5	97%	80%	120%	96%	80%	120%	99%	70%	130%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Total Phosphorus

PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Lower	Upper	Recovery	Lower	Upper	Recovery	Lower	Upper
Total Phosphorous as P	593399		0.03	<0.03	NA	< 0.03	100%	80%	120%	100%	80%	120%	101%	80%	120%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Total Phosphorus

PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Lower	Upper	Recovery	Lower	Upper	Recovery	Lower	Upper
Total Phosphorous as P	602463	602463	0.28	0.27	2.5%	< 0.03	100%	80%	120%	101%	80%	120%	102%	80%	120%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Cyanide, Strong and Weak Acid Dissociable (SAD and WAD)

PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Lower	Upper	Recovery	Lower	Upper	Recovery	Lower	Upper
Cyanide (SAD)	599220		<0.002	<0.002	NA	< 0.002	91%	85%	115%	104%	90%	110%	107%	80%	120%
Cyanide (WAD)	599220		0.003	0.003	NA	< 0.002	106%	70%	130%	103%	90%	110%	89%	80%	120%

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

Mercury in Water (Dissolved) - CCME FWAL

PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Lower	Upper	Recovery	Lower	Upper	Recovery	Lower	Upper
Dissolved Mercury	1606811		<0.026	<0.026	NA	< 0.026	102%	90%	110%	101%	80%	120%	102%	80%	120%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

<Original signed by>

Certified By: ____________________

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Method Summary

CLIENT NAME: GEMTEC LIMITED

AGAT WORK ORDER: 19K528418

PROJECT: 80018.05

ATTENTION TO: Carolyn Anstey-Moore

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Miscellaneous Analysis			
Subcontracted Data			

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Method Summary

CLIENT NAME: GEMTEC LIMITED
AGAT WORK ORDER: 19K528418
PROJECT: 80018.05
ATTENTION TO: Carolyn Anstey-Moore
SAMPLING SITE:
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Cyanide (SAD)	INOR-181-6010	EPA 335.3	CONTINUOUS FLOW ANALYZER
Cyanide (WAD)	INOR-181-6010	EPA 335.3	CONTINUOUS FLOW ANALYZER
Dissolved Mercury	MET-93-6100	EPA SW 846 7470 & 245.1	CVAAS
pH	INOR-121-6001	SM 4500 H+B	PC TITRATE
Reactive Silica as SiO2	INOR-121-6027	SM 4500-SiO2 F	COLORIMETER
Chloride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Alkalinity	INOR-121-6001	SM 2320 B	
True Color	INOR-121-6014	SM 2120 C	NEPHELOMETER
Turbidity	INOR-121-6022	SM 2130 B	NEPHELOMETER
Electrical Conductivity	INOR-121-6001	SM 2510 B	PC TITRATE
Nitrate + Nitrite as N	INORG-121-6005	SM 4110 B	CALCULATION
Nitrate as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-121-6047	SM 4500-NH3 H	COLORIMETER
Total Organic Carbon	INOR-121-6026	SM 5310 B	TOC ANALYZER
Ortho-Phosphate as P	INOR-121-6012	SM 4500-P G	COLORIMETER
Dissolved Sodium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Potassium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Calcium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Magnesium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Bicarb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Carb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Hydroxide	INORG-121-6001	SM 2320 B	PC-TITRATE
Calculated TDS	CALCULATION	SM 1030E	CALCULATION
Hardness	CALCULATION	SM 2340B	CALCULATION
Langelier Index (@20C)	CALCULATION	CALCULATION	CALCULATION
Langelier Index (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 20C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Anion Sum	CALCULATION	SM 1030E	CALCULATION
Cation sum	CALCULATION	SM 1030E	CALCULATION
% Difference/ Ion Balance	CALCULATION	SM 1030E	CALCULATION
Dissolved Aluminum	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Antimony	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Arsenic	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Barium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Beryllium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Bismuth	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS

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Method Summary

CLIENT NAME: GEMTEC LIMITED
AGAT WORK ORDER: 19K528418
PROJECT: 80018.05
ATTENTION TO: Carolyn Anstey-Moore
SAMPLING SITE:
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Dissolved Boron	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Cadmium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Chromium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Cobalt	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Copper	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Iron	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Lead	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Manganese	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Molybdenum	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Nickel	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Phosphorus	MET-121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Selenium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Silver	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Strontium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Thallium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Tin	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Titanium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Uranium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Vanadium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Zinc	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Suspended Solids	INOR-123-6006	Based on SM 2540D	GRAVIMETRIC
Total Phosphorous as P	INOR-121-6046	SM 4500-P H, EPA 365.4	COLORIMETER

AGAT Laboratories

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Chain of Custody Record

Laboratory Use Only

Arrival Condition: ☑ Good ☐ Poor (see notes)
Arrival Temperature: 4.3, 4.8, 7.3
Hold Time:
AGAT Job Number: 19K528418
Notes:

Report Information

Company: GEMTEC Consulting Engineers and Scientist Ltd
Contact: Carolyn Anstey-Moore
Address: 10 Maverick Place, Octagon Industrial Park
Paradise, NL
Phone: 9709)722.2275 ext. 267 Fax:
Client Project #: 80018.05
AGAT Quotation: GEMTEC SO
Please Note: If quotation number is not provided client will be billed full price for analysis.

Report Information (Please print):

1. Name: Carolyn Anstey-Moore
Email: carolyn.anstey-moore@gemetec.ca
2. Name:
Email:

Report Format

☐ Single Sample per page
☑ Multiple Samples per page
☑ Excel Format Included

Turnaround Time Required (TAT)

Regular TAT ☑ 5 to 7 working days
Rush TAT ☐ Same day ☐ 1 day ☐ 2 days ☐ 3 days
Date Required:

Invoice To

Same Yes ☐ / No ☐
Company: Same as above
Contact: Accounts Payable
Address:
Phone: Fax:
PO/Credit Card#:

Regulatory Requirements (Check):

☐ List Guidelines on Report ☑ Do not list Guidelines on Report
☐ PIRI
☐ Tier 1 ☐ Res ☐ Pot ☐ Coarse
☐ Tier 2 ☐ Com ☐ N/Pot ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Industrial ☐ NL DOEC GW
☐ Commercial
☐ Res/Park ☐ NLDOEC Discharge
☐ Agricultural
☐ FWAL
☐ Sediment ☐ Other

Drinking Water Sample: ☐ Yes ☐ No Salt Water: ☐ Yes ☐ No
Reg. No.:

Sample Identification	Date/Time Sampled	Sample Matrix	# Containers	Comments - Site/Sample Info. Sample Containment	Field Filtered/Preserved	Standard Water Analysis	Metals: ☐ Total ☑ Diss ☐ Available	Mercury (DISSOLVED)	☐ BOD ☐ CBOD	pH	☑ TSS ☐ TDS ☐ VSS	TKN	Total Phosphorus	Phenols	Tier 1: TPH/BTEX (PIRI) ☐ low level	Tier 2: TPH/BTEX Fractionation	CCME-CWS TPH/BTEX	VOC	THM	HAA	PAH	PCB	TC + EC ☐ P/A ☐ MPN ☐ MF	☐ HPC ☐ Pseudomonas	Fecal Coliform ☐ MPN ☐ MF	Other: Cyanide (strong & weak acid)	Other: Radium 226	Hazardous (Y/N)
MW1	Oct 7, 2019	Water			x	☑	☑	☑			☑		☑													X	X	
MW2	Oct. 6, 2019	Water			x	☑	☑	☑			☑		☑													X	X	
MW7	Oct. 6, 2019	Water			x	☑	☑	☑			☑		☑													X	X	
MW8	Oct. 7, 2019	Water			x	☑	☑	☑			☑		☑													X	X	

Samples Relinquished By (Print Name):
<Original signed by>
Date/Time Oct. 9, 2019
Date/Time Oct. 9, 2019

<Original signed by>
Date/Time Oct 9/19
Date/Time 11:10

Pink Copy - Client
Yellow Copy - AGAT
White Copy- AGAT

Page [ ] of [ ]
Nº:

Date revised: March 16, 2018

SRC SASKATCHEWAN RESEARCH COUNCIL
Environmental Analytical Laboratories
143-111 Research Drive, Saskatoon, SK Canada S7N 3R2
T: 306-933-6932 F: 306-933-7922
Toll-free: 1-800-240-8808
E: analytical@src.sk.ca
www.src.sk.ca/analytical

SRC Group # 2019-14646

Oct 25, 2019

AGAT Laboratories
122-11 Morris Drive
Dartmouth, NS B3B 1M2
Attn:

Date Samples Received: Oct-10-2019 Client P.O.: 136203

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 4 authorized by Vicky Snook, Supervisor

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* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

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SRC Group # 2019-14646

Oct 25, 2019

AGAT Laboratories

122-11 Morris Drive
Dartmouth, NS B3B 1M2
Attn:

Date Samples Received: Oct-10-2019 Client P.O.: 136203

58581	**10/07/2019 19K528418-602458 *WATER***
58582	**10/06/2019 19K528418-602463 *WATER***
58583	**10/06/2019 19K528418-602464 *WATER***

Analyte	Units	58581	58582	58583
Lab Section 4				
Radium-226	Bq/L	<0.005	0.008	0.18

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

Note for Sample # 58583
This sample was reanalyzed for Radium 226. Reanalysis confirms original results are within the expected measurement uncertainty.

The temperature of the cooler was 6.1 °C upon receipt.

SASKATCHEWAN RESEARCH COUNCIL
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SRC Group # 2019-14646

Oct 25, 2019

AGAT Laboratories

58584 **10/07/2019 19K528418-602465 *WATER***

Analyte	Units	58584
Lab Section 4		
Radium-226	Bq/L	<0.005

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 6.1 °C upon receipt.

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

CLIENT NAME: GEMTEC LIMITED
10 Maverick Place
Paradise, NL A1L 1Y8
709722-2275

ATTENTION TO: Carolyn Anstey-Moore

PROJECT:

AGAT WORK ORDER: 19X530462

MISCELLANEOUS ANALYSIS REVIEWED BY: Michelle Hildebrand, Inorganics Analyst, B.Sc, P.Chem

WATER ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganics Supervisor

DATE REPORTED: Oct 30, 2019

PAGES (INCLUDING COVER): 15

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

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Certificate of Analysis

AGAT WORK ORDER: 19X530462
PROJECT:

CLIENT NAME: GEMTEC LIMITED
SAMPLING SITE:

ATTENTION TO: Carolyn Anstey-Moore
SAMPLED BY:

Subcontracted Data Received

DATE RECEIVED: 2019-10-15

DATE REPORTED: 2019-10-30

			SAMPLE DESCRIPTION:	MW4	MW5
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2019-10-08	2019-10-08
Parameter	Unit	G / S	RDL	616541	616545
Subcontracted Data				Y	Y

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Halifax (unless marked by *)

<Original signed by>

Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 19X530462
PROJECT:

CLIENT NAME: GEMTEC LIMITED
ATTENTION TO: Carolyn Anstey-Moore
SAMPLING SITE:
SAMPLED BY:

Cyanide, Strong and Weak Acid Dissociable (SAD and WAD)

DATE RECEIVED: 2019-10-15
DATE REPORTED: 2019-10-30

			SAMPLE DESCRIPTION:	MW4	MW5
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2019-10-08	2019-10-08
Parameter	Unit	G / S	RDL	616541	616545
Cyanide (SAD)	mg/L		0.002	<0.002	<0.002
Cyanide (WAD)	mg/L		0.002	<0.002	<0.002

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Vancouver (unless marked by *)

<Original signed by>

Certified By:

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
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TEL (902)468-8718
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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 19X530462
PROJECT:

CLIENT NAME: GEMTEC LIMITED
ATTENTION TO: Carolyn Anstey-Moore
SAMPLING SITE:
SAMPLED BY:

Mercury in Water (Dissolved) - CCME FWAL

DATE RECEIVED: 2019-10-15
DATE REPORTED: 2019-10-30

			SAMPLE DESCRIPTION:	MW4	MW5
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2019-10-08	2019-10-08
Parameter	Unit	G / S	RDL	616541	616545
Dissolved Mercury	µg/L		0.026	<0.026	<0.026

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Toronto (unless marked by *)

<Original signed by>

Certified By:

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
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Certificate of Analysis

AGAT WORK ORDER: 19X530462
PROJECT:

CLIENT NAME: GEMTEC LIMITED
ATTENTION TO: Carolyn Anstey-Moore
SAMPLING SITE:
SAMPLED BY:

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2019-10-15
DATE REPORTED: 2019-10-30

			SAMPLE DESCRIPTION:	MW4	MW5
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2019-10-08	2019-10-08
Parameter	Unit	G / S	RDL	616541	616545
pH				7.87	7.94
Reactive Silica as SiO2	mg/L		0.5	7.9	13.3
Chloride	mg/L		1	4	4
Fluoride	mg/L		0.12	<0.12	<0.12
Sulphate	mg/L		2	5	6
Alkalinity	mg/L		5	78	114
True Color	TCU		5	<5	8
Turbidity	NTU		0.1	12.3	657
Electrical Conductivity	umho/cm		1	142	200
Nitrate + Nitrite as N	mg/L		0.05	0.05	<0.05
Nitrate as N	mg/L		0.05	0.05	<0.05
Nitrite as N	mg/L		0.05	<0.05	<0.05
Ammonia as N	mg/L		0.03	0.08	0.27
Total Organic Carbon	mg/L		0.5	2.6	6.1
Ortho-Phosphate as P	mg/L		0.01	<0.01	<0.01
Dissolved Sodium	mg/L		0.1	3.0	11.8
Dissolved Potassium	mg/L		0.1	2.0	3.7
Dissolved Calcium	mg/L		0.1	23.4	29.5
Dissolved Magnesium	mg/L		0.1	1.9	1.6
Bicarb. Alkalinity (as CaCO3)	mg/L		5	78	114
Carb. Alkalinity (as CaCO3)	mg/L		10	<10	<10
Hydroxide	mg/L		5	<5	<5
Calculated TDS	mg/L		1	86	126
Hardness	mg/L			66.3	80.3
Langelier Index (@20C)	NA			-0.45	-0.13
Langelier Index (@ 4C)	NA			-0.77	-0.45
Saturation pH (@ 20C)	NA			8.32	8.07
Saturation pH (@ 4C)	NA			8.64	8.39
Anion Sum	me/L			1.78	2.52
Cation sum	me/L			1.51	2.27

<Original signed by>

Certified By:

Certificate of Analysis

AGAT Laboratories

AGAT WORK ORDER: 19X530462

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CLIENT NAME: GEMTEC LIMITED

ATTENTION TO: Carolyn Anstey-Moore

SAMPLING SITE:

SAMPLED BY:

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2019-10-15

DATE REPORTED: 2019-10-30

			SAMPLE DESCRIPTION:	MW4	MW5
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2019-10-08	2019-10-08
Parameter	Unit	G / S	RDL	616541	616545
% Difference/ Ion Balance	%			8.1	5.2
Dissolved Aluminum	ug/L		5	6	17
Dissolved Antimony	ug/L		2	<2	<2
Dissolved Arsenic	ug/L		2	<2	14
Dissolved Barium	ug/L		5	11	51
Dissolved Beryllium	ug/L		2	<2	<2
Dissolved Bismuth	ug/L		2	<2	<2
Dissolved Boron	ug/L		5	<5	<5
Dissolved Cadmium	ug/L		0.017	<0.017	0.045
Dissolved Chromium	ug/L		1	2	1
Dissolved Cobalt	ug/L		1	<1	<1
Dissolved Copper	ug/L		2	<2	<2
Dissolved Iron	ug/L		50	<50	244
Dissolved Lead	ug/L		0.5	<0.5	<0.5
Dissolved Manganese	ug/L		2	26	751
Dissolved Molybdenum	ug/L		2	<2	<2
Dissolved Nickel	ug/L		2	3	3
Dissolved Phosphorus	mg/L		0.02	<0.02	<0.02
Dissolved Selenium	ug/L		1	<1	<1
Dissolved Silver	ug/L		0.1	<0.1	<0.1
Dissolved Strontium	ug/L		5	40	87
Dissolved Thallium	ug/L		0.1	<0.1	<0.1
Dissolved Tin	ug/L		2	<2	<2
Dissolved Titanium	ug/L		2	<2	<2
Dissolved Uranium	ug/L		0.1	0.1	0.8
Dissolved Vanadium	ug/L		2	<2	<2
Dissolved Zinc	ug/L		5	<5	<5

<Original signed by>

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CLIENT NAME: GEMTEC LIMITED | ATTENTION TO: Carolyn Anstey-Moore

SAMPLING SITE: | SAMPLED BY:

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2019-10-15 | DATE REPORTED: 2019-10-30

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

616541-616545 Metals analysis completed on a filtered sample.

Analysis performed at AGAT Halifax (unless marked by *)

<Original signed by>

Certified By:

AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 19X530462

PROJECT:

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CLIENT NAME: GEMTEC LIMITED

ATTENTION TO: Carolyn Anstey-Moore

SAMPLING SITE:

SAMPLED BY:

TSS

DATE RECEIVED: 2019-10-15

DATE REPORTED: 2019-10-30

			SAMPLE DESCRIPTION:	MW4	MW5
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2019-10-08	2019-10-08
Parameter	Unit	G / S	RDL	616541	616545
Total Suspended Solids	mg/L		5	9	532

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Halifax (unless marked by *)

<Original signed by>

Certified By:

AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 19X530462

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CLIENT NAME: GEMTEC LIMITED

ATTENTION TO: Carolyn Anstey-Moore

SAMPLING SITE:

SAMPLED BY:

Total Phosphorus

DATE RECEIVED: 2019-10-15

DATE REPORTED: 2019-10-30

			SAMPLE DESCRIPTION:	MW4	MW5
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2019-10-08	2019-10-08
Parameter	Unit	G / S	RDL	616541	616545
Total Phosphorous as P	mg/L		0.03	0.16	0.78

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Halifax (unless marked by *)

<Original signed by>

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Quality Assurance

CLIENT NAME: GEMTEC LIMITED
PROJECT:
SAMPLING SITE:

AGAT WORK ORDER: 19X530462
ATTENTION TO: Carolyn Anstey-Moore
SAMPLED BY:

Water Analysis

RPT Date: Oct 30, 2019			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Standard Water Analysis + Dissolved Metals															
pH	617078		7.65	7.72	0.9%	<	101%	80%	120%	NA	80%	120%	NA	80%	120%
Reactive Silica as SiO2	616881		11.6	12.9	10.8%	< 0.5	110%	80%	120%	103%	80%	120%	113%	80%	120%
Chloride	616033		108	113	4.5%	< 1	102%	80%	120%	NA	80%	120%	NA	80%	120%
Fluoride	616033		<0.12	<0.12	NA	< 0.12	111%	80%	120%	NA	80%	120%	100%	80%	120%
Sulphate	616033		17	16	5.1%	< 2	117%	80%	120%	NA	80%	120%	NA	80%	120%
Alkalinity	617078		120	120	0.1%	< 5	89%	80%	120%	NA	80%	120%	NA	80%	120%
True Color	611461		5	<5	NA	< 5	95%	80%	120%	NA			NA		
Turbidity	611461		0.7	0.8	8.1%	< 0.1	95%	80%	120%	NA			NA		
Electrical Conductivity	617078		457	451	1.4%	< 1	104%	80%	120%	NA	80%	120%	NA	80%	120%
Nitrate as N	616033		1.08	1.15	5.6%	< 0.05	108%	80%	120%	NA	80%	120%	NA	80%	120%
Nitrite as N	616033		<0.05	<0.05	NA	< 0.05	98%	80%	120%	NA	80%	120%	113%	80%	120%
Ammonia as N	616768		0.10	0.10	NA	< 0.03	106%	80%	120%	102%	80%	120%	104%	80%	120%
Total Organic Carbon	607890		4.5	5.2	14.1%	< 0.5	101%	80%	120%	NA	80%	120%	87%	80%	120%
Ortho-Phosphate as P	616881		0.02	0.02	NA	< 0.01	98%	80%	120%	98%	80%	120%	97%	80%	120%
Dissolved Sodium	610400		4.9	4.7	4.6%	< 0.1	110%	80%	120%	110%	80%	120%	NA	70%	130%
Dissolved Potassium	610400		1.3	1.2	9.8%	< 0.1	96%	80%	120%	98%	80%	120%	NA	70%	130%
Dissolved Calcium	610400		59.9	58.2	2.9%	< 0.1	97%	80%	120%	99%	80%	120%	87%	70%	130%
Dissolved Magnesium	610400		2.7	2.6	4.3%	< 0.1	99%	80%	120%	96%	80%	120%	NA	70%	130%
Bicarb. Alkalinity (as CaCO3)	617078		120	120	0.1%	< 5	NA	80%	120%	NA	80%	120%	NA	80%	120%
Carb. Alkalinity (as CaCO3)	617078		<10	<10	NA	< 10	NA	80%	120%	NA	80%	120%	NA	80%	120%
Hydroxide	617078		<5	<5	NA	< 5	NA	80%	120%	NA	80%	120%	NA	80%	120%
Dissolved Aluminum	610400		6	5	NA	< 5	98%	80%	120%	98%	80%	120%	70%	70%	130%
Dissolved Antimony	610400		<2	<2	NA	< 2	80%	80%	120%	120%	80%	120%	94%	70%	130%
Dissolved Arsenic	610400		31	33	6.6%	< 2	102%	80%	120%	101%	80%	120%	NA	70%	130%
Dissolved Barium	610400		<5	5	NA	< 5	107%	80%	120%	103%	80%	120%	85%	70%	130%
Dissolved Beryllium	610400		<2	<2	NA	< 2	105%	80%	120%	101%	80%	120%	92%	70%	130%
Dissolved Bismuth	610400		<2	<2	NA	< 2	118%	80%	120%	116%	80%	120%	NA	70%	130%
Dissolved Boron	610400		7	7	NA	< 5	105%	80%	120%	100%	80%	120%	85%	70%	130%
Dissolved Cadmium	610400		<0.017	<0.017	NA	< 0.017	103%	80%	120%	101%	80%	120%	90%	70%	130%
Dissolved Chromium	610400		1	1	NA	< 1	114%	80%	120%	109%	80%	120%	81%	70%	130%
Dissolved Cobalt	610400		<1	<1	NA	< 1	98%	80%	120%	92%	80%	120%	75%	70%	130%
Dissolved Copper	610400		<2	<2	NA	< 2	100%	80%	120%	96%	80%	120%	73%	70%	130%
Dissolved Iron	610400		948	957	1.0%	< 50	102%	80%	120%	98%	80%	120%	NA	70%	130%
Dissolved Lead	610400		<0.5	<0.5	NA	< 0.5	106%	80%	120%	101%	80%	120%	80%	70%	130%
Dissolved Manganese	610400		1320	1310	0.8%	< 2	100%	80%	120%	97%	80%	120%	NA	70%	130%
Dissolved Molybdenum	610400		<2	<2	NA	< 2	106%	80%	120%	102%	80%	120%	79%	70%	130%
Dissolved Nickel	610400		5	5	NA	< 2	97%	80%	120%	92%	80%	120%	70%	70%	130%
Dissolved Phosphorus	610400		<0.02	<0.02	NA	< 0.02	89%	80%	120%	95%	80%	120%	NA	70%	130%
Dissolved Selenium	610400		<1	<1	NA	< 1	97%	80%	120%	103%	80%	120%	NA	70%	130%

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Quality Assurance

CLIENT NAME: GEMTEC LIMITED
PROJECT:
SAMPLING SITE:

AGAT WORK ORDER: 19X530462
ATTENTION TO: Carolyn Anstey-Moore
SAMPLED BY:

Water Analysis (Continued)

RPT Date: Oct 30, 2019			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
Dissolved Silver	610400		<0.1	<0.1	NA	< 0.1	109%	80%	120%	108%	80%	120%	NA	70%	130%
Dissolved Strontium	610400		126	125	0.8%	< 5	104%	80%	120%	97%	80%	120%	NA	70%	130%
Dissolved Thallium	610400		<0.1	<0.1	NA	< 0.1	101%	80%	120%	98%	80%	120%	78%	70%	130%
Dissolved Tin	610400		<2	<2	NA	< 2	104%	80%	120%	102%	80%	120%	78%	70%	130%
Dissolved Titanium	610400		<2	<2	NA	< 2	95%	80%	120%	94%	80%	120%	70%	70%	130%
Dissolved Uranium	610400		0.2	0.2	NA	< 0.1	115%	80%	120%	112%	80%	120%	92%	70%	130%
Dissolved Vanadium	610400		<2	<2	NA	< 2	109%	80%	120%	107%	80%	120%	89%	70%	130%
Dissolved Zinc	610400		929	942	1.4%	< 5	115%	80%	120%	109%	80%	120%	NA	70%	130%
Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.															
TSS															
Total Suspended Solids	609522		196	206	5%	< 5	92%	80%	120%	NA			96%	80%	120%
Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.															
Total Phosphorus															
Total Phosphorous as P	607890		0.19	0.20	6.6%	< 0.03	91%	80%	120%	NA	80%	120%	104%	80%	120%
Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.															
Cyanide, Strong and Weak Acid Dissociable (SAD and WAD)															
Cyanide (SAD)	616541		<0.002	<0.002	NA	< 0.002				95%	90%	110%	97%	80%	120%
Cyanide (WAD)	616541		<0.002	<0.002	NA	< 0.002	106%	70%	130%	102%	90%	110%	108%	80%	120%
Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.															
Mercury in Water (Dissolved) - CCME FWAL															
Dissolved Mercury	616545	616545	<0.026	<0.026	NA	< 0.026	105%	90%	110%	99%	80%	120%	101%	80%	120%
Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.															

<Original signed by>

Certified By: ____________________

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Method Summary

CLIENT NAME: GEMTEC LIMITED
AGAT WORK ORDER: 19X530462
PROJECT:
ATTENTION TO: Carolyn Anstey-Moore
SAMPLING SITE:
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Miscellaneous Analysis			
Subcontracted Data			

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Method Summary

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SAMPLING SITE:

AGAT WORK ORDER: 19X530462
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SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Cyanide (SAD)	INOR-181-6010	EPA 335.3	CONTINUOUS FLOW ANALYZER
Cyanide (WAD)	INOR-181-6010	EPA 335.3	CONTINUOUS FLOW ANALYZER
Dissolved Mercury	MET-93-6100	EPA SW 846 7470 & 245.1	CVAAS
pH	INOR-121-6001	SM 4500 H+B	PC TITRATE
Reactive Silica as SiO2	INOR-121-6027	SM 4500-SiO2 F	COLORIMETER
Chloride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Alkalinity	INOR-121-6001	SM 2320 B	
True Color	INOR-121-6014	SM 2120 C	NEPHELOMETER
Turbidity	INOR-121-6022	SM 2130 B	NEPHELOMETER
Electrical Conductivity	INOR-121-6001	SM 2510 B	PC TITRATE
Nitrate + Nitrite as N	INORG-121-6005	SM 4110 B	CALCULATION
Nitrate as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-121-6047	SM 4500-NH3 H	COLORIMETER
Total Organic Carbon	INOR-121-6026	SM 5310 B	TOC ANALYZER
Ortho-Phosphate as P	INOR-121-6012	SM 4500-P G	COLORIMETER
Dissolved Sodium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Potassium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Calcium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Magnesium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Bicarb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Carb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Hydroxide	INORG-121-6001	SM 2320 B	PC-TITRATE
Calculated TDS	CALCULATION	SM 1030E	CALCULATION
Hardness	CALCULATION	SM 2340B	CALCULATION
Langelier Index (@20C)	CALCULATION	CALCULATION	CALCULATION
Langelier Index (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 20C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Anion Sum	CALCULATION	SM 1030E	CALCULATION
Cation sum	CALCULATION	SM 1030E	CALCULATION
% Difference/ Ion Balance	CALCULATION	SM 1030E	CALCULATION
Dissolved Aluminum	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Antimony	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Arsenic	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Barium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Beryllium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Bismuth	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS

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Method Summary

CLIENT NAME: GEMTEC LIMITED
PROJECT:
SAMPLING SITE:

AGAT WORK ORDER: 19X530462
ATTENTION TO: Carolyn Anstey-Moore
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Dissolved Boron	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Cadmium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Chromium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Cobalt	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Copper	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Iron	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Lead	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Manganese	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Molybdenum	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Nickel	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Phosphorus	MET-121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Selenium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Silver	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Strontium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Thallium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Tin	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Titanium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Uranium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Vanadium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Zinc	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Suspended Solids	INOR-121-6024, 6025	SM 2540C, D	GRAVIMETRIC
Total Phosphorous as P	INOR-121-6046	SM 4500-P H, EPA 365.4	COLORIMETER

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AGAT Laboratories

Chain of Custody Record

Laboratory Use Only

Arrival Condition: ☐ Good ☐ Poor (see notes)
Arrival Temperature: 4.9, 5.8, 6.5
Hold Time:
AGAT Job Number: 19X530462
Notes:

Report Information

Company: GEMTEC Consulting Engineers and Scientists Ltd.
Contact: Carolyn Anstey-Moore
Address: 10 Maverick Place
St. John's, NL A1L 0J1
Phone: 709-693-9171 Fax:
Client Project #: 80002.08
AGAT Quotation: GEMTEC SOA #205862
Please Note: If quotation number is not provided client will be billed full price for analysis.

Report Information (Please print):

1. Name: Carolyn Anstey-Moore
   Email: carolyn.anstey-moore@gemtec.ca
2. Name:
   Email:

Report Format

☐ Single Sample per page
☐ Multiple Samples per page
☐ Excel Format Included

Turnaround Time Required (TAT)

Regular TAT ☒ 5 to 7 working days
Rush TAT ☐ Same day ☐ 1 day ☐ 2 days ☐ 3 days
Date Required:

Invoice To Same Yes ☐ / No ☐

Company: GEMTEC Consulting Engineers and Scientist Ltd.
Contact:
Address:
Phone: Fax:
PO/Credit Card#:

Regulatory Requirements (Check):

☐ List Guidelines on Report ■ Do not list Guidelines on Report
☐ PIRI
☐ Tier 1 ☐ Res ☐ Pot ☐ Coarse
☐ Tier 2 ☐ Com ☐ N/Pot ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Industrial ☐ Other
☐ Commercial
☐ Res/Park
☐ Agricultural
☐ FWAL
☐ Sediment

Drinking Water Sample: ☐ Yes ☐ No **Salt Water:** ☐ Yes ☐ No
Reg. No.:

Sample Identification	Date/Time Sampled	Sample Matrix	# Containers	Comments – Site/Sample Info. Sample Containment	Field Filtered/Preserved	Standard Water Analysis	Metals: ☐ Total ☒ Diss ☐ Available	Mercury (dissolved)	☐ BOD ☐ CBOD	pH	☒ TSS ☐ TDS ☐ VSS	TKN	Total Phosphorus	Phenols	Tier 1: TPH/BTEX (PIRI) ☐ low level	Tier 2: TPH/BTEX Fractionation	CCME-CWS TPH/BTEX	VOC	THM	HAA	PAH	PCB	TC + EC ☐ P/A ☐ MPN ☐ MF	☐ HPC ☐ Pseudomonas	Fecal Coliform ☐ MPN ☐ MF	Other: Cyanide (Strong/weak [illegible])	Other: Radium 226	Hazardous (Y/N)
MW4	Oct 8/19	water	7		X	X	X	X			X		X													X	X	
MW5	Oct 9/19	water	7		X	X	X	X			X		X													X	X	

Samples Relinquished By (Print Name): <Original signed by>
Date/Time: Oct10/19
Samples Relinquished By (Sign): Matthew Clarke
Date/Time:
Samples Received By (Print Name): <Original signed by>
Date/Time: Oct 15
Samples Received By (Sign):
Date/Time: 12:47

Pink Copy - Client
Yellow Copy - AGAT
White Copy- AGAT

Page of
Nº:

SASKATCHEWAN RESEARCH COUNCIL

Environmental Analytical Laboratories
143-111 Research Drive, Saskatoon, SK Canada S7N 3R2

T: 306-933-6932 F: 306-933-7922
Toll-free: 1-800-240-8808
E: analytical@src.sk.ca

www.src.sk.ca/analytical

SRC Group # 2019-14876

Oct 25, 2019

AGAT Laboratories
122-11 Morris Drive
Dartmouth, NS B3B 1M2
Attn: Janetta Fraser

Date Samples Received: Oct-16-2019 Client P.O.: 136118

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 4 authorized by Vicky Snook, Supervisor

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
  * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
  * Environment Canada
  * US EPA
  * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

SASKATCHEWAN RESEARCH COUNCIL

Environmental Analytical Laboratories
143-111 Research Drive, Saskatoon, SK Canada S7N 3R2

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Toll-free: 1-800-240-8808
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www.src.sk.ca/analytical

SRC Group # 2019-14876

Oct 25, 2019

AGAT Laboratories

122-11 Morris Drive
Dartmouth, NS B3B 1M2
Attn: Janetta Fraser

Date Samples Received: Oct-16-2019

Client P.O.: 136118

59987 **19X530462-616541-MW4 *WATER***
59988 **19X530462-616541-MW5 *WATER***

Analyte	Units	59987	59988
Lab Section 4			
Radium-226	Bq/L	0.005	0.04

The temperature of the cooler was 8.3 °C upon receipt.

57 Old Pennywell Road, Unit I
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CANADA A1E 6A8
TEL (709)747-8573
FAX (709 747-2139
http://www.agatlabs.com

CLIENT NAME: GEMTEC LIMITED
10 Maverick Place
Paradise, NL A1L 1Y8
709722-2275

ATTENTION TO: Carolyn Anstey-Moore

PROJECT: 80018.05

AGAT WORK ORDER: 20K579897

WATER ANALYSIS REVIEWED BY: Marta Manka, Data Reporter

DATE REPORTED: Mar 12, 2020

PAGES (INCLUDING COVER): 13

VERSION*: 2

Should you require any information regarding this analysis please contact your client services representative at (709)747-8573

*Notes

VERSION 2:Version 2.0:Version 2.0 supersedes Version 1.0. Work order 20K579897, version 1, issued March 11th, 2020.Subcontracted data added.

AGAT Laboratories
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FAX (709 747-2139
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 20K579897
PROJECT: 80018.05

CLIENT NAME: GEMTEC LIMITED
SAMPLING SITE:

ATTENTION TO: Carolyn Anstey-Moore
SAMPLED BY:

Cyanide, Strong and Weak Acid Dissociable (SAD and WAD)

DATE RECEIVED: 2020-03-02

DATE REPORTED: 2020-03-12

			SAMPLE DESCRIPTION:	MW3	MW6	MW2	MW7	MW8
			SAMPLE TYPE:	Water	Water	Water	Water	Water
			DATE SAMPLED:	2020-02-28	2020-02-28	2020-02-28	2020-02-28	2020-02-28
Parameter	Unit	G / S	RDL	981670	981689	981690	981691	981692
Cyanide (SAD)	mg/L		0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cyanide (WAD)	mg/L		0.002	<0.002	<0.002	<0.002	<0.002	<0.002

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Vancouver (unless marked by *)

<Original signed by>

Certified By:

Certificate of Analysis

AGAT WORK ORDER: 20K579897
PROJECT: 80018.05

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FAX (709 747-2139
http://www.agatlabs.com

CLIENT NAME: GEMTEC LIMITED
ATTENTION TO: Carolyn Anstey-Moore
SAMPLING SITE:
SAMPLED BY:

Mercury Analysis in Water (Dissolved)

DATE RECEIVED: 2020-03-02
DATE REPORTED: 2020-03-12

			SAMPLE DESCRIPTION:	MW3	MW6	MW2	MW7	MW8
			SAMPLE TYPE:	Water	Water	Water	Water	Water
			DATE SAMPLED:	2020-02-28	2020-02-28	2020-02-28	2020-02-28	2020-02-28
Parameter	Unit	G / S	RDL	981670	981689	981690	981691	981692
Dissolved Mercury	ug/L		0.026	<0.026	<0.026	<0.026	<0.026	<0.026

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
Analysis performed at AGAT Halifax (unless marked by *)

<Original signed by>

Certified By:

AGAT Laboratories
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St. John's, NL
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Certificate of Analysis

AGAT WORK ORDER: 20K579897
PROJECT: 80018.05

CLIENT NAME: GEMTEC LIMITED
SAMPLING SITE:
ATTENTION TO: Carolyn Anstey-Moore
SAMPLED BY:

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2020-03-02
DATE REPORTED: 2020-03-12

			SAMPLE DESCRIPTION:	MW3	MW6	MW2	MW7	MW8
			SAMPLE TYPE:	Water	Water	Water	Water	Water
			DATE SAMPLED:	2020-02-28	2020-02-28	2020-02-28	2020-02-28	2020-02-28
Parameter	Unit	G / S	RDL	981670	981689	981690	981691	981692
pH				7.01	8.01	6.67	6.42	7.94
Reactive Silica as SiO2	mg/L		0.5	6.6	8.3	6.3	6.4	12.2
Chloride	mg/L		1	3	3	2	2	4
Fluoride	mg/L		0.12	<0.12	<0.12	<0.12	<0.12	<0.12
Sulphate	mg/L		2	<2	7	<2	<2	14
Alkalinity	mg/L		5	52	138	24	35	133
True Color	TCU		5	7	<5	<5	116	19
Turbidity	NTU		0.1	44.6	15.9	1510	2780	16.3
Electrical Conductivity	umho/cm		1	122	298	50	84	325
Nitrate + Nitrite as N	mg/L		0.05	0.14	0.06	<0.05	<0.05	<0.05
Nitrate as N	mg/L		0.05	0.14	0.06	<0.05	<0.05	<0.05
Nitrite as N	mg/L		0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ammonia as N	mg/L		0.03	0.04	0.04	<0.03	0.51	0.04
Total Organic Carbon	mg/L		0.5	<0.5	<0.5	5.6	29.4	20.6
Ortho-Phosphate as P	mg/L		0.01	<0.01	<0.01	<0.01	<0.01	0.01
Dissolved Sodium	mg/L		0.1	3.0	4.2	2.0	1.3	28.5
Dissolved Potassium	mg/L		0.1	0.3	0.2	<0.1	0.3	1.0
Dissolved Calcium	mg/L		0.1	14.5	42.7	5.3	9.8	29.2
Dissolved Magnesium	mg/L		0.1	3.0	4.7	0.5	0.7	6.7
Bicarb. Alkalinity (as CaCO3)	mg/L		5	52	138	24	35	133
Carb. Alkalinity (as CaCO3)	mg/L		10	<10	<10	<10	<10	<10
Hydroxide	mg/L		5	<5	<5	<5	<5	<5
Calculated TDS	mg/L		1	58	145	24	43	164
Hardness	mg/L			48.6	126	15.3	27.4	101
Langelier Index (@20C)	NA			-1.68	0.18	-2.75	-2.60	-0.08
Langelier Index (@ 4C)	NA			-2.00	-0.14	-3.07	-2.92	-0.40
Saturation pH (@ 20C)	NA			8.69	7.83	9.42	9.02	8.02
Saturation pH (@ 4C)	NA			9.01	8.15	9.74	9.34	8.34
Anion Sum	me/L			1.13	2.99	0.54	0.76	3.06
Cation sum	me/L			1.19	2.71	0.40	0.94	3.30

<Original signed by>

Certified By: ____________________

Laboratories

Certificate of Analysis

AGAT WORK ORDER: 20K579897

PROJECT: 80018.05

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St. John's, NL
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CLIENT NAME: GEMTEC LIMITED

ATTENTION TO: Carolyn Anstey-Moore

SAMPLING SITE:

SAMPLED BY:

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2020-03-02

DATE REPORTED: 2020-03-12

Parameter	Unit	G / S	RDL	MW3	MW6	MW2	MW7	MW8
			SAMPLE TYPE:	Water	Water	Water	Water	Water
			DATE SAMPLED:	2020-02-28	2020-02-28	2020-02-28	2020-02-28	2020-02-28
				981670	981689	981690	981691	981692
% Difference/ Ion Balance	%			2.4	5.0	14.8	10.9	3.7
Dissolved Aluminum	ug/L		5	<5	<5	7	278	8
Dissolved Antimony	ug/L		2	<2	<2	<2	<2	<2
Dissolved Arsenic	ug/L		2	<2	<2	<2	8	4
Dissolved Barium	ug/L		5	187	14	5	13	77
Dissolved Beryllium	ug/L		2	<2	<2	<2	<2	<2
Dissolved Bismuth	ug/L		2	<2	<2	<2	<2	<2
Dissolved Boron	ug/L		5	<5	<5	<5	<5	11
Dissolved Cadmium	ug/L		0.017	0.040	<0.017	0.024	<0.017	0.047
Dissolved Chromium	ug/L		1	2	2	1	2	2
Dissolved Cobalt	ug/L		1	3	<1	<1	1	1
Dissolved Copper	ug/L		2	4	<2	5	<2	<2
Dissolved Iron	ug/L		50	1100	<50	<50	6800	<50
Dissolved Lead	ug/L		0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dissolved Manganese	ug/L		2	1070	4	94	457	532
Dissolved Molybdenum	ug/L		2	4	3	<2	<2	34
Dissolved Nickel	ug/L		2	9	<2	3	2	<2
Dissolved Phosphorus	mg/L		0.02	<0.02	<0.02	<0.02	0.07	0.09
Dissolved Selenium	ug/L		1	<1	<1	<1	<1	<1
Dissolved Silver	ug/L		0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Strontium	ug/L		5	21	63	14	19	176
Dissolved Thallium	ug/L		0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Tin	ug/L		2	<2	<2	<2	<2	<2
Dissolved Titanium	ug/L		2	<2	<2	<2	4	<2
Dissolved Uranium	ug/L		0.1	<0.1	0.6	<0.1	0.2	1.4
Dissolved Vanadium	ug/L		2	<2	<2	<2	<2	<2
Dissolved Zinc	ug/L		5	12	<5	7	38	<5

<Original signed by>

Certified By: _

AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 20K579897
PROJECT: 80018.05

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CLIENT NAME: GEMTEC LIMITED
SAMPLING SITE:

ATTENTION TO: Carolyn Anstey-Moore
SAMPLED BY:

Standard Water Analysis + Dissolved Metals

DATE RECEIVED: 2020-03-02   DATE REPORTED: 2020-03-12

Comments:	RDL - Reported Detection Limit; G / S - Guideline / Standard
981670-981689	Metals analysis completed on a filtered sample.
981690-981691	Metals analysis completed on a filtered sample. The cation and anion sums are at, or below, 1 me/L, therefore the acceptable criteria is a difference of less than 0.3me/L.
981692	Metals analysis completed on a filtered sample.

Analysis performed at AGAT Halifax (unless marked by *)

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Certified By:

Certificate of Analysis

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CLIENT NAME: GEMTEC LIMITED

ATTENTION TO: Carolyn Anstey-Moore

SAMPLING SITE:

SAMPLED BY:

TSS

DATE RECEIVED: 2020-03-02

DATE REPORTED: 2020-03-12

			SAMPLE DESCRIPTION:	MW3	MW6	MW2	MW7	MW8
			SAMPLE TYPE:	Water	Water	Water	Water	Water
			DATE SAMPLED:	2020-02-28	2020-02-28	2020-02-28	2020-02-28	2020-02-28
Parameter	Unit	G / S	RDL	981670	981689	981690	981691	981692
Total Suspended Solids	mg/L		5	32	32	1200	2860	41

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT St John's (unless marked by *)

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Certified By:

Certificate of Analysis

AGAT WORK ORDER: 20K579897

PROJECT: 80018.05

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CLIENT NAME: GEMTEC LIMITED

ATTENTION TO: Carolyn Anstey-Moore

SAMPLING SITE:

SAMPLED BY:

Total Phosphorus

DATE RECEIVED: 2020-03-02

DATE REPORTED: 2020-03-12

			SAMPLE DESCRIPTION:	MW3	MW6	MW2	MW7	MW8
			SAMPLE TYPE:	Water	Water	Water	Water	Water
			DATE SAMPLED:	2020-02-28	2020-02-28	2020-02-28	2020-02-28	2020-02-28
Parameter	Unit	G / S	RDL	981670	981689	981690	981691	981692
Total Phosphorous as P	mg/L		0.03	0.07	0.11	2.76	3.18	0.30

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Halifax (unless marked by *)

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Certified By:

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Quality Assurance

CLIENT NAME: GEMTEC LIMITED
PROJECT: 80018.05
SAMPLING SITE:

AGAT WORK ORDER: 20K579897
ATTENTION TO: Carolyn Anstey-Moore
SAMPLED BY:

Water Analysis

RPT Date: Mar 12, 2020			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
Standard Water Analysis + Dissolved Metals															
pH	985412		7.94	7.97	0.4%	<	101%	80%	120%	NA	80%	120%	NA	80%	120%
Reactive Silica as SiO2	981952		2.9	3.2	10.5%	< 0.5	100%	80%	120%	101%	80%	120%	102%	80%	120%
Chloride	981481		<1	<1	NA	< 1	84%	80%	120%	NA	80%	120%	92%	70%	130%
Fluoride	981481		<0.12	<0.12	NA	< 0.12	91%	80%	120%	NA	80%	120%	86%	70%	130%
Sulphate	981481		<2	<2	NA	< 2	108%	80%	120%	NA	80%	120%	98%	70%	130%
Alkalinity	985412		108	108	0.3%	< 5	92%	80%	120%	NA			NA		
True Color	981670	981670	7	<5	NA	< 5	115%	80%	120%	NA			NA		
Turbidity	981670	981670	44.6	46.7	4.6%	<0.1	99%	80%	120%	NA			NA		
Electrical Conductivity	985412		245	246	0.4%	< 1	102%	90%	110%	NA			NA		
Nitrate as N	981481		<0.05	<0.05	NA	< 0.05	100%	80%	120%	NA	80%	120%	94%	70%	130%
Nitrite as N	981481		<0.05	<0.05	NA	< 0.05	90%	80%	120%	NA	80%	120%	98%	70%	130%
Ammonia as N	993527		0.06	<0.03	NA	< 0.03	103%	80%	120%	97%	80%	120%	99%	70%	130%
Total Organic Carbon	974095		2.0	2.0	NA	< 0.5	95%	80%	120%	NA	80%	120%	106%	80%	120%
Ortho-Phosphate as P	981952		<0.01	<0.01	NA	<0.01	98%	80%	120%	102%	80%	120%	98%	80%	120%
Dissolved Sodium	981692	981692	28.5	27.6	3.3%	< 0.1	95%	80%	120%	99%	80%	120%	93%	70%	130%
Dissolved Potassium	981692	981692	1.0	1.0	5.2%	< 0.1	100%	80%	120%	100%	80%	120%	82%	70%	130%
Dissolved Calcium	981692	981692	29.2	28.7	1.7%	< 0.1	102%	80%	120%	104%	80%	120%	NA	70%	130%
Dissolved Magnesium	981692	981692	6.7	6.3	5.7%	< 0.1	99%	80%	120%	103%	80%	120%	NA	70%	130%
Bicarb. Alkalinity (as CaCO3)	985412		108	108	0.3%	< 5	NA	80%	120%	NA	80%	120%	NA	80%	120%
Carb. Alkalinity (as CaCO3)	985412		<10	<10	NA	< 10	NA	80%	120%	NA	80%	120%	NA	80%	120%
Hydroxide	985412		<5	<5	NA	< 5	NA	80%	120%	NA	80%	120%	NA	80%	120%
Dissolved Aluminum	981692	981692	8	7	NA	< 5	96%	80%	120%	103%	80%	120%	84%	70%	130%
Dissolved Antimony	981692	981692	<2	<2	NA	< 2	80%	80%	120%	101%	80%	120%	94%	70%	130%
Dissolved Arsenic	981692	981692	4	4	NA	< 2	93%	80%	120%	98%	80%	120%	98%	70%	130%
Dissolved Barium	981692	981692	77	74	3.2%	< 5	98%	80%	120%	100%	80%	120%	NA	70%	130%
Dissolved Beryllium	981692	981692	<2	<2	NA	< 2	96%	80%	120%	105%	80%	120%	114%	70%	130%
Dissolved Bismuth	981692	981692	<2	<2	NA	< 2	110%	80%	120%	117%	80%	120%	82%	70%	130%
Dissolved Boron	981692	981692	11	12	NA	< 5	92%	80%	120%	100%	80%	120%	110%	70%	130%
Dissolved Cadmium	981692	981692	0.047	0.052	NA	< 0.017	91%	80%	120%	95%	80%	120%	94%	70%	130%
Dissolved Chromium	981692	981692	2	2	NA	< 1	98%	80%	120%	100%	80%	120%	94%	70%	130%
Dissolved Cobalt	981692	981692	1	1	NA	< 1	97%	80%	120%	100%	80%	120%	99%	70%	130%
Dissolved Copper	981692	981692	<2	<2	NA	< 2	99%	80%	120%	101%	80%	120%	92%	70%	130%
Dissolved Iron	981692	981692	<50	<50	NA	< 50	80%	80%	120%	81%	80%	120%	83%	70%	130%
Dissolved Lead	981692	981692	<0.5	<0.5	NA	< 0.5	100%	80%	120%	103%	80%	120%	90%	70%	130%
Dissolved Manganese	981692	981692	532	523	1.7%	< 2	80%	80%	120%	82%	80%	120%	NA	70%	130%
Dissolved Molybdenum	981692	981692	34	35	3.1%	< 2	92%	80%	120%	95%	80%	120%	NA	70%	130%
Dissolved Nickel	981692	981692	<2	<2	NA	< 2	99%	80%	120%	99%	80%	120%	96%	70%	130%
Dissolved Phosphorus	981692	981692	0.09	0.08	NA	< 0.02	88%	80%	120%	101%	80%	120%	NA	70%	130%
Dissolved Selenium	981692	981692	<1	<1	NA	< 1	91%	80%	120%	96%	80%	120%	130%	70%	130%

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Quality Assurance

CLIENT NAME: GEMTEC LIMITED
PROJECT: 80018.05
SAMPLING SITE:

AGAT WORK ORDER: 20K579897
ATTENTION TO: Carolyn Anstey-Moore
SAMPLED BY:

Water Analysis (Continued)

RPT Date: Mar 12, 2020			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
Dissolved Silver	981692	981692	<0.1	<0.1	NA	< 0.1	95%	80%	120%	109%	80%	120%	NA	70%	130%
Dissolved Strontium	981692	981692	176	175	0.5%	< 5	80%	80%	120%	81%	80%	120%	NA	70%	130%
Dissolved Thallium	981692	981692	<0.1	<0.1	NA	< 0.1	107%	80%	120%	110%	80%	120%	99%	70%	130%
Dissolved Tin	981692	981692	<2	<2	NA	< 2	91%	80%	120%	96%	80%	120%	93%	70%	130%
Dissolved Titanium	981692	981692	<2	<2	NA	< 2	98%	80%	120%	102%	80%	120%	84%	70%	130%
Dissolved Uranium	981692	981692	1.4	1.3	3.9%	< 0.1	112%	80%	120%	117%	80%	120%	103%	70%	130%
Dissolved Vanadium	981692	981692	<2	<2	NA	< 2	99%	80%	120%	98%	80%	120%	99%	70%	130%
Dissolved Zinc	981692	981692	<5	<5	NA	< 5	95%	80%	120%	96%	80%	120%	93%	70%	130%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Mercury Analysis in Water (Dissolved)

PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Lower	Upper	Recovery	Lower	Upper	Recovery	Lower	Upper
Dissolved Mercury	988811		<0.00005	<0.00005	NA	< 0.026	93%	80%	120%		80%	120%	110%	70%	130%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Total Phosphorus

PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Lower	Upper	Recovery	Lower	Upper	Recovery	Lower	Upper
Total Phosphorous as P	967760		0.34	0.34	0.3%	0.07	99%	80%	120%	100%	80%	120%	74%	70%	130%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

TSS

PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Lower	Upper	Recovery	Lower	Upper	Recovery	Lower	Upper
Total Suspended Solids	974359		140	140	0.0%	< 5	95%	80%	120%				111%	80%	120%

Cyanide, Strong and Weak Acid Dissociable (SAD and WAD)

PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Lower	Upper	Recovery	Lower	Upper	Recovery	Lower	Upper
Cyanide (SAD)	987139		0.003	0.003	NA	< 0.002	92%	70%	130%	100%	90%	110%	108%	70%	130%
Cyanide (WAD)	987139		0.005	0.005	NA	< 0.002	109%	70%	130%	92%	90%	110%	108%	70%	130%

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.

<Original signed by>

Certified By:

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Method Summary

CLIENT NAME: GEMTEC LIMITED
PROJECT: 80018.05
SAMPLING SITE:

AGAT WORK ORDER: 20K579897
ATTENTION TO: Carolyn Anstey-Moore
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Cyanide (SAD)	INOR-181-6010	EPA 335.3	CONTINUOUS FLOW ANALYZER
Cyanide (WAD)	INOR-181-6010	EPA 335.3	CONTINUOUS FLOW ANALYZER
Dissolved Mercury	MET-121-6100 & MET-121-6107	SM 3112 B	CV/AA
pH	INOR-121-6001	SM 4500 H+B	PC TITRATE
Reactive Silica as SiO2	INOR-121-6027	SM 4500-SiO2 F	COLORIMETER
Chloride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Alkalinity	INOR-121-6001	SM 2320 B	
True Color	INOR-121-6014	SM 2120 C	NEPHELOMETER
Turbidity	INOR-121-6022	SM 2130 B	NEPHELOMETER
Electrical Conductivity	INOR-121-6001	SM 2510 B	PC TITRATE
Nitrate + Nitrite as N	INORG-121-6005	SM 4110 B	CALCULATION
Nitrate as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INORG-121-6005	SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-121-6047	SM 4500-NH3 H	COLORIMETER
Total Organic Carbon	INOR-121-6026	SM 5310 B	TOC ANALYZER
Ortho-Phosphate as P	INOR-121-6012	SM 4500-P G	COLORIMETER
Dissolved Sodium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Potassium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Calcium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Magnesium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Bicarb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Carb. Alkalinity (as CaCO3)	INORG-121-6001	SM 2320 B	PC TITRATE
Hydroxide	INORG-121-6001	SM 2320 B	PC-TITRATE
Calculated TDS	CALCULATION	SM 1030E	CALCULATION
Hardness	CALCULATION	SM 2340B	CALCULATION
Langelier Index (@20C)	CALCULATION	CALCULATION	CALCULATION
Langelier Index (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 20C)	CALCULATION	CALCULATION	CALCULATION
Saturation pH (@ 4C)	CALCULATION	CALCULATION	CALCULATION
Anion Sum	CALCULATION	SM 1030E	CALCULATION
Cation sum	CALCULATION	SM 1030E	CALCULATION
% Difference/ Ion Balance	CALCULATION	SM 1030E	CALCULATION
Dissolved Aluminum	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Antimony	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Arsenic	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Barium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Beryllium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Bismuth	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS

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Method Summary

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AGAT WORK ORDER: 20K579897
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SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Dissolved Boron	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Cadmium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Chromium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Cobalt	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Copper	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Iron	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Lead	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Manganese	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Molybdenum	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Nickel	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Phosphorus	MET-121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Selenium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Silver	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Strontium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Thallium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Tin	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Titanium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Uranium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Vanadium	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Dissolved Zinc	MET121-6104 & MET-121-6105	modified from SM 3125/SM 3030 B/SM 3030 D	ICP-MS
Total Suspended Solids	INOR-123-6006	Based on SM 2540D	GRAVIMETRIC
Total Phosphorous as P	INOR-121-6046	SM 4500-P H, EPA 365.4	COLORIMETER

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Chain of Custody Record

Laboratory Use Only

Arrival Condition: ☑ Good ☐ Poor (see notes)

Arrival Temperature: 4.1, 4.2, 5.8

Hold Time:

AGAT Job Number: 20K579897

Notes:

Report Information

Company: Gemtec Consulting Engineers and Scientists Ltd.

Contact: Carolyn Anstey-Moore

Address: 10 Maverick Place
Paradise, NL, A1L 0J1

Phone: 709 693-9171 Fax:

Client Project #: 80018.05

AGAT Quotation: GEMTEC SOA #306598BP

Please Note: If quotation number is not provided client will be billed full price for analysis.

Report Information (Please print):

1. Name: Carolyn Anstey-Moore
   Email: carolyn.anstey-moore@gemtec.ca
2. Name:
   Email:

Report Format

☐ Single Sample per page
☑ Multiple Samples per page
☑ Excel Format Included

Turnaround Time Required (TAT)

Regular TAT ☑ 5 to 7 working days

Rush TAT ☐ Same day ☐ 1 day ☐ 2 days ☐ 3 days

Date Required:

Invoice To Same Yes ☐ / No ☐

Company: GEMTEC

Contact: GEMTEC Accounts Payable

Address: email: accountspayable@gemtec.ca

Phone: Fax:

PO/Credit Card#: 80018.05

Regulatory Requirements (Check):

☐ List Guidelines on Report ☑ Do not list Guidelines on Report

☐ PIRI
☐ Tier 1 ☐ Tier 2 ☐ Gas
☐ Res ☐ Com ☐ Fuel ☐ Lube
☐ Pot ☐ N/Pot
☐ Coarse ☐ Fine

☐ CCME
☐ Industrial ☐ Commercial ☐ Res/Park ☐ Agricultural ☐ FWAL ☐ Sediment

☐ CDWQ ☐ NL DOEC GW ☐ NLDOEC Discharge ☐ Other

Drinking Water Sample: ☐ Yes ☐ No Salt Water: ☐ Yes ☐ No

Reg. No.:

Sample Identification	Date/Time Sampled	Sample Matrix	# Containers	Comments – Site/Sample Info. Sample Containment	Field Filtered/Preserved	Standard Water Analysis	Metals: ☐ Total ☑ Diss ☐ Available	Mercury	☐ BOD ☐ CBOD	pH	☑ TSS ☐ TDS ☐ VSS	TKN	Total Phosphorus	Phenols	Tier 1: TPH/BTEX (PIRI) ☐ low level	Tier 2: TPH/BTEX Fractionation	CCME-CWS TPH/BTEX	VOC	THM	HAA	PAH	PCB	TC + EC ☐ P/A ☐ MPN ☐ MF	☐ HPC ☐ Pseudomonas	Fecal Coliform ☐ MPN ☐ MF	Other: Cyanide (strong and weak acid	Other: Radium 226 - SRC	Hazardous (Y/N)
MW3	Feb 28/ 2020	Water	7		X	☑	☑	☑			☑		☑													☑	☑	
MW6	Feb 28/ 2020	Water	7		X	☑	☑	☑			☑		☑													☑	☑	
MW2	Feb 28/ 2020	Water	7		X	☑	☑	☑			☑		☑													☑	☑	
MW7	Feb 28/ 2020	Water	7		X	☑	☑	☑			☑		☑													☑	☑	
MW8	Feb 28/ 2020	Water	7		X	☑	☑	☑			☑		☑													☑	☑	

Samples Relinquished By (Print Name): Leanne Stein Date/Time

Samples Relinquished By (Sign): <Original signed by> Date/Time Mar 2/2020

Samples Received By (Print Name): <Original signed by> Date/Time 03/02/20 Date/Time 13:25

Pink Copy - Client
Yellow Copy - AGAT
White Copy- AGAT

Page ☐ of ☐

Nº:

Date revised March 16, 2018

SASKATCHEWAN RESEARCH COUNCIL

Environmental Analytical Laboratories
143-111 Research Drive, Saskatoon, SK Canada S7N 3R2

T: 306-933-6932 F: 306-933-7922
Toll-free: 1-800-240-8808
E: analytical@src.sk.ca

www.src.sk.ca/analytical

SRC Group # 2020-2479

Mar 11, 2020

AGAT Laboratories
122-11 Morris Drive
Dartmouth, NS B3B 1M2
Attn:

Date Samples Received: Mar-04-2020 Client P.O.: 155112

All results have been reviewed and approved by a Qualified Person in accordance with the Saskatchewan Environmental Code, Corrective Action Plan Chapter, for the purposes of certifying a laboratory analysis

Results from Lab Section 4 authorized by Vicky Snook, Supervisor

---

* Test methods and data are validated by the laboratory's Quality Assurance Program.

* Routine methods follow recognized procedures from sources such as
    * Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF
    * Environment Canada
    * US EPA
    * CANMET

* The results reported relate only to the test samples as provided by the client.

* Samples will be kept for 30 days after the final report is sent. Please contact the lab if you have any special requirements.

* Additional information is available upon request.

* Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

This is a final report.

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SRC Group # 2020-2479

Mar 11, 2020

AGAT Laboratories

122-11 Morris Drive
Dartmouth, NS B3B 1M2
Attn:

Date Samples Received: Mar-04-2020

Client P.O.: 155112

11696	**02/28/2020**	**20K579897-981670**	***WATER***
11697	**02/28/2020**	**20K579897-981689**	***WATER***
11698	**02/28/2020**	**20K579897-981690**	***WATER***

Analyte	Units	11696	11697	11698
Lab Section 4				
Radium-226	Bq/L	<0.005	<0.005	0.05

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 7.6 °C upon receipt.

SRC SASKATCHEWAN RESEARCH COUNCIL

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SRC Group # 2020-2479

Mar 11, 2020

AGAT Laboratories

11699 02/28/2020 20K579897-981691 *WATER*
11700 02/28/2020 20K579897-981692 *WATER*

Analyte	Units	11699	11700
Lab Section 4			
Radium-226	Bq/L	0.16	<0.005

Symbol of "<" means "less than". This indicates that it was not detected at level stated above.

The temperature of the cooler was 7.6 °C upon receipt.

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SRC Group # 2020-2479

Mar 11, 2020

AGAT Laboratories

Analyte Methods

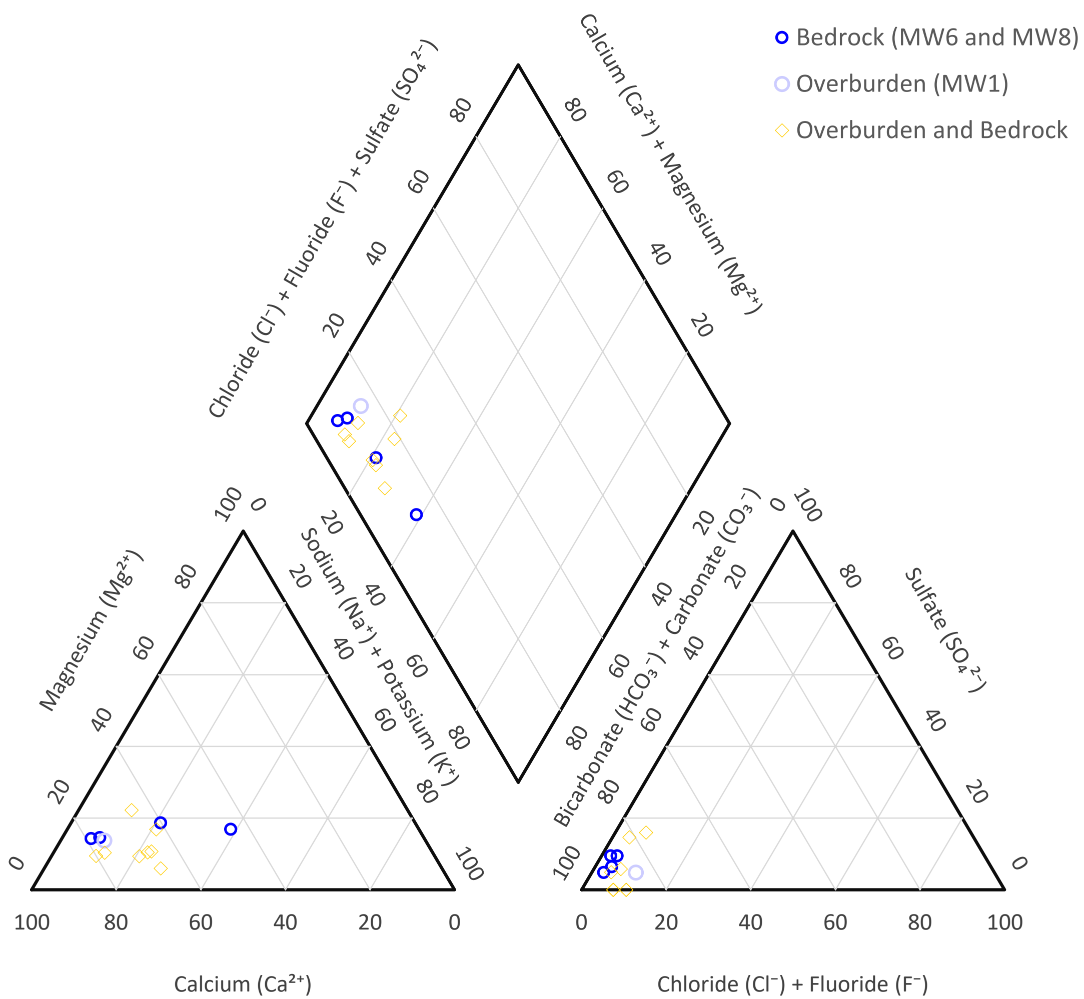
Name	Units	Method
Radium-226	Bq/L	Rad-105

APPENDIX K

Piper Plot

Title: **Piper Plot - 2019 Monitoring Wells**

Project: Hydrogeology Baseline Report
Marathon Valentine Gold Project, Central Newfoundland



experience • knowledge • integrity

civil	civil
geotechnical	géotechnique
environmental	environnementale
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

expérience • connaissance • intégrité