Appendix G8

2017 Groundwater Monitoring Program Report

MEADOWBANK GOLD PROJECT

Groundwater Monitoring Plan

In Accordance with Water License 2AM-MEA1525

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 8
November 2017

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EXECUTIVE SUMMARY

This Groundwater Monitoring Plan presents the historic of groundwater monitoring at Meadowbank mine since 2003, the extensive groundwater monitoring campaign achieved on site in 2017, and a proposed groundwater monitoring program adapted for in-pit deposition operations that will potentially begin in 2019. Moreover, this document reviews methodology and best practices for drilling, well installation and groundwater sampling, especially in the arctic climate.

The annual monitoring plan is a requirement for the Meadowbank Type A Water License No. 2AM-MEA1525 and is a continuation of previous Monitoring Plans.

The following activities were fulfilled in 2017:

- Agnico Eagle received technical advice and field services from an experts firm in the field of hydrogeology and geochemistry to improve the data collected for water quality model updates, as it was suggested by Environment and Climate Change Canada (ECCC). The whole groundwater monitoring program was revisited in 2017;

- The 2017 groundwater monitoring program included the following seventeen (17) monitoring stations, specifically: two (2) groundwater observation wells (MW-08-02 and MW-16-01), two (2) lakes, seven (7) wall seepages, four (4) dike seepages, one (1) pit sump, and one (1) reclaim water;

- A total of twenty-nine (29) water samples were collected in the course of two sampling campaigns which includes twenty-four (24) groundwater samples and five (5) surface water samples;

- The sampling program was repeated twice over the summer as well as low-flow sampling techniques, with duplicate, field blanks, and transport blanks;

- Formation of thick ice bridges in the annular space challenged the sampling of wells MW-08-02 again this year.

Groundwater chemistry data is used to predict the quality of water accumulating in open pits, and to determine any effects of mining on groundwater quality, particularly with respect to tailings deposition.

Groundwater sampling is carried out twice annually. Analytical parameters will comply as per Schedule 1, Table 1, Group 2 of the Meadowbank Water License. Quality Assurance/Quality Control procedures will be implemented during each sampling event.

The installation of three (3) new groundwater monitoring wells is proposed at strategic locations, based on groundwater numerical simulation results aiming to reproduce in-pit deposition conditions. Moreover, methods to obtain representative groundwater samples and improve well designs under artic climate continue to be investigated.

A groundwater monitoring report will be submitted by Agnico Eagle Mines Limited to the Nunavut Water Board (NWB) with each Annual Report. This report will include all data from the previous year's results as well as a historical record, dates and methods of sampling, and an assessment of the data obtained with particular regards to salinity parameters and indicators of tailings reclaim water movement, with respect to total cyanide and dissolved copper.

IMPLEMENTATION SCHEDULE

This Plan will be implemented immediately (2018) subject to any modifications proposed by the NWB as a result of the review and approval process.

DISTRIBUTION LIST

AGNICO EAGLE – Geology Superintendent

AGNICO EAGLE – Engineering Superintendent

AGNICO EAGLE – Geotechnical Engineer

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DOCUMENT CONTROL

Version	Date (YMD)	Section	Revision
1	08/08/08		Comprehensive plan for Meadowbank Project
2	09/03/31	all	Comprehensive update of plan to include 2008 well installations
3	11/12/14		Update Executive Summary; insert Figure 1; update Table 1; addition of information on wells created in 2011; include well installation section;
4	14/01		Update Executive Summary; update Section 1.2 to reflect current wells; add Section 3.3 and 3.4 (seep and production drill hole sampling methods); update Section 5 (additional reporting on tailings-related parameters)
5	15/04	1.3 and 3.3 2.3	Sampling of pit wall seeps discontinued. Sampling of Goose Pit sump added. Updated with installation information for new well.
6	15/09	4.1 and 4.2	Updated list of analyse parameters. QAQC Section to include Trip and Field Blank Remove Goose Pit sump as monitoring station
7	17/03	Section 1.5, 3, 5 and 6	Add Section 5 and 6 and modify section 1.5 and 3
8	17/11	all	Comprehensive update

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1 INTRODUCTION

The annual monitoring plan is a requirement for Meadowbank Type A Water License No. 2AM-MEA1525.

This document is the 8th version of the Groundwater Monitoring Plan for Meadowbank Mine. This version presents an update of the groundwater monitoring program described in Version 7 (AEM, 2017).

This version relates the historic of groundwater monitoring at Meadowbank mine since 2003, presents the extensive groundwater monitoring campaign achieved on site in 2017, and proposed a groundwater monitoring program adapted for in-pit deposition that will begin in early 2019. Moreover, this document reviews methodology and best practices for drilling, well installation and groundwater sampling, especially in the arctic climate.

1.1 PURPOSE OF GROUNDWATER MONITORING

Groundwater data is used as a tool to predict the chemistry of water accumulating in open pits and to determine any effects of mining on groundwater quality, particularly with respect to tailings deposition activities. To this end, groundwater monitoring wells have been installed to sample groundwater in open talik areas, where unfrozen ground extends beneath large lakes. No groundwater monitoring wells is installed at the Vault Deposit, as the Vault Pit is developed in an area of permafrost.

Groundwater monitoring has traditionally been conducted using installed monitoring wells, but difficulties in obtaining representative samples by this method prompted the investigation of alternative methods from 2013 to 2016 based on technical advices from firms of experts. Nevertheless, groundwater samples are still collected in operable monitoring wells.

In 2017, the whole groundwater monitoring program was revisited, as suggested by Environment and Climate Change Canada (ECCC), to improve the data collected for water quality model updates. Due to sustained difficulties in maintaining and sampling monitoring wells, Agnico Eagle received technical advice and field services from a firm of experts, to optimize low-flow sampling techniques as well as further sampling improvements and pursued opportunities for sampling groundwater from alternative methods as well as the existing wells. An extensive monitoring program campaign took place in 2017 to collect representative samples across the mine site to understand the groundwater background geochemistry and the potential interaction between groundwater and surface water especially in relation to tailing migration.

The next phase for 2018 is to prepare a groundwater program that will ensure groundwater monitoring in relation to tailing deposition inside existing pits at Meadowbank that will potentially begin in 2019.

1.2 TAILING STORAGE FACILITY EXPANSION AT MEADOWBANK

Since 2015, Agnico Eagle is working on diverse options to accommodate additional tailings storage facility at Meadowbank. After a Multi-Account Assessment (MAA), the In-Pit Tailings Deposition (IPD) was selected as the preferred option to store tailings waste produced from Whale Tail Mine in addition to its current tailings storage facilities (TSF). IDP demonstrated superior performance capacities in the following categories: health and safety, quality of life, water, air, capital cost, technology, natural hazards, and adaptability (SNC-Lavalin, 2016; 2017a).

To ensure the environment protection and evaluate potential risks for tailing migration into groundwater, a feasibility study was conducted by SNC-Lavalin professionals in 2016-2017 (SNC-Lavalin, 2017a). The feasibility study included a complementary characterization of the geological structures and permafrost extent on site and the development of a detailed hydrogeological numerical 3D model. The numerical simulations were designed to represent the worst-case scenarios in terms of contaminant transport within the aquifers. Therefore, a groundwater monitoring program can be designed in relation to the groundwater flow and contaminant transport simulation results.

1.3 FUTURE GROUNDWATER MONITORING PROGRAM ADAPTED FOR IN-PIT DEPOSITION AT MEADOWBANK

Meadowbank groundwater monitoring program will be adapted to IDP. After regulators' approval, IPD could begin in Q1-2019 with a daily filling rate of 9,000 tons of dry tailings. IPD would start in Goose Pit, already mine out, followed by an alternate filling of Portage Pit A and Pit E (SNC-Lavalin, 2017a).

Future groundwater monitoring program will be adapted for IPD at Meadowbank. The installation of three (3) new groundwater monitoring wells is proposed at strategic locations, based on groundwater numerical simulation results and 2017 borehole data. Moreover, methods to obtain representative groundwater samples and improve well designs under artic climate continue to be investigated. The groundwater monitoring program will be updated as the project progresses. New information from the hydrogeological numerical model and from hydrogeological field data will be integrated throughout.

2 GROUNDWATER MONITORING PROGRAM

2.1 GROUNDWATER MONITORING PROGRAM 2003-2016

Groundwater data is used as a tool to predict the chemistry of water accumulating in open pits, and to determine any effects of mining on groundwater quality particularly with respect to tailings deposition activities. Important components surveyed are chloride concentrations, salinity and Total Dissolved Solid (TDS) calculated via conductivity measurements. Copper and cyanide are also monitored to trace potential effects of mining operations on groundwater quality. To this end, groundwater monitoring wells have been installed to sample groundwater in open talik areas, where unfrozen ground extends beneath large lakes. No groundwater monitoring wells are installed at the Vault Deposit, as the Vault Pit is developed in an area of permafrost.

Groundwater samples have traditionally been collected in monitoring wells. From 2003 to 2016, fourteen (14) monitoring wells were installed at Meadowbank mine. Throughout these years, thirty four (34) groundwater samples, twenty-one (21) duplicates were collected from these wells. Moreover, for quality insurance three (3) field blanks and 1 transport blank were also collected in the field.

Well installation and representative groundwater collection have been a major challenge under artic conditions in permafrost environment. Some of the challenges were:

- Well damaged by frost action;
- Heat traces malfunctioning, therefore ice bridges forming in well annulus;
- Well damaged during site operations;
- Well obstructed with development material, once again due to frost action.

Despite multiple attempts to overcome these challenges, the collection of representative groundwater sampled was unsuccessful for most problematic wells. For example, saline solution was used to melt ice bridges formed in well annulus. The concentration of saline solution required to unplug the well could not be purged afterwards, the groundwater flow was not sufficient and the amount of time that would have been required to purge the well unrealistic under permafrost conditions.

Since well installation and representative groundwater samples collection has been a tremendous challenge at Meadowbank, alternative methods to obtain representative groundwater samples were investigated from 2013 to 2016 (see 2012 Groundwater Monitoring Report and recommendations by Golder Associates). Alternative groundwater monitoring stations investigated includes: pit wall seepages, production drill holes, pit sumps, horizontal wells installed into pit walls, and temporary wells for pit dewatering.

From 2013 to 2016, six (6) groundwater samples were collected from horizontal wells installed in Pit E southeastern wall, one (1) sample from a temporary well for pit dewatering, two (2) samples from pit sumps during exploitation and one (1) production borehole.

Although production and preshear drill holes with sufficient flow rates only occurred on occasion, when sufficient groundwater flow was encountered, sampling was achieved. Moreover, a sample was collected from a temporary dewatering well (6 inches in diameter, 65 meters depth), installed in Pit E from July to August 2016, to reduce water table and ensure pit slope stability. Prior 2016, seepage from pit walls, commonly occurring at different locations, has indicated surface water rather than groundwater flow.

In 2017, only two (2) wells remain operable for groundwater sampling. Aside from the wells, none of the previous monitoring stations were available for sampling in 2017. Due to the difficulties encountered in maintaining and sampling monitoring wells, Agnico Eagle contracted experts to obtain technical advice on optimizing low-flow sampling techniques. Moreover, further sampling improvements and pursued opportunities for sampling groundwater from alternative sources as well as the existing wells were carried out. An extensive monitoring program campaign took place in 2017 to collect representative samples across the mine site to understand the groundwater background geochemistry and the potential interaction between groundwater and surface water especially in relation to tailing migration.

The next phase for 2018 is to prepare a groundwater program that will ensure groundwater monitoring in relation to tailing deposition inside the existing pits at Meadowbank.

The locations of each former and existing groundwater wells and other types of groundwater monitoring stations are provided in appendix A.

2.2 GROUNDWATER MONITORING PROGRAM ACHIEVED IN 2017

Two field visits were completed by a SNC-Lavalin professional in the course of summer 2017. A thorough investigation of the pit walls, mine infrastructures, dike seepages and groundwater monitoring stations network was achieved during the site visits. State of the art sampling techniques were performed and each sampling station, which were selected based on its contribution to the global understanding of groundwater quality. A photographic report is presented on Appendix B, showing the sampling procedures and the main water sampling stations. Twenty-nine (29) water samples were collected in the vicinity of Goose Pit, Portage Pit E and Pit A. The groundwater monitoring program 2017 aimed to:

- Improve the density and spatial distribution of groundwater monitoring stations and get representative samples;

- Investigate best practices to improve groundwater sampling methodologies;
- Achieve and repeat a complete groundwater sampling program as well as low-flow sampling techniques for licensing requirements;
- Collect groundwater chemical data required to understand the potential interaction between groundwater and surface water, especially in relation to tailing migration;
- Emit recommendations to improve the groundwater sampling program in the future.

Table 1 summarized the sample collected during the two site visits. In total, the stations sampled are represented by two (2) groundwater wells, two (2) lakes, seven (7) wall seepages, three (3) dike seepages, one (1) sump and one (1) reclaim water. A map illustrating the locations for each water sample is presented in Appendix A. The next section explains the context of each sampling station.

Table 1: Samples collected in 2017

Sample name	Location	Type	July 2017	August 2017
MW-16-01-100 m	Between Central Dump and Central Dike	Groundwater well	X	X
MW-16-01-20 m			X	X
MW-08-02 110 m	Southeast end of Central Dump		X	-
MW-08-02 150 m			X	X
SP-Lake	Second Portage Lake at 30 m depth (open talik)	Deep lake	X	-
Dog Leg Lake	Dog Leg Lake (close talik)		X	-
STS-5	Between Central Dike and MW-16-01	Dike seepage	X	X
ST8-North	Between Central Dump and East Dike		X	X
ST8-South			X	X
BG-Seepage-42 m	Goose Pit	Wall seepage	X	X
BG-Seepage-21 m			X	X
BG-seep-80 m			-	X
Pit A East Wall	Pit A		-	X
Pit A-Seepage			X	-
Pit E-seep-40 m	Pit E		-	X
Pit E-Seepage			X	X
Pit A- sump	Pit A	Pit Sump	-	X
BG Lagoon	West of Goose Pit	Sump/dyke seepage	X	X
ST-21 South	South Cell TSF	Reclaim water	-	X

2.3 MONITORING STATIONS AND SAMPLING METHODOLOGIES 2017

2.3.1 Monitoring well

Only two wells were operable in 2017. Installation details for operational monitoring wells (MW-16-01 and MW08-02) are provided in Appendix C. Details for all other decommissioned wells are presented in the Groundwater Monitoring Report related to the year of installation.

Formation of thick ice bridges in the annular space challenged the sampling of wells MW-08-02 again this year. Therefore, sampling protocols were different for the two wells and methodologies are described below.

2.3.1.1 MW-16-01

A portable double valve sampling pump (DVP) was installed permanently at approximately 95 meters down for the well so that the pump is installed in front of the screened interval. The well was purged to remove standing water inside the well and to induce a fresh groundwater flow from the rock formation by activating the DVP. The pump is activated by pushing compressed air into a ¼ inch Low Density Polyethylene (LDPE) tubing attached to the DVP. The in-situ physicochemical parameters are measured with a PCStestr 35 Oakton Probe that was calibrated prior usage. Purged water quality is monitored for pH, electrical conductivity, temperature, water clarity and colour (visual observation) during this operation. A minimum of 3 well volumes (volume of water between the in-well packer and bottom of screened interval) are to be removed prior sampling or until the monitored parameters stabilize (values remaining within 10% for three consecutive readings).

Groundwater sampling was carried out immediately after well purging with low-flow techniques. Groundwater samples were collected in clean, laboratory-supplied containers. Groundwater was sampled following quality control procedure on sampling and analysis described in section 2.5 and detailed in Appendix D.

2.3.1.2 MW-08-02

Well MW-08-02, installed 191 m below ground, has an ice bridge from 30 m to 150 m below ground. The ice blocking the well annulus was melted using a steamer and clean lake water. It took about 4 hours to melt 120 m of ice from the well. Following this procedure, the well remains free of ice for a maximum of 24 hours. To not waste any expensive equipment, the well was purged using compressed air push through a tube lowered 150 m down the well for another 4 hours. Then, the well was allowed to recover for 12 hours to a static water level before sampling. Afterwards, a 200 mL clean bailer was lowered 160 m below ground to retrieve a representative groundwater sample just above the screen interval. Groundwater sampling was carried out immediately after purging reading the in-situ parameters and sampling was carried out as mentioned in the previous section.

After interpreting the geochemical data, it can be stated that there is too much variability in some of the major elements to pursue the sampling of this well as is. Until the well can be free of ice for a period longer than 24 hours, to ensure a proper purge, there is no point trying to retrieve a groundwater samples from this well since it is never going to be truly representative of groundwater by using this methodology (steaming the well).

2.3.2 Dike seepage

The name "dike seepage" as a monitoring station applies to samples collected from dewatering wells (ST-8 North and ST-8 South), installed at the bedrock surface (6 m depth), to control dike seepages. It also includes sumps created naturally by dike seepage (ST-S-5) or sump found between dikes near rock stockpiles (BG Lagoon). In most cases, samples are collected through a tap connected to a dewatering pump.

These sampling stations can be monitored though time, contribute to the understanding of groundwater quality at the mine and can be added to the long term groundwater monitoring program.

2.3.3 Wall seepage

The name "wall seepage" as a monitoring station applies to groundwater collected on pit walls where water comes directly through the bedrock and where a small ¼ diameter LDPE tubing can be inserted into small fracture to prevent the sample to be in contact with the atmosphere. The groundwater runs through the tubing by gravity and physicochemical parameters are recorded and standard sampling procedures are followed.

These sampling stations can be monitored though time, contribute to the understanding of groundwater quality at the mine and can be added to the long term groundwater monitoring program until the pit will be decommissioned.

2.3.4 Pit sump

The name "Pit sump" as a monitoring station applies to groundwater collected at the bottom of a pit when groundwater filled a cavity during exploitation. After interpreting the geochemical data, it can be stated that there is too much ambiguity of the provenance of some elements found in these analysis to pursue the sampling of this well as is. Excavated ground is reworked and a lot of mine operations occur around the sumps such as drilling, blasting, and excavating. Moreover, the exact location of the sampling can never be reproduced year after year. Since an interesting groundwater sample could derive from the pit bottom, a good alternative would be to install a temporary well about 10 m from the sump that could be sample for groundwater.

2.3.5 Deep Lake

The name "Deep Lake" as a monitoring station applies to water collected near lake bottom at its deepest point. Water was collected through a small ¼ inch diameter LDPE tubing, connected to a peristaltic pump. These samples were collected to verify the quality of groundwater at lake’s bottom. Also, it aims to compare the different water geochemistry signatures originating from an open talik and a close talik, and later to compare the data with the ones collected on site. These stations were monitored only once in 2017.

2.3.6 Geotechnical investigation holes

Field campaigns in summer 2017 at Meadowbank included drilling of new boreholes susceptible to encounter groundwater. Attempt was made to collect a groundwater sample at borehole IPD-17-06. Although geotechnical holes are made under controlled conditions when compared to production holes, the inside diameter of metal casing are filled with grease, water is dirty and full of particles. After interpreting the physicochemical parameters for groundwater coming from geotechnical holes, and geochemical data from production holes and preshear holes, it can be stated that these holes are not a proper environment to retrieve representative groundwater samples.

2.4 PHYSICOCHEMICAL AND GEOCHEMICAL PARAMETERS

2.4.1 Groundwater parameters required by the water license

For each samples, field parameters are recorded (pH, turbidity, salinity and electrical conductivity). Analytical parameters included the following (per Schedule 1, Table 1, Group 2 of the Meadowbank Water License):

<u>Total and Dissolved Metals</u>: aluminum, antimony, arsenic, boron, barium, beryllium, cadmium, copper, chromium, iron, lithium, manganese, mercury, molybdenum, nickel, lead, selenium, tin, strontium, titanium, thallium, uranium, vanadium and zinc.

<u>Nutrients:</u> Ammonia-nitrogen, total kjeldahl nitrogen, nitrate nitrogen, nitrite-nitrogen, ortho-phosphate, total phosphorous, total organic carbon, total dissolved organic carbon and reactive silica.

<u>Conventional Parameters:</u> bicarbonate alkalinity, chloride, carbonate alkalinity, conductivity, hardness, calcium, potassium, magnesium, sodium, sulphate, pH, total alkalinity, TDS, and TSS, turbidity.

<u>Total cyanide and Free cyanide.</u> If total cyanide is detected above 0.05 mg/L at a monitoring station in receiving environment; further analysis of Weak Acid Dissociable Cyanide (CN WAD) will be triggered.

2.4.2 Additional parameters

Each groundwater sample has a distinctive signature on the basis of its dissolved concentrations of chemical constituents. Geochemical interpretation of groundwater data can be very useful to support a conceptual model by improving the understanding of groundwater movements and processes along pathways as water composition varies. It can also help identify zones where surface water and groundwater continually interact or only during permafrost thawing.

The geochemical composition of groundwater is defined by its main anions (HCO_3^-, SO_4^{2-}, Cl^-) and its main cations (Ca^{2+}, Na^+, Mg^{2+} K^+). Mass balance calculations for main ions dissolved in groundwater are a mandatory reliability check for any geochemical analysis (Hounslow, 1995). Mass balance calculations are useful to gain a first insight into water chemistry. From these calculations, groundwater chemical composition can be represented in Piper and Stiff diagrams, which facilitate its interpretation.

For the reasons presented above, additional parameters were also analyses: dissolved calcium, dissolved potassium, dissolved magnesium, dissolved sodium, fluorides, bromides, and ammonium-nitrogen. The following physicochemical in-situ parameters were also recorded on site: Oxydo-reduction Potential (ORP) and Dissolved Oxygen (DO).

2.5 QUALITY CONTROL ON SAMPLING AND ANALYSIS

2.5.1 Handling

The following procedures will be followed to provide data quality control:

- Measurement of field parameters at selected intervals until stable readings (within 10% of each other);
- Minimization of the exposure of the sampled water to the atmosphere;
- Use of compressed gas to evacuate water for sample collection;
- In-situ measurement of sensitive chemical parameters (pH, electrical conductivity, dissolved oxygen, alkalinity), where applicable; and
- Abiding by sample preservation methods (refrigeration and use of preservatives where needed), and specified holding times;
- Filtering for dissolved metal analysis with a 0.45 microns filter on site.

2.5.2 Duplicates, field and trip blank

A duplicate sample will be collected for one monitoring well per sampling event, and submitted as a blind duplicate to the analytical laboratory. When both results are higher than five times the method detection limit (MDL), the relative percent difference (RPD) will be calculated as:

RPD = absolute difference in concentration/average concentration x 100

USEPA (1994) indicates that an RPD of 20% or less is acceptable. Where one or both results are less than five times the MDL, a margin of +/- MDL is acceptable.

One field and one trip blank will also be collected at each sampling campaign.

3 ADAPTED GW MONITORING PROGRAM FOR IPD

Since 2015, Agnico Eagle is seeking options to increase Meadowbank's total tailing storage capacity to accommodate the mining of Amaruq ore deposit. After a Multi-Account Assessment (MAA), the In-Pit Tailings Deposition (IPD) was selected as the preferred option to store tailings waste produced from Whale Tail Mine in addition to its current TSF (SNC-Lavalin, 2016; 2017a).

After regulators' approval, IPD could begin in Q1-2019 with a daily filling rate of 9,000 tons of dry tailings. IPD would start in Goose Pit, already mined out, and followed by an alternate filling of Portage Pit A and Pit E (SNC-Lavalin, 2017a).

To ensure the environment protection and evaluate potential risks for tailing migration into groundwater, a feasibility study was conducted by SNC-Lavalin professionals in 2016-2017 (SNC-Lavalin, 2017a). The feasibility study included a complementary characterization of the geological structures and permafrost extent on site and the development of a detailed hydrogeological numerical 3D model. The groundwater numerical model aimed at representing the geological and hydrogeological conditions found at the mine site at the end of deposition to reproduce the groundwater flow and contaminant transport in talik zones located throughout the permafrost environment. The numerical simulations were designed to represent the worst-case scenarios in terms of contaminant transport within the aquifers. Therefore, a groundwater monitoring program can be designed in relation to the groundwater flow and contaminant transport simulation results.

Moreover, extensive physical and chemical laboratory analyses were performed on the Amaruq's tailings that will be deposited to verify their properties and their potential for acid rock drainage (ARD) and release of chemicals (Golder, 2017). Finally, the new Meadowbank groundwater monitoring program will be adapted to monitor the groundwater quality in the vicinity of pit shells with considerations of IPD operations.

Future groundwater monitoring program will be adapted for in-pit deposition at Meadowbank. Three new groundwater monitoring wells will be installed at strategic locations based on groundwater numerical simulation results and 2017. Well screen interval will be defined based in 2017 borehole data. Moreover, methods to obtain representative groundwater samples and improve well designs under arctic climate continue to be investigated. The groundwater monitoring program will be updated as the project progresses. New information from the hydrogeological numerical model and from hydrogeological field data will be integrated throughout.

Groundwater samples will be collected from the new wells at least once prior the pit deposition. The groundwater data will represent background geochemistry data prior to in-pit tailings deposition. Finally, the groundwater sampling program will be performed twice annually using on-site monitoring wells and other monitoring stations. One sample per sampling event will be collected in duplicate and submitted blind (using different reference numbers) to the analytical laboratory. One transport blank and field blank will also be collected each year. Specific details on sampling methodologies in monitoring wells are provided on appendix D.

4 DRILLING, WELLS INSTALLATION AND GW SAMPLING IN DEEP PERMAFROST ENVIRONMENT: CHALENGES AND SOLUTIONS FOR BEST PRACTICES

The first objective of this section is to review the challenges encounter while drilling and for the design and operation of groundwater monitoring well in deep permafrost environment. Based on current knowledge, the second objective is to propose better practices to successfully install long-lasting monitoring wells and retrieve representative groundwater samples at the Meadowbank mine site. Two tables synthetizing the information from different sources are presented. Table 1 documents the challenges encounter while drilling and installing wells. Some tested methods to resolve the enumerated problems are listed and promising solutions that could be attempt in the future are presented. Table 2 documents the challenges encounter during groundwater sampling.

Table 2: Protocol review for drilling and well design in permafrost setting

Borehole drilling and well design challenges	Tested methodology	Innovative solution (What could be done)
Drilling operation in permafrost.	• Advance the boreholes with standard HQ (Golder 2008 a) • Use heated water for drilling fluid (Golder 2008 a) • The fluid remaining in the borehole should have a target temperature of 60°C as water near boiling may freeze more quickly (Statler et al. 2010) • Borehole instrumentation should be on site and ready for installation once drilling is complete (Statler et al. 2010) • Drilling should proceed more slowly, providing the rock surrounding the borehole to warm up and allow a maximum time for installation of bottom hole assembly (Statler et al. 2010) • A bottom hole assembly is 15 m long and is used to isolate the bottom of the hole to allow sampling and monitoring (Statler et al. 2010) (includes pneumatic packer inflated with N_2 head over propylene glycol, a	***Define permafrost and talik location prior or while drilling*** Temperature gauging should be conducted and logged during drilling operation. This information is key decision parameter for heat tracing cable length and elevation of purge and sampling pumps (Franz Environmental Inc. 2009) Pressure, salinity parameters should be taking in consideration to define talik/permafrost zones

	U tube sampling system with a sample reservoir and a temperature sensor line (Freifeld et al. 2008) • Vertical well have less chances of failure. Inclination must be defined accordingly. • When installing bottom hole assembly, the sampling lines and heat tape should be wrapped with insulation to help prevent freezing • Heat tape should be installed with a safety factor i.e. if the highest thermal conductivity expected is 4 W/mK, plan 10 W/mK (Statler et al. 2010) • Heating cables must be attached on the downward side of the well (Franz 2009).	
<u>Breakage of well pipes.</u> Freezing of the standing water exposed to permafrost in the well causing breakage of well pipes or obstruction within the pipes	Use steel instead of PVC. PVC centralizers were used to keep the well centered with boring but PVC centralizer may fail. Using two inflatable packers; one with the borehole annulus and another with the well pipe, to prevent talik water to rise in the permafrost section (Golder 2008). Inflate packers according to their purpose, note status of packers year after year to follow the same procedure and minimize damage potential (Franz 2009).	Use centralizer made of another material than PVC, the objective is to keep the well riser in the center of the borehole and prevent that the riser pipe assembly bends (Franz 2009).
<u>Packer failure.</u> Water bypass packers due to cold temperature-induced contraction of packer, loss of inflation	Ensure enough fuel in the generator so it can run continuously during purging so that the heating cable work all the time and both inside and outside packers should be inflated.	
<u>Material damage through shipping.</u> Stainless steel	Material shipped to the site must be properly package and should arrived and be inspected well ahead of the time the material is needed to be used (Franz	

tubing damage during shipping, cause leakage through casing	2009).	
Well installation. Well installed from 2003 through 2014 failed for various reasons	Install pre-pack bentonite wells (Meeting minute on lessons learned at Meadowbank 2016) 1-1/2’’ screen is installed in the hole with a 1-1/2 pipe. Prepack bentonite is installed above the screen to create the bentonite plug. Heat trace is tightly taped around the 1-1/2’’ pipe during to installation to avoid the heat trace to touch each other and create a shortcut. Metal casing is installed and anchored in the bedrock in order to protect the well from material movement. No more grouting is used to fill the space between the casing and the pipe as it didn’t prevent the hole MW-11-01 from collapsing. Packer was used in the past to replace the bentonite Proper well inclination should be considered for well installation and in the case of an inline well, heating cables must be attached on the downward side of the well (Franz 2009).	Verify if using U-sampler methodology with borehole assembly would be better over this

Table 3: Protocol review for sampling representative groundwater in permafrost setting

GW sampling challenges	Tested methodology	Innovative solution (What should be done)
Unrepresentative groundwater sample because of cross contamination. Groundwater sample contaminated by borehole drilling or well operation Mixing between resident groundwater and brines/drill fluid used for drilling restricts a proper interpretation of groundwater chemistry Potential contamination through borehole operations (drill bit, drill cuttings, packers), sampling equipment, sampling environment or during sample transportation		Contamination of samples with drilling brine should be minimized Use a tracer and analyses salinity of drill fluid. Tracer such as sodium fluorescein (Henkemans 2016) or perfluorocarbon tracer (PFT) with drill fluid (Pfiffner et al. 2008) to define the amount of contamination from drilling fluid from sampled groundwater. At the end of the borehole, block the drill string and perform a "wet" pull to remove as much drill water as possible from the borehole before it froze to the rock surface (Pfiffner et al. 2008). Perform a "wet" pull following borehole drilling to remove as much drilling fluid as possible. To further clean the hole use a bailer (Statler et al. 2010; Pfiffner et al. 2008). Use a sampling system such as: U-Tube (Freifeld 2009) or Thermos bottle concept (Sutphin et al. 2006). Minimize contamination with proper sampling equipment i.e. cleaned pump, sanitized equipment dedicated to borehole, test equipment for contamination, use blank sample and transport blank to verify a potential contamination. Field samples must be immediately preserved using appropriate methods to retain competency for subsequent geochemical analyses (Wilkins et

		al. 2014).
Ice bridge formation within wells. Borehole ice formation freezing of the standing water exposed to permafrost in the well also preclude the collection of more than one set of fluid samples from a given borehole due to post drilling formation.	Heat tracer cables penetrating the permafrost zone were attached to the outside of the well pipe and were activated at the sample collection time. Ensure generator run continuously to energized heat cables. Use a downhole camera if necessary to inspect well damage before proceeding to groundwater sampling.	
Difficulties encounter while well purging and sampling Melted the nylon line of the DVP pump system used to remove water from the well annulus above the casing packers Inoperable pump in the borehole annulus, therefore packers are of no use. Heat cable (energized to keep the well from freezing)	Required activation of the heating cables to melt the ice in the well prior sampling Use stainless steel tubing connected to the DVD pump rather than nylon	Temperature gauging should be conducted and logged during drilling operation. This will allow defining depth of permafrost and talik water location. This information is key decision parameter for heat tracing cable length and elevation of purge and sampling pumps (Franz Environmental Inc. 2009) Pump should be located within unfrozen water at all times is a key factor in avoiding problems due to freezing groundwater during purging/sampling (Franz 2009)
Line of the U-tube sampling system froze	Use an insulated hose encompassing both the sampling lines and the heat trace cable would have prevented the freezing (Statler et al. 2010; Friefeld et al. 2008).	

5 KEY POINTS AND RECOMMANDATIONS

- An extensive groundwater monitoring campaign was achieved on site in 2017

- In total, twenty-nine (29) water samples were collected in the course of two sampling campaigns which include twenty-four (24) groundwater samples and five (5) surface water samples. The groundwater monitoring program included the following seventeen (17) monitoring stations: two (2) groundwater observation wells (MW-08-02 and MW-16-01), two (2) lakes, seven (7) wall seepages, four (4) dike seepages, one (1) pit sump, and one (1) reclaim water;

- Monitoring station need consistency (same station need to be sample through time), and more well are required. After geochemical data analysis of groundwater attempts to retrieve representative groundwater samples should not be done for the following stations:

  - MW-08-02 until the well can remain unfrozen for more than 24 h;

  - Pit sumps, preshear, production holes and geotechnical holes.

- Future groundwater monitoring program will be adapted for in-pit deposition at Meadowbank. The installation of three (3) new groundwater monitoring wells is proposed at strategic locations based on groundwater numerical simulation results and 2017. Well screen interval will be defined based in 2017 borehole data related to permeable fractures. Moreover, methods to obtain representative groundwater samples and improve well designs under arctic climate continue to be investigated. The groundwater monitoring program will be updated as the project progresses. New information from the hydrogeological numerical model and from hydrogeological field data will be integrated throughout. Moreover, methods to obtain representative groundwater samples and improve well designs under artic climate continue to be investigated.

- Only a few studies are available on deep permafrost environment. In most study, permafrost is defined by the temperature isotherm zero. However, pressure and salinity will influence the actual freezing point of water and therefore the presence or the absence of ice (Stotler et al. 2010; van Everdigen 1976). Pressure, salinity and the visual absence of ice in cores should be considered in the search for talik zones instead of just relying on temperature data.

  - Important to define properly talik zones not only based on temperature gradient. Pressure and salinity will influence freezing temperature and the definition of permafrost/talik zone.

  - Drilling methodology is the basis to a proper setting form representative groundwater sampling (many procedures have to be followed).

- Groundwater sample contamination can come from many sources, it is important to minimize and prevent the effect of sample contamination as much as possible (avoid drill/brine fluid, purge well as much as possible, clean purging and sampling equipment before use, installed well properly to avoid leakage of cross-contamination of fluid).

There is always a percentage of drill fluid left in the rock formation, so it is relevant to use a tracer to define the percentage of contamination (Pfiffner et al. 2008). Brine and drill fluid get pushed into fractures and former drill fluid stays in the rock formation and risk to contaminate groundwater samples. This would lead to erroneous groundwater salinity and TDS concentrations. What is suggested is that fresh water be used during the drilling. Cross-contamination between layers can occur as brine water from drilling won't freeze as readily as fresh water, heated fresh water would form an icy zone around the borehole and could be removed during the melting and purging procedures of the monitoring well. Some suggestions include the use of tracer with drilling fluid to define the degree of contamination of a groundwater sample, the usage of a U-sampler known for high purity samples for real-time and laboratory analysis, and a rigorous assessment of sample contamination including subsampling of material in contact with the borehole, drilling lubricant, drill cuttings, tools used for groundwater sampling, etc. The collection of blank samples during well and sampling operation is recommended.

- Agnico Eagle will make effort to put in place or use the innovative solutions and best practices when possible to improve the groundwater well installation and sampling program.

- Agnico Eagle will seek new opportunities from forthcoming field campaigns at Meadowbank Mine to collect representative groundwater samples at new locations.

6 REPORTING

An annual groundwater monitoring report will be submitted by Agnico Eagle Mines Limited to the Nunavut Water Board (NWB) with the Meadowbank Annual Report of the following year. This report will include the following information:

- Installation logs for any new monitoring wells;
- Location in UTM coordinates of all groundwater monitoring locations;
- Description of the working condition of the existing wells;
- Date of groundwater sampling;
- Details of sampling methods;
- Analytical results including: field data, laboratory analytical data and QA/QC information;
- Comparative assessment of data obtained to date to input values used in the Water Quality Model for the site (relevant salinity parameters); and
- Comparative assessment of parameters indicative of mine impacts to groundwater, with particular regard to tailings (total cyanide and dissolved copper);
- Actions taken regarding recommendations for the groundwater sampling program.

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APPENDIX A

Meadowbank site visit and groundwater sampling – Factual Report

Title of document: **MEADOWBANK SITE VISIT AND GROUNDWATER SAMPLING – FACTUAL REPORT**

Client: **AGNICO EAGLE MINES LIMITED**

Project: **GROUNDWATER MONITORING**

Prepared by: Laurie Tremblay, Ph,D.

Reviewed by: Guillaume Comeau, Eng., M.Sc.

Approved by: Dominic Tremblay, P.Eng., M.A.Sc

REVISION INDEX

Revision				Pages Revised	Remarks
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PA	L.T.				
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00	L.T.	D.T.	2018-03-12	1, 5, 6, 8, 10, 11, 14.	Issue for use
				Appendix A	

NOTICE TO READER

This document contains the expression of the professional opinion of SNC-Lavalin Inc. (“SNC-Lavalin”) as to the matters set out herein, using its professional judgment and reasonable care. It is to be read in the context of the agreement dated May 19th 2017 (the “Agreement”) between SNC-Lavalin and Agnico Eagle Mines Limited (the “Client”) and the methodology, procedures and techniques used, SNC-Lavalin’s assumptions, and the circumstances and constraints under which its mandate was performed. This document is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of the Client, whose remedies are limited to those set out in the Agreement. This document is meant to be read as a whole, and sections or parts thereof should thus not be read or relied upon out of context.

SNC-Lavalin has, in preparing estimates, as the case may be, followed accepted methodology and procedures, and exercised due care consistent with the intended level of accuracy, using its professional judgment and reasonable care, and is thus of the opinion that there is a high probability that actual values will be consistent with the estimate(s). Unless expressly stated otherwise, assumptions, data and information supplied by, or gathered from other sources (including the Client, other consultants, testing laboratories and equipment suppliers, etc.) upon which SNC-Lavalin’s opinion as set out herein are based have not been verified by SNC-Lavalin; SNC-Lavalin makes no representation as to its accuracy and disclaims all liability with respect thereto.

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1.0 Introduction

1.1 Background and Review of previous sampling campaigns

Groundwater chemistry data is a tool to predict the chemistry of water accumulating in open pits and to determine any effects of mining on groundwater quality, particularly with respect to Meadowbank facilities: tailings storage facilities (TSF), potentially acid generating (PAG) rock storage facilities (RSF) and reclaim water.

As a first step of this mandate, SNC-Lavalin reviewed the annual groundwater monitoring reports and related chemical data prior 2017. Before 2013, groundwater samples were collected in monitoring wells. However, well installation and groundwater collection have been a major challenge under artic conditions in permafrost environment at Meadowbank. From 2013 to 2016, alternative methods were investigated to obtain representative groundwater samples (see 2012 Groundwater Monitoring Report and recommendations by Golder Associates). The locations of each former and existing groundwater wells and other groundwater monitoring stations are provided in Appendix A.

From 2003 to 2016, fourteen (14) monitoring wells were installed at Meadowbank mine. Throughout these years, thirty four (34) groundwater samples and twenty-one (21) duplicates were collected from these wells. To this day, only two wells remain operable, while the others broke after ice bridge formations inside the wells.

From 2013 to 2016, alternative methods investigated to sample groundwater included pit wall seepages, production drill holes, pit sumps, subhorizontal wells installed into pit walls, and temporary wells for dewatering purpose. A total of six (6) groundwater samples were collected from subhorizontal wells installed in Portage Pit E southeastern wall, one (1) sample from a temporary dewatering well, two (2) samples from pit sumps during pit exploitation and one (1) production borehole.

Despite efforts to overcome multiple challenges related to sampling water under artic conditions in permafrost environment at Meadowbank, groundwater historical data seem unrepresentative of the actual conditions. Conclusions drawn from the SNC review of historical data are the following:

> De-icing salt, calcium chloride, used to prevent boreholes from freezing after drilling operation remains in groundwater for years despite intensive purging of wells after installation. When this product is use in drill holes it becomes impossible to establish background conditions of groundwater chemistry, despite extensive purging of the wells. Salinity, concentration of calcium and chloride dissolved in groundwater fluctuate from multiple order of magnitude throughout the years and show no logical trend;

> The sampling methodology could induce a dilution when it is not collected in front of the well screen. The presence of some chemical parameters (suspended solids and metals) may also be higher than expected in groundwater when sampled from sumps or horizontal wells and when groundwater sample are not filtered on site;

> Important chemical parameters (major ions dissolved in groundwater) are missing from the data set and do not allow to establish a complete background chemistry check.

In 2017, to remediate the situation, an extensive groundwater sampling program took place with Agnico Eagle Mines Limited (thereafter named AEM) and SNC-Lavalin. The program aimed at better characterizing natural groundwater chemistry, potential sources of contaminants at the mine site, and potential link between surface and groundwater. The sampling methodology, preliminary interpretation of analytical results, conclusions and recommendations for further sampling field campaigns will be addressed in this factual field report.

1.2 Objectives

SNC-Lavalin offered its technical services to accomplish the actions and recommendations stated within the Groundwater Monitoring Report 2016 and the Groundwater Monitoring Plan 2017. SNC-Lavalin professionals supported AEM with the following:

- Achieve a complete groundwater sampling program as well as low-flow sampling techniques for Water licensing requirements;
- Investigate best practices to improve groundwater sampling methodologies and the spatial distribution of groundwater samples;
- Collect groundwater and surface water samples to provide a basic understanding of the potential interaction between groundwater and surface water, especially in relation to tailing reclaim water potential migration.

1.3 Mandate

Meadowbank Mine site visits included three components: (1) site visit planning; (2) the site visit itself and; (3) the redaction of a factual field report. The tasks performed during those three project steps are described below:

Planning:

- Review sampling procedures and equipment available based on 2017 Groundwater Plan and, with the assistance of AEM's technicians, evaluate the need for additional equipment and the need to adjust groundwater sampling procedures;
- Elaborate a rigorous and detailed groundwater sampling protocol including the locations to be monitored. This protocol included equipment disinfection to avoid cross-contamination and filtering groundwater for dissolved metal analysis on site.
- Plan the amount of sampling bottles required for the groundwater sampling (duplicate, field blank, trip blank, etc.)
- Propose strategic monitoring well locations for future groundwater monitoring. The selected locations will target talik zones and sensitive areas for tailing reclaim water potential migration based on knowledge acquired through the In-Pit tailings Deposition Prefeasibility Study (PFS);

Site visits (7 days for each visit):

- Site visit with an AEM's technician who is familiar with the site and the sampling procedures, to get a better understanding of mine infrastructures and operations and related hydraulic conditions (groundwater, surface drainage, etc.);
- Locate available wells, validate location for future well sites and evaluate the necessity to include surface water in the groundwater sampling program;
- Inspect groundwater sampling equipment on site, clean and prepare the equipment;
- Unfreeze 120 m of ice bridge inside monitoring well MW-08-02;
- Purge and sample monitoring wells MW-08-02 and MW-16-01;
- Sample duplicates, field blanks and trip blanks;
- Identify and collect additional groundwater sampling locations (pit wall seepages, drill or production holes) favorable to collect representative groundwater samples not affected by melted permafrost or surface water chemical signature;

- Identify and collect surface water samples that are representative of natural background setting and others that are potentially affected by mine site activities.

Factual field report:

- Produce a factual field report describing groundwater sampling methodologies and key findings related to groundwater monitoring at the site;
- Formulate recommendations for future groundwater monitoring.

2.0 Sampling Program

2.1 Site Visit

Two (2) site visits were done by an SNC-Lavalin professional at Meadowbank Mine from July 13th to July 20th, and from August 31st to September 6th, 2017. The site visits objective was to provide technical advices to improve the groundwater sampling program as well as low-flow sampling techniques. Moreover, the site visit allowed SNC-Lavalin's hydrogeologist to familiarize with the mine site conditions, settings and operations. The site visit included carrying out the sampling program 2017 for licencing requirement. Also, the incentive behind running the complete sampling program at a single period of the year was to ease the interpretation of the geochemical groundwater data. Finally, the execution of the sampling program by SNC-Lavalin staff aimed to provide better recommendations to improve long term groundwater monitoring and sampling techniques.

2.2 Sampling Stations

In 2017, a total of seventeen (17) groundwater samples and twelve (12) surface water samples were collected at the nineteen (19) sampling locations. Those sampling stations name and type, general location and sampling period are provided at Table 1. Sampling stations include two (2) monitoring wells sampled at two (2) levels, two (2) lakes, seven (7) wall seepages, three (3) dike seepages, two (2) sump and one (1) reclaim water pond. All former and new 2017 sampling stations are located on Map 1 (Appendix A).

Table 2-1 : Samples collected in July and September 2017

Station name	Location	Type	July 2017	August 2017
MW-16-01-100 m	Between Central Dump and Central Dike	Monitoring well	X	X
MW-16-01-20 m			X	X
MW-08-02 110 m	Southeast end of Central Dump		X	-
MW-08-02 150 m			X	X
SP-Lake	Second Portage Lake at 30 m depth (open talik)	Deep lake	X	-
Dog Leg Lake	Dog Leg Lake (close talik)		X	-
ST-S-5	Between Central Dike and MW-16-01	Dike seepage	X	X
ST8-North	Between Central Dump and East Dike		X	X
ST8-South			X	X

Station name	Location	Type	July 2017	August 2017
BG-Seepage-42 m	Goose Pit	Wall seepage	X	X
BG-Seepage-21 m			X	X
BG-seep-80 m			-	X
Pit A East Wall	Pit A		-	X
Pit A-Seepage			X	-
Pit E-seep-40 m	Pit E		-	X
Pit E-Seepage			X	X
Pit A-sump	Pit A	Sump	-	X
BG Lagoon	West of Goose Pit		X	X
ST-21 South	South Cell TSF	Reclaim water pond	-	X

2.3 Sampling methodology for each station type

The sampling methodologies were reviewed by SNC-Lavalin; the equipment was tested, cleaned and adapted when required. Specifically, AEM's Solinst double valve pumps and control unit were tested prior the first visit. The control unit was replaced and the pumps were taken apart and cleaned with Liquinox® soap. The sampling procedures were reviewed and sampling bottles were added for supplementary chemical analysis. Specialized equipment was packaged (peristaltic pump, YSI® Pro multiparameter probe) and missing equipment ordered in prevision for the sampling program.

After arrival on site, an AEM's field technician accompanied the SNC's hydrogeologist to visit the mine facilities and to perform the sampling program. As only two groundwater monitoring wells were operable in 2017, efforts were dedicated at finding and sampling alternative groundwater locations as pit walls seeping fractures, pit sumps and dewatering wells. Appendix B presents a photographic report describing the tasks completed during both site visits.

After the sampling program completion, water quality data were compiled and a preliminary interpretation of the chemical results was done. Details for the sampling program are provided in the following sections.

At each location, new and clean Low Density Polyethylene (LDPE) tubing was used for each sample. Equipment was cleaned and calibrated prior collecting each sample. Water samples were filtered on site for dissolved metals with a 0.45 microns filters and water was collected in bottles containing preservatives. Groundwater and surface water samples were collected in clean, laboratory-supplied containers. Duplicates samples and transport blanks were used for quality control. Water bottles were preserved onsite at 4°C, transported to the lab within 24 h with its transport blank. Moreover, multiple samples were collected at a same location to test how to retrieve a representative groundwater sample under difficult conditions. The sampling methodologies were adapted for each station and site conditions.

2.3.1 Monitoring wells

Only two groundwater monitoring wells were operable in 2017. Formation of thick ice bridges challenged the sampling of wells MW-08-02 again this year. Therefore, sampling protocols were different for the two wells and the detailed methodologies are described below. Water levels were recorded and the data is presented in Appendix C. Details for the well installations are provided in Appendix D.

2.3.1.1 MW-16-01

At this monitoring well location, water sample were collected at two specific depths (20 m and 95 m). To perform this task, a portable double valve pump (DVP) was installed permanently at approximately 95 meters into the well so that the pump was located in front of the screened interval. The well was purged to remove standing water inside the well and to induce a fresh groundwater flow from the rock formation by activating the DVP. The pump was activated by pushing compressed nitrogen into a ¼ inch LDPE tubing attached to the DVP. At the same time, an Alexis® peristaltic pump was installed 20 m deep above the screen interval, to verify the implication of sampling depth on chemical results.

During both sampling, the in situ physicochemical parameters were measured with a flow-through cell using a YSI® Pro Probe that was calibrated prior usage. The well was purged over 3 well volume prior sampling and until the monitored parameters stabilized (values remaining within 10% for three consecutive readings). A minimum of 40 liters, representing over three well water volumes, was removed prior sampling (picture P8, Appendix B). Purged water was monitored for pH, electrical conductivity, temperature, water clarity and color (visual observation) during this operation. Groundwater sampling was carried out immediately after well purging with low flow techniques at both depths (20 m and 95 m). Groundwater was sampled following quality control procedure on sampling and analysis described in section 2.2 and in Appendix C. Both depths (20 and 95 m) were sample in July and September.

2.3.1.2 MW-08-02

Well MW-08-02 was filled with ice from 30 m to 150 m below ground. The ice blocking the well annulus was melted using a steamer and clean lake water (P9-P11, Appendix B). It took about 4 hours to melt 120 m of ice from the well. Following this procedure, the well remains free of ice for a maximum of 24 hours. To prevent equipment damage, the well was purged using compressed air push through a tube lowered 150 m down the well for about four (4) hours. Afterwards, the well was allowed to recover for 12 hours to a static water level before sampling. Afterwards, a 200 mL clean bailer was lowered 160 m below ground to retrieve a groundwater sample just above the screen interval. Groundwater sampling was carried out immediately after well purging. Three samples were collected from this well: 1) one right after purging the well at 110 m deep in July, 2) another 12 hours later at 160 m deep in July, and 3) one at 160 m deep in September 6 hours after purging the well. In situ parameters and sampling were carried out as mentioned in the previous section.

2.3.2 Wall seepage

The name "wall seepage" as a monitoring station applies to groundwater collected in pit walls where water flows directly out of the bedrock. To sample those pit groundwater inflows, a small ¼ diameter LDPE tubing was inserted into small fracture to prevent the sample to be in contact with the atmosphere. The water run through the line by gravity, physicochemical parameters are recorded and standard sampling procedures are followed (P23-P32, appendix B).

These sampling stations can be monitored though time, contribute to the understanding of groundwater quality at the mine and can be added to the long term groundwater monitoring program until the pit will be decommissioned.

The pit walls were carefully investigated to find accessible groundwater seepages which are clearly coming from the bedrock (groundwater), where they ejected clean groundwater and had a sufficient flow to be sampled. Only the station Pit-A-Seepage could not be repeated because not enough water was outflowing for this pit wall at the beginning of September.

2.3.3 Dike seepage

The name "dike seepage" as a monitoring station applies to samples collected from dewatering wells installed 6 m below ground level to control East Dike seepage (ST-8 North and ST-8 South; P15-P16 of Appendix B), from a sump at the toe of Central Dike seepage (ST-S-5; P17 of Appendix B) or from the sump found between Goose Dike and the nearby NAG rock stockpiles (BG Lagoon; P18-P22 of appendix B). In most cases, samples are collected from a tap connected to a dewatering pump.

These sampling stations can be monitored though time, contribute to the understanding of groundwater quality at the mine, help link surface water conditions with groundwater and can be added to the long term groundwater monitoring program.

2.3.4 Pit sump

The name "Pit sump" as a monitoring station applies to groundwater collected at the bottom of a pit when groundwater filled a cavity during exploitation (P35-P36, appendix B). Sampling groundwater in Pit A sump was done with a clean LDPE tubing and a peristaltic pump. However, the ground was too reworked and there were too much sediment in suspension to get a representative groundwater sample. After interpreting the geochemical data, provenance of water is too much ambiguous to pursue the sampling of this type of monitoring station for groundwater monitoring purpose. Excavated ground is reworked and a lot of mine operations occur at proximity of the sumps such as drilling, blasting, and excavating. Moreover, the location of the sampling can never be reproduced more than once. A more appropriate and representative groundwater sample could be collected from a temporary well installed about 10 m deep close from the pit sump that could be sample with standardized methods.

2.3.5 Deep lake

The station type named "deep Lake" applies to water collected near the lake bottom where bathymetry is at its deepest (P37-P39, Appendix B). Water was collected through a small ¼ inch LDPE tubing connected to a peristaltic pump. Two lake samples were collected. A metal rod was attached to clean LDPE ¼ inch diameter tubing. The rod and tubing were lowered down into the lake where bathymetry was known to be at its deepest for the area. Water was pump via a peristaltic pump and physicochemical parameters were recorded via the flow through cell before taking a sample. Water was dirty at first because the rod inserted to Lake Bottom, but became clear soon after the beginning of pumping.

These samples were collected to verify potential groundwater inflow into the lakes and to compare the geochemistry of the water from open talik lake versus close talik lake. These stations were to be monitored only in July.

2.3.6 Geotechnical boreholes

As a geotechnical field investigation was in progress during summer 2017, attempt was made to collect a groundwater sample between 140.6 and 146 m at borehole IPD-17-06. A double valve pump (DVP) was lowered down as closed as possible to the open screened interval (7.7 m above the screen). The pump was operated with compress air instead of nitrogen (P40-P43, appendix B). Although geotechnical holes are made under controlled conditions when compared to production holes, the inside diameter of metal casing are filled with grease, water is dirty and full of particles. After interpreting the physicochemical parameter and laboratory results for groundwater coming from geotechnical holes, production holes and preshear holes, it can be stated that these holes are not a proper environment for representative groundwater samples.

2.4 Analytical program

For each sample, the following in situ physic-chemical parameters were recorded: pH, turbidity, salinity and electrical conductivity, oxydo-reduction potential (ORP) and dissolved oxygen (DO). In situ parameters were recorded via a flow-through cell for most samples with a YSI® Pro probe (P24, Appendix A). An Excel spreadsheet named “Station_coordinates” (appendix C) shows the parameters that were recorded. Salinity was measured with AEM’s instrument and was calibrated by their staff.

Analytical parameters included the following parameters with respect of the Meadowbank Water License (Schedule 1, Table 1, Group 2):

Total and Dissolved metals: aluminum, antimony, arsenic, boron, barium, beryllium, cadmium, copper, chromium, iron, lithium, manganese, mercury, molybdenum, nickel, lead, selenium, tin, strontium, titanium, thallium, uranium, vanadium and zinc.

Nutrients: Ammonia-nitrogen, total kjeldahl nitrogen, nitrate-nitrogen, nitrite-nitrogen, ortho-phosphate, total phosphorous, total organic carbon, total dissolved organic carbon and reactive silica.

Conventional Parameters: bicarbonate alkalinity, chloride, carbonate alkalinity, conductivity, hardness, calcium, potassium, magnesium, sodium, sulphate, pH, total alkalinity, total dissolved solids (TDS), total suspended solids (TSS) and turbidity.

Total cyanide and free cyanide: If total cyanide is detected above 0.05 mg/L for a monitoring station that is in receiving environment, further analysis of Weak Acid Dissociable Cyanide (CN WAD) will be triggered.

Additional analyses were performed to calculate mass balance reliability check on each analysis and include: dissolved calcium, dissolved potassium, dissolved magnesium, dissolved sodium, fluoride, bromide and ammonium-nitrogen.

2.5 Quality Assurance / Quality Control (QA/AC)

Before interpreting the data, some verification was done to make sure that nothing affected the sample quality during sampling or transport from the site to the laboratory. Five (5) field duplicates and two (2) transport blanks were sampled in 2017.

Field duplicates assure a quality control and allow verifying if two water samples collected at the same time and at the same station have reproducible analytical results. Duplicates 2017 results were verified with the same method as referenced in AEM Groundwater Report 2016. This USGS (1994) method can be applied when both concentrations are higher than five times the method detection limit (MDL). Then, the relative percent difference (RPD) of those duplicates is calculated as following:

RPD = absolute difference in concentration/average concentration x 100

USEPA (1994) indicates that a RPD of 20% or less is acceptable. If one or both concentrations are less than five times the MDL, a margin of +/- MDL is acceptable. Poor results indicate an inappropriate field sampling operations such as: unclean sampling bottles, poor sampling methodology, inefficient monitoring well purge, etc.

Transport blanks are present in every steps of shipping, field sampling and are returned to the laboratory with other samples to verify if there is any sample contamination occurring during transport that could affect the integrity of the results. Contamination could be due to a leaky bottle containing preservative during transport, contact between highly and low contaminated water bottles or just due to an unfit container.

3.0 Analytical results and Preliminary interpretation

Each groundwater sample has a distinctive signature defined by its dissolved concentrations of chemical constituents. The interpretation of groundwater chemistry data contributes to a better understanding of groundwater flow, contaminants migration and transformation processes along pathways as water composition varies. It can also help identifying zones where surface water and groundwater interact and defining if the interaction is continuous or only during permafrost thawing.

Water chemical results are presented at Appendix C. The following sections present the preliminary interpretation of groundwater chemical data and includes:

- Quality Assurance / Quality Control (QA/QC):
  - Verification of duplicates for sample integrity and reproducibility;
  - Verification of transport blanks for potential contamination during sample transport;
- Water chemical results and criteria;
- Stiff diagrams;
- Status on sample representativeness;
- Graphical interpretation;
- Hydrogeochemical cross-sections.

3.1 Quality Assurance / Quality Control (QA/QC)

Calculations of the relative percent difference (RPD) from duplicates are available in Appendix C for all duplicates collected in 2017. Results show that all field duplicates have RPD values within 20% range or concentrations within 1xMDL, demonstrating that the sampling methodology and operations were appropriate.

Analytical results for the transport blank are also presented at Appendix C and show high concentrations for the following parameters: alkalinity, reactive silica, total organic carbon, total dissolved solid (TDS), total chromium, ammonium, kjeldahl nitrogen, bromide, WAD cyanide and total cyanide, nitrate and sulfate. During the next field investigation, water used by the laboratory to fill the blank bottles should be analyzed for the same parameters than the field samples to verify if those parameters are coming from the laboratory water or from an external source of contamination. Transport containers should be cleaned and selected accordingly. Moreover, transport blank should be kept in a refrigerator that is not used to store samples.

3.2 Water chemical results and criteria

Water analytical results are compared to criteria listed in AEM Groundwater Report 2016, considering parameter exceeding when they are three time the concentrations of Third Portage Lake (TPL) fresh water. Analytical results are found in Appendix C (Excel spreadsheet) and concentrations exceeding these criteria are in bold format. Table 2 also shows the sampling stations and parameters that are exceeding criteria. Note that some samples are not or may not be representative based on the mass balance calculations which will be discussed at section 3.2.1.

Alkalinity and TSS are higher in groundwater than in 3PL surface water for most samples. Most of the exceeding parameters (copper, total mercury, total ammonia nitrogen and total cyanide) are related to the reclaim water signature. Aside from reclaim water sample, high concentrations above 3PL background are found at monitoring station ST-S-5 for ammonia nitrogen and at Pit-A-seep and Pit-E-seep for nitrates. Nitrogen is one the few parameters that could help trace contaminant source across the site. Moreover, Stormwater Lake was not sampled and could represent a source of contaminants on site and therefore should be investigated.

Table 3-1 : Samples and Parameters over criteria (three time 3PL concentration)

Station name	Sample Representativity	Alkalinity	TSS	Total Copper	Total Mercury	Total Ammonia Nitrogen	Total Cyanide	Nitrate
MW-16-01-100 m	Yes	X	X					
MW-16-01-20 m	No	X						
MW-08-02 110 m	No	X	X					
MW-08-02 150 m	Uncertain	X	X					
SP-Lake	Yes	X						
Dog Leg Lake	Yes	X	X					
ST-S-5	Yes	X				X		
ST-8-North	Yes	X	X					
ST-8-South	Uncertain	X	X		X			
BG-Seepage-42 m	Yes	X						
BG-Seepage-21 m	Yes	X						
BG-seep-80 m	Yes	X						
Pit A East Wall	Yes	X						
Pit A-Seepage	Uncertain	X						X
Pit E-seep-40 m	Uncertain	X						
Pit E-Seepage	Yes	X	X					X
Pit A-sump	No	X	X			X	X	X
BG Lagoon	Yes	X	X					
ST-21 South	Yes	X	X	X	X	X	X	

Provincial criteria (Quebec) and Federal criteria for groundwater quality and resurgence in surface water are also listed in the Appendix C table as a reference. However, since many water samples are considered to be surface water instead of groundwater, the results were not compared to these groundwater criteria.

Finally, it was observed that cyanide concentrations from September results fluctuate in an illogical manner when compared to July samples. For the next field investigation, some samples should be sent to a different lab for quality control on this parameter.

3.3 Stiff diagrams

The geochemical composition of groundwater is defined by dissolved main anions (HCO_3^-, SO_4^{2-}, Cl^-) and main cations (Ca^{2+}, Na^+, Mg^{2+}, K^+). Mass balance calculation (expressed in meq/L) is the difference between main anions and cations dissolved in groundwater and is a mandatory reliability check for any geochemical analysis

(Hounslow, 1995). Mass balance calculations are useful to gain a first insight into water chemistry. From these calculations, a chemical composition can be represented by a Stiff diagram which is a visual tool facilitating groundwater interpretation. Mass balance calculations were performed with the free software “Diagramme” available at http://www.lha.univ-avignon.fr/LHA-Logiciels.htm .

Although few samples collected in 2017 need to be discarded of the further analysis (section 3.4), the major chemistry of all samples was illustrated under the form of those Stiff diagrams (Appendix E). The left side represents the major cation concentrations (sodium+potassium, calcium and magnesium), while the right side represents the major anions (chloride, bicarbonate+carbonate and sulfate+nitrate). Each side of the diagram should be equivalent, meaning that both concentrations (in meq/l) of cations and anions should equal within 5% difference.

To ease the visual interpretation, samples with high concentrations were represented on the first page of Appendix E, with a scale of 0 to 40 meq/l, while less charged water (for example: fresh lake water) were illustrated on the second page with a scale of 0 to 5 meq/l. Some conclusions about the samples are also written on the side of the diagram. Stiff diagrams were used to support comparison and interpretation of the following variants:

- Sampling period (July vs September);
- Duplicate samples;
- Sampling depth inside a same well;
- Sampling location and nearby mining activities;
- Sampling elevation/depth in the bedrock;
- Sampling methodology and equipment (such as bailer, tap, DVP pump, peristaltic pump).

Sampling period (July vs September)

- ST-S-5 water chemical concentrations vary through time and is probably affected by snow melt season;
- Concentration of all major elements increases at Pit E-seepage monitoring station in September compared to values obtained in July and may have been diluted following snow melting season;
- BG-Lagoon also shows increases in concentration of some parameters from July to September samples, and may have been also affected by snow melt.

Potential source of contamination

- Reclaim water in South Cell is a source of sulfate, chloride, sodium, potassium, calcium, manganese, and other traces elements for surface and groundwater on the site and can be traced at ST-S-5, MW-16-01, Pit E seepage and Pit A seepage (Figure 3.1 and 3.2);
- Pit-A-seep-East and Pit-E-seep-40m seem to be under the influence of a higher source of calcium and sulfate. Waste rock from Central dump and Portage NAG Stockpile could be a potential source;

Sampling methodologies or Sampling stations types

- Samples collected at 20 m in MW-16-01 are diluted compared to the ones collected in front of the well screen, at 95 m deep. Purging and sampling MW-16-01 should be done with low flow technique in front of the well screen or just above it to ensure that water is coming from the rock formation (see Appendix D for well installation details);
- Chemistry of groundwater samples collected in well MW-02-08 is different. The sample collected with a bailer immediately after steaming the well at 110 m is diluted compared to the two others collected 12 hours after purging at 160 m. Although both samples from July and September were collected 12 hours

after steaming operations, the concentrations of major ions are different (higher Cl versus HCO_3 in September). Since the 500 feet of steaming lines are stretched on the ground prior purging the well with compress air, dirt of the road can be introduce into the well. Moreover, 120 m thick permafrost is melted with heated Third Portage Lake water and dilutes the sample. Since ground particles (dirt) are inserted into the well, it is difficult to ensure that the sample represents real groundwater chemistry.

- Alkalinity concentrations (HCO_3 values) are measured at the lab from bottle that has no preservative. The alkalinity should be measured directly on the site as no external processes could be altered the sample (contact with ambient air, storage in a refrigerator and transportation to the lab).
- Samples collected in pit sump are not representative of groundwater conditions (duplicated samples are similar in shape but concentrations are distinct for samples collected at the same time, water coming from the ground is in contact with oxygen, there are lots of suspended solids that is not representative of groundwater, surrounding soil is disturbed, remixed and altered by blasting and mining).

General comments related to groundwater and surface water chemistry

- Concentrations of major elements increase with depths for Bay Goose wall seepage groundwater samples. This is coherent with the fact that groundwater dissolves more components from the bedrock as it remains longer in the ground;
- Dewatering wells ST-8-North and ST-8-South show a calcium bicarbonate water type and low concentrations which is coherent with the shallow well depth (6 m below ground) and its proximity to Second Portage Lake fresh water.
- Lake water was used as a reference to distinguished natural surface water from groundwater. Sample collected from Second Portage Lake bottom is in an open talik area and was much deeper than the sample collected in Dog Leg's Lake which is in a close talik area.

3.4 Samples representativeness

Based on the mass balance calculations, four (4) samples are not representative of water conditions found on site and should be discarded and not used for interpretation (See Appendix C, as non-representative sample are shaded in gray):

- MW-08-02-110 m
- MW-16-01-Sur (July and September). "Sur" in the samples' name, was used to indicate a groundwater sample collected at a depth of 20 m into the well.
- Pit A sump

Five (5) samples may not be representative and should be considered with some reserve (See Appendix C, as semi-representative sample are shaded in orange):

- MW-08-02 150-160 m (July and September)
- ST-8 South July
- Pit A seep-E
- Pit E seep 40 m.

3.5 Graphical representation

Although not all samples are considered representative, all 2017 samples were plotted on graphs to show some major chemical components and to demonstrate the chemical signature and evolution of reclaim water (see Figure 3-1 and Figure 3-2).

Reclaim water source was sampled at ST-21-South, illustrated by black cross on both graphs (Figure 3-1 and Figure 3-2). On the mine site, reclaim water is a main source of sulfate and calcium in water. On Figure 3-1, samples having a calcium concentration above 50 mg/L show a general decreasing trend of pH and calcium along flow paths. Furthermore, Figure 3-2 shows the same dilution effect on main reclaim water components along flow paths. From Figure 3-2, three (3) potential groups could be interpreted: 1) the samples containing reclaim water signature, 2) the sample containing a potential signature from waste rock PAG stockpiles (further investigation would be required), and 3) the natural surface water and groundwater signature.

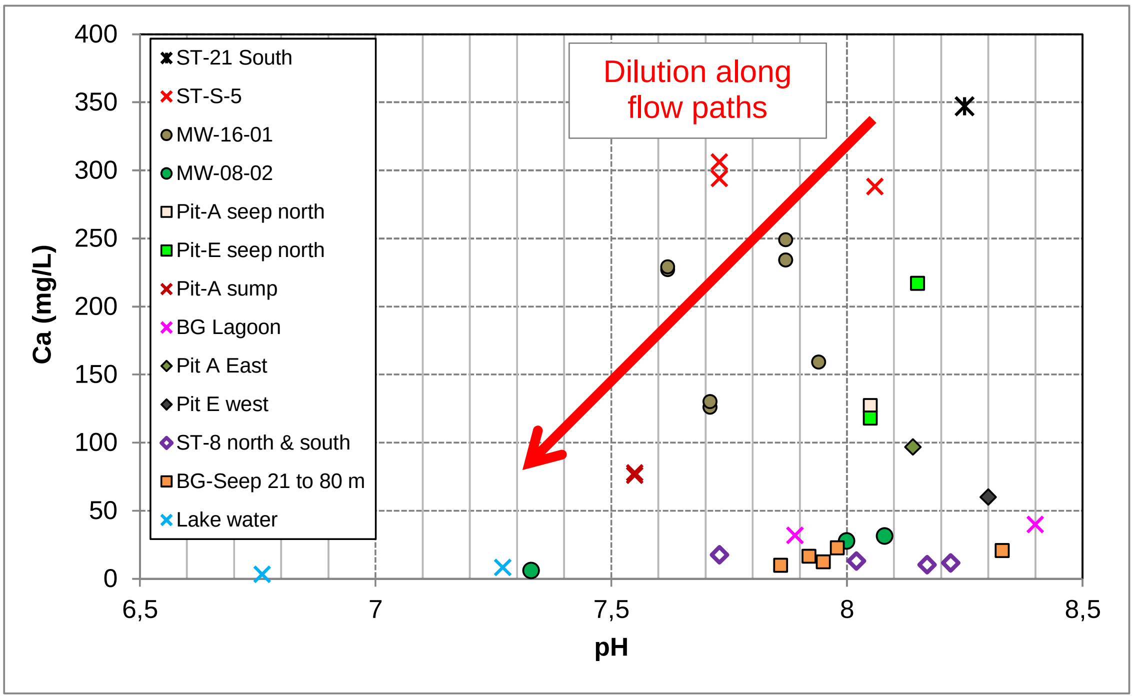


Figure 3-1 : Dissolved Calcium concentrations vs pH

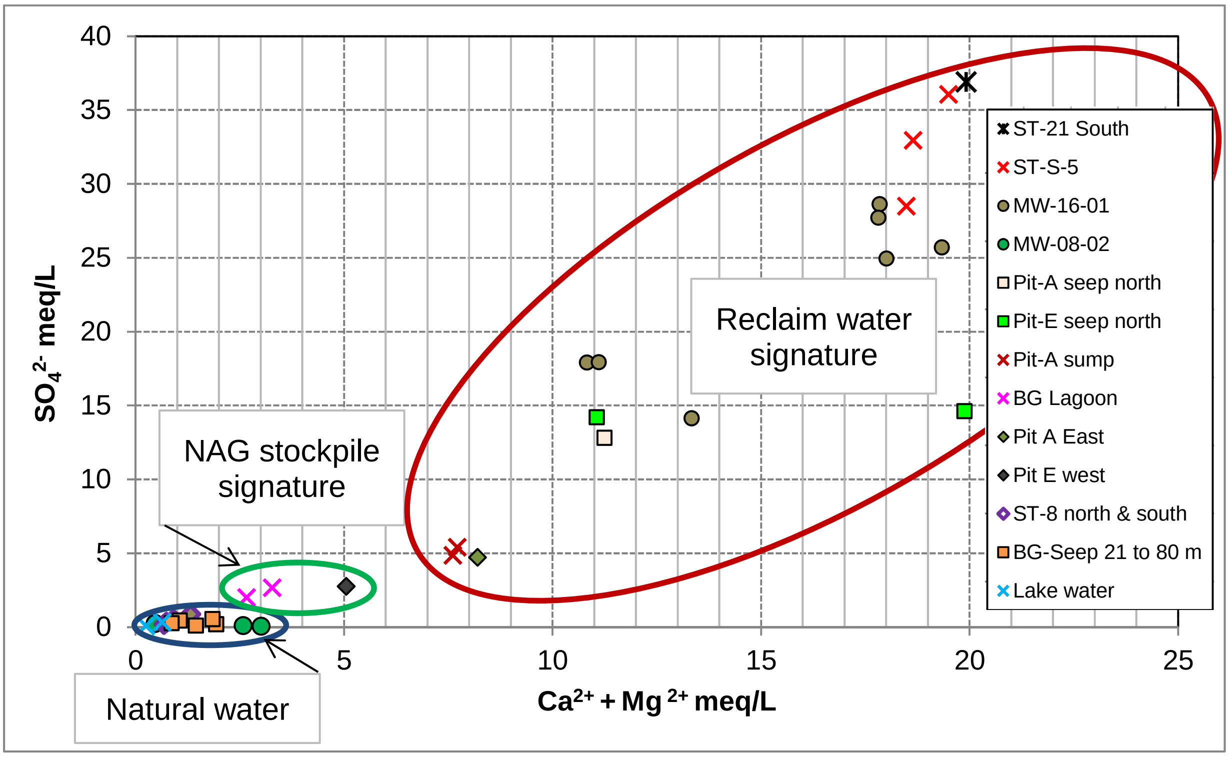


Figure 3-2 : Sulfate concentration vs dissolved calcium and magnesium concentrations

3.6 Hydrogeochemical cross-section

Another tool that could be refined for the next sampling campaigns is a visual representation of sampling results on geological cross-sections. Hydrogeological cross-sections help to see the water types in relation to their sampling elevation and location along different groundwater flow paths.

The hydrogeochemical cross-sections location are presented on Appendix F map and the cross-section are illustrated in Appendix G (Excel spreadsheet). Stiff diagrams were represented directly on cross-section with the same scale. The cross-section sections were drawn along potential flow path in talik area where groundwater movement is more predictable. Former Lake bathymetry was also added to the cross-section to infer approximate unconsolidated sediment thickness over bedrock and elevation of former monitoring well before the pits mining.

Hydrogeochemical cross-sections are a useful tool to support the conceptual groundwater model and to define possible flowpaths for groundwater by tracing contaminants from sources to receptors.

4.0 Conclusions

After the completion of two site visits in 2017, the active participation of SNC-Lavalin professionals to the Meadowbank field sampling program review, elaboration and interpretation, led to the following conclusions:

> To find new monitoring stations for groundwater sampling, a thorough field investigation of the pit walls, mine infrastructure, dike seepages and groundwater monitoring stations network was achieved during the two-site visits;

> Equipment was inspected, replaced or calibrated when required and cleaned to prevent any contamination during sampling operations;

> State of the art sampling techniques were performed and each sampling station was selected based on its contribution to the global understanding of groundwater quality;

> Interpretation of 2017 geochemical data aims to provide a global portrait of groundwater quality at the mine site and its potential linkage to surface water of mining activities;

> Some samples are not representative and can be discarded from further interpretations;

> Some monitoring stations types should be removed from future water sampling programs (e.g. Pit sump, geotechnical boreholes);

> Reclaim water is a source of sulfate and can be traced along the groundwater flow paths (from ST-21 to ST-S-5, MW-16-01);

> Waste rock piles could be a potential source for calcium and sulfate for the surrounding surface and groundwater and could be investigated further (Pit-E-seep-40m, Pit-A-seepage);

> Conclusions drawn from the preliminary interpretation of chemical data should be investigated further and need to be validated with additional groundwater analysis throughout time.

5.0 Recommendations

Recommendations for the groundwater sampling program at Meadowbank are made on the basis of a throughout investigation of analytical results obtained prior 2017, two site visits and participation to the field sampling campaigns in 2017 by SNC-Lavalin professionals:

> New wells are required to complete the monitoring program and monitoring network. New wells should be implemented considering the current state of knowledge and well should be installed in talik areas (see recommendations and well design submitted to AEM Geotechnical department);

> Monitoring station types need to be selected carefully and need consistency. To be able to compare data within a dataset, all stations need to be sampled during the same week of the same month, year after year. A long-term groundwater monitoring network should be established;

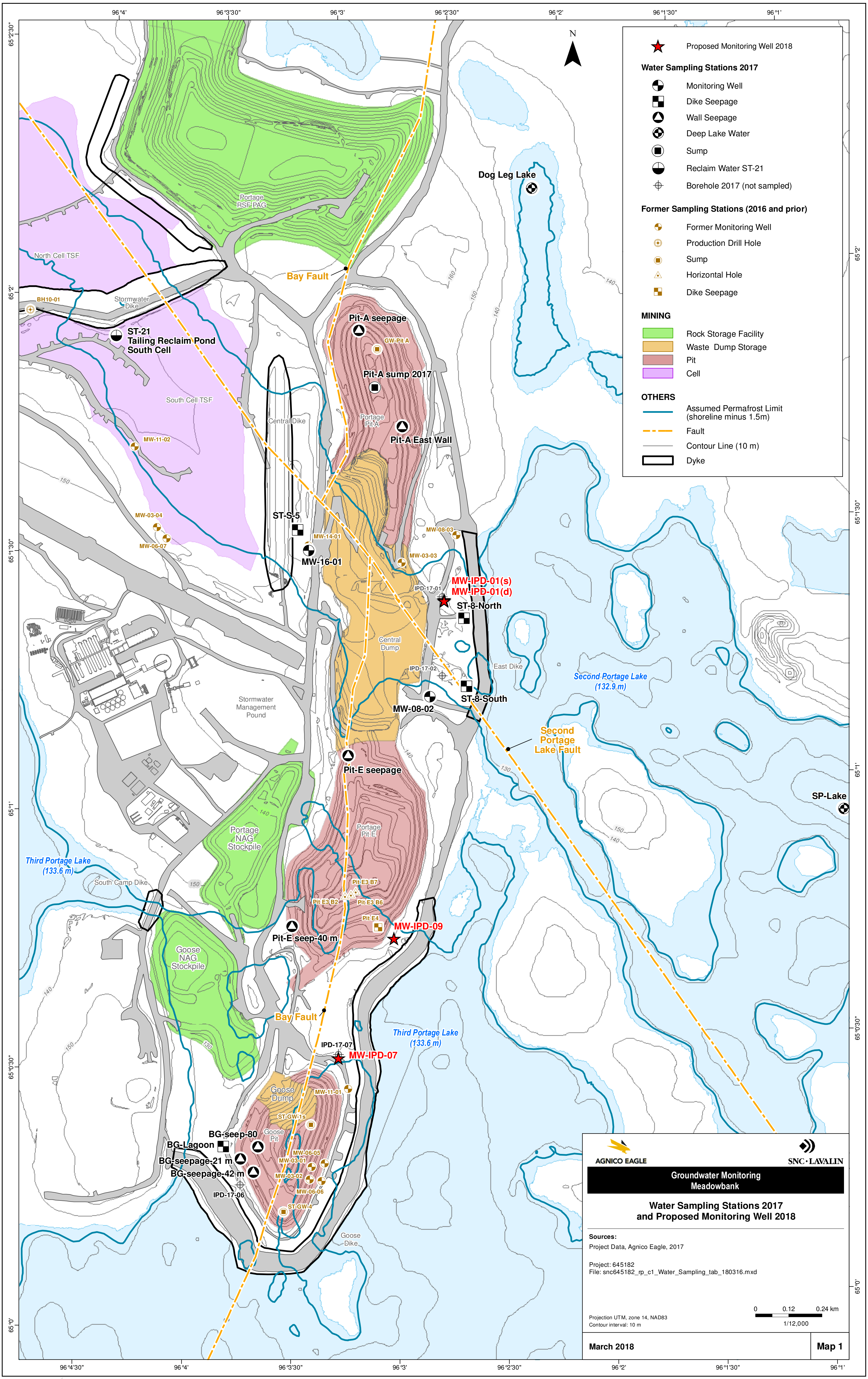
> Same sampling methodologies have to be used at each station and AEM staff need to be trained accordingly to be familiar with the technical equipment;

> Equipment has to be cleaned before using it for a different sampling station;

> Heat traces must be installed in monitoring wells. Pumps and tubing for groundwater monitoring should be dedicated to each well. A new tubing should be used for each alternative monitoring station (pit wall seepage, dike seepage as for BG-Lagoon);

- Low flow technique with nitrogen gas is recommended for wells. A double valve pump could be dedicated to a well as long as the heat traces are working;
- It takes 2 to 6 hours to melt MW-08-02 water and more than 24 h to freeze back. This groundwater well should be sampled with low-flow techniques for the next season. The Solinst double valve pump should be installed right after blowing out the excess water following ice melt inside the well. The pump should be lowered at 150 m and 200 L of groundwater should be pumped before collecting a sample;
- Appropriate and calibrated probes have to be used to measure salinity and TDS. Currently, the value given by the probe is just a calculation from the conductivity measurements;
- Tubing has to be dedicated to each sampling station and should not be reused for any other station;
- Groundwater has to be filtered on the mine site with 0,45 microns filters for dissolved metal analysis;
- Duplicate and transport blanks are needed on a regular basis (5% of total samples);
- For the next field investigation, water used by the laboratory to fill the blank samples should be analyzed for the same parameters than the monitoring samples itself. If water used for the blank samples is cleaned (free of all parameters), then a source of contamination during transport should be identified by AEM regarding the following parameters: carbon, nitrogen, cyanide, sulfate, etc. Transport containers should be cleaned and selected accordingly. Moreover, transport blank should be kept in a refrigerator that is not used to store samples.
- Groundwater major dissolved ions Ca, Na, Mg, K, Cl, SO_4, and HCO_3 should always be analyzed. This way, ionic balance can be calculated to establish if a sample is representative. Therefore, a few parameters should be added to the list to complete the monitoring program and certify data quality. For example, analysis of some isotopes would support the comprehension of groundwater migration along flow paths and the origin of those chemical components;
- To deduce the source of calcium and sulfate potentially present into surrounding water, recharge rates from rain water and snow melt could be establish within waste rock piles (NAG, RAG, and Central Dump) to establish a potential leaching rate for these parameters.

Appendix A
Map of sampling locations



AGNICO EAGLE

SNC · LAVALIN

Groundwater Monitoring
Meadowbank

Water Sampling Stations 2017
and Proposed Monitoring Well 2018

Sources:
Project Data, Agnico Eagle, 2017

Project: 645182
File: snc645182_rp_c1_Water_Sampling_tab_180316.mxd

Projection UTM, zone 14, NAD83
Contour interval: 10 m

0 0.12 0.24 km
1/12,000

March 2018

Map 1

S:\Généralités\GÉOMATIQUE\Projets\645182_Meadowbank\geomatique\interne\diffusion\produit\rapport\snc645182_rp_c1_Water_Sampling_tab_180316.mxd

Appendix B
Photographic report

P1: EQUIPMENT TESTING AND CLEANING

Equipment testing and cleaning prior field work:

Double valve pump (DVP) and control unit were tested. Two DVP pump were taken apart and cleaned with phosphate free soap Liquinox®.

Former control unit Model 466 was replaced with a control unit Solinst 464 250 psi version. https://www.solinst.com/products/groundwater-samplers/464-pneumatic-pump-control-units/electronic-control-unit-datasheet/

P2: EQUIPMENT PREPARATION ON SITE

Materiel for sampling was prepared on site. Probes were calibrated at the environment office.

P3-P6: MINE VISIT AND PIT WALLS INVESTIGATION

A pickup ride was taken around the mine to get familiar with infrastructures, sumps, surface water, reclaim water, and pit walls. Pit walls were investigated for groundwater seepages. Different types of seepage were observed. The idea was to find seepages that would be accessible, representative of groundwater and remain through the summer.

P7: SAMPLING RECLAIM WATER ST_21

Sampling reclaim water S-21

P8: SAMPLING GROUNDWATER WELL MW-16-01

Sampling groundwater well MW-16-01:

Groundwater well MW-16-01 was sample with low flow techniques using nitrogen gaz.

A double valve pump (DVP) was installed at around 95 m below ground. The DVP pump was installed at the screen interval level.

The pumps and the tubing were dedicated to the well.

P9-P11: STEAMING AND PURGING ICE IN WELL MW-08-02

Since the heat traces on well MW-08-02 are damaged, the well is blocked with 120 m of ice. He ice is melted with a steamer used with 500 feet of hoses.

Melting 120 m of ice in MW-08-02 takes about 2 hours. Some water comes back up the well since ice is obstructing the well.

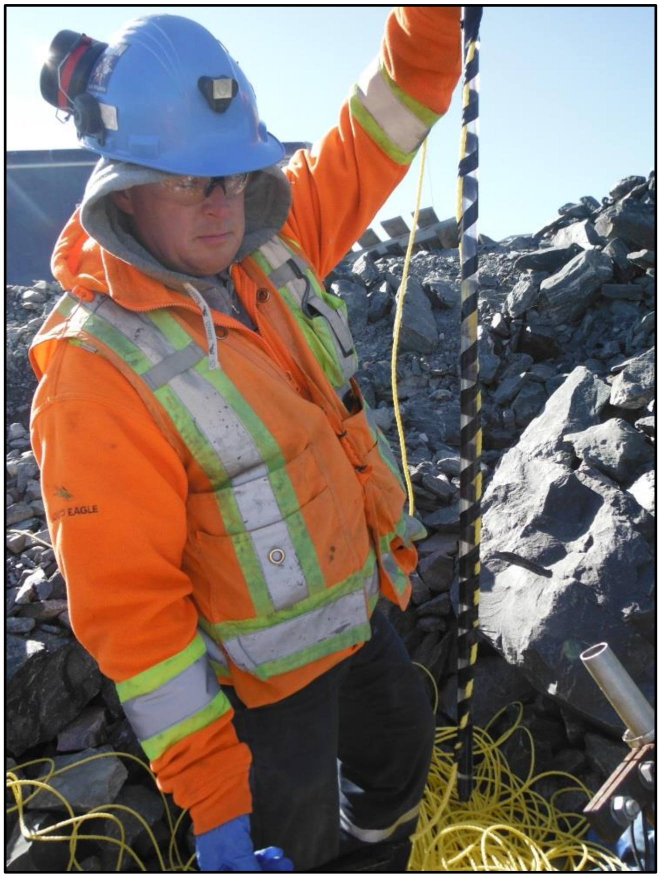
MW-08-02 was purged with compress air to remove the melted ice and the water added through the steaming operations. All the operations to free the well from ice together take an entire day. Despite the extensive purging, it is impossible to remove all trace of the operation from the well. The hose have to be extended on the ground and dirt end up going into the well. It is impossible to keep all material clean.

P12-P14: SAMPLING GROUNDWATER WELL MW-08-02

The water level is measured. If the groundwater level is back to its static level of about 30 m for this well, a groundwater sample is collected. At this points ice already stated to form in water.

To retrieve a water sample closest to the screened interval, a rope and a metal rod are taped on the 200 mL clean bailer plastic bailer. The bailer is lowered down to the maximal depth of 160 m for this well where a water sample is collected. It takes twenty (20) full 200 mL bailer to fill the bottles for the required analysis.

Despite the fact that sample collected in July is similar in composition from the one collected in September, there are too much variability in major constituent. This is not a proper method to sample this well. The well would need to be purged with a DVP for multiple hours before collecting a sample.



P15: SAMPLING DIKE SEEPAGE ST-8-NORTH

A temporary well is installed at ST-8 North for dewatering. The well is 6 m deep. A sample through a tap connected to a dewatering pump

P16: SAMPLING DIKE SEEPAGE ST-8-SOUTH

A temporary well is installed at ST-8 South for dewatering. The well is 6 m deep. A sample is collected through a tap connected to a dewatering pump.

P17: SAMPLING DIKE SEEPAGE ST-S-5 (SURFACE WATER)

ST-S-5 is a dyke seepage that is continuously pumped. A sample is collected through a tap connected to a dewatering pump installed at the bottom.

P18-P22: SAMPLING DIKE SEEPAGE LAGOON BG (SURFACE WATER)

Water level higher in July

Water level in September (much dryer)

P23-P24: SAMPLING WALL SEEPAGE BG-21 m

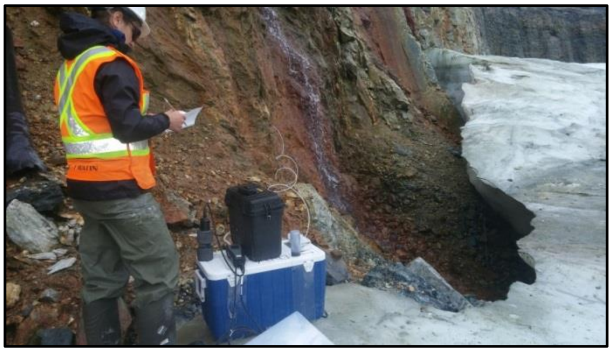
The pit walls were carefully investigated to find seepages accessible that were: clearly coming from the rock (groundwater), and that had a flow sufficient to be sampled.

Clean LDPE ¼ diameter tubing is inserted into the bedrock cavity to capture groundwater and prevent it to come in contact with air.

The water runs by gravity into a flow through cell, one again to prevent water to come in contact with air, to measure representative multiple physicochemical parameters with a YSI Pro 556.

All wall seepages are sampled the same manner.

P25-P28: SAMPLING WALL SEEPAGE BG (42 m and 80 m)



July - Sampling groundwater at Bay Goose Pit wall at approximatively two benches down the ground surface ~42 m.

A tube is inserted into the wall to capture groundwater and prevent it to come in contact with air.

September - Sampling groundwater at Bay Goose Pit wall at approximatively two benches down the ground surface ~42 m.

A tube is inserted into the wall to capture groundwater and prevent it to come in contact with air.

The ice on the ramp had melted.

September - Sampling groundwater at Bay Goose Pit wall at approximatively four benches down the ground surface ~80 m.

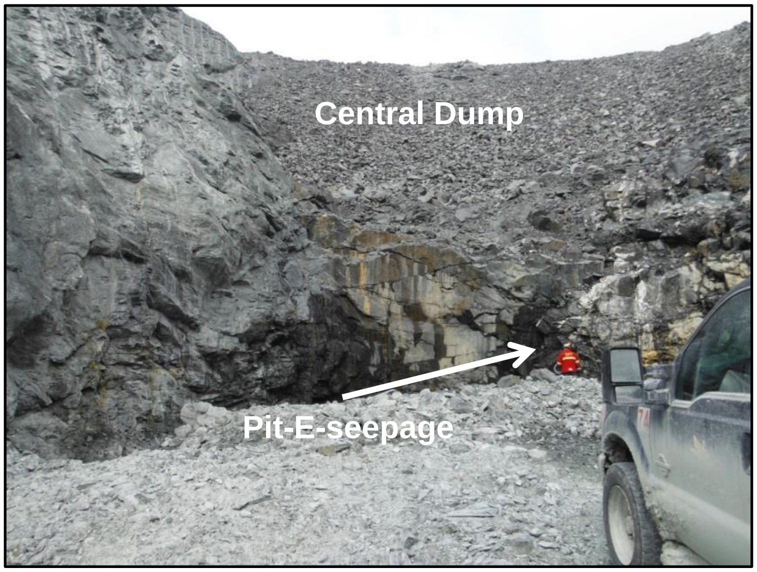
A tube is inserted into the wall to capture groundwater and prevent it to come in contact with air.

P29-P32: SAMPLING WALL SEEPAGE PIT A

July - Sampling groundwater on Pit A north wall, not enough water was flowing to sample this wall seepage in September

Septembre - Sampling groundwater on Pit A east wall.

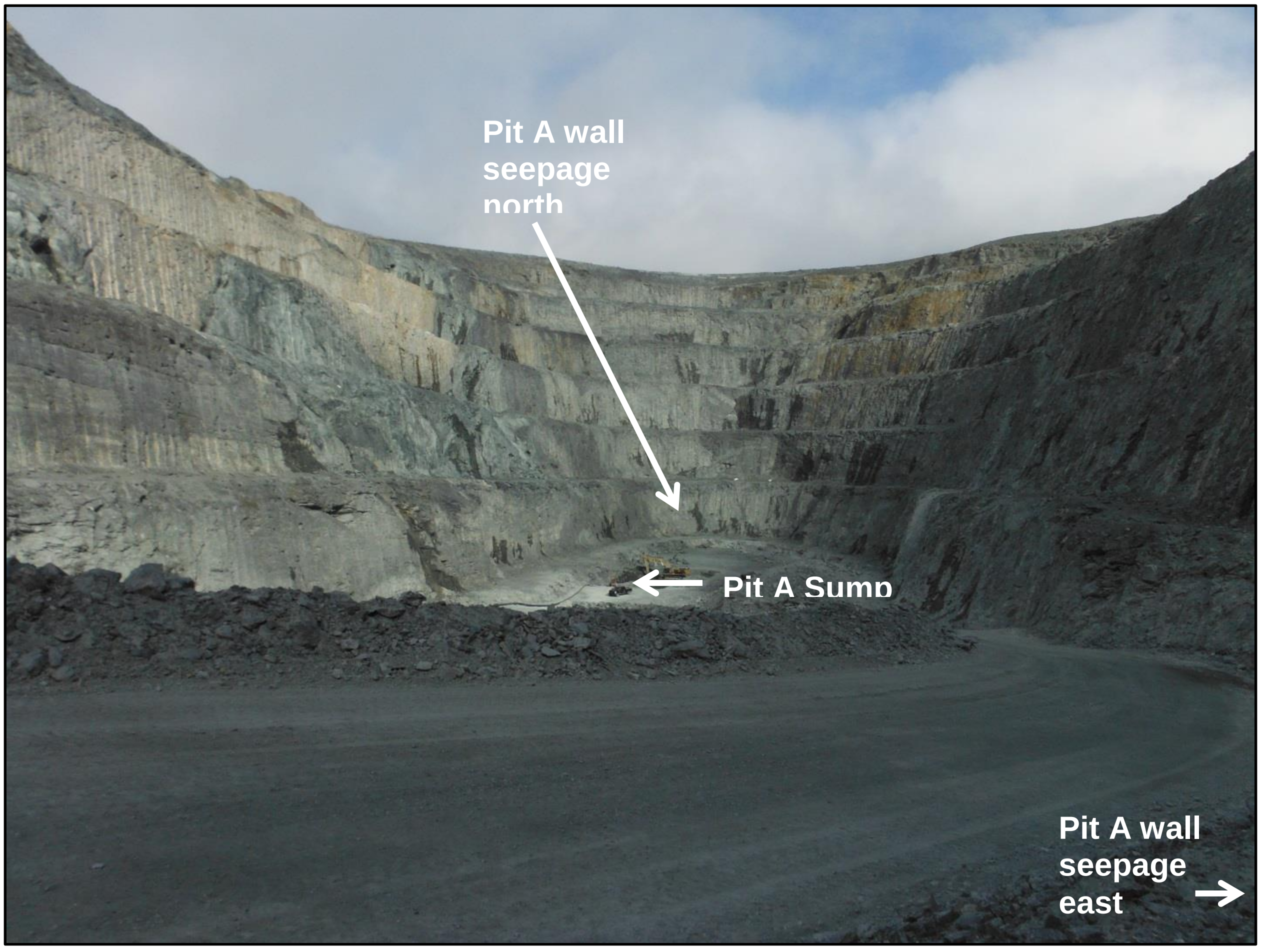
P33: SAMPLING WALL SEEPAGE PIT E



July and Septembre - Sampling groundwater on Pit E interface with Central dump

P34: SAMPLING WALL SEEPAGE PIT E WEST WALL

P35-P36: SAMPLING PIT A SUMP

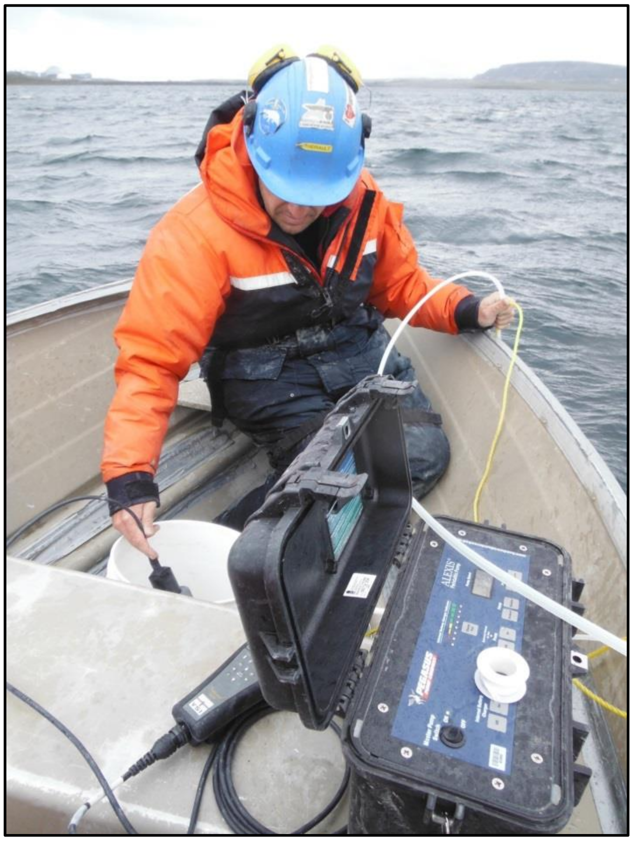


Septembre - Sampling groundwater on Pit A sump. Clean LDPE tubing was used with a peristaltic pump to sample the sump. However, the ground was too reworked and there was to much sediments in suspention for the sample to be representative of groundwater. When water comes up in pit bottom during exploitation, a temporary well could be installed to sample groundwater with standard methods.

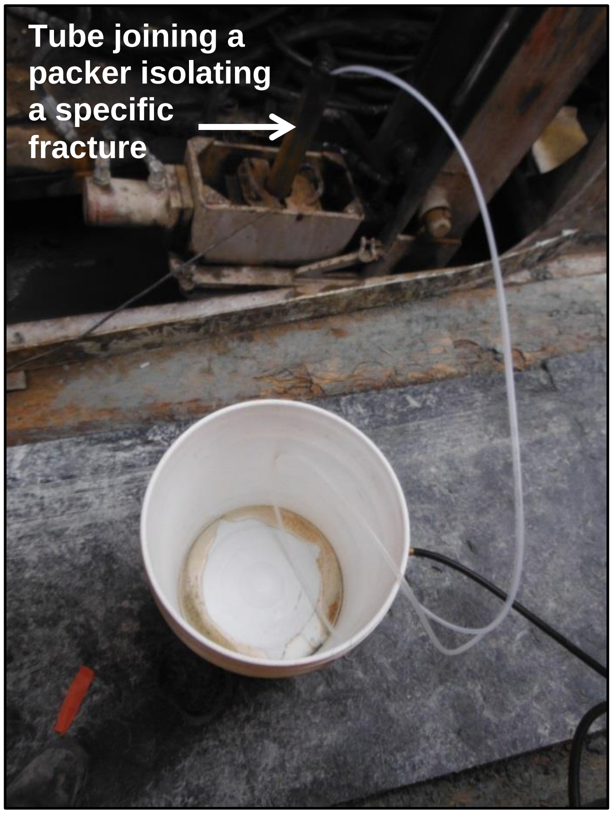
P37-P39: SAMPLING DEEP LAKE (SURFACE WATER)

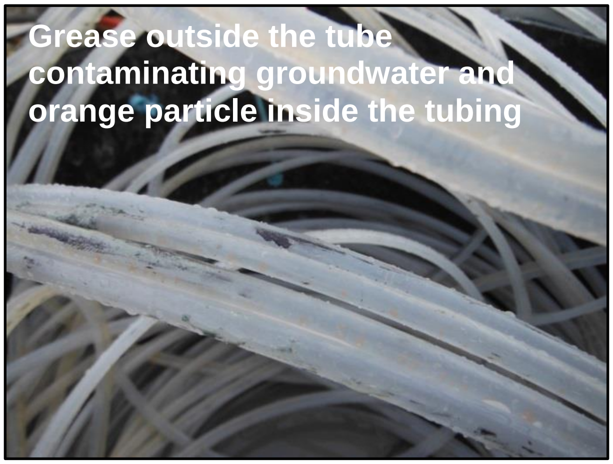
July – Two lake samples were collected. A metal rod was attached to clean LDPE ¼ diameter tubing. The rod and tubing were lowered down into the lake where bathymetry was known to be at its deepest for the area.

Water was pump via a peristaltic pump and physicochemical parameters were recorded via the flow through cell before taking a sample. Water was dirty at first because the rod inserted to Lake Bottom, but became clear soon after the beginning of pumping.



P40-P43: SAMPLING GEOTECHNICAL BOREHOLES





An attempt was made to sample IPD-17-06 Geotechnical hole at interval 140,6-146 m – A double valve pump was lowered down as closed as possible to the open screened interval (7,7 m above). The pump was operated with compress air instead of nitrogen. However, it was soon realized that the water coming out was too dirty to be sampled and that it would be impossible with the equipment in place to get cleaned water since the pump was too far from the screened interval. The inside of the casing were full of grease.

Appendix C
Analytical results

(provided in numerical Microsoft Excel format)

	Qc-Provincials		Federals guidelines			Discharge criteria ^{5} 3x PL	LDR ^{6}	Units	Samples and duplicates																																		Transport Blanks	
Sample ID	Drinking Water ^{1}	Surface water resurgence ^{2}	Guidelines for Canadian Drinking Water Quality ^{3}	Water Quality Guidelines for the Protection of Aquatic Life for Fresh Water ^{4}					MW-16-01-D	MW-16-01-D - DUP	MW-16-01-Sur	MW-16-01-Sur-DUP	BG-SEEP-42m	BG-SEEP-21m	MW-08-02	MW-08-02-DEEP	Pit E-SEEP-f	Pit A-SEEP-North	SP-DEEP	Dog leg deep	ST-S-5	ST-S-5 DUP	ST-8 North	ST-8 South	BG Lagoon	ST-21 South	MW-08-02	BG-21M	BG-42M	BG-80M	MW-16-01-SUR	ST-8 South GW	ST-8 North GW	BG-LAGOON	ST-S-5 GW	MW-16-01-Deep	MW-16-01-Deep DUP	Pit A sump	Pit A sump DUP	Pit A Seep E	Pit E seep	Pit E seep 40m		
Sampling Date				Short Term	Long Term				July 16, 2018	July 16, 2018	July 16, 2018	July 16, 2018	July 16, 2018	July 16, 2018	July 17, 2018	July 18, 2018	July 18, 2018	July 18, 2018	July 19, 2018	July 19, 2018	July 19, 2018	July 19, 2018	July 19, 2018	July 19, 2018	July 19, 2018	September 03, 2017	September 03, 2017	September 03, 2017	September 03, 2017	September 03, 2017	September 04, 2017	September 04, 2017	September 04, 2017	September 04, 2017	September 04, 2017	September 04, 2017	September 04, 2017	September 05, 2017	September 05, 2017	September 05, 2017	September 05, 2017	September 05, 2017	July 19, 2018	September 05, 2017
Physico-chemical parameters																																												
Field-measured																																												
Conductivity	-	-	-	-	-	-	-	uS/cm	2.083	2.083	1.278	1.278	193	87	42	311	1.066	908	23	66	2.256	2.256	90	108	243	3.147	323	93	168	232	1.433	87	69	383	2.531	2.260	2.260	877	877	587	1.426	438		
Specific conductivity	-	-	-	-	-	-	-	uS/cm	2.744	2.744	1.651	1.651	302	153	71	556	1.720	1.350	33	94	3.776	3.776	134	164	347	4.484	572	160	286	347	1.977	126	98	480	4.179	3.090	3.090	1.468	1.468	933	2.301	646		
DO %	-	-	-	-	-	-	-	%	2.2	2.2	4.6	4.6	32.6	1.2	92.1	21.7	99.1	97.1	91.3	87.5	-	-	89.2	95.7	95.6	68.0	12.2	0.6	0.6	90.0	25.1	100.0	100.0	98.4	54.9	-	-	36.1	36.1	94.3	100.0	99.8		
DO	-	-	-	-	-	-	-	mg/L	0.24	0.24	0.48	0.48	4.10	0.17	12.28	2.97	12.59	11.47	10.32	9.78	7.61	7.61	10.44	11.50	10.98	7.62	1.69	0.08	0.08	10.74	2.00	11.51	12.50	10.54	6.99	-	-	4.72	4.72	11.83	12.64	11.72		
Oxygen Reduction Potential	-	-	-	-	-	-	-	mV	-184.1	-184.1	-80.0	-80.0	-156.9	-160.6	-9.2	-146.2	-2.2	6.2	62.3	-27.5	-37.7	-37.7	-17.6	-18.1	17.2	114.7	-182.5	-188.2	-174.2	-60.7	-181.2	-49.4	-46.0	-63.8	-71.8	-186.6	-186.6	-106.6	-106.6	-68.6	-68.3	-82.9		
pH	-	-	7.0-10.5 ^{7}	-	-	-	-	-	7.62	7.62	7.71	7.71	7.98	7.95	7.33	8.00	8.05	8.05	6.76	7.27	7.73	7.73	8.17	7.73	7.89	8.25	8.08	7.86	7.92	8.33	7.94	8.02	8.22	8.40	8.06	7.87	7.87	7.55	7.55	8.14	8.15	8.30		
Salinity	-	-	-	-	-	-	-	ppm	1.43	1.43	0.84	0.84	0.14	0.07	0.03	0.03	0.86	0.68	0.01	0.04	1.98	1.98	0.06	0.08	0.17	2.38	0.27	0.08	0.14	0.16	1.01	0.06	0.05	0.23	2.21	1.62	1.62	0.73	0.73	0.46	1.18	0.31		
Temperature	-	-	15 ^{7}	-	-	-	-	°C	12.4	12.4	13.2	13.2	6.2	2.5	3.4	2.0	5.0	7.9	9.9	9.6	3.9	3.9	8.1	7.3	9.2	9.7	1.6	3.0	3.5	7.6	10.6	8.8	9.4	12.2	4.4	11.0	11.0	4.1	4.1	5.6	5.0	8.6		
Total Dissolved Solids	-	-	500 ^{7}	-	-	-	-	mg/L	1,781	1,781	1,072	1,072	195.65	99.45	46.15	361.4	1,118	877.5	20.8	61.1	2,457.0	2,457.0	87.1	106.6	225.6	2,892.6	371.15	104	185.9	224	1,287.59	81.9	63.7	312	2,717	2,015	2,015	949	949	604.5	1,495	416		
Turbidity	-	-	-	-	-	-	-	NTU	0.45	0.45	9.66	9.66	4.79	1.57	54	26.2	7.31	6.26	2.25	3.18	15.2	15.2	7.35	4.02	15.7	24.1	13.9	3.49	2.30	2.74	28.1	1.45	1.14	43.0	17.2	59.2	59.2	1.23	1.23	2.10	2.40	1.88		
Calculation																																												
Eh		-						mV	63.28	63.28	166.34	166.34	98.54	99.65	249.88	114.70	254.80	259.43	312.93	223.52	220.70	220.70	235.37	235.91	268.74	365.59	78.92	71.40	84.75	192.92	68.52	202.66	205.28	183.84	185.98	62.60	62.60	151.57	151.57	187.62	188.70	169.42		
pe	-	-	-	-	-	-	-	-	1.22	1.22	3.20	3.20	1.90	1.92	4.81	2.21	4.90	4.99	6.02	4.30	4.24	4.24	4.53	4.54	5.17	7.03	1.52	1.37	1.63	3.71	1.32	3.90	3.95	3.54	3.58	1.20	1.20	2.91	2.91	3.61	3.63	3.26		
Laboratory																																												
Alkalinity (CaCO$_3$)	-	-	-	-	-	1.5	2	mg CaCO$_3$/L	**181**	**182**	**167**	**167**	**108**	**68**	**23**	**181**	**90**	**83**	**20**	**51**	**122**	**122**	**41**	**52**	**63**	**127**	**75**	**61**	**104**	**97**	**166**	**27**	**29**	**77**	**121**	**172**	**173**	**153**	**155**	**86**	**152**	**94**	**90**	**2**
Bicarbonate Alkalinity (HCO$_3^-$)	-	-	-	-	-	-	2	mg CaCO$_3$/L	181	182	167	167	108	68	23	181	90	83	20	51	122	122	41	52	63	127	75	61	104	97	166	27	29	77	121	172	173	153	155	86	152	94	90	2
Carbonate Alkalinity (CO$_3^{2-}$)	-	-	-	-	-	-	2	mg CaCO$_3$/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dissolved Organic Carbon	-	-	-	-	-	-	0.2	mg/L	36.2	36.4	21.3	27.5	4.3	3	11.8	47.5	4.6	5.2	2.2	4.4	48.6	47.9	1.7	2.5	5.1	38.7	23.6	2.6	4.2	3.1	29	2.4	1.9	6.1	29.3	48	47.8	6.2	6	3.1	4.8	4.5	0.3	<0.2
Hardness (CaCO$_3$)	-	-	-	-	-	-	1	mg CaCO$_3$/L	896	937	607	576	101	54	25	190	775	692	13	39	1026	995	38	61	133	997	160	46	75	95	615	41	36	173	871	959	986	444	458	557	1214	324	<1	<1
Reactive silica	-	-	-	-	-	-	1	mg/L	8.6	8.4	9.1	8.2	7.8	9.4	0.32	1.4	10	5	0.57	0.65	7.7	6.8	1.2	1.6	1.5	5.1	3.8	7.9	7.8	4.4	6.7	2.1	1.3	2.8	6	8	7.1	6.9	7.4	4.6	8.5	7.6	0.2	0.16
Salinity	-	-	-	-	-	-	1	ppm	1	1	1	1	<1	<1	<1	<1	<1	1	<1	<1	2	2	<1	<1	<1						1	<1	<1	<1	2						1		<1	
Total Organic Carbon	-	-	-	-	-	-	0.2	mg/L	36.2	36.4	29.9	27.5	4.3	3.2	11.8	47.5	4.6	5.2	2.7	4.4	48.6	48.6	2.4	2.9	5.1	38.7	23.6	2.6	4.2	3.1	29	2.4	2.0	6.1	29.3	48	47.8	6.2	7.6	3.1	4.8	4.5	0.7	0.4
Total Suspended Solids	-	-	-	-	^{7}	15	1	mg/L	14	14	4	<1	1	<1	**35**	**22**	**16**	4	4	**24**	13	14	**26**	**23**	**22**	**78**	10	1	2	6	15	6	6	**62**	11	**17**	12	**162**	**136**	<1	<1	<1	<1	<1
Total Dissolved Solids	-	-	500 ^{7}	-	-	-	1	mg/L	1971	1967	1198	1206	212	106	52	303	393	1222	25	69	2664	2670	68	118	255	2847	380	106	194	238	1258	81	65	317	2112	1962	1963	912	921	602	1464	404	962	1
Dissolved metals and metalloids																																												
Dissolved Aluminium (Al)	0.1 ^{7}	-	^{7}	-	^{7}	1	0.006	mg/L	<0.006	<0.006	<0.006	<0.006	<0.006	0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.123	<0.006	<0.006	<0.006	<0.006	<0.006	0.122	<0.006	0.006	<0.006	<0.006	0.013	<0.006	0.016	0.008	<0.006	<0.006	<0.006	0.285	0.495	<0.006	<0.006	<0.006	<0.006	<0.006
Dissolved Antimony (Sb)	0.006	1.1	0.006	-	-	-	0.0001	mg/L	<0.0001	<0.0001	0.0014	0.0015	0.0002	<0.0001	0.0041	0.0001	0.0026	0.004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0011	0.0193	<0.0001	<0.0001	<0.0001	0.0006	0.0003	<0.0001	<0.0001	0.0018	0.0001	<0.0001	<0.0001	0.0034	0.0032	0.0021	0.002	0.0025	<0.0001	0.0001
Dissolved Arsenic (As)	0.0003 ^{7}	0.34	0.01	-	0.005	-	0.0005	mg/L	0.2336	0.2349	0.0085	0.0039	<0.0005	0.0018	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0083	0.0131	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0376	<0.0005	<0.0005	<0.0005	<0.0005	0.1929	0.1976	0.0284	0.0299	<0.0005	0.023	0.008	<0.0005	<0.0005
Dissolved Baryum (Ba)	1	0.6 ^{7}	1	-	-	-	0.0005	mg/L	0.0282	0.0298	0.0366	0.036	0.0746	0.0209	0.004	0.0137	0.013	0.0585	<0.0005	0.0025	0.0222	0.0195	0.0068	0.0077	0.0269	0.0874	0.0241	0.0203	0.0707	0.0305	0.0357	0.0053	0.0074	0.0307	0.0216	0.0301	0.0307	0.0258	0.0258	0.0193	0.0254	0.0906	<0.0005	<0.0005
Dissolved Beryllium (Be)	-	-	-	-	-	-	0.0005	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Dissolved Boron (Bo)	5	28	5	-	-	-	0.01	mg/L	0.01	0.01	<0.01	<0.01	0.04	<0.01	<0.01	0.07	0.15	0.02	<0.01	<0.01	0.08	0.03	<0.01	<0.01	<0.01	0.16	0.13	0.01	0.07	0.07	0.03	<0.01	<0.01	0.11	0.08	0.03	0.04	0.07	0.08	0.01	0.26	<0.01	<0.01	<0.01
Dissolved Cadmium (Cd)	0.005	0.0011 ^{7}	0.005	0.001	0.00009	-	2E-05	mg/L	<0,00002	<0,00002	<0,00002	<0,00002	<0,00002	<0,00002	<0,00002	0.00003	0.00022	0.00119	<0,00002	<0,00002	0.00133	0.00075	<0,00002	<0,00002	0.00004	0.00137	<0,00002	<0,00002	<0,00002	<0,00002	<0,00002	<0,00002	<0,00002	<0,00002	0.00066	0.00004	0.00003	0.00047	0.00052	0.00037	0.0003	<0,00002	<0,00002	<0,00002
Dissolved Calcium (Ca)	-	-	-	-	-	-	0.03	mg/L	227	229	126	130	22.7	12.4	6.07	27.7	118	127	3.28	8.19	306	294	10.4	17.7	31.7	347	31.4	9.93	16.4	20.6	159	13.1	11.7	39.9	288	234	249	77.8	76	96.7	217	59.9	<0.03	<0.03
Dissolved Chromium (Cr)	0.05	-	0.05	-	-	-	0.0006	mg/L	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	0.003	<0.0006	0.0011	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	0.0007	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	0.0036	0.0074	<0.0006	<0.0006	<0.0006	0.0014	<0.0006
Dissolved Copper (Cu)	1	0.0073 ^{7}	1 ^{7}	-	^{7}	-	0.0005	mg/L	0.0026	0.003	0.0012	0.0011	<0,0005	<0,0005	<0,0005	0.002	0.0011	0.0009	<0,0005	0.0012	0.0073	0.0063	0.0006	0.001	0.0021	0.5703	<0,0005	<0,0005	<0,0005	0.0047	0.0015	0.0032	<0,0005	0.0024	0.0037	0.0023	0.0028	0.0005	0.0013	0.0006	0.0013	0.0017	<0,0005	<0,0005
Dissolved Iron (Fe)	-	-	0.3 ^{7}	-	0.3	-	0.01	mg/L	6.32	6.42	1.79	1.81	0.69	0.81	<0,01	1.47	0.05	0.02	<0,01	0.57	0.15	0.2	<0,01	0.02	0.01	<0,01	0.02	0.27	0.03	<0,01	3.92	0.05	0.04	0.02	0.05	6.1	6.15	1.23	1.98	0.01	0.1	0.01	<0,01	<0,01
Dissolved Lead (Pb)	0.01	0.034 ^{7}	0.01	-	^{7}	-	0.0003	mg/L	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Dissolved Lithium (Li)	-	-	-	-	-	-	0.005	mg/L	0.01	0.009	0.007	0.007	0.014	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	0.005	0.006	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	0.005	<0.005	0.014	<0.005	<0.005	<0.005	0.008	0.019	0.018	0.006	0.008	<0.005	0.009	0.005	<0.005	<0.005
Dissolved Magnesium (Mg)	-	-	-	-	-	-	0.02	mg/L	79.2	77.6	55.2	56.2	9.77	5.43	2.06	14.6	62.9	59.7	1.11	2.78	51.4	48.3	1.93	5.29	13.2	31.6	17.6	4.49	7.67	9.94	65.6	3.04	1.89	15.7	50	76.9	84	46.6	46.4	41	110	25.1	<0.02	<0.02
Dissolved Manganese (Mn)	0.05 ^{7}	2.3 ^{7}	0.05 ^{7}	-	-	-	0.0005	mg/L	2.287	2.384	1.375	1.436	0.0712	0.0729	0.1569	0.0662	0.0607	0.075	0.001	0.0164	1.773	1.784	0.0035	0.0451	0.1065	0.1831	0.0768	0.0569	0.0458	0.0059	1.617	0.0104	0.0016	0.0293	1.669	2.495	2.545	0.0936	0.1013	0.0151	0.2469	0.1595	<0.0005	<0.0005
Dissolved Mercury (Hg)	0.001	0.0000013	0.001	-	0.000026	-	1E-05	mg/L	<0.00001	0.00002	0.00031	0.00029	0.00029	0.00017	<0.00001	0.00015	0.00001	<0.00001	<0.00001	<0.00001	0.0001	<0.00001	<0.00001	<0.00001	<0.00001	0.00052	0.00013	0.00029	0.0003	0.00007	0.00022	0.00004	<0.00001	<0.00001	0.00011	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00009	<0.00001	<0.00001
Dissolved Molybdenum (Mo)	0.07	29	-	-	0.073	-	0.0005	mg/L	0.0192	0.0202	0.0228	0.0236	0.0116	0.0119	0.0012	0.0094	0.0544	0.2837	<0.0005	<0.0005	0.3174	0.2731	0.0009	0.0006	0.0033	0.4996	0.0091	0.011	0.0089	0.0104	0.0205	0.0005	<0.0005	0.0031	0.201	0.0222	0.0223	0.162	0.1571	0.1089	0.1027	0.0149	<0.0005	<0.0005
Dissolved Nickel (Ni)	0.07 ^{7}	0.26 ^{7}	-	-	^{7}	-	0.0005	mg/L	0.0073	0.0073	0.011	0.0111	0.002	0.0006	0.0049	0.0012	0.0444	0.0054	<0.0005	0.001	0.0201	0.0168	0.0015	0.0087	0.0096	0.1538	0.0009	0.001	<0.0005	0.0334	0.0099	0.0033	<0.0005	0.0057	0.0222	0.0089	0.0098	0.1149	0.1105	0.0087	0.1699	0.0332	<0.0005	<0.0005
Dissolved Potassium (K)	-	-	-	-	-	-	0.05	mg/L	17.4	17.5	8.05	7.77	2.74	3.37	0.86	1.75	19	10	0.4	1.02	65.5	63.6	0.89	1.74	5.82	97.3	1.41	2.58	2.07	3.92	10.8	1.59	1.22	9.84	73.3	20.1	20.6	48.3	47.8	11.8	49.5	11.1	<0.05	<0.05
Dissolved Selenium (Se)	0.01	0.062	0.05	-	0.001	-	0.001	mg/L	0.004	0.005	0.004	0.004	0.001	<0.001	<0.001	0.002	0.008	0.004	<0.001	<0.001	0.014	0.01	<0.001	<0.001	<0.001	0.038	0.003	<0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	0.008	0.004	0.004	0.001	0.002	0.002	0.002	0.001	<0.001	<0.001
Dissolved Silver(Ag)	0.1	0.00062 ^{7}	-	^{7}	0.0003	-	0.0001	mg/L	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	0.0018	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001
Dissolved Sodium (Na)	200 ^{7}	-	200 ^{7}	-	-	-	0.05	mg/L	296	306	140	147	19.8	8.16	2.3	17.5	41.4	27.1	0.73	2.38	428	410	1.13	1.78	11.1	436	22.2	6.67	17.7	18.5	199	2.01	1.61	19.2	377	322	341	46.3	43.8	20.2	90.1	13.6	<0,05	<0,05
Dissolved Strontium (Sr)	-	-	-	-	-	-	0.005	mg/L	1.02	1.02	0.808	0.719	0.307	0.149	0.05	0.542	1.39	0.768	0.016	<0.005	1.31	1.3	0.067	0.086	0.206	1.71	0.504	0.138	0.305	0.248	1.23	0.085	0.067	0.358	1.65	1.76	1.69	0.702	0.951	0.446	1.55	0.371	<0.005	<0.005
Dissolved Thallium (Tl)	-	-	-	-	0.0008	-	0.0008	mg/L	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
Dissolved Tin (Sn)	-	-	-	-	-	-	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Titanium (Ti)	-	-	-	-	-	-	0.01	mg/L	0.29	0.29	0.14	0.14	0.01	<0.01	<0.01	0.02	0.12	0.13	<0.01	0.01	0.37	0.37	0.01	0.02	0.04	0.54	0.02	<0.01	0.01	0.01	0.15	0.01	0.01	0.04	0.28	0.23	0.24	0.06	0.06	0.07	0.17	0.04	<0.01	<0.01
Dissolved Uranium (U)	0.02	0.32 ^{7}	0.02	0.033	0.015	-	0.001	mg/L	0.004	0.004	0.021	0.021	<0.001	<0.001	<0.001	<0.001	0.058	0.134	<0.001	<0.001	0.026	0.025	<0.001	0.002	0.007	0.028	<0.001	<0.001	<0.001	0.013	0.019	0.001	0.001	0.011	0.028	0.004	0.004	0.043	0.042	0.068	0.196	0.024	<0.001	<0.001
Dissolved Vanadium (V)	-	-	-	-	-	-	0.0005	mg/L	<0.0005	<0.0005	0.0008	0.0008	0.0007	0.0023	0.0016	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0008	0.0007	<0.0005	<0.0005	<0.0005	<0.0005	0.0008	<0.0005	<0.0005
Dissolved Zinc (Zn)	5	0.067 ^{7}	5 ^{7}	-	0.03	-	0.001	mg/L	<0,001	0.001	0.005	0.004	0.008	<0,001	0.14	0.023	<0,001	<0,001	<0,001	<0,001	<0,001	0.001	<0,001	<0,001	0.001	<0,001	0.002	0.002	<0,001	<0,001	0.004	0.002	0.006	0.001	0.003	0.003	0.003	<0,001	0.001	0.003	<0,001	0.002	<0,001	<0,001
Total metals and metalloids																																												
Aluminium (Al)	0.1 ^{7}	-	^{7}	-	^{7}	-	0.006	mg/L	0.007	0.012	0.01	0.018	0.013	0.011	0.409	0.134	0.081	0.084	0.01	0.169	0.018	<0,006	0.307	0.038	0.27	0.157	0.026	<0,006	0.01	0.031	<0,006	0.022	0.019	0.729	0.028	<0,006	<0,006	0.649	0.787	0.095	0.041	0.245	<0,006	<0,006
Antimony (Sb)	0.006	1.1	0.006	-	-	-	0.0001	mg/L	<0.0001	<0.0001	0.0016	0.0018	<0.0001	<0.0001	0.0077	0.0011	0.0038	0.0045	<0.0001	0.0001	0.0001	0.0002	<0.0001	<0.0001	0.0015	0.0168	0.0006	0.0001	<0.0001	0.0006	0.0005	<0.0001	0.0001	0.0014	0.0002	<0.0001	<0.0001	0.0038	0.004	0.0026	0.0023	0.0026	<0.0001	<0.0001
Arsenic (As)	0.0003 ^{7}	0.34	0.01	-	0.005	-	0.0005	mg/L	0.2236	0.2364	0.0226	0.0205	<0,0005	0.0023	<0,0005	<0,0005	0.0008	<0,0005	<0,0005	<0,0005	0.0174	0.0285	<0,0005	0.0022	0.0012	<0,0005	<0,0005	0.0083	<0,0005	<0,0005	0.0385	<0,0005	<0,0005	<0,0005	0.0112	0.2075	0.2141	0.063	0.0671	<0,0005	0.0296	<0,0005	<0,0005	<0,0005
Baryum (Ba)	1	0.6 ^{7}	1	-	-	-	0.0005	mg/L	0.0318	0.0347	0.0379	0.0389	0.0756	0.0215	0.0085	0.0223	0.0207	0.0677	0.0018	0.0047	0.0225	0.0237	0.0123	0.0078	0.0313	0.0906	0.0271	0.0262	0.0742	0.0295	0.0353	0.0048	0.0101	0.0358	0.0215	0.0305	0.0309	0.0296	0.0322	0.0215	0.0285	0.1065	<0.0005	<0.0005
Beryllium (Be)	-	-	-	-	-	-	0.0005	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron (Bo)	5	28	5	-	-	-	0.01	mg/L	0.04	0.04	0.03	0.03	0.08	<0.01	<0.01	0.12	0.22	0.04	<0.01	<0.01	0.08	0.07	<0.01	<0.01	0.01	0.16	0.14	0.02	0.07	0.07	0.02	<0.01	<0.01	0.07	0.07	0.03	0.04	0.04	0.1	<0.01	0.23	<0.01	<0.01	<0.01
Cadmium (Cd)	0.005	0.0011 ^{7}	0.005	0.001	0.00009	0.002	2E-05	mg/L	0.00003	<0.00002	<0.00002	<0.00002	<0.00002	0.00003	0.00012	0.00004	0.00029	0.00135	<0.00002	<0.00002	0.00105	0.00089	<0.00002	<0.00002	<0.00002	0.00127	<0.00002	<0.00002	<0.00002	<0.00002	0.00004	<0.00002	<0.00002	0.00003	0.00065	0.00003	0.00002	0.00043	0.00049	0.00037	0.00035	<0.00002	<0.00002	<0.00002
Calcium (Ca)	-	-	-	-	-	-	0.03	mg/L	225	239	140	133	23.4	12.5	6.15	41.5	166	152	3.55	9.82	326	311	11.5	16.5	30.9	347	33.3	10.7	17	21.2	149	12	11.7	42.6	271	251	258	86.3	88.8	128	257	76.8	<0.03	<0.03
Hexavalent Chromium (Cr(VI))	-	0.016	-	-	0.001	-	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trivalent Chromium (Cr(III))	-	1 ^{7}	-	-	0.0089	-	-	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Chromium (Cr)	0.05	-	0.05	-	-	-	0.0006	mg/L	<0.0006	<0.0006	<0.0006	0.0025	<0.0006	<0.0006	0.0094	0.0034	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	0.001	<0.0006	0.0019	0.0007	0.0014	<0.0006	0.001	0.0018	<0.0006	<0.0006	<0.0006	0.0051	<0.0006	<0.0006	<0.0006	0.0122	0.0131	0.0012	<0.0006	0.0016	0.0014	0.0019
Copper (Cu)	1	0.0073 ^{7}	1 ^{7}	-	^{7}	0.1	0.0005	mg/L	0.0036	0.0036	0.0033	0.003	0.0023	0.0013	0.0284	0.0214	0.0012	0.0008	<0.0005	0.0015	0.008	0.0072	0.0014	0.0011	0.0033	**0.6471**	0.0028	<0.0005	<0.0005	0.0058	0.0052	0.003	0.0017	0.0055	0.0045	0.0037	0.0036	0.0035	0.0018	<0.0005	0.0015	<0.0005	<0.0005	<0.0005
Iron (Fe)	-	-	0.3 ^{7}	-	0.3	-	0.01	mg/L	6.5	6.77	2.35	2.31	0.84	0.83	3.54	2.53	0.39	0.18	0.09	0.58	1.02	1.23	0.61	0.17	0.47	0.03	1.4	0.76	0.58	0.07	4.45	0.37	0.1	1.49	1.72	6.51	9.29	3.71	3.26	0.27	0.24	0.37	<0,01	<0,01
Lead (Pb)	0.01	0.034 ^{7}	0.01	-	^{7}	0.1	0.0003	mg/L	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	0.0008	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003
Lithium (Li)	-	-	-	-	-	-	0.005	mg/L	0.01	0.01	0.008	0.007	0.012	<0.005	<0.005	0.006	0.005	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	0.006	0.005	0.011	<0.005	<0.005	<0.005	0.007	0.015	0.014	0.005	0.005	<0.005	0.008	0.005	<0.005	<0.005
Magnesium (Mg)	-	-	-	-	-	-	0.02	mg/L	81.2	82.8	62.6	59.4	10.5	5.58	2.4	21.1	87.7	76.1	1.23	3.54	51.6	53.2	2.33	4.96	13.6	31.9	18.9	4.79	7.92	10.4	59	2.74	1.72	16.2	47.4	80.8	83.1	55.7	57.4	57.8	139	32.3	<0.02	<0.02
Manganese (Mn)	0.05 ^{7}	2.3 ^{7}	0.05 ^{7}	-	-	-	0.0005	mg/L	2.257	2.439	1.469	1.408	0.0733	0.067	0.1716	0.1057	0.091	0.0925	0.0038	0.0163	1.821	1.84	0.0162	0.0439	0.0956	0.1896	0.0805	0.0609	0.0462	0.0081	1.524	0.0133	0.0015	0.1027	1.595	2.531	2.615	0.0972	0.1003	0.0253	0.2891	0.2214	<0,0005	<0,0005
Total Mercury (Hg)	0.001	0.0000013	0.001	-	0.000026	0.0004	1E-05	mg/L	<0.00001	<0.00001	0.00025	0.00025	0.00023	0.00018	0.00004	0.00017	<0.00001	<0.00001	0.00002	<0.00001	0.00006	<0.00001	<0.00001	<0.00001	<0.00001	**0.00046**	0.00019	0.00027	0.00032	0.00002	0.00026	**0.00058**	0.00003	<0.00001	0.00009	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	0.00002	<0.00001	0.00002
Molybdenum (Mo)	0.07	29	-	-	0.073	-	5E-05	mg/L	0.0206	0.0218	0.0236	0.0228	0.0109	0.0108	0.0028	0.0121	0.078	0.3287	<0.0005	<0.0005	0.2753	0.3069	0.0008	0.0005	0.0031	0.4851	0.0092	0.0103	0.0084	0.0101	0.02	<0.0005	<0.0005	0.0033	0.1995	0.0213	0.0215	0.1856	0.1956	0.1336	0.1158	0.0163	<0.0005	<0.0005
Nickel (Ni)	0.07 ^{7}	0.26 ^{7}	-	-	^{7}	0.2	0.0005	mg/L	0.0074	0.0074	0.0116	0.0112	0.002	0.0006	0.0133	0.0052	0.0643	0.008	<0.0005	0.0014	0.0201	0.0178	0.0035	0.0085	0.0106	0.1616	0.0012	<0.0005	<0.0005	0.0342	0.0096	0.0028	<0.0005	0.0113	0.0224	0.0083	0.0087	0.149	0.1565	0.0113	0.1993	0.0337	<0.0005	<0.0005
Potassium (K)	-	-	-	-	-	-	0.05	mg/L	16.4	17.4	8.3	7.99	2.71	3.02	0.95	2.29	26.5	12.1	0.42	1.19	68.7	66.4	0.99	1.57	5.58	94.3	1.6	2.72	2.09	4.06	10.8	1.61	1.27	10.6	71	20.8	21.6	51.5	51.8	14.7	56.6	11.8	<0.05	<0.05
Selenium (Se)	0.01	0.062	0.05	-	0.001	-	0.001	mg/L	0.005	0.004	0.004	0.004	0.001	<0.001	<0.001	0.004	0.013	0.006	<0.001	<0.001	0.011	0.009	<0.001	<0.001	<0.001	0.034	0.005	<0.001	0.001	0.001	0.004	<0.001	<0.001	0.001	0.007	0.004	0.006	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Silver(Ag)	0.1	0.00062 ^{7}	-	^{7}	0.0003	-	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0021	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium (Na)	200 ^{7}	-	200 ^{7}	-	-	-	0.05	mg/L	293	313	157	150	20	7.89	2.28	26.1	58.3	37.2	0.79	3.02	451	440	1.21	1.76	11.5	429	23.9	7.1	17.7	18.9	176	1.77	1.55	19	342	335	351	53.5	55.3	27.7	110	17.4	<0.05	<0.05
Strontium (Sr)	-	-	-	-	-	-	0.005	mg/L	1.02	1.08	0.79	0.74	0.337	0.151	0.047	0.565	1.56	0.816	0.016	0.037	1.29	1.34	0.065	0.088	0.203	1.98	0.473	0.133	0.286	0.249	0.896	0.063	0.064	0.246	1.17	1.39	1.25	0.65	0.659	0.424	1.49	0.334	<0.005	<0.005
Thallium (Tl)	-	-	-	-	0.0008	-	0.0008	mg/L	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
Tin (Sn)	-	-	-	-	-	-	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium (Ti)	-	-	-	-	-	-	0.01	mg/L	0.27	0.31	0.16	0.15	0.01	0.01	0.01	0.03	0.17	0.16	<0.01	0.01	0.43	0.4	0.03	0.02	0.05	0.5	0.02	0.01	0.01	0.01	0.15	0.01	0.01	0.08	0.26	0.25	0.24	0.07	0.07	0.1	0.21	0.05	<0.01	<0.01
Uranium (U)	0.02	0.32 ^{7}	0.02	0.033	0.015	-	0.001	mg/L	0.004	0.004	0.022	0.021	<0,001	<0,001	<0,001	<0,001	0.08	0.156	<0,001	<0,001	0.026	0.027	<0,001	0.002	0.007	0.027	<0,001	<0,001	<0,001	0.013	0.018	0.001	0.001	0.012	0.028	0.004	0.004	0.049	0.051	0.084	0.229	0.028	<0,001	<0,001
Vanadium (V)	-	-	-	-	-	-	0.0005	mg/L	0.0005	0.0005	0.0005	0.0031	0.001	<0.0005	0.0027	<0.0005	0.0008	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0014	<0.0005	0.0005	0.0009	0.0009	<0.0005	<0.0005	0.0022	<0.0005	0.0007
Zinc (Zn)	5	0.067 ^{7}	5 ^{7}	-	0.03	0.4	0.001	mg/L	0.002	0.002	0.008	0.009	0.008	<0,001	0.215	0.096	<0,001	<0,001	<0,001	<0,001	0.003	<0,001	<0,001	<0,001	0.001	0.004	0.028	<0,001	0.003	<0,001	0.001	0.001	0.004	0.004	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	0.001	0.004	<0,001	<0,001
Other																																												
Ammonia (NH3) (non-ionized)	-	-	-	-	0.019	-	0.01	mg N/L	0.06	0.08	0.06	0.06	0.01	0.01	<0.01	<0.01	0.03	0.04	<0.01	<0.01	0.45	0.44	<0.01	<0.01	<0.01	1.4	<0.01	0.02	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.15	0.05	0.06	0.32	0.55	<0.01	0.05	<0.01	<0.01	<0.01
Ammonium (NH$_4^+$)	-	-	-	-	-	-	0.01	mg N/L	4.26	4.2	3.08	3.02	0.34	0.51	0.15	0.22	1.63	1.88	0.05	0.11	29.1	28.9	0.05	0.09	0.14	43.6	0.12	0.65	0.46	<0,05	3.99	<0,05	<0,05	0.14	24.8	7.25	6.94	42.7	44.5	0.05	6.45	0.13	0.01	0.06
Kjeldahl Nitrogen	-	-	-	-	-	-	0.05	mg N/L	50.6	52.1	18.7	21.6	0.51	1.46	0.76	0.66	<0.05	1.35	1.66	0.1	54.7	141	<0.05	20.6	0.43	91.5	0.24	0.61	0.38	0.21	14	0.7	<0.7	0.77	32	24	25	44	43	1.8	6.5	1.4	0.62	<0.70
Total Ammonia Nitrogen (NH$_4^+$ and NH$_3$)	-	^{7}	-	-	-	16	0.01	mg N/L	4.32	4.28	3.14	3.08	0.35	0.52	0.15	0.22	1.66	1.92	0.05	0.11	**29.6**	**29.4**	0.05	0.09	0.14	**45**	0.12	0.67	0.46	<0,05	4	<0,05	<0,05	0.14	**25**	7.3	7	**43**	**45**	0.05	6.5	0.13	0.01	0.06
Bromide (Br$^-$)	-	-	-	-	-	-	0.01	mg/L	1.44	1.5	1.01	0.99	0.28	0.05	0.08	1.21	0.92	0.46	<0.01	0.01	2.8	2.98	0.02	0.02	0.06	2.98	1.33	0.14	0.32	0.42	1.14	0.12	0.09	0.21	1.96	1.83	1.69	0.56	0.5	0.23	1.66	0.34	<0.01	0.08
Chloride (Cl$^-$)	250 ^{7}	860	250 ^{7}	640	120	1000	0.5	mg/L	290	300	159	156	32	2.9	6.7	100	90.8	60.1	0.8	4.3	83.2	82.1	0.9	1.6	6.7	337	132	2.7	23	33.3	200	<0,5	1.0	8.4	214	294	292	42.2	41.6	12	175	26.8	<0,5	<0,5
Cyanide W.A.D.	-	-	-	-	-	-	0.001	mg/L	0.009	0.006	0.003	0.003	<0.001	<0.001	<0.001	<0.001	0.005	0.008	<0.001	<0.001	0.104	0.095	<0.001	<0.001	<0.001	0.399	0.005	0.002	0.003	0.004	0.026	0.005	0.004	<0.001	0.015	0.018	0.022	0.16	0.179	0.002	0.019	0.008	<0.001	0.005
Total Cyanide (CN)	-	0.022	0.2	-	-	0.5	0.001	mg/L	0.138	0.077	0.069	0.073	0.003	<0,001	0.003	<0,001	0.021	0.025	<0,001	<0,001	0.246	0.316	0.002	<0,001	<0,001	**0.552**	0.002	0.003	0.002	0.003	0.099	0.005	0.003	0.001	0.043	0.175	0.16	**0.506**	**0.539**	0.003	0.044	0.013	<0,001	0.003
Total Fluoride (F)	1.5	4 ^{7}	1.5	-	0.12	-	0.02	mg/L	0.34	0.35	0.39	0.39	1.06	1	0.08	0.31	0.79	0.24	0.08	0.13	0.46	0.48	0.1	0.14	0.2	0.31	0.18	0.86	0.93	0.79	0.39	0.06	0.05	0.13	0.31	0.26	0.26	0.34	0.34	0.29	0.48	0.42	<0,02	<0,02
Nitrate (NO$_3^-$)	-	290	-	550	13	20	0.01	mg N/L	0.07	0.05	0.05	0.07	0.16	0.04	0.22	0.09	**46.4**	**20.6**	0.03	0.05	0.13	0.13	0.66	1.43	3.31	2.81	0.01	<0,01	<0,01	0.14	<0,01	0.61	0.6	3.82	4.88	<0,01	0.02	**59.7**	**48.4**	**38.5**	**43.8**	11.9	<0,01	0.03
Nitrite (NO$_2^-$)	1	^{7}	^{7}	-	-	-	0.01	mg N/L	0.02	0.03	0.01	0.01	0.03	<0,01	0.01	0.01	0.49	0.25	<0,01	0.02	0.02	0.02	<0,01	<0,01	0.02	0.16	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	0.02	0.24	0.01	0.02	0.94	0.94	0.01	0.35	0.02	<0,01	<0,01
Ortho-Phosphate (O-PO$_4$)	-	-	-	-	^{7}	-	0.01	mg P/L	0.01	0.01	0.01	0.01	0.05	0.52	<0,01	<0,01	0.01	<0,01	<0,01	<0,01	0.02	0.02	<0,01	<0,01	0.01	0.03	<0,01	0.41	0.15	0.01	0.04	<0,01	<0,01	0.03	0.02	0.05	0.05	0.11	0.11	0.02	0.02	0.01	<0,01	<0,01
Total Phosphorus (P)	-	^{7}	-	-	-	1	0.01	mg P/L	0.07	0.06	0.05	0.04	0.16	0.71	0.03	0.05	0.02	0.03	0.01	0.05	0.05	0.03	0.03	0.02	0.03	0.08	<0.04	0.52	0.19	<0.04	0.04	<0.04	<0.04	0.04	0.04	0.07	0.07	0.07	0.06	<0.04	<0.04	<0.04	<0.01	<0.04
Sulfate (SO$_4^{2-}$)	-	-	500 ^{7}	-	-	-	0.6	mg SO$_4$/L	1375	1331	860	861	9	21.1	11.1	5	682	615	3.2	14.9	1731	1582	8.7	41.5	95.7	1772	2.5	12	4	25	679	25.2	15.2	127	1368	1198	1234	259	233	226	702	132	<0,6	6.7

Notes :

- : No criteria available

(1) : MDDELCC Groundwater Criteria for Consumption (http://www.mddelcc.gouv.qc.ca/sol/terrains/guide-intervention/annexe2.pdf)

(2) : MDDELCC Surface water resurgence criterion (http://www.mddelcc.gouv.qc.ca/sol/terrains/guide-intervention/annexe2.pdf)

(3) : Drinking water recommendations from the Canadian Water Quality Guidelines – Summary Table (http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guide-res_recom/index-e.html#3)

(4) : Water Quality Guidelines for the Protection of Aquatic Life (http://st-ts.ccme.ca/en/index.html)

(5) : Site-specific Resurgence Criteria related to discharge in surface water based on 3 x Third Portage Lake analysis

(6) : Minimum Reported Detection Limits (LDR) provided by the laboratory (refer to analysis certificates for details)

(7) : For details, refer to MDDELCC Groundwater Criteria for Consumption, MDDELCC surface water resurgence criterion and Canadian Water Quality Guidelines

Legend

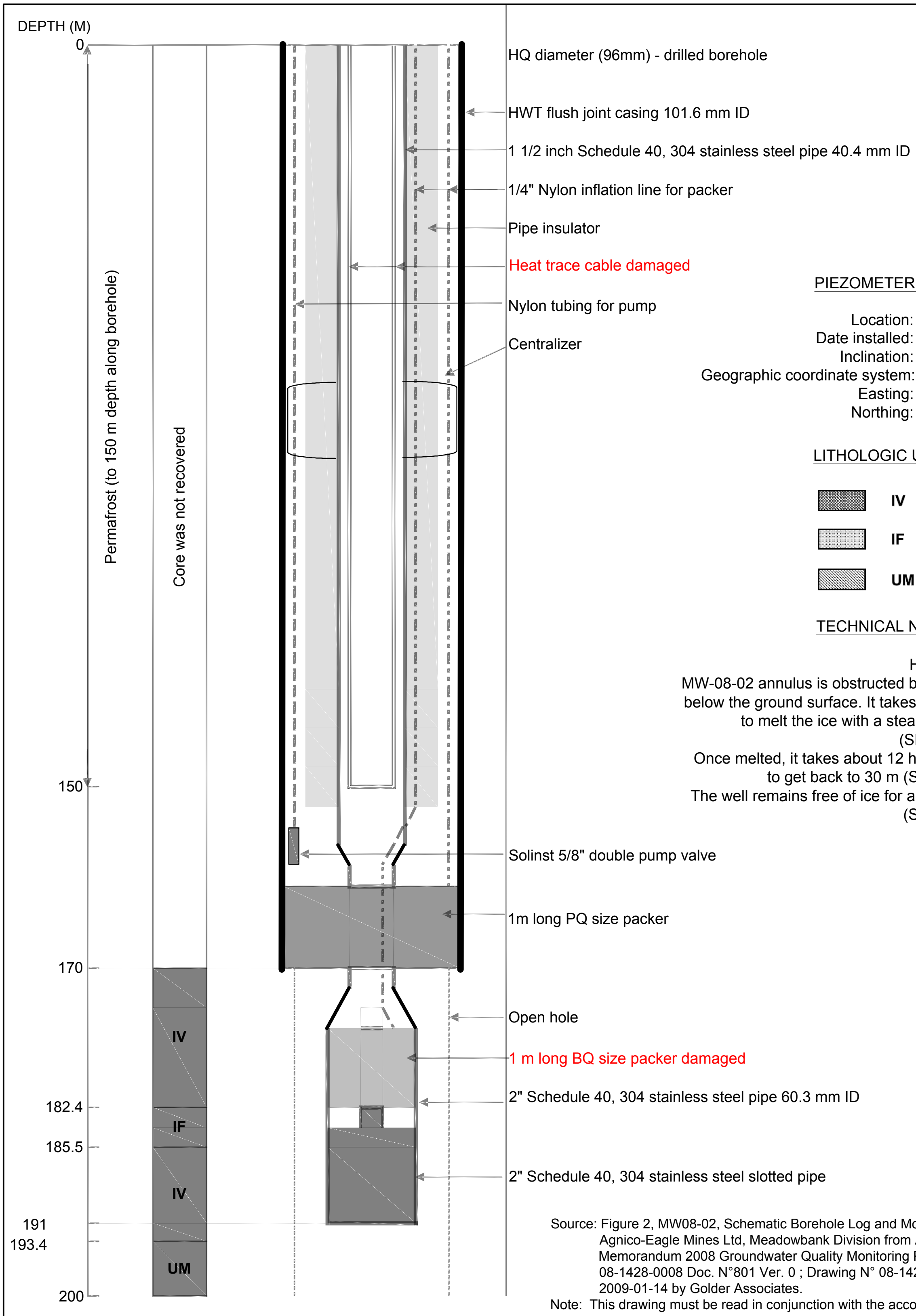
Representative samples

Semi-representative with some reservations

Not representatives

Appendix D

Monitoring well sketches



PIEZOMETER COMPLETION DETAIL

Location:	Meadowbank
Date installed:	November 2016
Inclination:	70°
Geographic coordinate system:	UTM NAD83 ZONE 14
Easting:	638750.9
Northing:	7214427.3

LITHOLOGIC UNIT LEGEND

▨	**IV**	Intermediate Volcanics
▨	**IF**	Iron Formation
▨	**UM**	Ultramafic

TECHNICAL NOTE

Heat traces are damaged.
MW-08-02 annulus is obstructed by ice from 30 m to 150 m below the ground surface. It takes a minimum of four hours to melt the ice with a steamer and 500 feet of hose (SNC-Lavalin: 2017-07-17).
Once melted, it takes about 12 hours for static water level to get back to 30 m (SNC-Lavalin:2017-07-18).
The well remains free of ice for a period of about 24 hours (SNC-Lavalin:2017-07-18).

Source: Figure 2, MW08-02, Schematic Borehole Log and Monitoring Well Instrumentation, Agnico-Eagle Mines Ltd, Meadowbank Division from Appendix C4 Technical, Memorandum 2008 Groundwater Quality Monitoring Program, Meadowbank Mine, 08-1428-0008 Doc. N°801 Ver. 0 ; Drawing N° 08-1428-0008/7000 realized the 2009-01-14 by Golder Associates.
Note: This drawing must be read in conjunction with the accompanying report.

SNC·LAVALIN

PROJECT : AE Meadowbank Groundwater Monitoring

CLIENT : AGNICO EAGLE

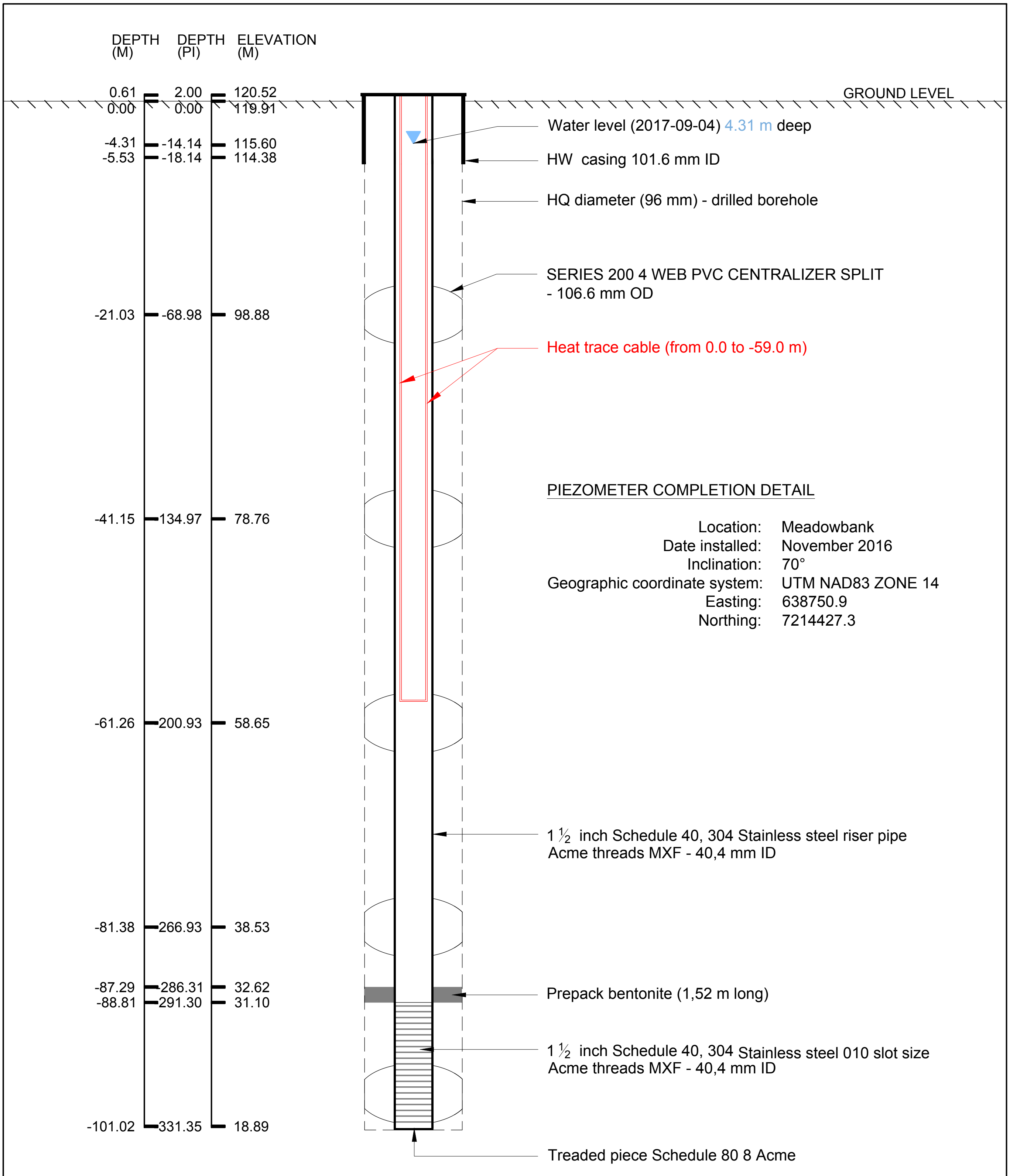
TITLE : MW08-02 Schematic Borehole Log and Monitoring Well Instrumentation

N°	DESCRIPTION	DATE
00	For consultation	2017-11-02

DRAWN : É. Cazeneuve
VERIFIED : L. Tremblay
SCALE: -
DATE : 2017-11-02
FILE: 645182
NO: 02

C:\Users\cazee2\Desktop\tout\645182\645182_Annexe_Forage_v5.dwg

FORMAT 8,5x11



PIEZOMETER COMPLETION DETAIL

Location:	Meadowbank
Date installed:	November 2016
Inclination:	70°
Geographic coordinate system:	UTM NAD83 ZONE 14
Easting:	638750.9
Northing:	7214427.3

Note : This drawing must be read in conjunction with the accompanying report.

SNC·LAVALIN

PROJECT : AE Meadowbank Groundwater Monitoring

CLIENT : AGNICO EAGLE

TITLE : MW-16-01 Schematic Monitoring Well Instrumentation

DRAWN : É. Cazeneuve

VERIFIED : L. Tremblay

N°	DESCRIPTION	DATE
00	For consultation	2017-11-02

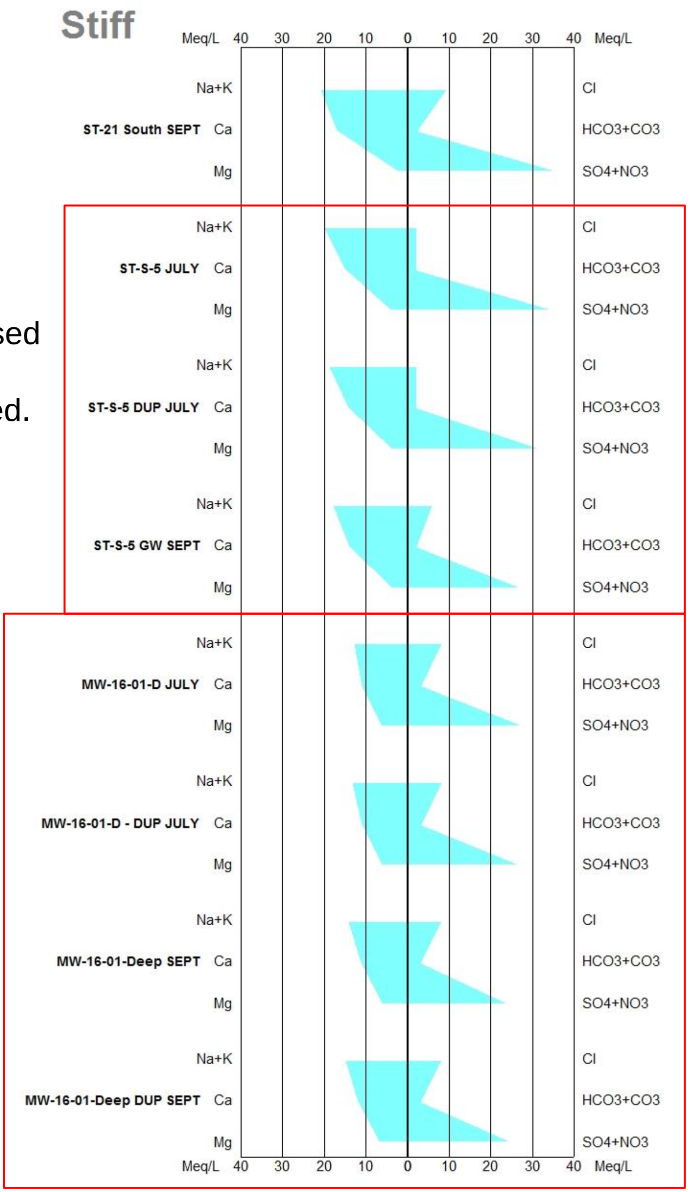
SCALE:	DATE :	FILE:	NO:
1Y : 10X	2017-11-02	645182	01

C:\Users\cazee2\Desktop\tout\645182\645182_Annexe_Forage_v4-3.dwg

FORMAT 8,5x11

Appendix E
Stiff diagrams

Water indicating Reclaim water signature (scale 0-40 Meq/L)



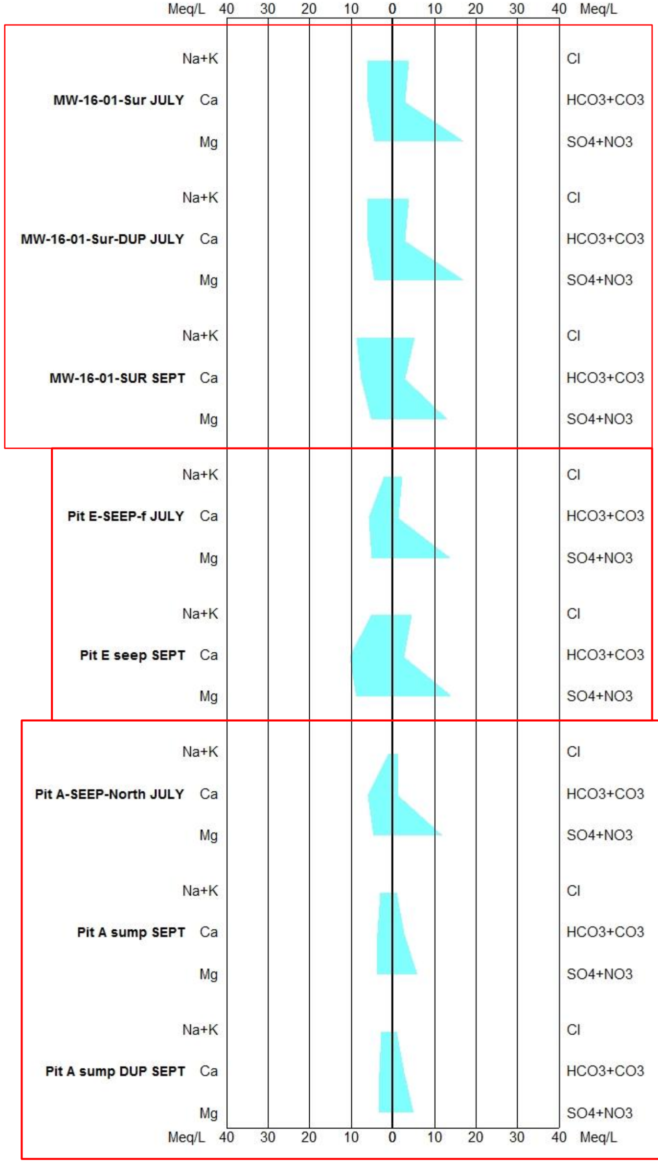
Reclaim water

ST-S-5

In September, Chloride increased and sulfate and nitrate decreased.

MW-16-01
95 m

Sample collected at 95 m from the ground surface (in front of well screen) are comparable for July and September



MW-16-01
30 m

Sample collected 30 m from ground surface (not in front of well screen) are diluted compared to sample collected at 95 m.

PIT E

Concentration have increased for September samples

PIT A

Chemical signature from wall seepage (collected in July) and pit sump (collected in September) are different.

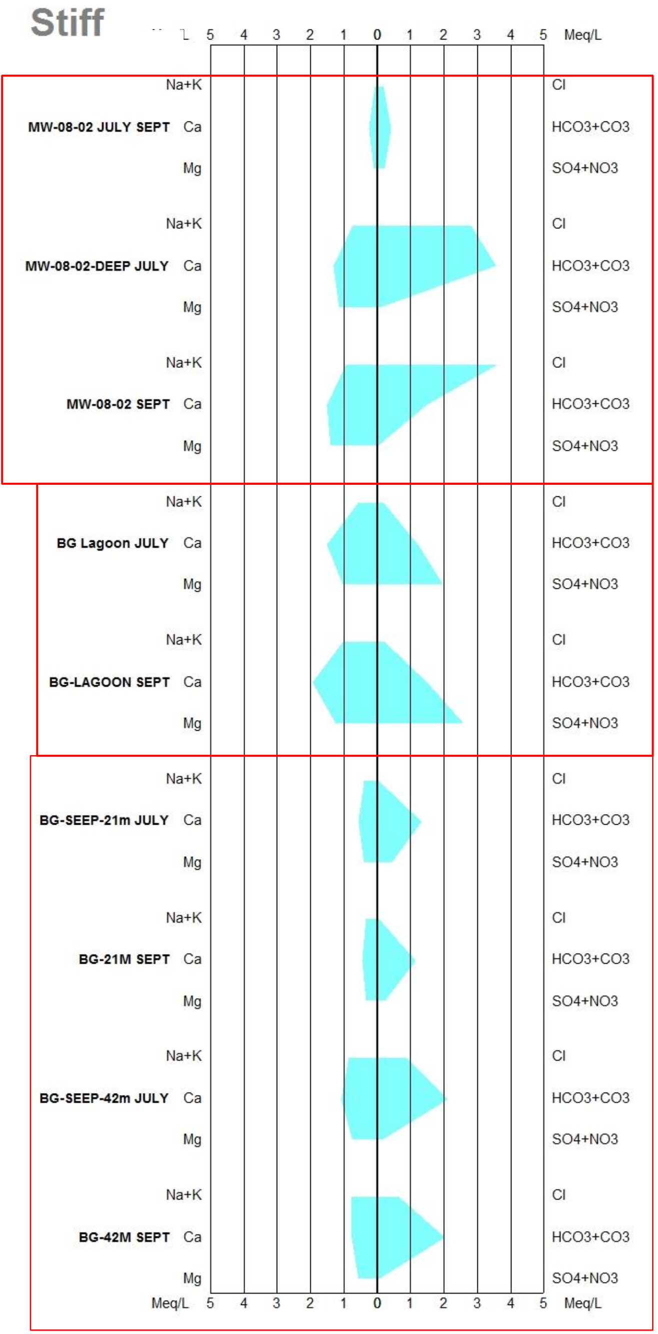
Natural groundwater signature (scale 0-5 Meq/L)

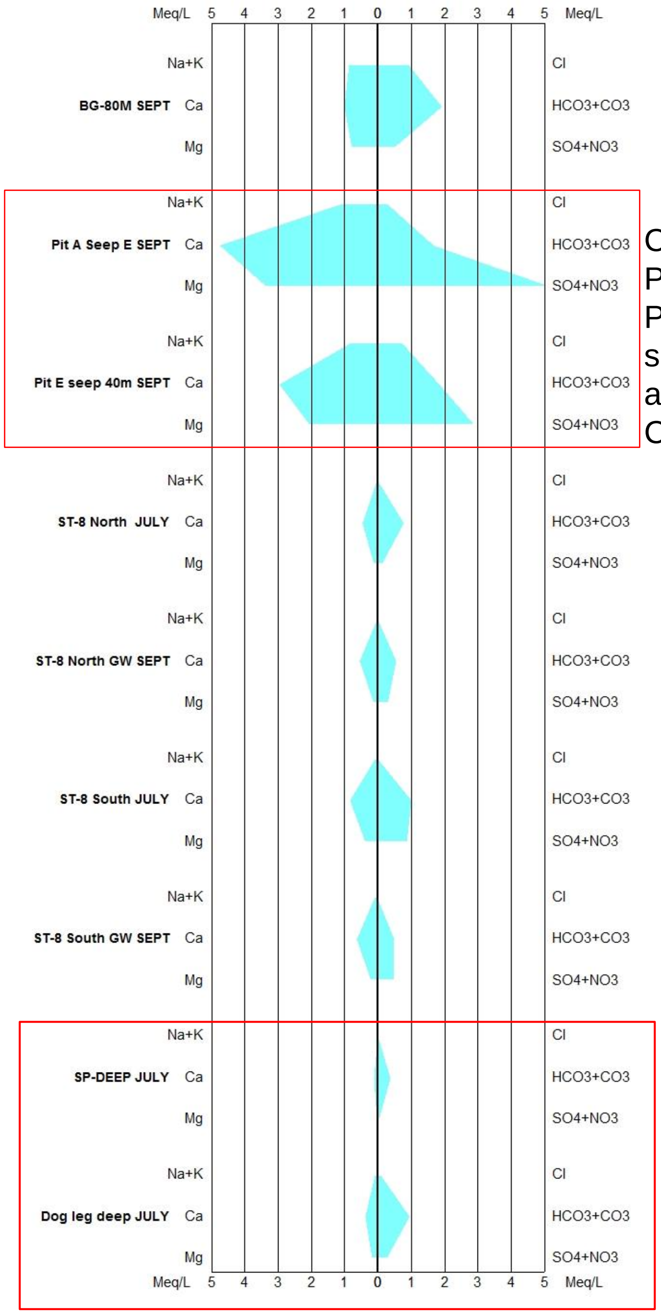
MW-08-02

Diluted sample collected after steaming the well. Sample is more representative after letting the well recover for 24 hours. Samples from July and september have different anion composition.

BG-Lagoon

Bay goose wall seepages at different depths





BG-80

Pit A and E

Concentrations at Pit A East wall and Pit-E West wall seem influenced by a source of higher Ca-SO_4

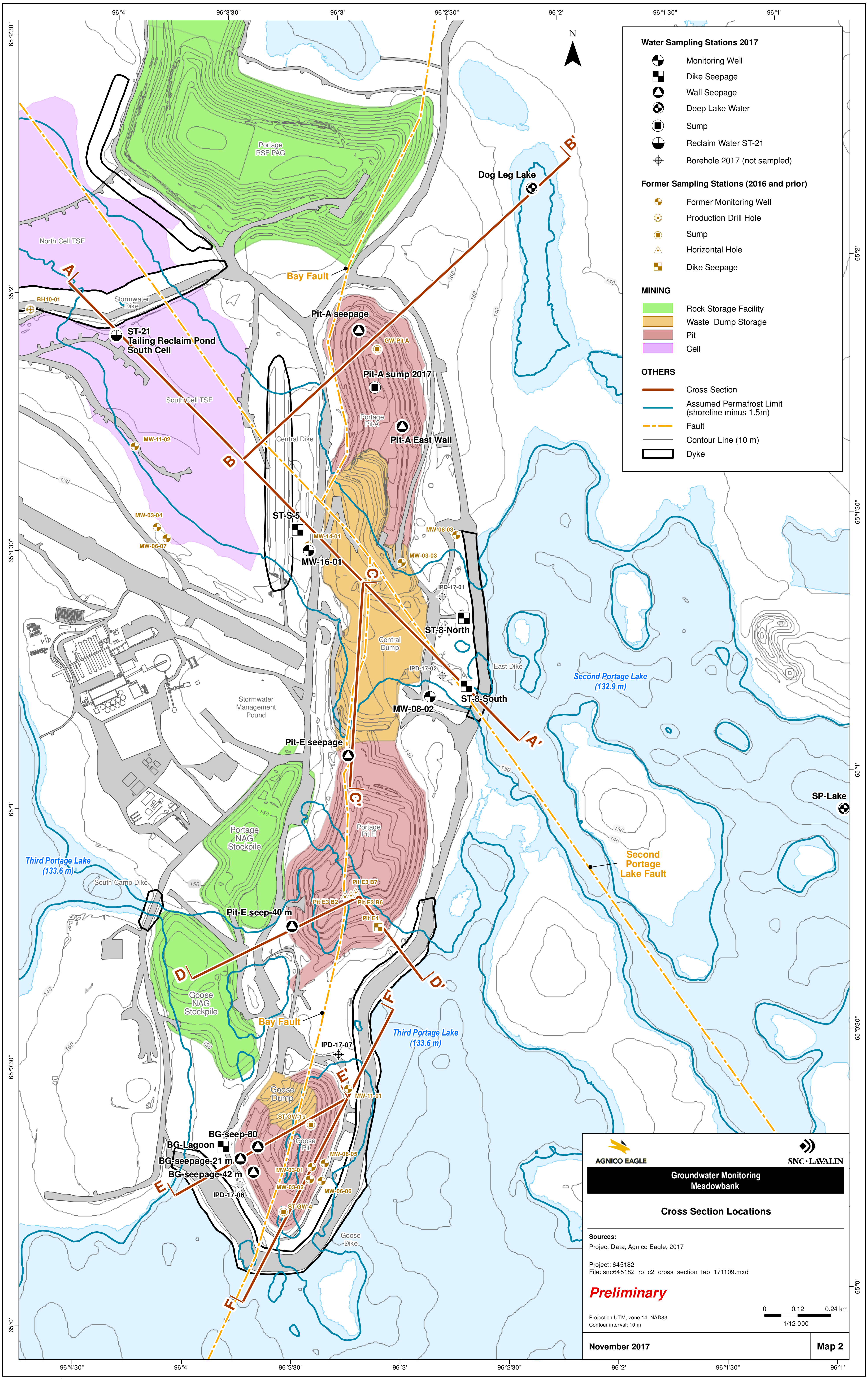
ST-8 North

ST-8 South

Lake samples

Appendix F

Map of hydrogeochemical cross sections



AGNICO EAGLE

SNC·LAVALIN

Groundwater Monitoring
Meadowbank

Cross Section Locations

Sources:
Project Data, Agnico Eagle, 2017

Project: 645182
File: snc645182_rp_c2_cross_section_tab_171109.mxd

Preliminary

0 0.12 0.24 km
1/12 000

Projection UTM, zone 14, NAD83
Contour interval: 10 m

November 2017 | **Map 2**

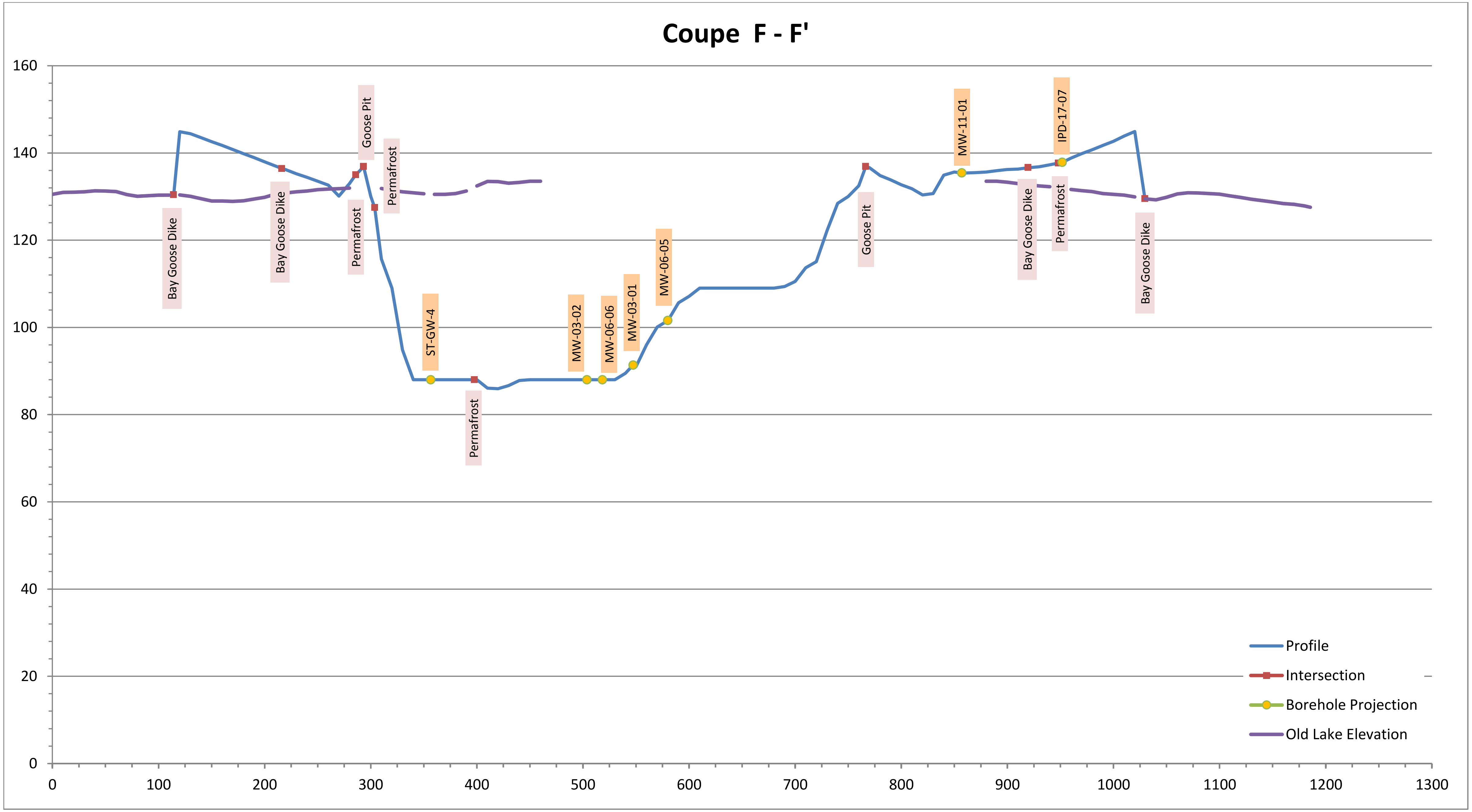
S:\Généralités\GÉOMATIQUE\Projets\645182_Meadowbank\geomatique\interne\diffusion\produit\rapport\snc645182_rp_c2_cross_section_tab_171109.mxd

SNC·LAVALIN

Appendix G

Hydrogeochemical cross-sections

(provided in numerical Microsoft Excel format)


Coupe F - F'
160
140
120
100
80
60
40
20
0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
Bay Goose Dike
Bay Goose Dike
Goose Pit
Permafrost
Permafrost
ST-GW-4
Permafrost
MW-03-02
MW-06-06
MW-03-01
MW-06-05
Goose Pit
MW-11-01
Bay Goose Dike
IPD-17-07
Permafrost
Bay Goose Dike
Profile
Intersection
Borehole Projection
Old Lake Elevation