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1.0 INTRODUCTION

This factual report provides a summary for the 2019 groundwater monitoring program carried out at the Meadowbank Mine (Meadowbank). The report includes a description of the surface water and groundwater sampling and a presentation of the water quality results. SNC-Lavalin professional offered its technical services to support Agnico Eagle Mines Limited (Agnico Eagle) with the following:

- Achieve two groundwater sampling programs from July 9 to 17, 2019 and October 7 to 14, 2019 using low-flow sampling techniques for licensing requirements; and
- Compile and interpret the water quality data collected to document the potential interaction between surface water and groundwater, especially in relation to tailings deposition activities.

1.1 Background

At Meadowbank, groundwater quality investigation is used to predict the chemistry of water accumulating in open pits and to assess any effects of mining on groundwater quality, particularly with respect to tailings deposition activities.

From 2003 to 2016, 14 groundwater monitoring wells have been installed to characterize the groundwater quality. Throughout these years, 34 groundwater samples and 21 duplicates were collected from these wells. However, most of the monitoring wells became inoperable due to the challenging arctic condition and permafrost environment at Meadowbank.

From 2013 to 2016, alternative methods were investigated to collect groundwater samples including pit wall seepages, production drill holes, pit sumps, horizontal wells installed into pit walls, and temporary wells for dewatering. In total, six (6) groundwater samples were collected from horizontal wells installed in pit E walls, one (1) sample from a temporary dewatering well, two (2) samples from pit sumps during pit exploitation and one (1) sample from production borehole.

Despite efforts to overcome multiple challenges related to the collection of groundwater sample under arctic conditions and permafrost environment at Meadowbank, groundwater historical chemistry data seem unrepresentative of the real conditions. Conclusions from the historical groundwater quality data review are:

- De-icing salt and calcium chloride brine used to prevent the boreholes from freezing after drilling operation remains in groundwater for years despite intensive purging of wells after installation. When those products are used in boreholes without a dye tracer, 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 used to retrieve groundwater samples induce the sample to be either diluted (sample not collected in front of the well screen) or charged with parameters that come from fine particulates found in dirty water (sediment in suspension in a sample from sumps and horizontal well can induce false results because groundwater samples are collected in bottle with preservatives but are not filtered in the field before adding the water to the bottles with preservatives); and
- Important chemical parameters to establish background chemistry were missing from the data set (major ions dissolved in groundwater).

In 2017, an extensive groundwater sampling program took place. The program aimed to improve the characterization of the baseline groundwater chemistry, identify potential sources of contaminants at the mine site, and identify potential interaction between surface and groundwater. The program included:

- Review of the sampling methodologies and the historical groundwater quality data;
- Testing and maintenance of the sampling equipment;
- Collection of surface and groundwater samples at specific locations and;
- Data compilation and basic interpretation of groundwater quality.

The groundwater investigation was repeated in 2018 with the remaining existing monitoring well and with the addition of four (4) new ones. However, access to the pit was limited and groundwater seepage from pit walls could not be sampled this year. In 2019, the same five (5) monitoring wells were sampled with the addition of three (3) pit wall seepages, three (3) dike seepages, two (2) water ponds and one (1) reclaim pond.

The locations of each former and currently operable groundwater monitoring wells and other alternative monitoring stations are provided in Appendix A.

2.0 GROUND WATER SAMPLING CAMPAIGNS

2.1 Methodology

In 2019, surface water and groundwater sampling campaigns were carried out twice from July 9 to July 17, 2019 and October 7 to October 14, 2019.

The main activities carried out are listed below:

- Purging of monitoring wells was performed by Agnico Eagle staff prior to the arrival of a SNC-Lavalin professional for the July campaign whereas it was done by SNC-Lavalin technician with the help of Agnico Eagle staff during the October campaign;
- Groundwater sampling in monitoring wells (pit wall seepages were not sampled in October due to safety considerations);
- Surface water sampling (only at specific location); and

2.1.1 Monitoring Wells Purging Methodology

The monitoring wells were purged by Agnico Eagle staff using an air compressor fitted on 60 m long High-Density Polyethylene (HDPE) Waterra® tubing with a diameter of ½ inch. The Waterra® tubing was introduced into the borehole and water was airlifted outside the boreholes with compressed air. Purge operation was monitored by Agnico Eagle staff and groundwater physicochemical parameters were recorded along with approximate volumes of groundwater removed from the monitoring well (Appendix C). During monitoring wells purging, turbidity was very high, especially for the shallow monitoring wells, and the other physicochemical parameters fluctuated and did not stabilize. Therefore, the monitoring well purging was performed to remove as much water as possible and further to gather the most representative groundwater samples.

2.1.2 Groundwater Sampling Methodology

Surface water and groundwater sampling were performed by a SNC-Lavalin field technician with the help of an Agnico Eagle environmental field technician. Prior to carry out the groundwater sampling program, the groundwater sampling methodologies were reviewed; the equipment was tested, cleaned and adapted when required by the SNC-Lavalin field technician. The specific information about each monitoring well can be found within the groundwater sampling protocol presented in Appendix B. Table 2-1 lists the samples collected in July and October 2019. The location of each station is shown on the map presented in Appendix A.

Water samples from the following stations were collected directly from a tap inside a small pumping building: ST-8-North and ST-8-South (East Dike seepage collection system), ST-S-5 (Central Dike seepage), and ST-21 (reclaim water). The stations ST-8-North and ST-8-South are both shallow (6 m depth) well system collecting the underground seepage water coming from East Dike. Samples ST-S-5 and ST-21 are respectively water from the Central Dike seepage collected at the downstream pond of the dike and reclaim water from the South Cell. Samples BG-Lagoon and Stormwater Management Pond (SWMP) were collected from the shore with a clean measuring cup and transferred directly to sampling bottles.

Table 2-1: Samples collected in 2019

Sample name	Type	Screen depth (m)	Pump depth (m)	July 2019	October 2019
MW-IPD-01 (s)	Groundwater well	51-69	60	x	x
MW-IPD-01 (d)	Groundwater well	163-181	175	x	x
MW-IPD-07	Groundwater well	42-50	40	x	x
MW-IPD-09	Groundwater well	62-80	70	x	x
MW-16-01	Groundwater well	89-101	95	x	x
ST-S-5	Central dike seepage	-	-	x	x
ST-21	Reclaim water in south cell (TSF)	-	-	x	x
ST-8-North	Dike seepage pumping well	6	-	x	x
ST-8-South	Dike seepage pumping well	6	-	x	x
BG-Seepage-42m	Pit wall seepage	-	-	x	- *
Pit-E-Seep-North	Pit wall seepage	-	-	x	- *
Pit-A-Seep-East	Pit wall seepage	-	-	x	- *
BG-Lagoon	Pond at western crest of Goose Pit	-	-	x	- *
SWMP (Stormwater management pond)	Pond water	-	-	x	- *

* In October 2019, no surface water sample taken due the frozen ponds. The pit seepages were also frozen.

At each monitoring well location, a dedicated clean Low-Density Polyethylene (LDPE) tubing was used for each sample. For dissolved metals analysis purpose, the water was passed through a 0.45 microns filter and kept in bottles containing preservatives to minimize any possible chemical alteration during transport to the laboratory. 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 and were transported to the lab within 24 h with its transport blank. For the July sampling campaign, three duplicates (MW-IPD-09, MW-IPD-01(d) and ST-8-South), two field blanks (MW-IPD-09 and Pit-E-Seep) and one transport blank (MW-IPD-09) were taken. For the October campaign, two duplicates (MW-IPD-09 and ST-8-North), one field blank (MW-IPD-09) and one trip blank (MW-IPD-09) were collected.

At the completion of the surface water and groundwater sampling program, water quality data were compiled, and a basic interpretation of the chemical results was completed.

2.2 Analytical program

Prior to water sample collection, the following in situ physicochemical parameters were recorded: pH, salinity and electrical conductivity, oxydoreduction potential (ORP), total dissolved solids (TDS) and dissolved oxygen (DO). In situ parameters were recorded via a flow-through cell for most samples with an YSI® Pro, Hanna or Eureka probe.

Laboratory analytical parameters included the following parameters with respect of the Meadowbank Water License 2AM-MEA1526 (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, free cyanide and Weak Acid Dissociable Cyanide (CN WAD).

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

2.3 Quality Assurance / Quality Control (QA/AC)

Prior data interpretation, some verification was completed to assess potential sample contamination during collection, shipping and analysis. Five (5) field duplicates, three (3) field blanks, and two transport blanks were sampled in 2019.

Field duplicates assure a quality control and assess if two (2) water samples collected from the same sampling station using identical sampling procedure have reproducible analytical results. Duplicate results were verified with the USEPA (1994)[1] method which 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 follows:

$$RPD = \frac{\text{maximum}\,concentration - \text{minimum}\,concentration}{average\ concentration} x100$$

USEPA (1994) indicates that an 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. For example, poor RPD results could indicate inappropriate field practice such as: unclean sampling bottles, poor sampling methodology, and inefficient monitoring well purge.

Field blanks and transport blanks and sample bottles filled with deionize water. Field blanks are open in the field while sampling. Transport blanks are shipped to the laboratory together with the collected samples to assess any potential sample contamination during shipping. Transport blanks are to accompany the sample bottles throughout the collection, handling, storage and shipping of the samples. 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.

[1] USEPA, 1994. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, DC, February 1994.

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 improve the understanding of groundwater flow, contaminants migration and transformation processes along pathways as water composition varies. It can also help to identify zones where surface water and groundwater interact and define if the interaction is continuous or is only during permafrost thawing.

Water chemical results are presented in Appendix D. The following sections present the preliminary interpretation of water quality result and include:

› Result for Quality Assurance / Quality Control (QA/QC):
  - Verification of duplicates for sample integrity and reproducibility;
  - Verification of field blank for potential contamination in the filed while sampling;
  - Verification of transport blanks for potential contamination during sample transport;
› 2019 water analysis results with comparison to regulatory criteria; and
› Comparison with the historical water quality data to outline potential trends.

3.1 Quality Assurance / Quality Control (QA/QC)

Water quality results show that, for most of the analyzed parameters, all duplicated samples have RPD values within the 20% range or meeting the +/- MDL criteria when concentrations are lower than 5 times MDL. It demonstrates that the sampling methodology and execution were appropriate. The parameters that did not meet these requirements are listed for each duplicate sample in Table 3-1.

During the July sampling campaign, the water turbidity was very high following the monitoring well purge at some of the sampling locations, i.e. at stations MW-16-01, MW-IPD-07, MW-IPD-09, MW-IPD-01(d) and SWMP. The highest turbidity was observed in MW-IPD-01(d) and MW-IPD-09 samples with values of 91.2 and 21.7 NTU respectively. This could be an explanation for the observed discrepancies between the samples and their duplicates.

Table 3-1: Parameters exceeding the validation criteria for the duplicate samples

Duplicate Sample ID	LDR	Unit	MW-IPD-09	ST-8-South	MW-IPD-01 (d)	MW-IPD-09	ST-8-North
Sampling Date			**July 12**	**July 013**	**July 16**	**October 9**	**October 12**
Alkalinity ($CaCO_3$)	2	mg $CaCO_3$/L	x		x		
Bicarbonate alkalinity (HCO_3^-)	2	mg $CaCO_3$/L	x		x		
Turbidity	0.02	NTU		x			
Dissolved organic carbon	0.2	mg/L				x	
Total suspended solids (TSS)	1	mg/L		x	x	x	x
Bromides	0.01	mg/L					x
Total nitrogen	0.05	mg/L		x		x	
Total aluminium (Al)	0.005	mg/L			x		
Total arsenic (As)	0.0005	mg/L			x		x
Total barium (Ba)	0.0005	mg/L			x		x
Total zinc (Zn)	0.001	mg/L			x		x
Dissolved aluminum (Al)	0.005	mg N/L		x			
Dissolved arsenic (As)	0.0005	mg N/L		x			
Dissolved mercury (Hg)	0.00001	mg/L		x			
Dissolved selenium (Se)	0.0005	mg/L		x			
Dissolved zinc (Zn)	0.001	mg/L		x	x		

The accuracy of water analysis is checked using a charge balance calculation based on the principle that the solution must be electrically neutral. The sum of cations (in meq/L) should equal the sum of anions (in meq/L) (Hounslow, 1995)[2]. The calculations were performed with the software The Geochemist's Work Bench[3]. The charge imbalance error is calculated by the following formula (ΣCations – ΣAnions) / (ΣCations + ΣAnions) x 100. If the calculated error is less than 5%, the analysis is assumed to be good. The calculation showed that 39% of the samples have an error less than 5%, 55% of the samples have an error between 5 and 13. This indicate that the quality of the analytical data is quite good. Only one sample has an error higher than 13%. It is the October sample from Station ST-8-South with an error of 44%. Such a high value could indicate an inaccurate analysis or the presence of constituents that were not included in the calculation.

Analytical results for the field and transport blanks are also presented in Appendix D. These results are only available for the October sampling campaign because the two field blanks and the transport blank from the July campaign

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[2] Hounslow, A. (1995) Water Quality Data: Analysis and Interpretation. CRC Press, Boca Raton.
[3] Aqueous Solutions LLC, 2019. The Geochemist Work Bench, version 12.0.4.

were lost during shipping and not received by the laboratory. The analytical results show that the field and the trip blanks have very low concentrations of total dissolved solids, total suspended solids and dissolved calcium. No metallic concentrations were detected. The field blank shows also a total nitrogen concentration above detection limit but still very low. No contamination of samples is suspected.

3.2 Water Quality Results and Criteria

Groundwater analytical results were compared to the criteria prescribed in the site Water License 2AM-MEA1526 for the maximum average concentration discharged to Third Portage Lake. Analytical results are found in Appendix D and concentrations exceeding these criteria are shaded. Table 3-2 shows the sampling stations and parameters that are exceeding these criteria.

Table 3-2: Samples and Parameters exceeding Water License criteria

Station name	2019 campaign	Total Suspended Solids	Total Copper	Total Phosphorus	Ammonia Nitrogen
MW-IPD-01 (d)	July	x			
MW-IPD-01 (d) (Dup)	July	x			
MW-IPD-07	July	x			
MW-IPD-09	July	x			
MW-IPD-09 (Dup)	July	x			
MW-IPD-09	October	x			
ST-S-5	July				x
ST-S-5	October				x
ST-8-North (Dup)	October	x			
ST-21 South	July		x		x
Portage Pit E Seep north	July	x			
SWMP	July	x		x	

The main parameter exceeding the Water License criteria is total suspended solids. High turbidity in the water of the monitoring wells MW-IPD-07, MW-IPD-01 (d) and MW-IPD-09 is observed in July following the monitoring well purge.

Exceeding parameters as total copper and ammonia nitrogen are related to the reclaim water signature which is sampled at Station ST-21-South (tailings storage facility South Cell reclaim water pump station). Aside from reclaim water sample, high concentrations above Water License criteria is found at monitoring station ST-S-5 (Central Dike seepage) for ammonia nitrogen. Total phosphorus is exceeding Water License criteria at the Storm Water Management Pond (SWMP).

3.3 Stiff Diagrams

The geochemical composition of groundwater is mainly defined by the concentration of dissolved main anions (HCO^{3}-, SO_4^{2-}, Cl^{-}) and main cations (Ca^{2+}, Na^{+}, Mg^{2+}, K^{+}). These data are presented on a Stiff diagram for each groundwater sample in Appendix E. The left side of the Stiff Diagram represents the major cation concentrations (sodium + potassium, calcium and magnesium), while the right side represents the major anions (chloride, bicarbonate + carbonate and sulfate). These diagrams are useful to gain a first insight into water chemistry. The water samples can be divided into two groups: samples with a natural groundwater signature and samples with a reclaim water signature. Samples with the least charged water (natural groundwater) were presented on a scale of 0 to 5 meq/L on Figure E-1 of Appendix E, while the samples with the higher concentrations were presented on Figure E-2, on a scale of 0 to 35 meq/L. Stiff diagrams were used to support comparison between the sampling period and the sampling locations nearby mining activities.

The Stiff patterns are similar to 2018 patterns except for Station ST-21-South where the dissolved content seems to be lower in 2019 than in 2018, and also lower in October 2019 than July 2019. This phenomenon might be linked to the interruption of the tailings disposal in the Tailings Storage Facility (TSF)in July 2019.

3.4 Historical data and trends

3.4.1 Available data

Table 3-3 summaries the available analytical results for each groundwater sampling station, grouped based on the following site areas: South Cell and Central Dike, East flat (East Dike area), Goose Pit, Portage Pit A and Portage Pit E.

Historical groundwater quality data starts from 2003. From 2003 to 2016, 14 groundwater monitoring wells were installed to characterize the groundwater in these areas. Throughout the years, a total of 34 groundwater samples and 21 duplicates were collected from these sampling wells.

However, most of the monitoring wells became inoperable due to the challenging artic condition and permafrost environment at Meadowbank. In 2017, groundwater samples were taken from four (4) wells (MW-08-02, MW-16-01, ST-8-North and ST-8-South) and pit wall seepages. In 2018, four (4) additional monitoring wells (MW-IPD-01(s), MW-IPD-01(d), MW-IPD-07 and MW-IPD-09) were added to the sampling network. To this day, out of the 17 installed monitoring wells, a total of five (5) remain operable, with addition to the two (2) pumping wells at East Dike location.

Table 3-3: Historical groundwater sampling available results

Site Area / Station ID	Station Type	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
South Cell / Central Dike		**x**			**x**				**x**	**x**			**x**	**x**	**x**	**x**	**x**	**x**
BH-10-01	Temporary borehole								x									
MW-03-04	Monitoring Well	x																
MW-06-07	Monitoring Well				x													
MW-11-02	Monitoring Well									x								
MW-14-01	Monitoring Well												x	x				
MW-16-01	Monitoring Well														x	x	x	x
East Flat / East Dike							**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
MW-08-02	Monitoring Well						x	x	x	x	x	x	x	x	x	x	x	
MW-08-03	Monitoring Well						x					x						
ST-8-North	Pumping well															x	x	x
ST-8-South	Pumping well															x	x	x
ST-8-discharge	Discharge from PW													x	x	x	x	
MW-IPD-01(S)	Monitoring Well																x	x
MW-IPD-01(D)	Monitoring Well																x	x
Goose Pit		**x**	**x**		**x**	**x**	**x**	**x**	**x**	**x**						**x**	**x**	**x**
BG-Seep-21m	Pit wall seepage															x	x	
BG-Seep-42m	Pit wall seepage															x	x	x
BG-Seep-80m	Pit wall seepage															x		
MW-03-01	Monitoring Well	x	x		x													
MW-03-02	Monitoring Well	x	x															
MW-06-05	Monitoring Well				x	x	x	x	x									
MW-06-06	Monitoring Well				x													
MW-11-01	Monitoring Well									x								
MW-IPD-07	Monitoring Well																x	x
Portage Pit A		**x**	**x**													**x**	**x**	**x**
MW-03-03	Monitoring Well	x	x															
Pit-A-Seep-East	Pit wall seepage															x		x
Pit-A-Seep-North	Pit wall seepage																x	
Portage Pit E														**x**	**x**	**x**	**x**	**x**
Pit E3-B2	Horizontal hole													x				
Pit E3-B6	Horizontal hole													x	x			
Pit E3-B7	Horizontal hole														x			
Pit E4	Pit wall seepage														x			
Pit-E-Seep-North	Pit wall seepage															x	x	x
Pit-E-Seep-SW	Pit wall seepage															x		
MW-IPD-09	Monitoring Well																x	x

3.4.2 Comparative criteria

Maximum average concentrations (MAC) for water discharged to Third Portage Lake, as per Meadowbank Mine Water License2AM-MEA1526, are found at Table 3-4 for selected parameters. High concentrations of these selected parameters could indicate a potential interaction between surface and groundwater quality, especially in relation to tailings deposition activities.

Table 3-4: Water Licenses discharge criteria

Analytical Parameter	Unit	Water License Maximum Average Concentration Discharge to Third Portage Lake
Chloride	mg/L	1000
Sulfate	mg/L	na
Total Cyanide	mg/L	0.5
Total Copper	mg/L	0.1
Total Iron	mg/L	na
Total Arsenic	mg/L	0.3
na: not applicable.		

3.4.3 2003-2019 Historical Groundwater Trends

Historical groundwater quality analytical results, including monitoring wells and pit wall seepages stations (listed in Table 3-3) were grouped by site location to prepare trend graphs. Surface water samples were discarded from this part of the analysis, i.e. samples from stations ST-21-South, ST-S-5, SWMP and BG-Lagoon. Analytical results are presented for the selected parameters (chloride, sulfate, total cyanide, total copper, total iron and total arsenic), which are typically associated with the reclaim water chemical signature.

In the case of non-detect parameter, half the value of the laboratory's detection limit was used for the graphs.

No analytical result was discarded from the produced graphs. Some results might not be representative of the groundwater quality for different reasons, such as the use of de-icing salts during former monitoring wells installations, purging or sampling methodology, etc.

Note that the water quality data shown on the figures for each site could come from different sampling stations located in the same area.

Chloride

- Total chloride concentrations remain below MAC, but for three (3) results.
- High chloride concentrations were found in several monitoring wells before 2014, especially in the Goose Pit area. The cause of these elevated level of chloride could related to the used of de-icing salt and calcium chloride brine solution used to prevent the boreholes of the monitoring well from freezing after drilling operation and remains present in the groundwater for years despite intensive purging of the wells after installation. Chloride concentrations are low in the wells installed in 2018 except for MW-IPD-01(d) in the East Flat area. The concentrations in this well are stable close to the 2018-2019 average of 56 mg/L. This concentration may be due to the installation depth of the screen because the salinity of the groundwater increases generally with depth.
- Chloride concentrations at South Cell and Central Dike area show higher values than the other monitoring wells and could be directly related to the reclaim water stored in the South Cell Tailings Storage Facility (TSF).

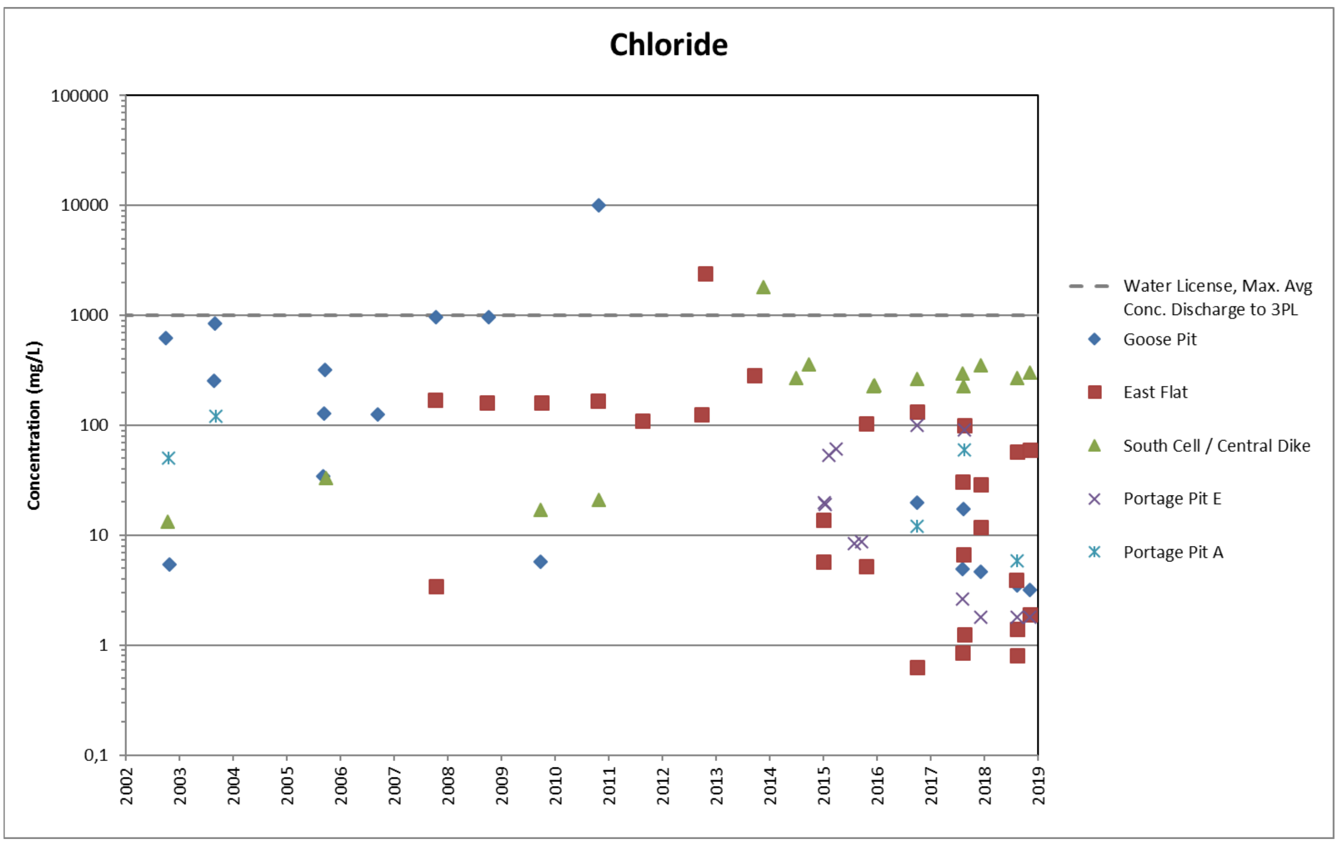


Figure 3-1: Historical Chloride Concentrations in Groundwater

Sulfate

- There is no MAC for sulfate concentrations.
- Sulfate concentrations seem to be trending upward since 2014 at South Cell / Central Dike and Pit A areas. The presence of sulfate could be directly related to the reclaim water or the potentially acid generating (PAG) tailings stored in the South Cell TSF since 2014.
- An upward trend seems to appear in the East Flat area. Higher values are observed since the last couple of years.
- At Portage Pit E, the higher sulfate concentrations that were observed in 2018 are lower in 2019 and closer to the 2015-2016 values.

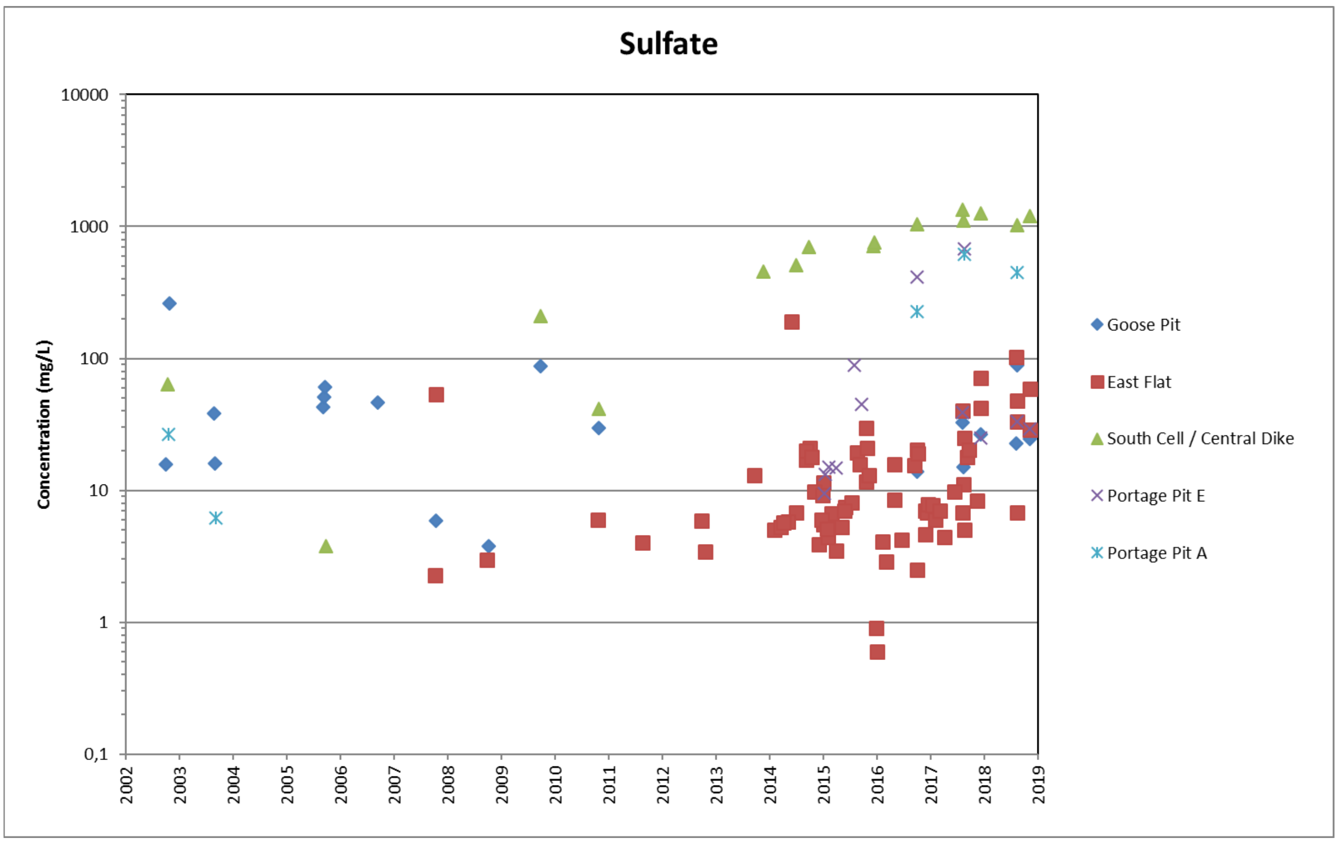


Figure 3-2: Historical Sulfate Concentrations in Groundwater

Total Cyanide

- All historical total cyanide concentrations in groundwater are below MAC criteria;
- Total cyanide concentrations are higher in samples taken around the South Cell and Central Dike area, since the reclaim pond is located nearby;
- No clear trend can be interpreted from these historical concentrations.

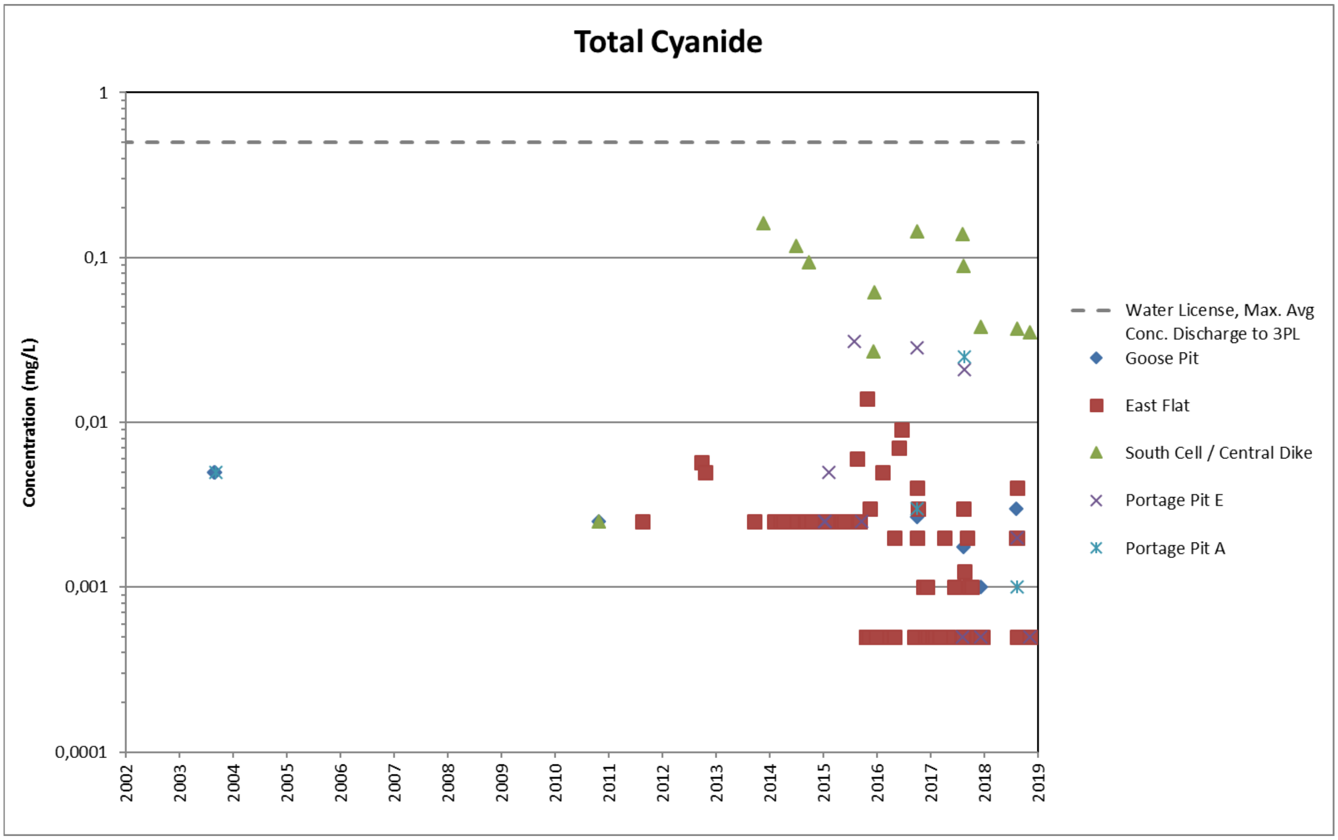


Figure 3-3: Historical Total Cyanide Concentrations in Groundwater

Total Copper

- All historical total copper concentrations in groundwater are below MAC criteria;
- Total copper concentrations in most areas seems to decrease with time, which could be caused by adsorption of copper onto the surrounding rock body and/or its precipitation.

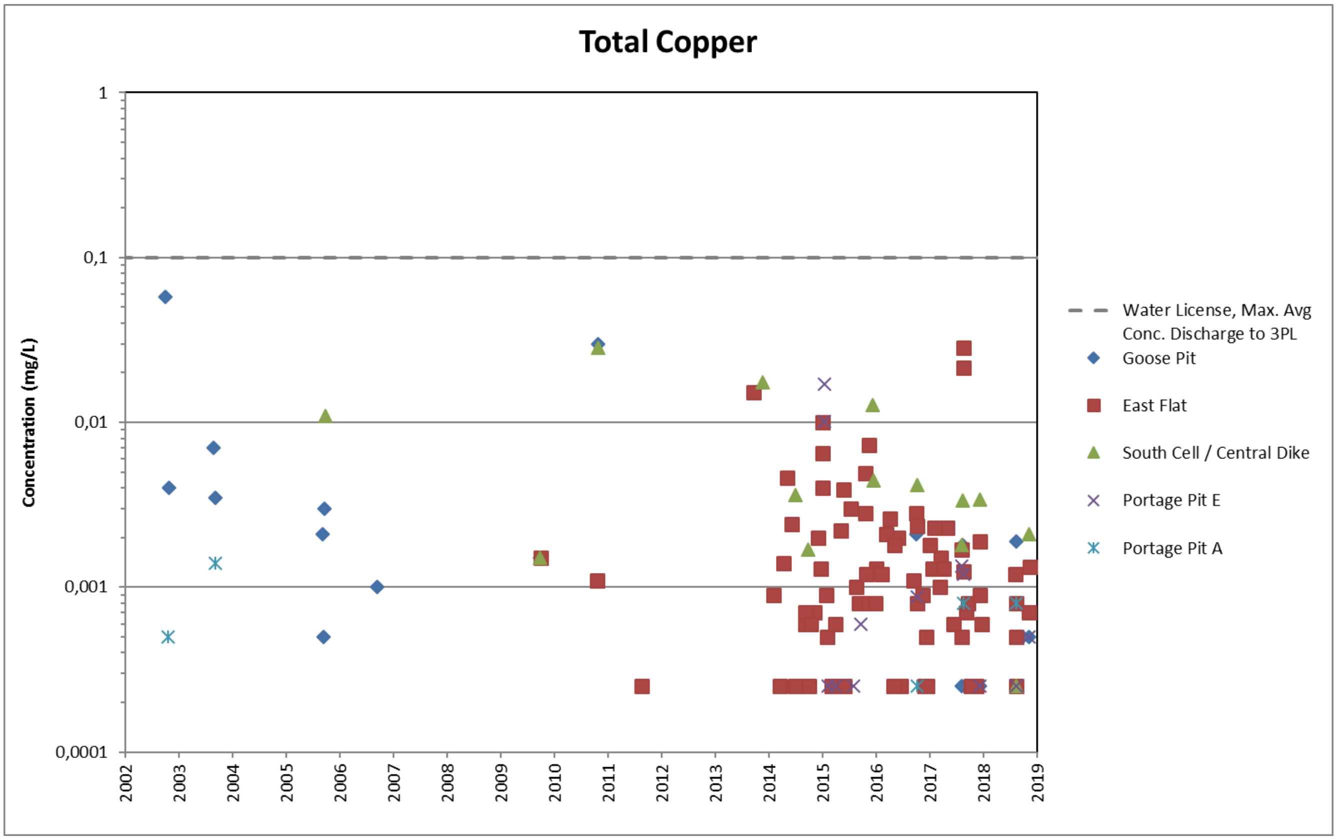


Figure 3-4: Historical Total Copper Concentrations in Groundwater

Total Iron

- There is no MAC for total iron concentrations;
- Total iron concentrations in groundwater seem to have increased slightly at South Cell and Central Dike area from 2005 to 2018, probably due to the influence of the storage of reclaim water in the South Cell TSF. In 2019, the concentrations are lower than in 2018 in most of the areas.

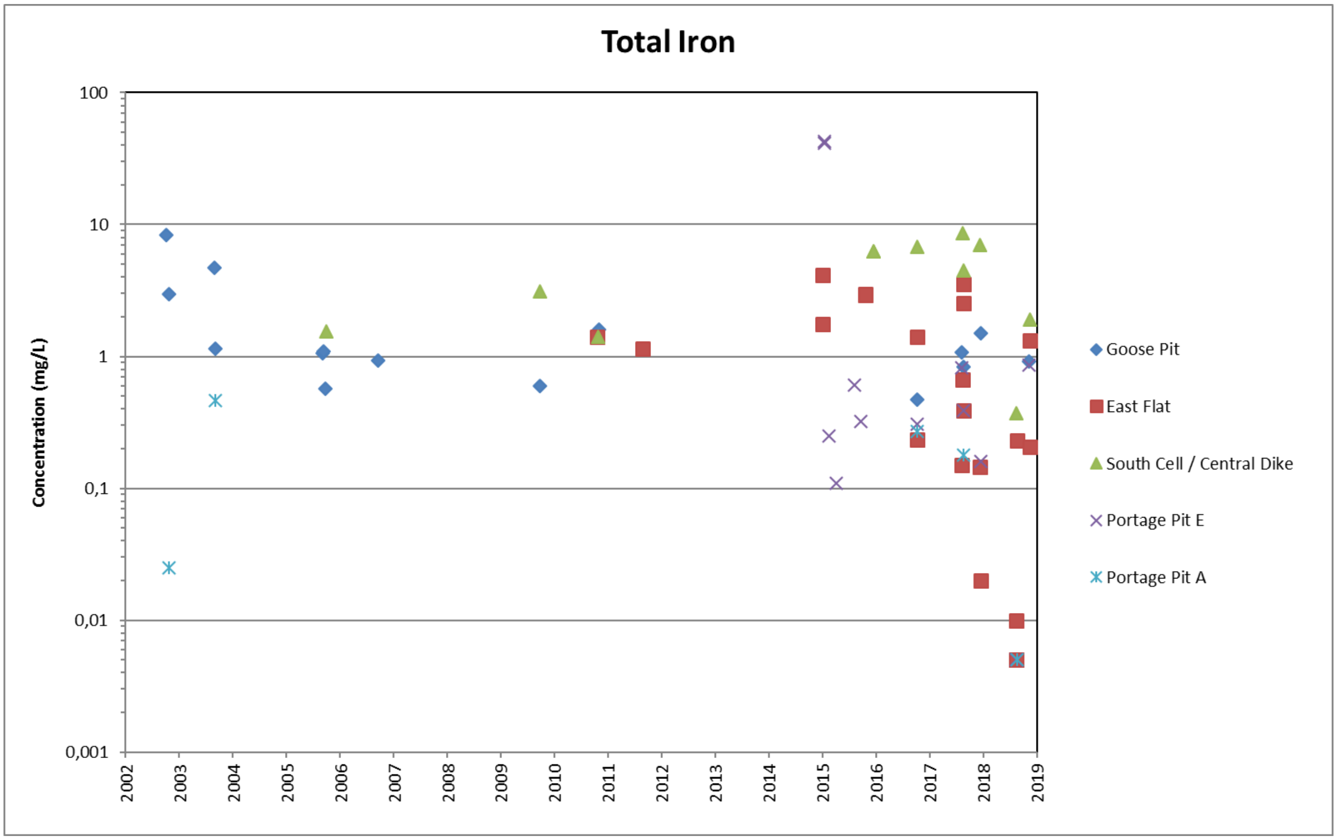


Figure 3-5: Historical Total Iron Concentrations in Groundwater

Total Arsenic

- All historical total arsenic concentrations in groundwater are below MAC criteria;
- Total arsenic concentrations at South Cell and Central Dike area are relatively stable since 2013 but are higher when compared to the other samples taken around the pit. This could be due to the presence of reclaim water stored in the South Cell TSF.

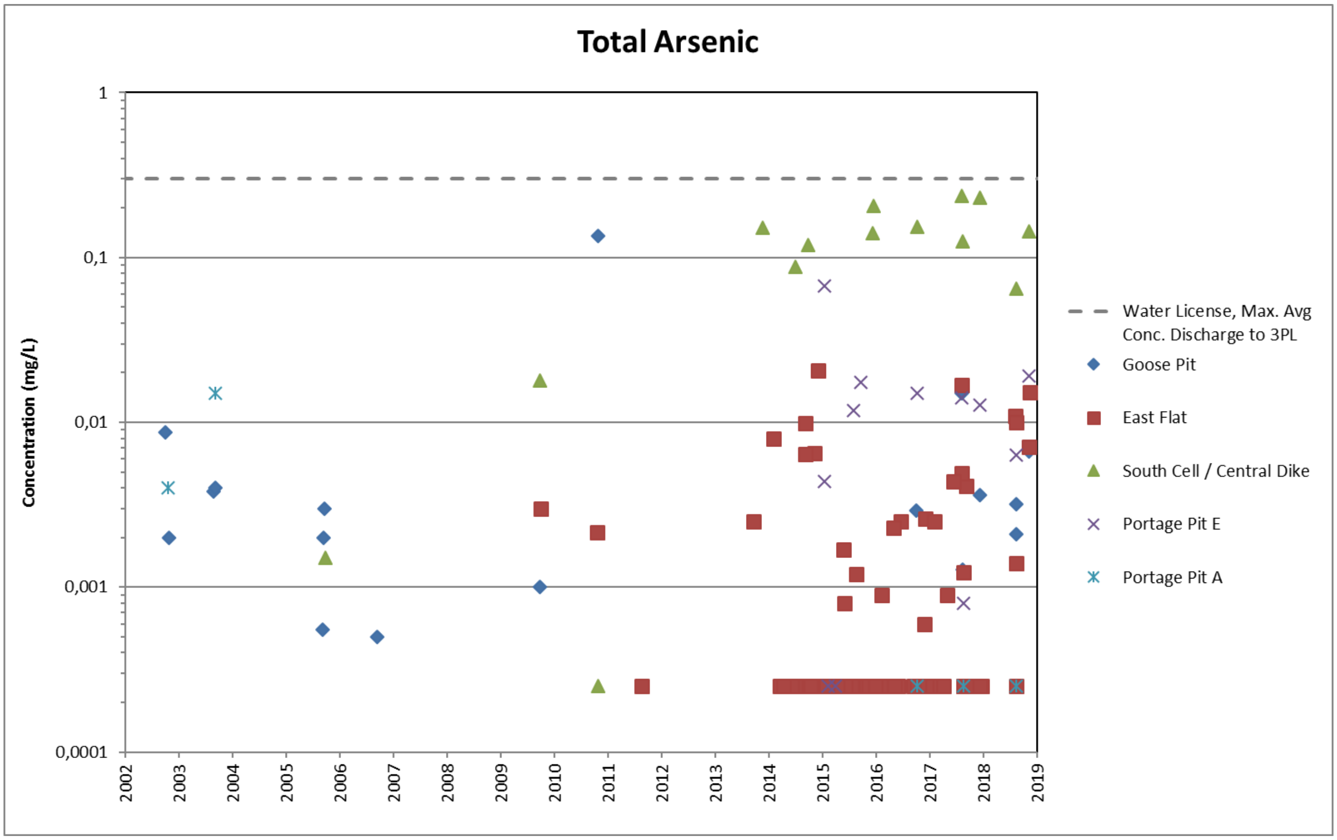


Figure 3-6: Historical Total Arsenic concentrations in groundwater

Sulfate versus Dissolved Calcium and Magnesium

On Figure 3-7, analytical results for 2019 samples (displayed in color) were plotted along with 2017-2018 values (displayed in light grey). This graph shows the sulfate concentration versus the sum of dissolved calcium and dissolved magnesium concentrations in groundwater. In 2019, three (3) potential groups of distinct chemical signatures can be identified: 1) samples with reclaim water signature (ST-21, ST-S-5, and MW-16-01), 2) samples with natural water signature (MW-IPD-07, MW-IPD-01(d), MW-IPD-01(s), ST-8-North, ST-8-South, and MW-IPD-09) and 3) samples with intermediate characteristics (Pit A and Pit E wall seepage samples).

The groundwater collected in 2019 from four (4) wells (MW-IPD-01(d), MW-IPD-01(s), MW-IPD-07 and MW-IPD-09) installed in 2018 is still within the natural groundwater signature category. The water quality at MW-IPD-07 does not seem to have been impacted by the in-pit tailings deposition which was started in July 2019 in Goose Pit only. As shown in Table 3-5, the 2019 mean annual concentrations for key parameters are lower or similar to 2018 values. The Total cyanide value is slightly higher in 2019 than 2018 but the difference is not significant enough for interpretation. For information purpose, the elevation of the surface of the tailings deposited in Goose pit was estimated at 62 m above sea level in October 2019. This elevation is 20 m below the bottom elevation of the screened section of well MW-IPD-07.

Table 3-5: Comparison of mean annual concentrations at MW-IPD-07 for selected parameters

Parameter	Units	2018	2019
Chloride	mg/L	4.85	3.45
Sulphate	mg SO_4/L	29.5	23.6
Total arsenic	mg/L	0.00985	0.00495
Total copper	mg/L	0.00025	0.000375
Total cyanide	mg/L	0.00075	0.00175
Total iron	mg/L	1.315	0.4625
Total phosphorus	mg/L	0.075	0.035

Reclaim water sampling station named ST-21-South, was identified in 2017 as the main source of sulfates and calcium found in water and is illustrated by black cross on the graph. As in 2018, the water quality at ST-S-5 (seepage of reclaim water collected in the Central Dike downstream pond) shows higher concentrations than in ST-21-South. Reclaim water signature can still be detected in the groundwater from well MW-16-01, located nearby, downgradient of the South Cell TSF. The diluted signal of reclaim water could be identified along flow path (shown by grey dots on the graph) from alternative sampling stations such as pit wall seepage.

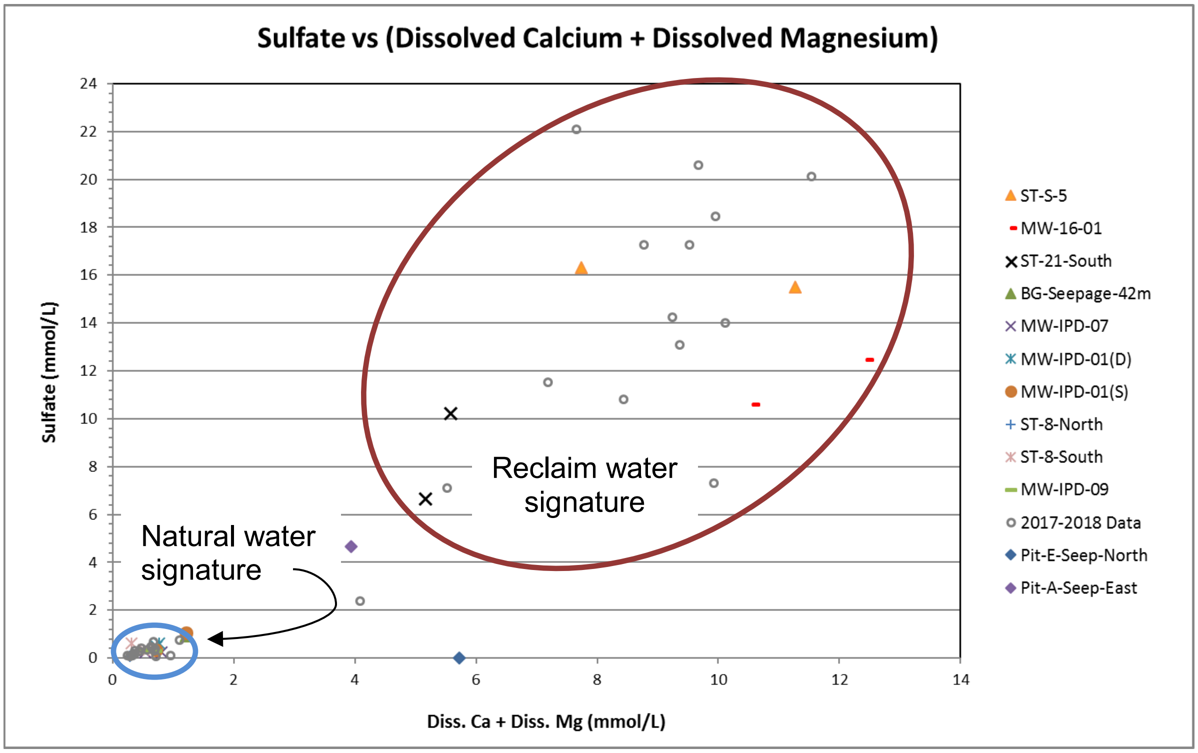


Figure 3-7: Sulfate Concentration vs Dissolved Calcium plus Dissolved Magnesium concentrations

Figure 3-8 shows the evolution of the chloride concentration in the South Cell and Central Dike area in surface water and groundwater over the 2014-2019 period. Since 2014, a slow decreasing trend was observed for ST-21 and ST-S-5 whereas, for monitoring well MW-16-01, the concentration was stable or with a slight trend upward. The chloride content in ST-21-South decreased significantly in the fall of 2019, potentially due to the interruption of the tailings deposition in the South Cell. Chloride concentrations did not decrease in ST-S-5 and MW-16-01 in the end of 2019. The effect of the interruption of the tailings deposition at the South Cell on the water quality at the different monitoring stations might potentially be observed during the 2020 monitoring campaigns.

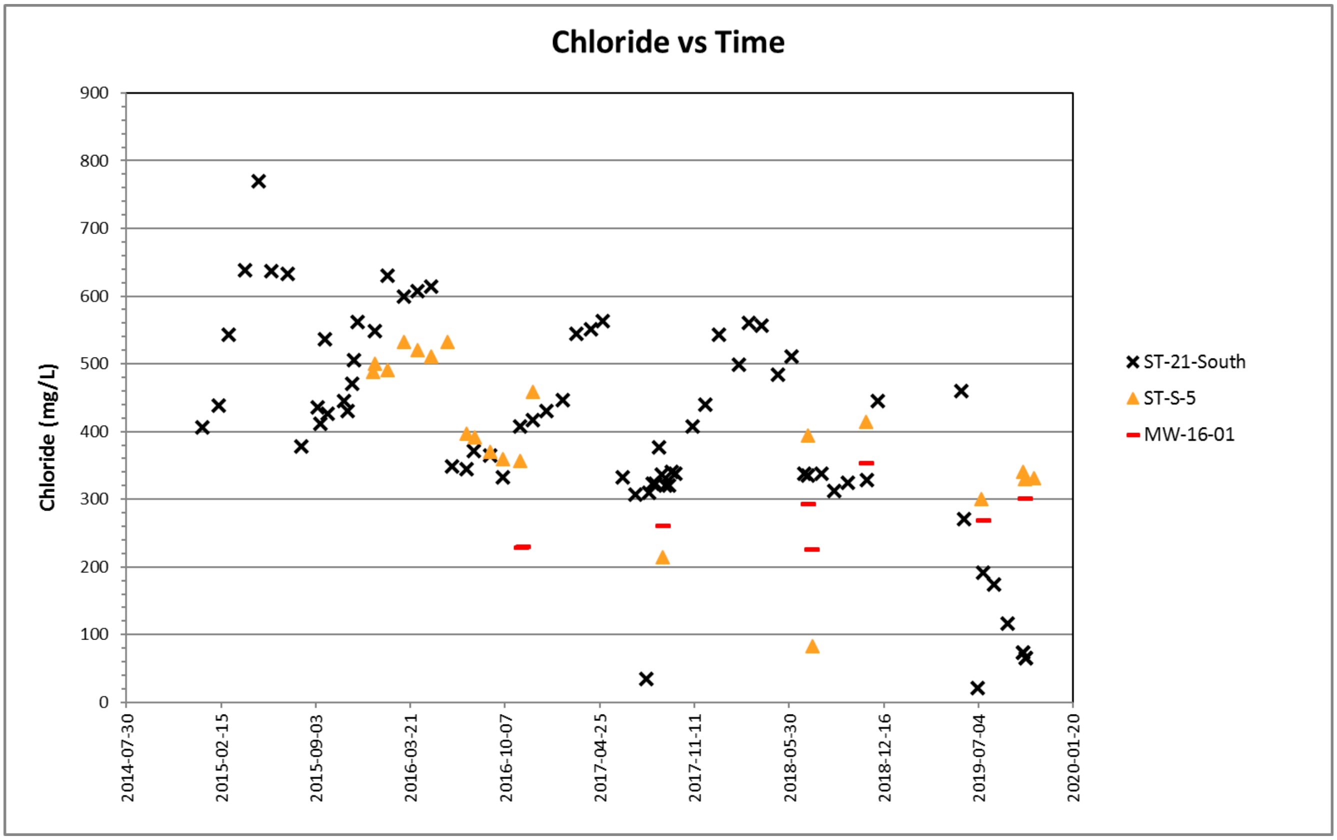


Figure 3-8: Chloride Concentration in the South Cell / Central Dike Area vs Time

4.0 KIVIA RECOMMANDATION - WHALE TAIL GROUNDWATER MONITORING

After the issuance of the 2018 groundwater monitoring report, the following comment was made by the Kivalliq Inuit Association (KivIA):

> *"AEM states, "The total dissolved solids (TDS) content in the Formation groundwater was determined to range between 2,198 mg/L and 4,042 mg/L (Golder 2016a)." These values are for the Whale Tail Pit area collected at a lower depth than those obtained for the Meadowbank Mine site. Results obtained at the Meadowbank site are from shallower sites and measured TDS concentrations between 52 and 1,727.7 mg/L.*
> *SNC Lavalin was commissioned to review historical groundwater throughout the Meadowbank and Whale Tail project area; they provided the following recommendations:*
> *"›De-icing salt and calcium chloride brine used to prevent the boreholes from freezing after drilling operation remains in groundwater for years despite intensive purging of wells after installation. When those products are used in boreholes without a dye tracer, 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 used to retrieve groundwater samples induce the sample to be either diluted (sample not collected in front of the well screen) or charged with parameters that come from fine particulates found in dirty water (sediment in suspension in a sample from sumps and horizontal well can induce false results because groundwater samples are collected in bottle with preservatives but are not filtered in the field before adding the water to the bottles with preservatives); and*
> *› Important chemical parameters to establish background chemistry were missing from the data set (major ions dissolve in groundwater)."*
> *The SNC Lavalin recommendations raise the question as to whether differences between measurements collected at Meadowbank and Whale Tail may indicate differences in site specific groundwater chemistry, sample collection depth or methodological differences between SNC Lavalin and Golder that have confounded the results.*
> *The KivIA recommends for the 2019 annual report that AEM provide a discussion of the implications of adopting SNC Lavalin's recommendations and whether observed differences between data gathered at Meadowbank and Whale Tail are due to site specific differences in groundwater chemistry, sample depth collection or methodological factors.*

Based on the available studies, the difference between the groundwater quality data obtained in Meadowbank mine site and those obtained for Whale Tail pit area could mainly be explained by different executions of the wells installation. During the installation of the Westbay equipment in Whale Tail, drilling fluid (brine) was injected in the drill hole[4] whereas the installation of the monitoring wells in 2017-2018 at Meadowbank were done without brine injection. A dye tracer (fluorescein) was added in the drilling fluid during well installation at Whale Tail. The concentration of the tracer is monitored at each sampling campaign to estimate the proportion of drilling fluid remaining in the sampled groundwater. Then, a calculation is done on the laboratory results to remove the portion of the chemical load due to the drilling fluid presence. This calculation approach allows to reconstitute water quality results that are more representative of the geological formation water quality. However, this methodology will not provide accurate water quality results but only an estimation of the groundwater quality based on several assumptions, one of which is the drilling fluid having a constant chemical composition. The observed fluorescein concentrations between 2016 and 2019 for some of the sampling ports of the Westbay system are still high, meaning that the brine proportion in the samples is still non-negligible. The presence of the brine impacts significantly the total dissolved solids values. Moreover, the variability of the drilling fluid chemical composition during the installation

[4] Golder, 2016. Westbay system installation summary – Whale Tail pit project, Nunavut, Technical memorandum no. 1649355-033-TM-Rev0-4000, July 2016.

process brings additional uncertainty on the final water quality results, uncertainty which may be increased by the mixing of different aquifer zones[5].

Figure 4-1 shows the 2019 development data for the Westbay system. Development consists of pumping water in the sampling port area until the fluorescein concentration indicates that most of the water sample is water from the geological formation. The figure shows that fluorescein content is still elevated in the sampling ports after development except for Port 3.

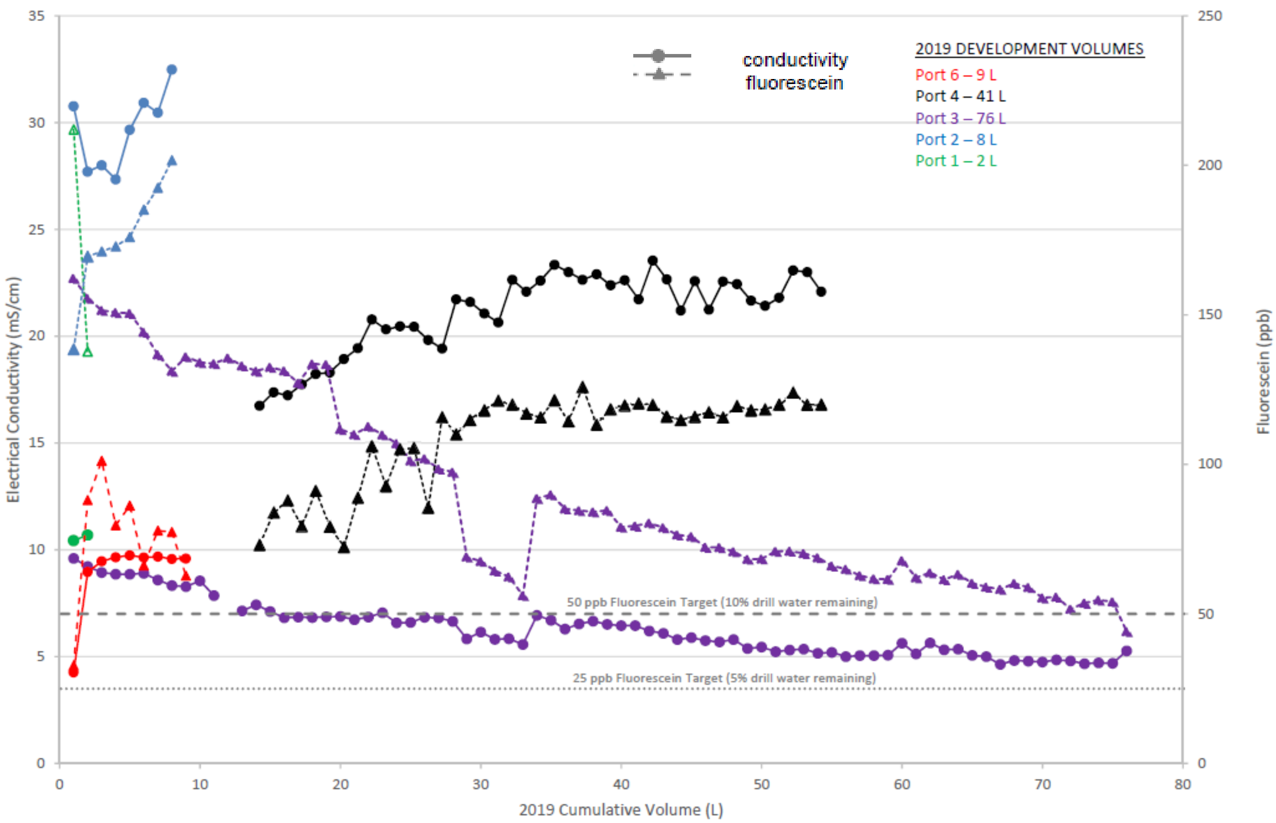


Figure 4-1: 2019 Development Record – Westbay System – Whale Tail (Golder, 2019[6])

At Meadowbank, the interpretation of the latest analytical results obtained at the newly installed "IPD" monitoring wells is more direct due to the absence of brine solution used either during drilling operations or to keep the borehole opened during well installation. The newly obtained results at Meadowbank are presently more representative of the sampled formation water quality than in Whale Tail, other sampling parameters considered equal.

[5] Golder, 2016. Westbay system installation summary – Whale Tail pit project, Nunavut, Technical memorandum no. 1649355-033-TM-Rev0-4000, July 2016.
[6] Golder, 2019. 2019 AMQ-626 Westbay groundwater monitoring investigation, Amaruq, Nunavut, Technical Memorandum No. 18108905-303-TM-Rev0, July 2019.

The site-specific conditions may have an impact on the TDS but the data available to date does not allow to discuss them. A detailed geological review could be done to compare both sites at the location of the monitoring wells. During the installation of the West Bay system in Whale Tail, a zone of faults infilled with clay was identified from 337.3 to 363 m along borehole, in which location was installed sampling port no.4 (Golder, 2016). It is possible that water sampled at this port shows higher TDS due to the contact with the clay. However, present available data does not allow to confirm this assumption.

At Meadowbank, the maximum sampling depth is at 172 m below ground surface at MW-IPD-01(d). Figure 4-2 shows the 2018-2019 TDS values for the wells installed in 2018 logged versus the sampling depth in each well. A linear trend curve was fitted to the data. It indicates that TDS measurements in groundwater might increase with sampling depth. The sampling ports of the Westbay system at Whale Tail are localized at depths between 258 and 466 m (vertical depth) below ground surface. Since the sampling depth at Whale Tail is deeper than in Meadowbank, the TDS values might be higher in Whale Tail samples than in Meadowbank samples. But it is not possible to validate this assumption as long as the drilling fluid is present in the Westbay system samples.

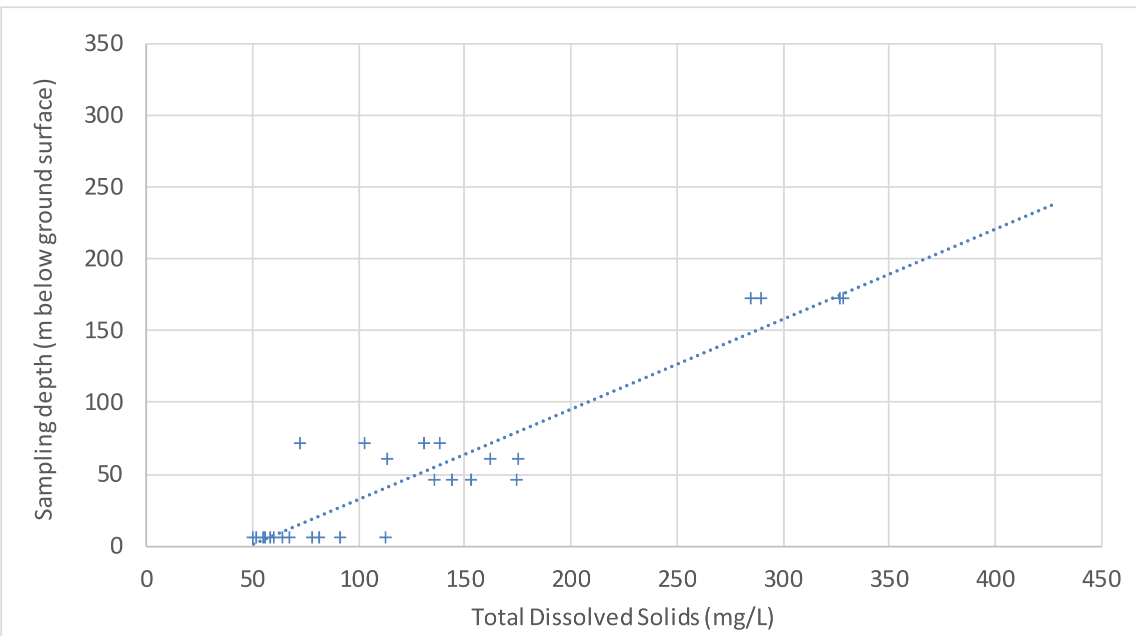


Figure 4-2: 2018-2019 evolution of TDS content versus sampling depth at Meadowbank

5.0 SUMMARY AND CONCLUSION

After the completion of two site visits in 2019, the active participation of SNC-Lavalin professionals to the Meadowbank groundwater field sampling program review, elaboration and interpretation, led to the following conclusions:

- 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. Sampling procedures are available in Appendix B;
- Low flow sampling technique using compressed nitrogen pumps was used for groundwater sampling;
- Duplicate, field and transport blanks were collected (5% of total samples), but July blanks were lost during bottle shipping;
- Purging the water from the wells a few days before the first sampling event of the season induced a lot of sediments in suspension in groundwater and explains the variabilities for many parameters for the duplicate samples in July.
- Interpretation of 2019 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;
- Reclaim water in South Cell is a source of sulfate, chloride, sodium, potassium, calcium, manganese, and other trace elements for surface and groundwater on the site and can be observed especially at ST-S-5 and MW-16-01;
- Groundwater collected in 2019 from the four (4) newly installed well fits within the natural groundwater category established on 2017 results and can be use as threshold values to monitor groundwater quality in the future.

6.0 RECOMMENDATIONS

Based on a review of the analytical results obtained prior 2017, participation to the field sampling campaigns in 2017, 2018 and 2019 by SNC-Lavalin professional, the following recommendations are made:

6.1 Recommendations to improve monitoring well sketches

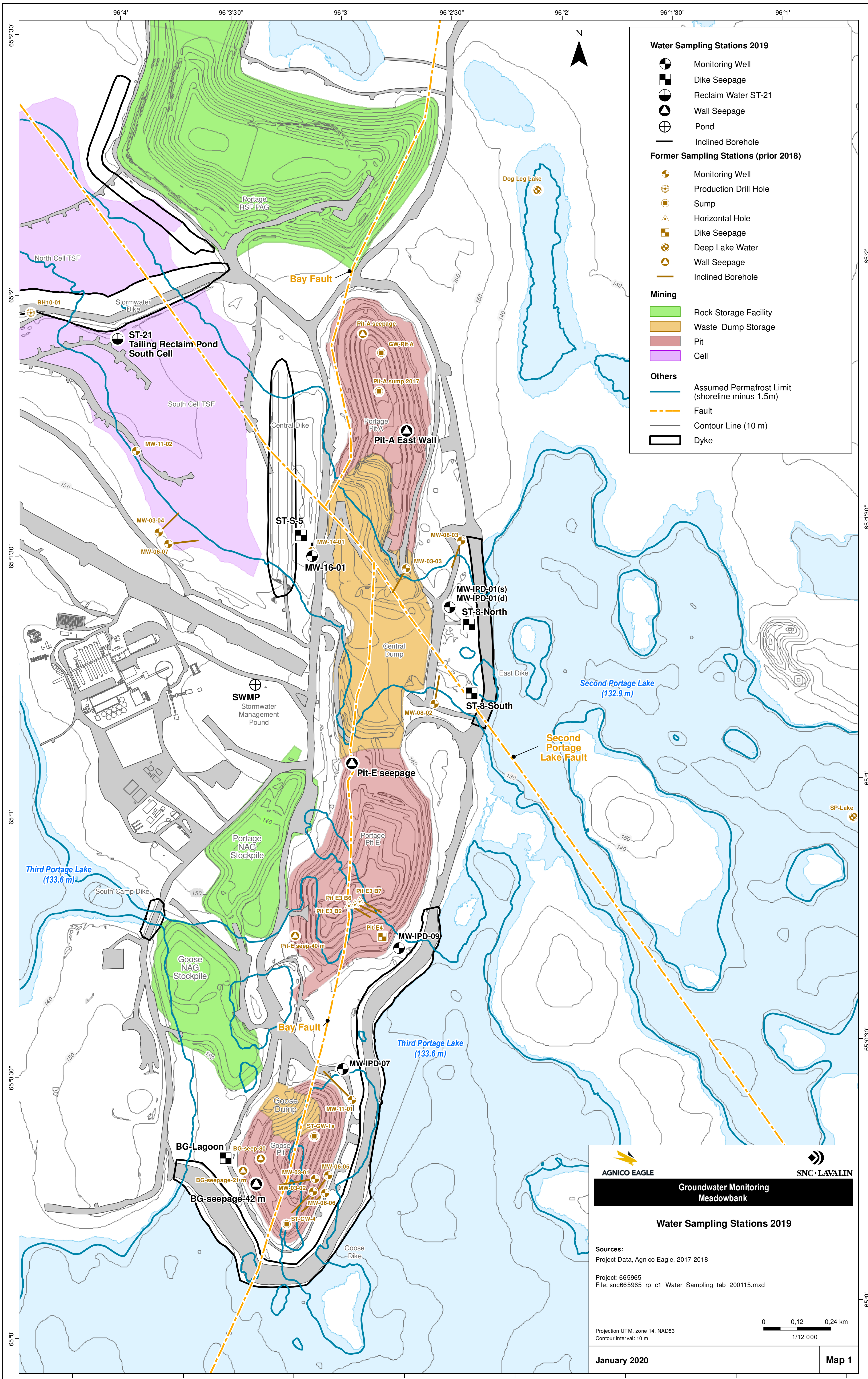
- Display on the same log the following information:
  - Thermistor profile;
  - Geological description;
  - Geomechanical description; and
  - Well installation details.
- Verify the sealing integrity of each monitoring well with a dye tracer as the prepack bentonite sleeves installed in the new wells had smaller diameter (63.5-76.2 mm O.D.) than the one suggested (88.9 mm O.D.). Sealing integrity test is recommended to verify the proper sealing of each MW screen from water coming from overburden or upper bedrock levels. The sealing integrity test can be performed after collection of the first sample by adding a dye tracer between the casing and the S.S. pipe. If no dye tracer appears while pumping the MW, seal integrity will be confirmed. Volume and concentration of dye tracer to be added must be calculated by a professional;

- Add to well sketch all the specific measurements for the well material installed (ex. well riser inside and outside diameters, bentonite sleeve diameter)
- Add to well sketch the duration of the borehole drilling, notes on difficulties encounter during drilling (rock alteration and brittle intervals making drilling difficult) and well installation duration (Appendix B).

6.2 Recommendations for future groundwater monitoring

- Check that nitrogen gas pressure at each MW station is enough for the next sampling campaign. Purchase and install new nitrogen tanks if required;
- Replace Waterra® tubing used for purging. The existing one is broken at several places and fixed with electrical tape. There is a high risk of losing a well if this line breaks in it. SNC-Lavalin recommends having on site at all time two 200' long coils of Waterra® tubing (1 for operation and 1 spare);
- Verify the integrity of MW-16-01 dedicated sampling system (pump, sampling and gas lines at the bottom of the well). SNC-Lavalin did retrieve the pump setup so that the system (pump and tubing condition) can be verified and fixed by AEM before next year summer sampling campaign;
- All five well heads mounted on a PVC tube have to be solidified so they do not slip along the original metal well pipe;
- Same sampling methodologies have to be used at each station and Agnico Eagle staff needs to be trained accordingly to be familiar with the technical equipment;
- 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 themselves. If water used for the blank samples is clean (free of all parameters), then a source of contamination during transport should be identified by Agnico Eagle regarding the following parameters: carbon, nitrogen, cyanide, sulfate, etc. Transport containers should be cleaned and selected accordingly. Moreover, transport blank should be kept all the time with sampling bottles;
- A few analytical parameters could be added to the list to complete the monitoring program. For example, analysis of some isotopes would support the comprehension of groundwater migration along flow paths and the origin of those chemical components.

APPENDIX A: WATER SAMPLING STATIONS 2019



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APPENDIX B: SAMPLING PROCEDURE

Purpose:

- Conduct a groundwater (GW) monitoring program to investigate mining impacts on local GW. This is in accordance with both Meadowbank NWB and NIRB permits.
- Standardize methodologies

Groundwater Sampling SOP:

GW sampling consists of measuring field parameters and collecting GW samples within the designated bottles, twice a year, at the same period of the year (early July and early September).

Wells to sample:

Well name	x	y	Screens depth (m)	Pump depth (m)
MW-16-01	638750.9	7214427.3	89-101	95
MW-IPD-01 (s)	639240.3	7214249.9	51-69	60
MW-IPD-01 (d)	639240.0	7214245.0	163-181	175
MW-IPD-07	638859.6	7212597.2	42-50	40
MW-IPD-09	639065.2	7213024.5	62-80	70

A week before sampling check for:

- Heat trace cables functionality (can't be check at MW-IPD-01 (d) since heat trace cables start 2 m below ground, so the lines won't feel warm);
- Make sure the light tower generator are running at MW-IPD-07 and MW-IPD-09
- Make sure the nitrogen tanks are in place and secured

Light tower generator at MW-IPD-07 and MW-IPD-09 to keep the heat trace cables working

Material required for sampling:

- Nitrogen tanks (JDE number 134720) already installed at each sampling station
- Solinst double valve pump (already in the monitoring well), two spare pumps are in the cooler
- Nitrogen regulator
- Solinst Control unit 464 ECU 250 psi
- Black drive line and supply line
- Clean pails
- Graduated measuring cups
- Calibrated multi-parameter probe and a flow through cell (to prevent the water sample to be in contact with oxygen): temperature, specific conductivity, pH, oxydoreduction potential, dissolved oxygen, total dissolved solid, salinity, turbidity;
- Water level probe
- Sampling bottles (see list below)
- Syringe and adapted 0,45 micron filters
- Nitrile gloves
- Permanent marker

Sampling bottle check list:

- 1 * 1 L clear plastic bottle with no preservative
- 1 * 250 ml clear plastic bottle with no preservative
- 1 * 125 ml clear plastic bottle with H_2SO_4
- 2 * 125 ml clear plastic bottle with nitric acid (HNO_3)
- 1 *125 ml clear plastic bottle with NaOH
- 1 * 125 ml clear plastic bottle with NaOH - SGS laboratory bottle
- 1 * 125 ml clear plastic bottle with HCl

Well name	Pressure left in the nitrogen tank	Gas used for each sampling even	Comment
	psi	psi	
MW-IDP-01s	1600	200	-
MW-IDP-01d	200	800	Need a new nitrogen tank
MW-IDP-07	2200	150	-
MW-IDP-09	2000	150	-
MW-16-01	1000	500	Need a new nitrogen tank soon

Sampling procedures

Prior sampling the water in the monitoring well

1- Remove well head cap
2- Remove the red plug on well head
3- Lower the small water level probe into the hole where the red cap was located and measure the water level from the well head hole level
4- Place the ¼ inch waterra line on the well head

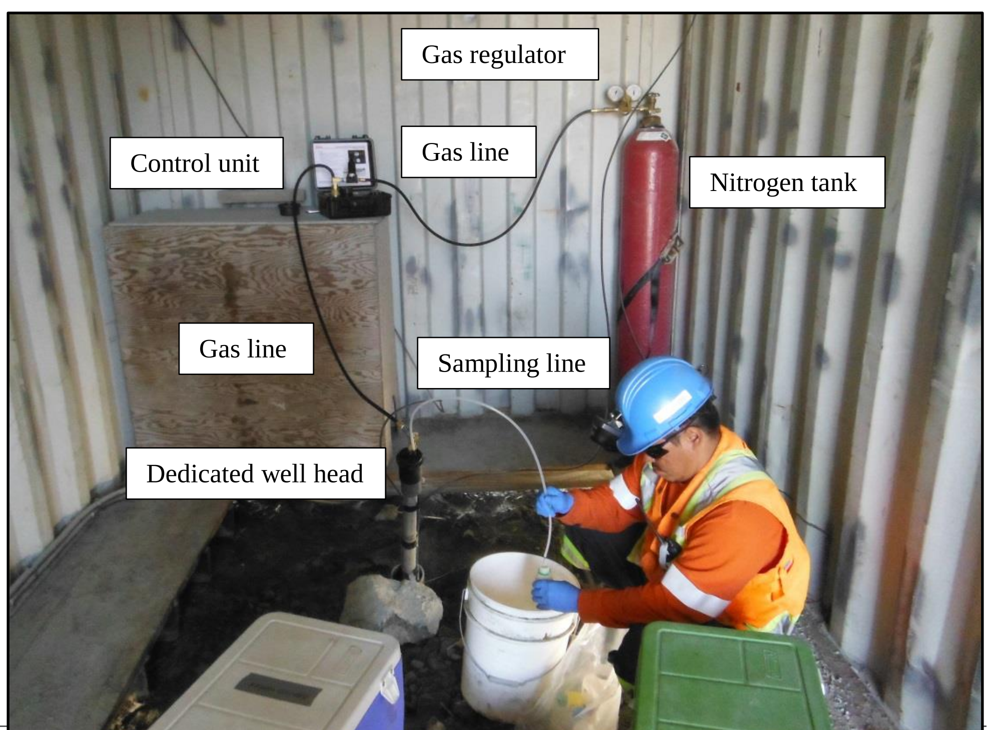
Well name	Water level at plastic well head level	HWT casing above ground level	Well casing above ground level	casing above ground level with PVC and well head addition
	m	m	m	m
MW-IDP-01 (s)	18,19	0,17	0,29	0,75
MW-IDP-01 (d)	18,07	0,00	0,28	0,35
MW-IDP-07	1,79	0,06	0,19	0,45
MW-IDP-09	2,36	0,00	0,26	0,45
MW-16-01	5,30	0,17	?	0,745

Setting up the nitrogen tank and the gas line

5- Screw on the nitrogen regulator on the nitrogen tank and tighten lightly with a 1 1/8in wrench ((ideally not an adjustable wrench since it will damage the bolt)
6- Connect the supply line into the regulator to "air in" on the control box
7- Connect the drive line from the air out on the control box to the well head

This end goes into the nitrogen

Solinst
Manual Control Button
Air Out
Air In
Regulator
Pressure Gauge
Battery Enclosure



Gas regulator
Control unit
Gas line
Nitrogen tank
Gas line
Sampling line
Dedicated well head

8- **<u>Open</u>** to its maximum position (turning towards the left side) the handle/valve located on the gas pressure regulator at the maximum (the close position would send the maximum nitrogen pressure to the air line and we want to avoid that). The valve should feel loose, not tighten;

9- **<u>Slowly open</u>** (1/4 turn to the left) the valve located on the nitrogen tank. You should be able to read the pressure left in the nitrogen tank on the pressure gage located on the right side of the regulator;

10- **<u>Slowly closed</u>** (a tiny bit, less than 1/8 turn to the right) the valve located on the gas pressure regulator until the gauge on the left side indicated 150 psi. **NEVER EXCEED 250 psi** or you are going to blow up the controller box**.**

11- On the control box press RUN than select the menu on AUTO mode for Preset Flow Rate.

12- This should take 1 minute before the water is flowing.

Well name	Pressure set on control unit box (flow rate set to medium)	Flow setting on controller unit	GW flow rate measured while pumping	Comments
	psi		mL/min	
MW-IDP-01s	50	medium	100	
MW-IDP-01d	110	medium	50	
MW-IDP-07	40	medium	200	Rate too fast, water level was decreasing
MW-IDP-09	50	high	165	
MW-16-01	50	high	100	

13- While the water is purging from the monitoring well measure the flow rate with a measuring cup and a timer. The ideal flow rate is equal or below 100 ml/min. Keep measuring and recording the water level. If the water level is not stable and diminishes it means that you are pumping the water from the well and not from the bedrock formation and you want to avoid that. You want to keep a flow rate that will keep your water level stable.
14- Let it run for 45 minutes, measure and record physicochemical parameters and record every 15 minutes.
15- Sample the water from the well when you have more than 3 consecutive readings that are:
    a. pH is within 0.1 or 0.2 of a standard unit;
    b. temperature is within 0.2 °C or 3%;
    c. specific conductance is within 5% for values equal to or less than 100 microsiemens and 3% for values greater than 100 microsiemens;
    d. DO (dissolved oxygen) is within 10%;
    e. Eh/ORP (oxido-reduction potential) is within 10 millivolts;
    f. Turbidity is within 10% for values greater than 1 NTU but less than 100 NTU;
16- To filter the sample for the dissolved metal analysis, use a larger filter and hold it to ¼ diameter LDPH tubing (respect the flow direction indicated by an arrow) or fill the syringe directly with the water coming out of the ¼ diameter LDPH tubing, install a small filter on the syringe and fill the dissolved metal bottles.
17- Remove the filter and fill all the other bottles.
18- See instruction to set up personalised drive and vent ranges.

https://www.solinst.com/products/groundwater-samplers/464-pneumatic-pump-control-units/electronic-control-unit-datasheet/

Optimizing Pumping Pressure

To collect a representative sample, especially when monitoring for volatiles, it is important to avoid the drive gas to enter the pump and aerate the sample water during a drive period. This means, you need to carefully calculate the appropriate pumping pressure to be applied. To do so, it is important to measure the depth of the static water level.

The pumping pressure needed is calculated due that it takes about 1 psi of pressure to raise 2.3 ft. of water plus 10 psi fo line loss. To calculate the pumping pressure needed in psi, take depth to static level in feet, and multiply by 0.43 psi/ft. (1 psi /2.3 feet = 0.43 psi/ft.). E.g., if depth to static water level is 50 ft., the pumping pressure needed is calculated by the following:

50 ft. to static level x 0.43 psi/ft. + 10 psi = 32 psi needed.

Refer to Solinst Website for more instruction: https://www.solinst.com/products/groundwater-samplers/408-double-valve-pumps/technical-bulletins/getting-best-quality-samples-double-valve-pump.php

APPENDIX C: PURGE DATA COLLECTED BY AGNICO EAGLE

Appendix C-1 : July 2019 Purge Data

MW-IPD-07 : July 2019 Purge data										
Date	Time	Water Depth (m)	Waterra Depth (m)	Approx.qty purged (L)	Turbidity (NTU)	Conductivity (µS/cm)	pH (-)	Salinity	Temperature (°C)	DO (mg/L)
2019-07-09	15:08	1.5	20	30	138	242	8.4	0.1	13.4	10.59
2019-07-09	15:35		20	35	263	241	8.36	0.1	12.5	10.58
2019-07-09	16:02		37	30	413	241	8.23	0.1	11.4	10.94

MW-IPD-01 (s) : July 2019 Purge data										
Date	Time	Water Depth (m)	Waterra Depth (m)	Approx.qty purged (L)	Turbidity (NTU)	Conductivity (µS/cm)	pH (-)	Salinity	Temperature (°C)	DO (mg/L)
2019-07-09		16.1	25	30	161	1379	7.89	0.6	12.6	10.64
2019-07-09			25	50	100	979	7.88	0.5	13.5	10.6
2019-07-09			40	60	28.3	880	7.89	0.4	12.55	12.55
2019-07-09	16:35		37	20	382	241	8.19	0.1	11.4	10.98

MW-IPD-09 : July 2019 Purge data										
Date	Time	Water Depth (m)	Waterra Depth (m)	Approx.qty purged (L)	Turbidity (NTU)	Conductivity (µS/cm)	pH (-)	Salinity	Temperature (°C)	DO (mg/L)
	09:05	1.3	20	15	104	294	7.69	0.1	12.9	10.32
	09:26		40	10	84.7	235	7.69	0.1	14.2	10.18
	09:58		55	15	256	245	7.78	0.1	12,0	10.55
	10:21		54	10	295	242	7.92		12.7	12.39
	11:17		56	10	321	249	7.89	0.1	12.7	10.53

MW-16-01 : July 2019 Purge data										
Date	Time	Water Depth (m)	Waterra Depth (m)	Approx.qty purged (L)	Turbidity (NTU)	Conductivity (µS/cm)	pH (-)	Salinity	Temperature (°C)	DO (mg/L)
2019-07-11	14:51	5.3	20	50	30.3	2580	7.84	1.3	10.5	
2019-07-11	17:02		20	35	85	3230	7.73	1.7	9.7	
2019-07-11	17:20		20	25	67.8	3210	7.73	1.7	9.9	
2019-07-11	17:45		40	40	61.7	3060	7.73	1.6	10.6	

Note: Missing data is highlighted by greyed cells

Appendix C-2: October 2019 Purge Data

MW-IPD-07 : October 2019 Purge data											
Date	Time	Water Depth (m)	Waterra Depth (m)	Approx.qty purged (L)	Turbidity (NTU)	Conductivity (µS/cm)	pH (-)	Salinity (PSU)	Temperature (ºC)	DO (mg/L)	DO %
2019-10-07	15:00	0.8	20	60	518	247	8.27	0.1	12.8	8.9	75
2019-10-07	15:40		38	60	22.3	284	8.29	0.1	6.7	11.5	109

MW-IPD-09 : October 2019 Purge data											
Date	Time	Water Depth (m)	Waterra Depth (m)	Approx.qty purged (L)	Turbidity (NTU)	Conductivity (µS/cm)	pH (-)	Salinity (PSU)	Temperature (ºC)	DO (mg/L)	DO %
2019-10-08	10:45	1.4	20	25	72.1	252	8.08				
2019-10-08	11:20		40	30							
2019-10-08	14:00		45	30							

MW-IPD-01 (s) : October 2019 Purge data											
Date	Time	Water Depth (m)	Waterra Depth (m)	Approx.qty purged (L)	Turbidity (NTU)	Conductivity (µS/cm)	pH (-)	Salinity (PSU)	Temperature (ºC)	DO (mg/L)	DO %
2019-10-11	14:50	14.9	20	40	6.0	189	7.94	0.1	12.9	10.1	100
2019-10-11			40	100	135	836	7.68	0.4	9.5	10.3	98
2019-10-11			46	100	60.7	337	7.88	0.1	9.6	10.7	101

Note: Missing data is highlighted by greyed cells

APPENDIX D: ANALYTICAL RESULTS

			GUIDELINES		DISCHARGE CRITERIA			Goose Pit			East Flat											South Cell / Central Dike		Portage Pit E							Portage Pit A	Goose Pit	South Cell / Central Dike				SWMP
		THIRD PORTAGE LAKE	CCME Guidelines		MMER Max. Monthly Mean	Water License, Max. Avg Conc. Discharge to 3PL	Water License, Max. Avg Conc. Discharge to Wally Lake	BG-Seepage-42m	MW-IPD-07		ST-8-North			ST-8-South			MW-IPD-01(S)		MW-IPD-01(D)			MW-16-01		Pit-E-Seep-North	MW-IPD-09						Pit-A-Seep-East	BG_Lagoon	ST-S-5		ST-21-South		SWMP
								V-88882	V-93098	V-88872	V-93280	V-93279	V-88878	V-93278	V-88879	V-88881	V-93282	V-88871	V-89052	V-89051	V-93277	V-93276	V-88875	V-88938	V-93099	V-88873	V-88874	V-93100	V-93101	V-93102	V-89053	V-88880	V-93275	V-88876	V-93281	V-88877	V-88937
											Duplicate					Duplicate			Duplicate								Duplicate	Duplicate	Field Blank	Trip Blank							
		Average-East Basin Summer 2015	Long Term, Based on 3PL quality	Notes	Schedule 4	Part F of License	Part F of License	2019-07-14	2019-10-09	2019-07-11	2019-10-12	2019-10-12	2019-07-12	2019-10-12	2019-07-13	2019-07-13	2019-10-12	2019-07-10	2019-07-16	2019-07-16	2019-10-11	2019-10-10	2019-07-13	2019-07-15	2019-10-09	2019-07-12	2019-07-12	2019-10-09	2019-10-09	2019-10-09	2019-07-16	2019-07-11	2019-10-10	2019-07-11	2019-10-12	2019-07-14	2019-07-15
FIELD PARAMETERS	**Units**																																				
Temperature	°C		--		--	--	--	9,9	17,9	18,3	-	2,2	7,1	4,5	7,7	-	22,4	26,6	-	22,9	18,1	11,9	13,6	14	-	17,7	-	-	-	-	18,6	15,4	1,3	7,7	0,6	10,6	-
pH	-		--		--	--	--	8,78	8,43	8,01	-	8,66	8,2	8,25	7,71	-	8,21	7,71	-	7,8	8,05	7,37	7,27	8,23	-	7,91	-	-	-	-	7,64	8,45	7,8	7,86	8,2	8,26	-
Conductivity	µS/cm		--		--	--	--	351,1	224,3	242,4	-	87,6	80,7	80,8	154,9	-	181,8	971	-	524,2	508	2512	2894	1350	160	217,9	-	-	-	-	972	352,2	3783	3566	1703	2647	-
Oxygen Reduction Potential	mV		--		--	--	--	93,2	259	-210,5	-	2,8	114,9	25,5	69,2	-	37,1	176,2	-	-199,3	-216,1	85,6	53,1	114,1	-222,6	-224,6	-	-	-	-	80,8	84,5	-71,9	46,6	92,2	167,9	-
Salinity	PSU		--		--	--	--	0,17	0,11	0,12	-	0,04	0,04	0,04	0,07	-	0,09	0,46	-	0,26	0,24	1,27	1,51	0,68	-	0,1	-	-	-	-	0,48	0,17	1,96	1,82	0,84	1,38	-
Total Dissolved Solids	mg/l		--		--	--	--	228,1	145,9	157,3	-	56,55	52,65	52,6	100,75	-	118,4	620	-	348,1	327,6	1759	1886	877,57	125,45	141,7	-	-	-	-	630,5	229,45	2457	2223	1111	1722	-
Dissolved Oxygen	%		--		--	--	--	3,1	22,8	0,12	-	120	52,12	99,4	46,97	-	14,4	64	-	0,19	4,2	56,3	19,9	9,47	35,1	-	-	-	-	-	2,57	84,94	50,3	40,5	12,67	25,9	-
LABORATORY ANALYSIS																																					
General																																					
Total Alkalinity	mg $CaCO_3$/L	9,1	--		--	--	--	44	87	66	33	31	19	27	21	19	44	31	77	96	109	118	111	73	54	30	50	49	8	7	24	31	71	67	79	71	74
Bicarbonate Alkalinity HCO3	mg $CaCO_3$/L		--		--	--	--	34	87	66	33	31	19	27	21	19	44	31	77	96	109	118	111	73	54	30	50	49	8	7	24	31	71	67	79	71	6
Carbonate Alkalinity CO3	mg $CaCO_3$/L		--		--	--	--	10	87	<2	<5	<5	<2	<5	<2	<2	<5	<2	<2	<2	<5	<5	<2	<2	<2	<2	<2	49	8	7	<2	<2	<5	<2	<5	<2	67
Reactive silica	mg/L		--		--	--	--	3,91	4,7	9,41	2,03	2,1	0,68	1,46	1,41	1,42	9,4	2,02	20,7	22	25,2	14,6	8,41	<0,02	6,3	10,9	10,9	6,7	<0,1	<0,1	5,5	2,02	11,1	5,72	6,97	4,19	7,56
Sulphate (SO4)	mg SO_4/L	5	--		--	--	--	89,4	24,5	22,7	13,9	12,1	6,8	58,3	33,4	34,5	31,5	103	46,3	47,5	58,4	1197	1016	<0,6	29	33,1	33,5	28,8	<0,6	<0,6	447	103	1489	1568	639	983	37,1
Hardness (CaCO3)	mg $CaCO_3$/L	12	--		--	--	--	113	79	54	36	41	28	32	51	49	89	344	80	72	80	1164	862	586	68	52	55	72	<1	<1	464	117	951	767	523	552	113
Dissolved Organic Carbon	mg/L		--		--	--	--	1,6	3,6	1	1,5	1,7	0,95	2,6	1,1	1,2	1,7	1,2	7,7	6,4	12	30,4	32	7,9	1	0,96	0,99	2,4	0,3	0,3	0,81	2,5	29,8	26	9,8	19	26
Total Organic Carbon	mg/L		--		--	--	--	1,6	1,3	0,93	1,1	1	0,85	1,2	1,2	1,1	0,82	1,3	7,3	7,7	9,3	29	56	8,4	1,1	0,91	1,1	1	<0,2	<0,2	0,74	2,4	29	28	5,4	19	22
Total Suspended Solids	mg/L	< 1	--	max. 5 mg/L increase from background	15	15	15	2	6	32	21	12	1	1	5	3	1	3	318	120	11	3	5	56	14	32	31	9	1	1	2	5	5	5	8	7	37
Total Dissolved Solids	mg/L	22	--		--	--	--	205	142	148	54	54	48	51	86	86	108	488	317	320	325	1514	1470	786	114	131	120	115	2	4	546	219	1984	1786	936	1356	271
Total Metals																																					
Total Aluminium	mg/L	0,00748	0,1	pH 3PL > 6.5	--	1,5	1,5	0,008	0,11	<0,005	0,159	0,162	0,024	0,021	0,014	0,013	0,017	<0,005	0,006	0,014	1,13	<0,005	<0,005	0,013	0,25	<0,005	<0,005	0,26	<0,01	<0,01	0,021	0,022	0,028	<0,005	0,055	0,013	0,038
Total Antimony	mg/L		--		--	--	--	0,0003	<0,001	0,0003	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	0,0003	<0,0001	<0,0001	<0,0001	0,0002	<0,0001	0,0003	<0,001	0,0001	<0,0001	<0,001	<0,001	<0,001	0,0011	<0,0001	<0,0001	0,001	0,002	0,0047	<0,0001
Total Arsenic	mg/L	0,00051	0,005		0,5	0,3	0,1	0,0021	0,0067	0,0032	0,0021	0,0035	<0,0005	0,0024	0,0014	0,0016	0,0526	0,0109	0,0125	0,01	0,0071	0,1441	0,0647	0,0047	0,019	0,0063	0,0063	0,02	<0,001	<0,001	<0,0005	<0,0001	0,0623	0,0168	0,0135	0,05	0,0064
Total Barium	mg/L	0,00366	--		--	--	--	0,0233	0,012	0,0115	0,0085	0,0106	0,0051	0,0098	0,0083	0,0081	0,0041	0,0187	0,017	0,013	0,0207	0,0326	0,0262	0,0401	0,0031	0,0049	0,0057	0,0029	<0,002	<0,002	0,0108	<0,0001	0,0214	0,0247	0,0247	0,0361	0,004
Total Beryllium	mg/L		--		--	--	--	<0,0005	<0,002	<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	<0,002	<0,0005	<0,0005	<0,002	<0,002	<0,002	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005
Total Boron	mg/L		--		--	--	--	<0,01	0,25	0,15	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	0,13	0,09	0,06	0,09	0,03	0,02	0,08	0,12	0,02	0,01	0,12	<0,05	<0,05	<0,01	<0,0005	0,07	0,06	0,03	0,04	<0,01
Total Cadmium	mg/L	0,00000	0,00004	3PL hardness < 17 mg/L CaCO3	--	0,002	0,002	<0,00002	<0,0002	<0,00002	<0,00002	<0,00002	<0,00002	<0,00002	<0,00002	0,00002	<0,00002	<0,00002	0,00003	0,00023	0,00003	0,00004	<0,00002	0,00003	<0,0002	<0,00002	<0,00002	<0,0002	<0,0002	<0,0002	<0,00002	0,00006	0,00037	<0,00002	0,00022	0,00007	<0,00002
Total Calcium	mg/L		--		--	--	--	27,8	16	11,4	10,6	12,1	8,94	9,58	14,5	13,6	20,7	71,5	16,8	15,8	16,7	282	210	156	15	13,3	13,7	16	<0,5	<0,5	112	28,7	294	247	165	194	30,4
Total Chromium	mg/L	0,00011	0,001	Based on Cr(VI)	--	--	--	0,0008	<0,005	<0,0006	0,0017	0,0015	0,0008	0,0009	0,0007	0,0008	0,001	<0,0006	0,0008	<0,0006	0,0011	0,0013	0,0008	0,0007	<0,005	<0,0006	<0,0006	0,0056	<0,005	<0,005	0,0009	0,0015	0,0014	0,0016	0,0011	0,0009	0,0008
Total Copper	mg/L	0,00060	0,002	3PL hardness < 82 mg/L CaCO3	0,3	0,1	0,1	0,0019	<0,001	<0,0005	0,0018	0,0018	<0,0005	0,0011	0,0008	0,0008	0,0006	0,0012	<0,0005	0,0005	0,0007	0,0021	<0,0005	0,0057	<0,001	<0,0005	<0,0005	<0,001	<0,001	<0,001	0,0008	0,0022	0,0036	0,0946	0,0462	0,4018	0,0029
Total Iron	mg/L	0,01733	0,3		--	--	--	<0,01	0,92	<0,01	0,34	0,34	0,01	0,04	<0,01	0,01	0,1	<0,01	0,22	0,23	1,33	1,91	0,37	0,02	0,86	<0,01	<0,01	0,9	<0,06	<0,06	<0,01	<0,01	1,95	0,02	0,29	<0,01	0,1
Total Lead	mg/L	0,00003	0,001	3PL hardness < 60 mg/L CaCO3	0,2	0,1	0,1	<0,0003	<0,0005	<0,0003	<0,0003	0,0005	<0,0003	0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	0,0009	<0,0003	<0,0003	<0,0003	<0,0005	<0,0003	<0,0003	<0,0005	<0,0005	<0,0005	<0,0003	<0,01	0,0003	<0,0003	0,0028	<0,0003	<0,0003
Total Lithium	mg/L		--		--	--	--	<0,005	<0,01	<0,005	<0,005	<0,005	<0,005	<0,005	<0,005	<0,005	<0,005	<0,005	0,02	0,017	0,022	0,015	0,012	0,015	<0,01	<0,005	<0,005	<0,01	<0,01	<0,01	0,006	<0,005	0,008	0,006	<0,005	<0,005	0,007
Total Magnesium	mg/L		--		--	--	--	10,8	9,5	6,34	2,33	2,62	1,44	2,01	3,8	3,82	9,23	40,5	9,28	8,06	9,38	112	82,1	47,9	7,5	4,74	5,24	8	<0,1	<0,1	45	11,2	52,8	37	26,6	16,3	9,11
Total Manganese	mg/L	0,00155	--		--	--	--	0,0019	0,07	0,0725	0,0066	0,0071	0,0011	0,0026	0,0833	0,0843	0,1734	1,15	0,2192	0,1973	0,2266	2,834	2,091	0,1658	0,052	0,0721	0,084	0,054	<0,001	<0,001	0,1601	0,0491	2,046	1,092	0,3684	0,2035	0,09
Total Mercury	mg/L	0,00000	0,000026		--	0,0004	0,0004	<0,00001	<0,0001	<0,00001	<0,00001	<0,00001	<0,00001	<0,00001	<0,00001	<0,00001	0,00002	0,0004	<0,00001	<0,00001	0,00003	<0,00001	<0,00001	<0,00001	<0,0001	<0,00001	<0,00001	<0,0001	<0,0001	<0,0001	<0,00001	<0,00001	<0,00001	<0,00001	<0,00001	<0,00001	<0,00001
Total Molybdenum	mg/L	0,00019	0,073		--	--	--	0,0054	0,0091	0,0063	0,0013	0,0014	<0,0005	<0,0005	0,001	0,0008	0,0049	0,0102	0,0295	0,0245	0,0277	0,0329	0,0237	0,0245	0,013	0,0087	0,0095	0,014	<0,001	<0,001	0,0782	0,0022	0,2361	0,213	0,1112	0,2271	0,0057
Total Nickel	mg/L	0,00059	0,025	3PL hardness < 60 mg/L CaCO3	0,5	0,2	0,2	0,0036	<0,002	0,0009	0,0021	0,0024	<0,0005	0,001	0,0149	0,0164	0,0083	0,0489	0,0054	0,0046	0,0023	0,0288	0,0245	0,0336	0,0024	0,0009	0,0008	0,0025	<0,002	<0,002	0,0379	0,01	0,0233	0,064	0,0429	0,1197	0,0074
Total Potassium	mg/L		--		--	--	--	5,33	2,4	1,72	1,05	1,13	0,79	0,91	1,34	1,32	2,94	6,53	1,4	1,21	1,37	21,1	15,8	23,2	1,1	0,97	1,13	1,2	<0,5	<0,5	11,6	4,66	78	66,2	44,7	62,1	11,8
Total Selenium	mg/L	0,00003	0,001		--	--	--	<0,0005	<0,003	<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	0,0011	<0,0005	<0,003	<0,0005	<0,0005	<0,003	<0,003	<0,003	0,0033	<0,0005	0,0022	0,0028	0,0027	0,006	<0,0005
Total Silver	mg/L	0,00001	0,00025		--	--	--	<0,0001	<0,001	<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	<0,001	<0,0001	<0,0001	<0,001	<0,001	<0,001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	0,0009	<0,0001
Total Sodium	mg/L		--		--	--	--	8,72	26	22,3	1,78	1,98	1,1	1,74	1,36	1,38	5,5	4,89	82,8	75,7	96,3	210	259	20,3	20	13,4	14,9	21	<0,5	<0,5	10,9	<0,0001	335	375	183	247	29
Total Strontium	mg/L	0,01323	--		--	--	--	0,184	0,15	0,124	0,06	0,07	0,052	0,055	0,067	0,068	0,128	0,36	0,246	0,222	0,249	1,5	1,11	1,29	0,13	0,113	0,124	0,13	<0,002	<0,002	0,521	0,138	1,29	1,08	0,772	0,799	0,244
Total Thallium	mg/L	0,00001	0,0008		--	--	--	<0,0002	<0,002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,002	<0,0002	<0,0002	<0,002	<0,002	<0,002	<0,0002	0,138	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002
Total Tin	mg/L		--		--	--	--	<0,001	<0,002	<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	<0,002	<0,001	<0,001	<0,002	<0,002	<0,002	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Total Titanium	mg/L		--		--	--	--	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	0,02	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Total Uranium	mg/L	0,00005	0,015		--	--	--	0,005	<0,001	<0,001	<0,001	0,001	<0,001	<0,001	0,001	0,001	0,004	0,005	0,003	0,002	<0,001	0,02	0,017	0,059	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	0,01	0,005	0,018	0,016	0,008	0,008	0,003
Total Vanadium	mg/L		--		--	--	--	<0,0005	<0,002	<0,0005	0,0051	0,0057	<0,0005	0,0046	<0,0005	<0,0005	0,0059	<0,0005	<0,0005	<0,0005	0,0057	0,0056	<0,0005	0,0006	<0,002	<0,0005	<0,0005	<0,002	<0,002	<0,002	<0,0005	<0,0005	0,0048	<0,0005	0,0054	<0,0005	<0,0005
Total Zinc	mg/L	0,00150	0,03		0,5	0,4	0,2	0,03	<0,007	<0,001	0,001	0,003	0,009	0,005	0,006	0,007	<0,001	0,023	0,012	0,144	0,004	0,003	0,032	0,012	<0,007	<0,001	<0,001	<0,007	<0,007	<0,007	0,008	0,002	0,006	<0,001	0,009	0,007	0,001
Dissolved Metals																																					
Dissolved Aluminum	mg/L	0,0018	--		--	1	1	0,009	<0,03	<0,005	<0,005	0,004	0,02	0,0012	0,018	0,01	<0,0005	<0,005	<0,0005	<0,005	<0,0005	<0,0005	0,005	0,007	<0,03	<0,005	<0,005	<0,03	<0,03	<0,03	0,011	0,01	0,0141	0,007	<0,0005	0,011	0,026
Dissolved Antimony	mg/L		--		--	--	--	<0,0001	<0,003	0,0003	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	0,0003	<0,0001	<0,0001	<0,0001	0,0003	<0,0001	0,0003	<0,003	0,0001	<0,0001	<0,003	<0,003	<0,003	0,0005	0,0004	0,0002	0,0016	0,0021	0,0043	<0,0001
Dissolved Arsenic	mg/L	0,00048	--		0,5	--	--	0,0033	0,0049	0,0032	0,001	0,0009	<0,0005	0,0007	0,0016	0,0023	0,0399	0,0109	0,0062	0,007	0,0035	0,0803	0,0576		0,014	0,0063	0,0063	0,014	<0,0003	<0,0003	<0,0005	<0,0005	0,0169	0,0144	0,0103	0,0479	0,0057
Dissolved Barium	mg/L	0,00366	--		--	--	--	0,0279	<0,02	0,0115	0,0104	0,0104	0,0046	0,0104	0,0091	0,0096	0,0065	0,0187	0,0122	0,0137	0,0135	0,0319	0,0266	0,0401	<0,02	0,0049	0,0057	<0,02	<0,02	<0,02	0,0115	0,0212	0,0221	0,0251	0,0262	0,0351	0,0041
Dissolved Beryllium	mg/L		--		--	--	--	<0,0005	<0,002	<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	<0,002	<0,0005	<0,0005	<0,002	<0,002	<0,002	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005
Dissolved Boron	mg/L		--		--	--	--	<0,01	0,25	0,15	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	0,13	0,08	0,08	0,1	0,04	<0,01	0,06	0,1	0,02	0,01	0,12	<0,05	<0,05	<0,01	<0,01	0,15	0,07	0,01	0,05	<0,01
Dissolved Cadmium	mg/L	0,00000	--		--	--	--	<0,00002	<0,001	<0,00002	<0,00002	<0,00002	<0,00002	<0,00002	0,00006	<0,00002	<0,00002	<0,00002	0,00003	<0,00002	0,00003	0,00005	0,00005	<0,00002	<0,001	<0,00002	<0,00002	<0,001	<0,001	<0,001	0,00003	0,00008	0,00039	0,00009	0,0002	0,00004	<0,00002
Dissolved Calcium	mg/L		--		--	--	--	30	17	11,4	10,4	10,3	9,07	9,39	14,7	14	16,8	28,8	15,5	15,4	16,2	281	210	154	15	13,3	13,7	16	0,53	0,58	96,2	28,8	350	249	163	196	29,7
Dissolved Chromium	mg/L	0,00005	--		--	--	--	<0,0006	<0,005	<0,0006	<0,0006	<0,0006	<0,0006	<0,0006	<0,0006	<0,0006	<0,0006	<0,0006	<0,0006	<0,0006	<0,0006	<0,0006	<0,0006	<0,0006	<0,005	<0,0006	<0,0006	-	<0,005	<0,005	<0,0006	<0,0006	<0,0006	<0,0006	<0,0006	<0,0006	<0,0006
Dissolved Copper	mg/L	0,00052	--		0,3	--	--	0,0014	<0,003	<0,0005	<0,0005	<0,0005	0,0006	0,0006	0,0008	0,0008	<0,0005	0,0012	<0,0005	<0,0005	<0,0005	0,0017	<0,0005	0,0045	<0,003	<0,0005	<0,0005	<0,003	<0,003	<0,003	0,0008	0,0023	0,003	0,0794	0,0281	0,3937	0,0023
Dissolved Iron	mg/L	0,00500	--		--	--	--	<0,01	<0,1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	0,08	<0,01	<0,01	<0,1	<0,01	<0,01	<0,1	<0,1	<0,1	<0,01	<0,01	0,13	<0,01	0,07	<0,01	0,05
Dissolved Lead	mg/L	0,00003	--		0,2	--	--	<0,0003	<0,001	<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	<0,001	<0,0003	<0,0003	<0,001	<0,001	<0,001	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003	<0,0003
Dissolved Lithium	mg/L		--		--	--	--	<0,005	<0,1	<0,005	<0,005	<0,005	<0,005	<0,005	<0,005	<0,005	<0,005	<0,005	0,018	0,018	0,021	0,015	0,012	0,014	<0,1	<0,005	<0,005	<0,1	<0,1	<0,1	0,005	<0,005	0,01	0,006	<0,005	<0,005	0,006
Dissolved Magnesium	mg/L		--		--	--	--	11,2	9,4	6,34	2,17	2,13	1,44	1,92	3,92	3,8	7,32	11,9	8,04	8,42	8,94	114	81,9	45,6	7,1	4,74	5,24	8	<0,1	<0,1	37,4	11,9	61,8	37,2	26,6	16,7	8,73
Dissolved Manganese	mg/L	0,00117	--		--	--	--	<0,0005	0,065	0,0725	<0,0005	<0,0005	<0,0005	0,0021	0,0847	0,0791	0,137	1,15	0,1829	0,192	0,21	2,943	2,135	0,1519	0,046	0,0721	0,084	0,048	<0,003	<0,003	0,1365	0,0431	2,392	1,141	0,3607	0,2079	0,0503
Dissolved Mercury	mg/L	0,00000	--		--	--	--	<0,00001	<0,0001	<0,00001	<0,00001	<0,00001	0,00018	<0,00001	0,00005	<0,00001	0,00002	0,00041	<0,00001	<0,00001	0,00003	<0,00001	<0,00001	<0,00001	<0,0001	<0,00001	<0,00001	<0,0001	<0,0001	<0,0001	<0,00001	0,00002	<0,00001	0,00009	<0,00001	0,0001	<0,00001
Dissolved Molybdenum	mg/L	0,00018	--		--	--	--	0,0056	<0,01	0,0063	0,0012	0,0012	<0,0005	0,0006	0,001	0,0008	0,004	0,0102	0,0231	0,0251	0,0265	0,0336	0,0239	0,0213	0,012	0,0087	0,0095	0,013	<0,01	<0,01	0,0638	0,0027	0,2871	0,2244	0,1131	0,2305	0,0048
Dissolved Nickel	mg/L	0,00049	--		0,5	--	--	0,0041	<0,01	0,0009	0,0005	0,0006	<0,0005	0,0005	0,0159	0,0148	0,0064	0,0489	0,0047	0,0046	0,0019	0,0292	0,0242	0,0315	<0,01	0,0009	0,0008	<0,01	<0,002	<0,002	0,0303	0,0101	0,0262	0,0656	0,0418	0,1225	0,0079
Dissolved Potassium	mg/L		--		--	--	--	5,53	2,3	1,72	0,93	0,92	0,81	0,86	1,41	1,32	2,39	5,02	1,21	1,21	1,26	21,6	16	22,3	1,1	0,97	1,13	1,2	<0,5	<0,5	9,68	5,02	91,5	68,6	45,4	63,9	11,8
Dissolved Selenium	mg/L	0,00003	--		--	--	--	0,0008	<0,001	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	0,0019	<0,0005	<0,0005	<0,0005	<0,0005	<0,0005	0,0007	0,001	<0,0005	<0,001	<0,0005	<0,0005	<0,001	<0,001	<0,001	0,0028	<0,0005	0,0055	0,0014	0,0026	0,0045	<0,0005
Dissolved Silver	mg/L	0,000005	--		--	--	--	<0,0001	<0,0003	<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	<0,0003	<0,0001	<0,0001	<0,0003	<0,0003	<0,0003	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	0,0007	<0,0001
Dissolved Sodium	mg/L		--		--	--	--	9,01	26	22,3	1,66	1,66	1,11	1,86	1,44	1,34	4,4	8,78	73	75,1	96,3	207	261	19,5	20	13,4	14,9	21	<0,2	<0,2	9,16	8,78	354	391	190	251	28,9
Dissolved Strontium	mg/L	0,01345	--		--	--	--	0,198	0,15	0,124	0,058	0,058	0,051	0,052	0,07	0,064	0,103	0,36	0,216	0,225	0,237	1,54	1,13	1,19	0,13	0,113	0,124	0,13	<0,05	<0,05	0,427	0,151	1,52	1,11	0,779	0,831	0,223
Dissolved Thallium	mg/L	0,00001	--		--	--	--	<0,0002	<0,01	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,01	<0,0002	<0,0002	<0,01	<0,01	<0,01	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002	<0,0002
Dissolved Tin	mg/L		--		--	--	--	<0,001	<0,05	<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	<0,05	<0,001	<0,001	<0,05	<0,05	<0,05	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Dissolved Titanium	mg/L		--		--	--	--	<0,01	<0,05	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,05	<0,01	<0,01	0,01	<0,05	<0,05	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Dissolved Uranium	mg/L	0,00005	--					0,005		<0,001	<0,001	<0,001	<0,001	<0,001	0,001	0,001	0,003	0,005	0,002	0,002	<0,001	0,02	0,017	0,056	-	<0,001	<0,001	-	-	-	0,009	0,005	0,021	0,016	0,008	0,008	0,002
Dissolved Vanadium	mg/L		--		--	--	--	<0,0005	<0,01	<0,0005	0,001	0,0007	<0,0005	0,0006	<0,0005	<0,0005	0,0012	<0,0005	<0,0005	<0,0005	0,0005	0,0015	<0,0005	0,0005	<0,01	<0,0005	<0,0005	0,02	<0,01	<0,01	<0,0005	<0,0005	0,0012	<0,0005	0,0008	<0,0005	<0,0005
Dissolved Zinc	mg/L	0,00063	--		0,5	--	--	<0,001	<0,005	<0,001	0,001	<0,001	0,01	0,002	0,004	0,008	0,001	0,023	0,002	0,004	0,002	0,003	0,012	0,008	<0,005	<0,001	<0,001	<0,005	<0,005	<0,005	0,004	0,002	0,002	0,002	0,006	0,004	<0,001
Anions																																					
Bromide	mg/L		--		--	--	--	0,06	-	0,04	0,08	0,1	0,1	0,11	0,04	0,03	0,13	0,09	0,64	0,6	0,87	2,5	1,75	0,89	-	0,02	<0,01	-	-	-	0,12	0,09	2,91	2,01	0,86	1,28	0,21
Chloride	mg/L	0,793	120		--	1000	500	3,5	3,2	3,7	1,2	1	0,8	1,5	1,4	1,2	3,9	3,9	53,5	58	59,4	301	269	<0,5	1,8	1,8	2,1	1,7	<0,5	<0,5	5,8	3,9	330	300	65,4	191	44,1
Fluoride	mg/L	0,0793	0,12		--	--	--	0,36	1,18	1,12	0,09	0,09	0,09	0,1	0,1	0,1	0,36	0,14	0,48	0,47	0,57	0,31	0,29	0,02	1,07	0,94	0,93	1,06	0,02	<0,02	0,21	0,14	0,5	0,42	0,34	0,37	0,28
Nutrients																																					
Total Nitrogen	mg N/L		--		--	--	--	0,25	0,24	0,21	<0,05	0,07	0,22	0,2	0,13	0,05	0,27	0,42	0,29	0,35	0,2	30,1	35,2	1,07	0,13	0,14	0,1	0,3	0,1	<0,05	0,3	0,49	53,3	57,9	15,9	41,2	5,82
Ammonia-Nitrogen (NH3-NH4)	mg N/L	0,015	1,83	@15 C & pH 7.5	--	16	20	<0,01	0,395	0,1	<0,01	<0,01	0,1	<0,01	0,055	0,05	0,09	0,125	0,04	0,04	0,01	5,15	6,62	0,8	0,04	0,05	0,07	0,045	<0,01	<0,01	0,025	0,02	22,4	26,85	12,5	27,95	0,46
Ammonia (NH3) (non-ionized)	mg N/L	n/a	19		--	--	--	<0,01	0,01	<0,01	-	-	<0,01	-	<0,01	<0,01	-	<0,01	<0,01	<0,01	-	-	0,1	0,02	<0,01	<0,01	<0,01	<0,01	-	-	<0,01	<0,01	-	0,45		1,02	0,54
Nitrate (NO3)	mg N/L	0,0331	2,93548387	13 mg/L as NO3	--	20	50	1,58	<0,01	0,01	0,15	0,15	0,11	0,16	0,71	1,71	0,33	3,27	0,06	0,06	<0,01	<0,01	<0,01	10,6	0,013	<0,01	<0,01	0,014	<0.01	<0.01	4,99	1,11	0,35	2,14	0,56	4,88	0,34
Nitrite (NO2)	mg N/L		--		--	--	--	<0,01	<0,01		<0,01	<0,01	<0.01	<0,01	<0.01	<0.02	0,01	0,01	<0,01	0,02	0,01	<0,01	0,01	0,19	0,04	0,01	0,01	0,05	<0.01	<0.01	<0,01	0,01	0,07		0,05	0,16	0,06
Orthophosphate	mg P/L		--		--	--	--	0,04	0,02	0,03	0,06	0,06	<0,01	0,02	<0,01	<0,01	0,07	<0,01	0,21	0,25	0,02	0,02	<0,01	<0,01	0,02	0,05	0,04	0,02	<0,01	<0,01	<0,01	<0,01	0,03	<0,01	0,05	0,01	1,38
Total Phosphorus	mg P/L	0,0026	0,0040	guidance only: 4 to 10 ug/L for oligotrophic lakes	--	1	1,5	0,06	0,05	0,02	0,01	0,01	<0,01	0,01	<0,01	0,01	0,02	0,05	0,08	0,08	0,02	0,02	0,03	0,06	0,02	0,03	0,02	0,03	<0,01	<0,01	0,02	<0,01	0,07	0,05	0,04	0,05	2,27
Cyanide																																					
Total Cyanide	mg/L	0,0005	0,005		1	0,5	0,5	0,002	<0,001	0,003	<0,001	<0,001	0,004	<0,001	0,002	0,003	<0,001	0,002	<0,001	<0,001	<0,001	0,035	0,037	0,008	<0,001	0,002	0,002	<0,001	<0,001	<0,001	0,001	0,002	0,037	0,075	0,02	0,048	0,002
Free Cyanide	mg/L		--		--	--	--	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		<0,01	-	-	-	-	-	-	-
Weak Acid Dissociable Cyanide	mg/L		--		--	--	--	0,002	<0,001	0,003	<0,001	<0,001	0,003	<0,001	0,002	0,002	<0,001	0,003	<0,001	<0,001	<0,001	0,011	0,004	0,002	<0,001	0,003	0,002	<0,001	<0,001	<0,001	<0,001	0,003	0,004	0,037	0,001	0,018	0,001

Notes :

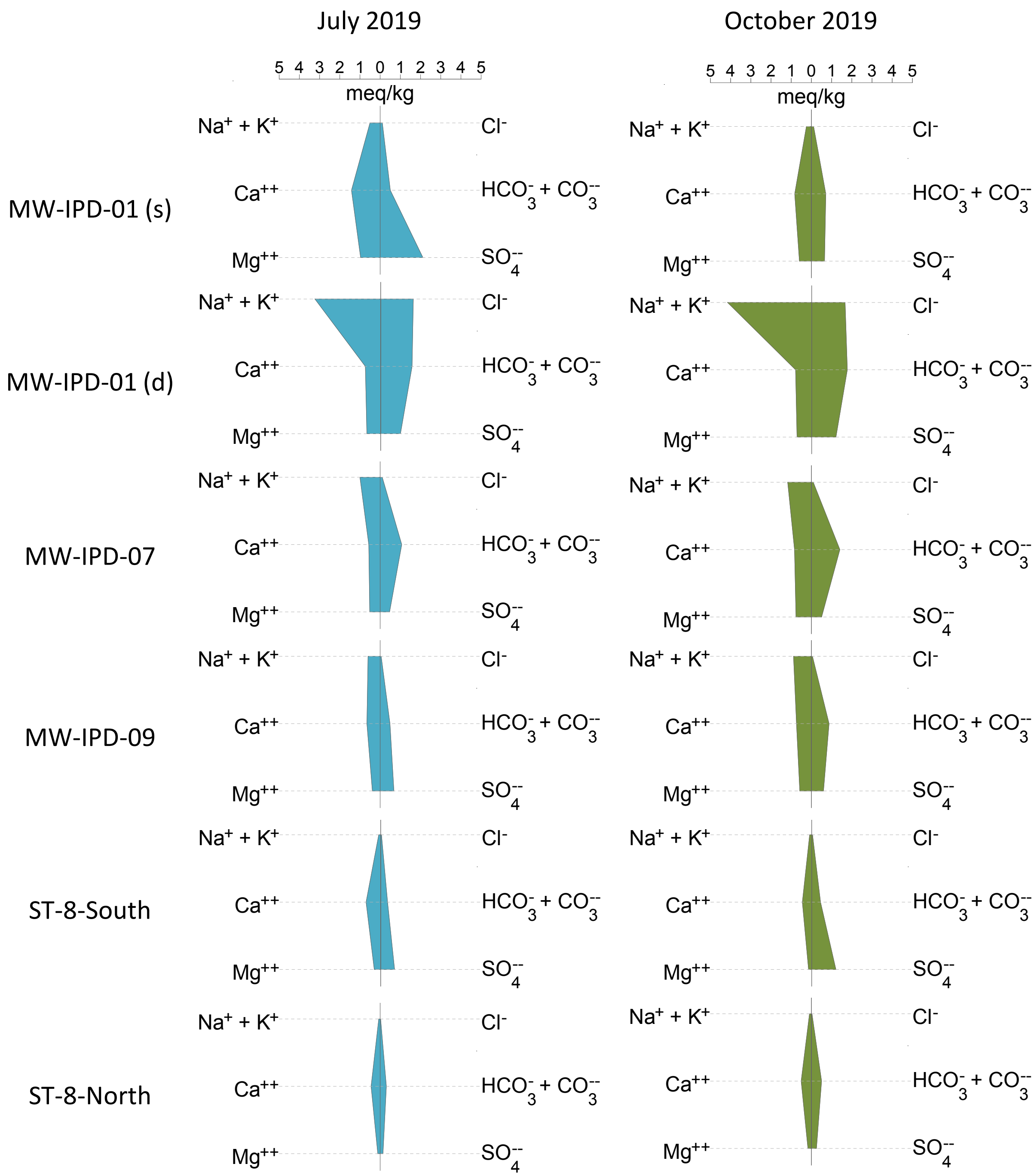
- : No data available

-- : No criteria available

Shaded values are exceeding Water License, Max. Avg Conc. Discharge to 3PL

APPENDIX E: STIFF DIAGRAMS

2019 results for sampling stations who were showing natural water signature in 2018 (scale 0-5 meq/L)



SNC·LAVALIN	2019 Groundwater sampling campaign Stiff Diagrams	Project: 665965 FIGURE E-1

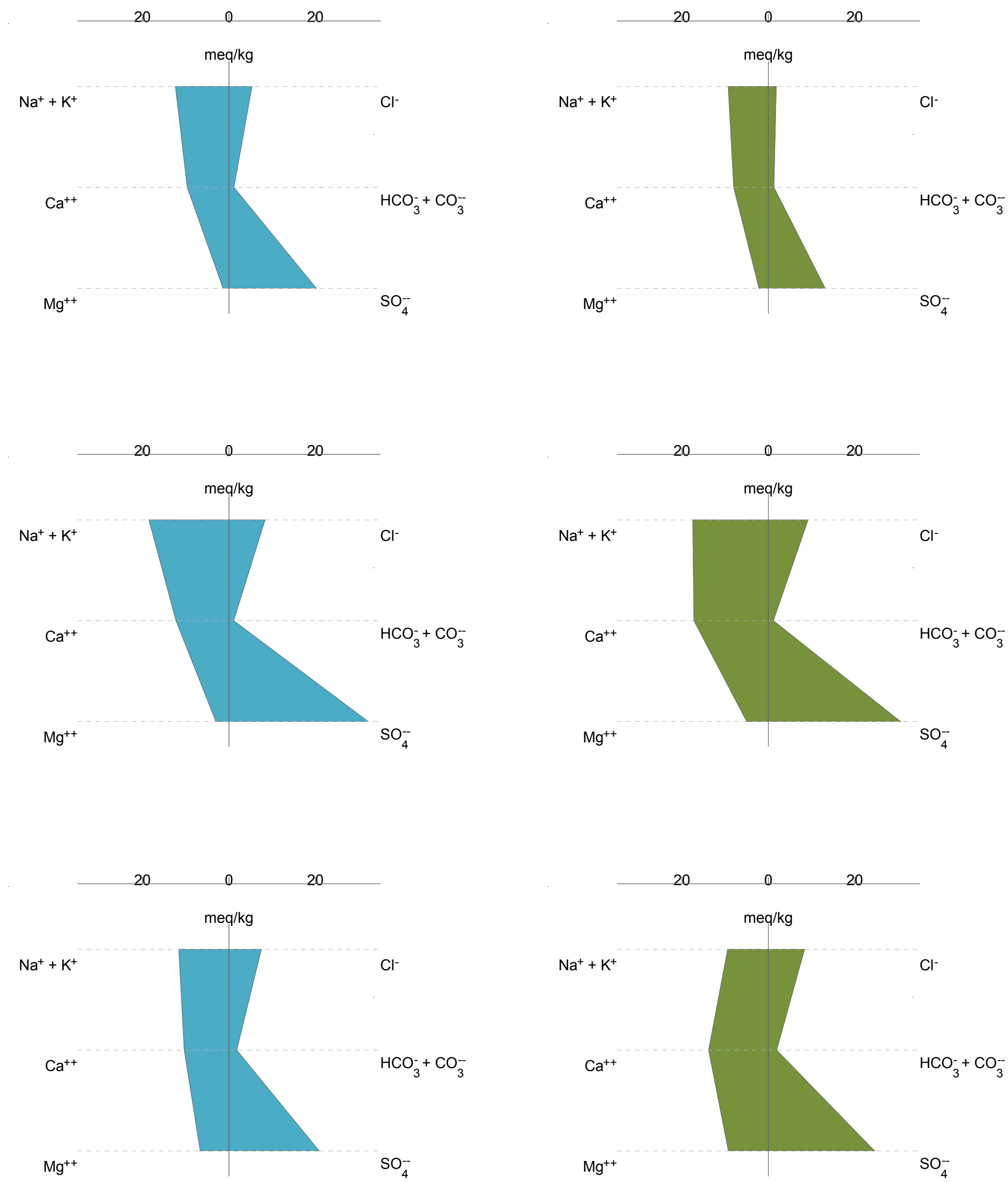
2019 results for sampling stations who were showing reclaim water signature in 2018 (scale 0-35 meq/L)

July 2019 | October 2019

ST-21-South

ST-S-5

MW-16-01



SNC·LAVALIN	2019 Groundwater sampling campaign Stiff Diagrams	Project: 665965 FIGURE E-2