

WESTBAY FLUID PRESSURE MONITORING AND GROUNDWATER SAMPLING IN IGNACE BOREHOLES

2022 Annual Report

APM-REP-01332-0457

June 2024

Geofirma Engineering Ltd.

nwmo

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MANAGEMENT
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Nuclear Waste Management Organization
22 St. Clair Avenue East, 4th Floor
Toronto, Ontario
M4T 2S3
Canada

Tel: 416-934-9814
Web: www.nwmo.ca

Westbay Fluid Pressure Monitoring and Groundwater Sampling in Ignace Boreholes

2022 Annual Report

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Prepared for:

Nuclear Waste Management Organization

22 St. Clair Avenue East, 4th Floor
Toronto, ON, M4T 2S3

Prepared by:




1 Raymond St. Suite 200, Ottawa, Ontario K1R 1A2
📞 613.232.2525 🏢 613.232.7149 🌐 geofirma.com

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Prepared by:	Amy Cartier, B.Sc., G.I.T.	
Reviewed by:	Sean Sterling, M.Sc, P.Eng., P.Geo., Morgan de Kroon, B.Sc., E.I.T., and Ian Clark, Ph.D., P.Geo. (University of Ottawa)	
Approved by:	 Sean Sterling, M.Sc, P.Eng., P.Geo. – Project Manager - Principal	

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1 INTRODUCTION

Geofirma Engineering Ltd. has been retained by the Nuclear Waste Management Organization (NWMO) to complete long-term monitoring of Westbay multilevel systems that are installed in deep bedrock boreholes in the Revell Site located in the Wabigoon Lake Ojibway Nation – Ignace Area in Ontario.

The purpose of this project is to measure groundwater pressures and temperatures and to collect groundwater samples for geochemical analysis. Measuring fluid pressures in each of the intervals of a single Westbay multilevel system is referred to as pressure profiling. Data obtained from this project will be used to evaluate the groundwater system at the Revell site.

The scope of work includes pressure profiling, groundwater sampling, and laboratory analysis of water samples for four Westbay multilevel systems installed in the boreholes at the Revell Site: IG_BH01, IG_BH03, IG_BH05 and IG_BH06. Pressure measurements are taken at each sampling port quarterly and selected intervals are targeted for groundwater sampling. Specific intervals targeted for groundwater sampling are selected by NWMO based on the interval hydraulic properties and the likelihood of collecting a groundwater sample that is representative for the target bedrock interval.

The fluid pressure monitoring and groundwater sampling program was initially planned on a quarterly basis between November 2022 and the end of 2023. Ongoing monitoring beyond 2023 will be decided by NWMO. Table 1 summarizes the fieldwork completed to date as part of the program.

An annual technical report is prepared by Geofirma to describe all work activities completed each calendar year including all pressure profiling, groundwater sampling, and laboratory analyses. This 2022 Annual Report is the third annual report prepared by Geofirma. The report describes the field activities, procedures, and results from four quarterly monitoring events completed in 2022.

Work described in this technical report was carried out in accordance with the project specific Test Plan, Project Quality Plan, and Health, Safety, and Environment Plan.

Table 1 Summary of fieldwork completed since the start of the fluid pressure monitoring (PP) and groundwater sampling program.

Year /Quarter		IG_BH01		IG_BH03		IG_BH05		IG_BH06	
		PP	Sampling	PP	Sampling	PP	Sampling	PP	Sampling
2020	Q4	✓	✓ INT_009 (I)	✓	-	-	-	-	-
	Q1	✓	✓ INT_009 (F)	✓	-	-	-	-	-
2021	Q2	✓	-	✓	-	-	-	-	-
	Q3	✓	✓ INT_007 (I)	✓	✓ INT_002 (I)	-	-	-	-
	Q4	✓	✓ INT_007 (F)	✓	✓ INT_002 (I)	-	-	-	-
	Q1	✓	✓ INT_004 (I)	✓	✓ INT_002 (I)	✓	✓ INT_007 (I)	-	-
2022	Q2	✓	✓ INT_004 (F)	✓	✓ INT_002 (I)	✓	✓ INT_007 (I)	-	-
	Q3	✓	✓ INT_002 (I)	✓	✓ INT_002 (F)	✓	✓ INT_007 (F)	✓	-
	Q4	✓	✓ INT_002 (I) INT_007 (R)	✓	✓ INT_021 (A)	✓	✓ INT_005 (I)	✓	✓ INT_008 (A)

(I) = interim sample collected
(F) = final sample collected
(R) = re-sample collected
(A) = archive sample collected

2 BACKGROUND

2.1 NWMO APM Program

The NWMO is implementing their Adaptive Phased Management (“APM”) plan for the long-term management of Canada’s used nuclear fuel. APM includes the emplacement of the used nuclear fuel in an underground deep geological repository (DGR). The initial borehole drilling and testing project at the Revell Site in northwestern Ontario is part of the Phase 2 geoscientific preliminary field investigations in the NWMO’s APM site selection process.

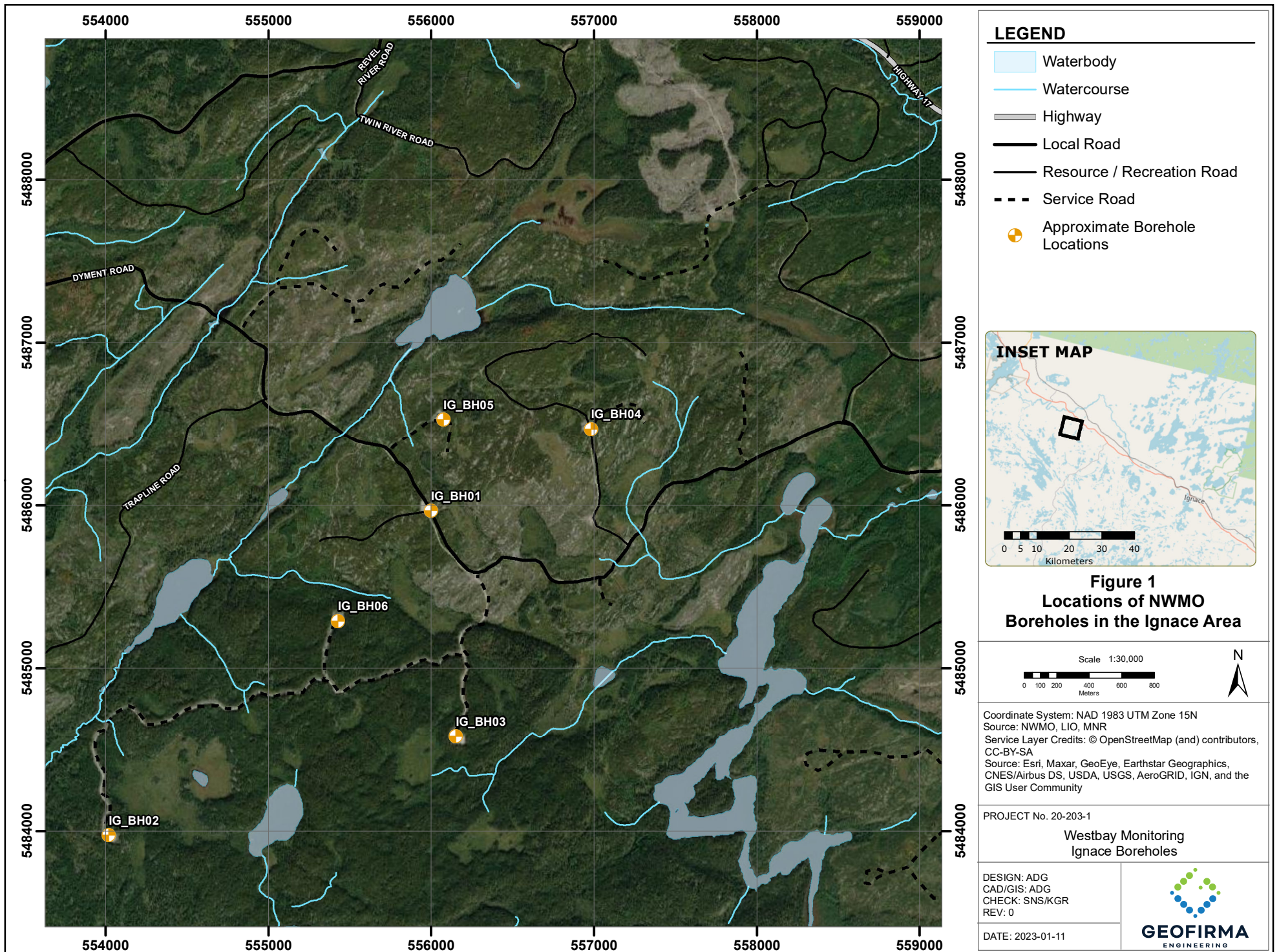
Phase 2 Preliminary Assessments involve, among other, the drilling and testing of six deep boreholes in a potential repository area (PRA) located within the northwestern portion of the Revell Batholith, approximately 50 km northwest of Ignace, Ontario. The Revell Site is located approximately 250 km northwest of Thunder Bay along the Trans-Canada Highway (HWY 17). Figure 1 shows the locations of all six boreholes drilled and tested as part of the APM Phase 2 geoscientific preliminary assessments. All fieldwork described in this report was completed by Geofirma at boreholes IG_BH01, IG_BH03, IG_BH05 and IG_BH06.

All boreholes were previously drilled using HQ3 wireline coring equipment that produces a 96 mm nominal diameter borehole to depths of approximately 1000m along borehole length. The first borehole, IG_BH01, was drilled vertically; the remaining five boreholes were drilled at an inclined angle of 70° from horizontal. The inclination of some boreholes varied during drilling, resulting in borehole true vertical depths ranging from approximately 883 to 1,000 metres below ground surface (m BGS).

Westbay multilevel monitoring systems, completed with MP38 casing (Multiport casing with inside diameter of 38 mm), have been installed in four of the six boreholes: IG_BH01, IG_BH03, IG_BH05 and IG_BH06. Boreholes IG_BH02 and IG_BH04 have been temporarily sealed using bridge plug-style packers to minimize vertical borehole fluid cross connections.

2.2 Geological Setting

The approximately 2.7-billion-year-old Revell batholith is located in the western part of the Wabigoon Sub province of the Archean Superior Province. The batholith is roughly elliptical in shape trending northwest, is approximately 40 km in length, 15 km in width, and covers an area of approximately 455 km². Based on recent geophysical modelling, the batholith has a relatively flat base that extends to depths of nearly 4 km in some regions (Sanders Geophysics Limited [SGL], 2020). The batholith is surrounded by supracrustal rocks of the Raleigh Lake (to the north and east) and Bending Lake (to the southwest) greenstone belts (Figure 2).



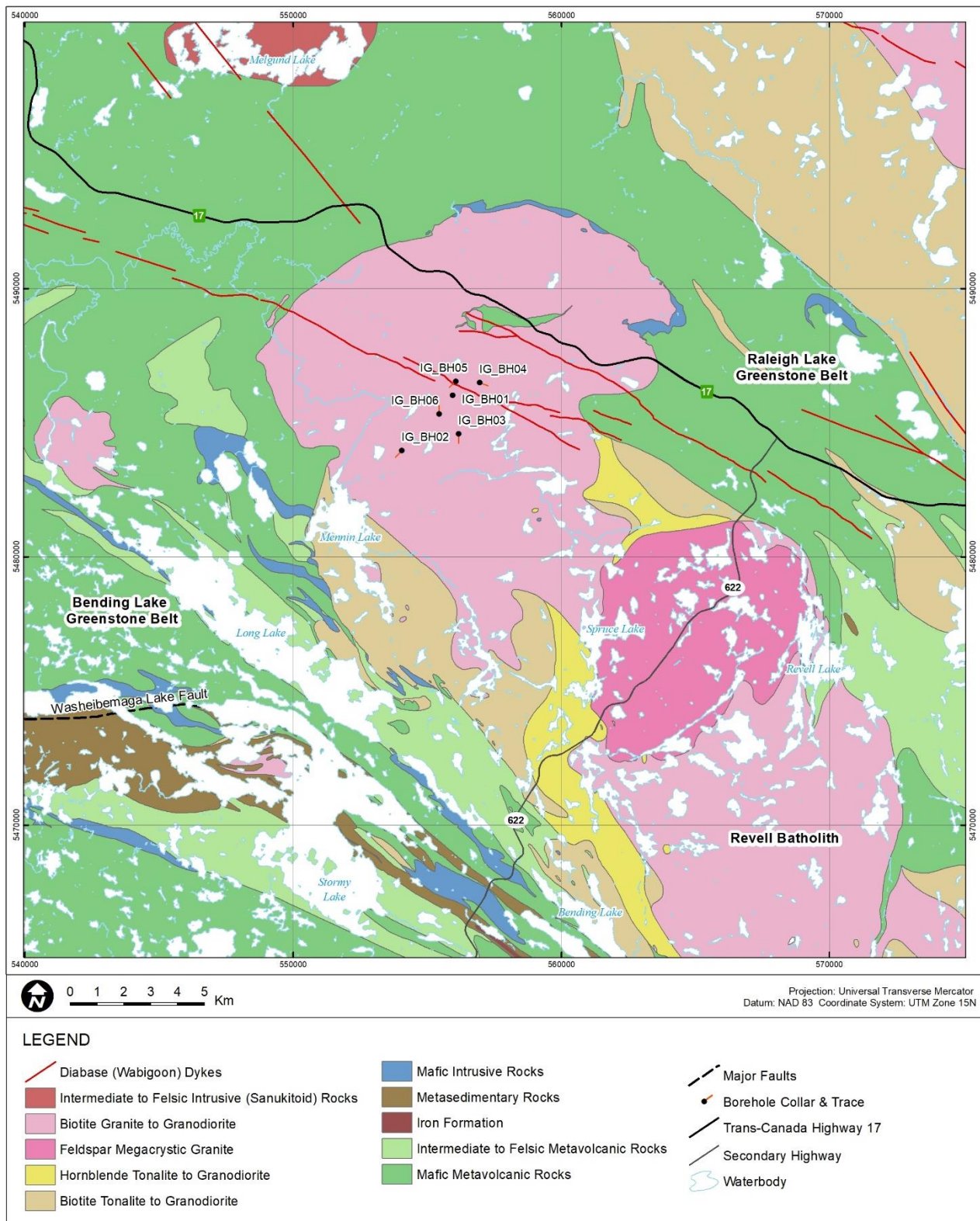


Figure 2 Bedrock Geology of the Revell Site and surrounding area

3 DESCRIPTION OF ACTIVITIES

The following section provides a summary of the field and laboratory activities that were completed for each quarterly monitoring event in 2022. All field measurements and equipment calibrations that were completed as part of water sampling activities were recorded in a excel-format Data Quality Confirmation (DQC) workbook and delivered to the NWMO.

3.1 Quarterly Monitoring Events

Details of the work activities completed in 2022 for each quarterly monitoring event are summarized in Table 2.

Table 2 Summary of 2022 Field Activities for Westbay Monitoring at Revell Site

Monitoring Event	Field Work Dates	Work Activities Completed
Q1	Mar 18 – Mar 30 2022	<ul style="list-style-type: none"> Pressure/temperature profiling at IG_BH01 Pressure/temperature profiling at IG_BH03 Pressure/temperature profiling at IG_BH05 Purging and sampling from IG_BH01_T_INT_004 Purging and sampling from IG_BH03_T_INT_002 Purging and sampling from IG_BH05_T_INT_007
Q2	May 27 – Jun 06 2022	<ul style="list-style-type: none"> Pressure/temperature profiling at IG_BH01 Pressure/temperature profiling at IG_BH03 Pressure/temperature profiling at IG_BH05 Pressure/temperature profiling at IG_BH06 Purging and sampling from IG_BH01_T_INT_004 Purging and sampling from IG_BH03_T_INT_002 Purging and sampling from IG_BH05_T_INT_007
Q3	Sep 16 – Sep 27 2022	<ul style="list-style-type: none"> Pressure/temperature profiling at IG_BH01 Pressure/temperature profiling at IG_BH03 Pressure/temperature profiling at IG_BH05 Pressure/temperature profiling at IG_BH06 Purging and sampling from IG_BH01_T_INT_002 Purging and sampling from IG_BH03_T_INT_002 Purging and sampling from IG_BH05_T_INT_007
Q4	Nov 30 – Dec 14 2022	<ul style="list-style-type: none"> Pressure/temperature profiling at IG_BH01 Pressure/temperature profiling at IG_BH03 Pressure/temperature profiling at IG_BH05 Pressure/temperature profiling at IG_BH06 Purging and sampling from IG_BH01_T_INT_002 Purging and re-sampling from IG_BH01_T_INT_007 Purging and sampling from IG_BH05_T_INT_005 Collection of field parameters from IG_BH03_T_INT_021 Collection of field parameters from IG_BH06_T_INT_008

3.2 Fluid Pressure and Temperature Profiling

Fluid pressure and temperature profiling was completed in the Westbay multilevel systems according to the methodology outlined in the Test Plan. All fluid pressure and temperature measurements from the systems were collected using NWMO-owned Westbay equipment (MOSDAX, MAGI, etc.).

Prior to the start of pressure profiling, Geofirma field staff completed measurements and quality checks to confirm the quality of the data collected using the MOSDAX probe during pressure profiling activities. A barometric logger (Solinst Barologger) was installed at ground surface within 100 meters of the wellhead to record barometric (atmospheric) pressure at a frequency of 60 seconds throughout the profiling event. Before lowering the MOSDAX probe into the well, surface inspections and function checks were completed. Manual water level measurements from within the MP38 casing were recorded, these measurements were used to assess the calibration of the MOSDAX probe when the probe was submerged to a known depth.

Pressure and temperature profiling was completed from the deepest to the shallowest sampling ports at each borehole (bottom to top), unless otherwise stated. At each sampling port, the following measurements were collected: start profile time, landed pressure inside of the MP38 casing, interval pressure and temperature, pressure inside the MP38 casing, and end profile time.

All field measurements and records of Westbay equipment operation during pressure and temperature profiling were recorded on purpose-built field data sheets within the DQC workbook.

Infield quality checks of pressure/temperature data were performed at each sampling port by ensuring that values were acceptable when compared to data from previous monitoring round(s). Anomalous values were noted in the DQC workbook and confirmed by collecting a second pressure measurement at the same interval.

3.3 Groundwater Purging

3.3.1 Westbay Interval Selection for Groundwater Purging and Sampling

Westbay intervals targeted for purging and groundwater sampling during each quarterly monitoring event were identified by NWMO prior to Geofirma mobilization. Geofirma performed a 24-hr purge (including recovery) prior to sampling each of the targeted Westbay intervals, however, due to the low hydraulic conductivities of the bedrock, NWMO personnel also completed frequent purging activities between Geofirma's quarterly monitoring events. Concentrations of fluorescein tracer are the primary criteria used to assess drill water concentrations in groundwater samples. Fluorescein concentration in the drill water during borehole drilling was maintained at a targeted range of approximately 100 µg/L (100 ppb). A groundwater sample with a drill water concentration of less than 5% (i.e., fluorescein < 5 ppb) was considered representative of formation chemistry and designated as a final sample.

Table 3 below summarizes the top depth, bottom depth, and sampling port depth of the Westbay intervals for which Geofirma completed purging and groundwater sampling for during 2022, listed in meters below ground surface (m BGS).

Table 3 Details on Westbay MP38 Intervals Purged and Sampled During 2022

Westbay Interval ID	Top of Interval (m BGS)	Bottom of Interval (m BGS)	Sampling Port Depth (m BGS)
Q1 (March) 2022			
IG_BH01_T_INT_004	765.77	799.95	769.06
IG_BH03_T_INT_002	865.35	884.86	868.28
IG_BH05_T_INT_007	731.50	742.60	734.54
Q2 (June) 2022			
IG_BH01_T_INT_004	765.77	799.95	769.06
IG_BH03_T_INT_002	865.35	884.86	868.28
IG_BH05_T_INT_007	731.50	742.60	734.54
Q3 (September) 2022			
IG_BH01_T_INT_002	885.19	972.71	888.49
IG_BH03_T_INT_002	865.35	884.86	868.28
IG_BH05_T_INT_007	731.50	742.60	734.54
Q4 (December) 2022			
IG_BH01_T_INT_002	885.19	972.71	888.49
IG_BH01_T_INT_007*	624.94	645.42	635.83
IG_BH03_T_INT_021**	65.09	150.15	68.16
IG_BH05_T_INT_005	795.80	802.70	798.79
IG_BH06_T_INT_008**	665.70	682.70	668.15

*Interval IG_BH01_T_INT_007 was previously purged and sampled in 2021. Geofirma completed re-sampling for missing noble gas analyses during Q4 2022. **No laboratory analyses were required for samples IG_BH03_GW019 and IG_BH06_GW001, they were collected as archive samples to collect in-field parameters only

Geofirma also completed purging and groundwater resampling of IG_BH01_T_INT_007 during Q4 2022, at the request of NWMO to re-collect samples for noble gas analyses. This interval had previously been purged and sampled in 2021, however the lab was unable to report any helium (He) results for the samples submitted due to the He abundance in the samples exceeding the inlet capacity of the mass spectrometer.

3.3.2 Westbay MP38 Interval Purging

Operation of the Westbay equipment for purging activities was completed by Geofirma staff according to procedures outlined in the Test Plan. A minimum 24-hour purge, including recovery time, was performed for each interval selected for groundwater sampling. Select chemical parameters (pH, temperature, electrical conductivity, dissolved oxygen, oxidation-reduction potential, turbidity and fluorescein) were measured in the field using a Horiba U52 multiparameter probe and Turner Designs AquaFluor fluorometer and recorded in the DQC workbook.

Purging was completed using a double valve pump (Solinst model 408) provided by Geofirma. The pump was set within the Westbay MP38 casing at a depth of approximately 85 meters below top of

casing. As described in the Test Plan, two methods were used for purging, dependant on the status of the selected interval. A brief description of the two methods is provided below:

- 1) Open Pumping Port Method: The pumping port of the interval remains open, and the double valve pump is lowered to into the MP38 casing to complete the purging. This purging method was used for Westbay intervals that were selected for interim sampling, when purging by NWMO is expected to continue after Geofirma completes the current sample collection activity.
- 2) Flow-through Sampling Port Method: The Westbay MOSDAX probe was lowered and attached to the selected interval's sampling port and the valve is opened. The double valve pump was then lowered into the MP38 casing to complete the purging. This purging method was used for Westbay intervals that were selected for "final" sampling or on intervals with low to moderate formation hydraulic conductivity (K). The pumping port remained closed during purging (or was closed prior to the final 24-hr purge immediately prior to collecting a "final" sample).

Details for each purging event are described in the subsections below and are summarized in Table 4.

During Q4 2022, 24-hour purging was also completed on interval IG_BH01_T_INT_007, which had previously been purged and sampled in 2021. As the pumping port for another interval (INT_002) was open for ongoing purging in borehole IG_BH01, purging for interval 7 was completed using the Westbay MOSDAX sampler probe and accessories, following the groundwater sampling method outlined in the Test Plan. Following purging, Geofirma measured field parameters to confirm the sample met the criteria for final sampling.

All water generated during purging was collected in 20 L plastic buckets and removed from site for disposal by NWMO personnel at the Ignace landfill following applicable regulations.

Table 4 Details of Purging Activities for Selected Intervals in 2022

Westbay Interval ID	Volume Purged Prior to Event (L)	Date Purged by Geofirma	Volume Purged by Geofirma (L)	Total Purged Volume (L)	Purging method used	Notes
Q1 (March) 2022						
IG_BH01_T_INT_004	1529	24-Mar-21	62	1591	Open Pumping Port	
IG_BH03_T_INT_002	930	20-Mar-22	20	950	Open Pumping Port	
IG_BH05_T_INT_007	256	21-Mar-22	55	311	Open Pumping Port	
Q2 (June) 2022						
IG_BH01_T_INT_004	2522	01-Jun-22	35	2557	Flow-through Sampling Port	Pumping port closed by NWMO on May 20, 2022
IG_BH03_T_INT_002	1142	31-May-22	20	1162	Open Pumping Port	
IG_BH05_T_INT_007	942	28-May-22	35	977	Open Pumping Port	
Q3 (September) 2022						
IG_BH01_T_INT_002	685	23-Sep-22	38	723	Open Pumping Port	
IG_BH03_T_INT_002	1191	17-Sep-22	18	1209	Flow-through Sampling Port	Pumping port closed by NWMO on June 10, 2022
IG_BH05_T_INT_007	1786	22-Sep-22	35	1821	Flow-through Sampling Port	Pumping port closed by NWMO on August 04, 2022
Q4 (December) 2022						
IG_BH01_T_INT_007 *	--	02-Dec-22	2	--	Groundwater Sampling Method	Pumping port closed in 2021
IG_BH01_T_INT_002	2814	08-Dec-22	51	2865	Open Pumping Port	
IG_BH05_T_INT_005	378	12-Dec-22	44	422	Open Pumping Port	

* Interval IG_BH01_T_INT_007 was previously purged and sampled in 2021. Geofirma completed re-sampling for missing noble gas analyses during Q4 2022.

3.4 Test Plan Groundwater Sampling

Groundwater sampling was performed by Geofirma staff using a NWMO-owned Westbay MOSDAX sampler probe and accessories. All sampling was completed in accordance with the Test Plan. A summary of the field procedures for groundwater sampling is provided in the following section.

3.4.1 Equipment Decontamination

Prior to sample collection, all sampling equipment (MOSDAX probe, stainless steel sample cannisters, fittings) was decontaminated by Geofirma field staff. Equipment decontamination was recorded in the DQC workbook and followed the procedure described below:

1. Put on new, powder-free nitrile gloves. Remove potential clothing that may contaminate field equipment.
2. Wipe off visible loose contamination (e.g., dirt) using a brush or paper towel.
3. Wash equipment with solution made of laboratory grade non-phosphate, non-perfumed detergent (e.g., Alconox) and water. Use a brush to apply detergent. For internal mechanisms or items that cannot be washed using a brush, flush two system volumes of the cleaning solution through the system.
4. Rinse the equipment using distilled water and allow the equipment to air dry. Try to place equipment in a location that minimizes potential of airborne contamination (e.g., dust) during drying.
5. Purge rinse water from MOSDAX sampling probe using high purity (alphagaz™, >99.999%) compressed nitrogen. Compressed nitrogen is applied to the inlet port using sampling tubing and flushed through the open port at the bottom of the tool.
6. Contain all water generated during decontamination procedures and dispose of it.
7. If a duplicate sample is being collected, collect a rinsate sample after decontamination is complete by running distilled water through the Westbay MOSDAX sampler probe.

Rinsate water and water containing laboratory standards and solutions was contained in a plastic bucket and transported offsite by Geofirma for offsite disposal.

3.4.2 Groundwater Sample Collection

Sample collection was completed using NWMO-owned Westbay MOSDAX sampling equipment. Four stainless steel sample cannisters (0.25 L each) were connected in series and attached to the bottom of the MOSDAX sampler probe. Prior to lowering the sample cannisters into the borehole, the four containers were flushed with high-purity nitrogen (N₂) and then evacuated using a vacuum pump to less than 35 kilopascals (kPa).

Once lowered, the sampler probe was connected to the sampling port or lowered to 2 m above the pumping port (if pumping port was left open), the valve on the MOSDAX sampler was opened so that groundwater could fill the vacated stainless-steel containers. The pressure in the MOSDAX sampler probe was monitored during sampling to ensure that the sample containers were filled (approximately 1-15 minutes). A successful sample collection is verified by Geofirma observing a drop in formation pressure once the valve of the MOSDAX has been opened, followed by formation pressure typically returning to within 10-15 kPa of the initial formation pressure reading once the cannisters are filled. Once the cannisters were filled, the valve on the MOSDAX sampler was closed, and the probe and all the cannisters were retrieved to surface. This process is referred to as a sampling “run”, multiple runs are required to collect sufficient sample water for analysis.

3.4.3 Field Parameter Measurements and Transfer of Water to Laboratory Bottles

Sample water collected with the MOSDAX sampler probe was used to fill laboratory bottles, complete field parameter measurements, and field analytical testing as outlined in Table 5. Calibration of the measurement equipment and measurement of field parameters (e.g., alkalinity) was completed following procedure outlined in the Test Plan.

To minimize exposure to the atmosphere, sample water used for field parameter measurements remained in the Westbay sample cannisters and only the quantity required to perform each field test was extracted. Polyethylene tubing was used to transfer the water directly from the Westbay stainless-steel sample cannisters into the Horiba flow-through cell, eliminating the exposure to the atmosphere. When required, high purity compressed nitrogen was used to pressurize the stainless steel cannisters to assist with water flow.

Water collected for laboratory analysis was decanted from the stainless-steel sample cannisters into laboratory provided bottles. All bottles were placed in coolers on ice and shipped/delivered to the analytical laboratories under chain of custody (COC) procedures.

An archive sample was collected as a part of every sample suite following the same procedures. The archive samples were kept on ice or refrigerated until they were hand-delivered to the NWMO in Ignace, ON.

Table 5 Field Parameter Measurement and Field Analytical Testing Methods

Parameter	Volume Required	Field-Measurement Method
Fluorescein	25 mL	Handheld Fluorometer (Turner Designs Aquafluor™)
Turbidity	500 mL	In sealed flow-through cell (i.e., Horiba Flow Chamber) with inserted water quality multi-probe (Horiba-U52/U50)
Dissolved Oxygen (DO)		
Electrical Conductivity		
Temperature		
Oxidation-Reduction Potential (ORP)		
pH		
Fluid Density		HACH™ Hydrometer (SG > 1.0)
Dissolved Total Sulphide [S ²⁻ Total]	25 mL	Dissolved total sulphide by methylene blue method (Hach Method No. 8131) and colorimeter (Hach DR900 Multiparameter Colorimeter)
Ferrous Iron [Fe ²⁺]	35 mL	1-10 Phenanthroline Method (Hach Method No. 8146) using portable colorimeter (Hach DR900 Multiparameter Colorimeter)
Dissolved Oxygen	50 mL	Indigo Carmine method (Hach Method No. 8316) using portable colorimeter (Hach DR900) for concentrations < 1mg/L and Horiba-U52/50 for concentrations > 1 mg/L

Parameter	Volume Required	Field-Measurement Method
Alkalinity	100 mL	Hach™ Alkalinity Test Kit, digital titration method using sulphuric acid (H ₂ SO ₄), phenolphthalein indicator, and bromcresol green-methyl red indicator; hydroxide, carbonate and bicarbonate alkalinities can be determined (Hach Method No. 8203)

3.4.4 Sampling Procedure for Noble Gas Samples

Water samples for noble gases analysis were collected using lab-provided 3/8-inch copper tubing connected to the Westbay MOSDAX sampler. A train of two or three copper tubes (~0.3 m long each) were connected in series below the MOSDAX sampler with a 250 mL stainless-steel Westbay sample cannister between the probe and the copper tubes (Figure 3a). The sample train followed the same sampling procedure as outlined in section 3.4.2.

Upon retrieval to the surface, lab-provided bar-style pinch-off clamps (Yellow Jacket 60665) were used to seal off both ends of each 0.3 m long copper tubing segment. By sealing each segment, triplicates (or quadruplets) were collected for each sample (Figure 3b). After clamping, the noble gas samples were wrapped in bubble wrap and placed in a rigid-sided cooler for transport.

After review of noble gas results from the samples collected during 2021, Geofirma and NWMO decided to increase the number of lengths of copper tubing, from three to four for the collection of noble gas samples starting in Q3 2022. This decision was taken to increase the volume of groundwater collected to allow flexibility and provide opportunity for additional or replicate laboratory analyses, as required.



Figure 3 Example photos of noble gas sampling.

- a) photo of sample train with Westbay cannister and three Cu tubes prior to sending downhole.
b) photo of sample tubes after being clamped and labelled.

3.4.5 Collection of QA/QC Samples

QA/QC samples were collected as part of each monitoring event in 2022. Three types of QA/QC samples were collected, including:

- *Rinsate blank* - to test the sampling equipment after decontamination for contamination, one sample collected per quarterly event.
- *Field blank* - tritium-free blanks to assess atmospheric contamination during sample collection and transport, one sample collected per quarterly event.
- *Duplicate samples* – complete set of duplicate samples, collected to assess the consistency of the laboratory analyses. Duplicate samples are collected from intervals that have met the criteria for final sampling or otherwise requested by NWMO.

The rinsate blank was collected by running distilled water through the Westbay MOSDAX sampler probe and sampler containers following the completion of decontamination activities and prior to sample collection. Sufficient water was run through the sampling equipment to fill laboratory-provided sample bottles for major elements and metals, trace elements, and anions.

A tritium-free “field” blank was collected to assess atmospheric contamination of groundwater samples. Tritium-free water is provided in bottles by the University of Ottawa. These bottles were stored on-site and left exposed to the atmosphere for the same duration as the tritium and ^{14}C -DIC samples. During sampling, the tritium-free water was decanted into sample bottles identical to the ones used for tritium and ^{14}C -DIC analyses. The field blank was analyzed for tritium and ^{14}C -DIC at the same time as the corresponding groundwater sample.

A full suite of duplicates was collected during the Q2, Q3 and Q4 monitoring events in 2022 to assess the reproducibility of concentrations in-situ. Duplicate samples were collected at the same time as the primary/original sample, on a bottle-by-bottle basis. For example, both the original and duplicate tritium bottles were filled before filling the next bottle type.

3.4.6 Samples Collected in 2022

A total of eleven (11) full groundwater samples and twelve (12) QA/QC samples were collected in 2022.

Unless otherwise specified, approximately 5.0 litres (L) of groundwater was required to meet the sampling objectives with an additional 1-2 L required to complete field parameter measurements for each selected interval. This requires between 6-7 sample runs to collect sufficient volume for sampling. Approximately double the amount of volume and runs were required on Westbay intervals that were selected for duplicate samples.

As described above and following the Test Plan, sample collection is completed by either of these two methods:

- 1) Within the MP38 casing: Samples collected by this method were from Westbay intervals that were continuing to be purged, therefore the pumping port remains open during sampling. The samples are collected by lowering the MOSDAX sample probe to approximately 2 m above the pumping port, then opening the valve for collection. They are therefore not sampled directly from the formation but from the water column in the MP38 casing. These samples are considered interim samples, with estimated drill fluid proportions above 5%.

- 2) Sampling port: Samples collected by this method were from Westbay intervals that were deemed as final with estimated drill fluid proportions below 5%. The samples are collected from the formation, with the MOSDAX sample probe attached to the sampling port.

A summary of samples collected in 2022 with details on collection method used is provided in Appendix A. The following noteworthy changes to the routine planned sampling program were implemented:

Q2 2022 (June)

During Q2 (June) 2022, Geofirma was initially informed by the NWMO that the pumping port for IG_BH03_T_INT_002 was closed in preparation for final sampling and to collect samples through the sampling port. However, field measurements completed by Geofirma (interval pressures and fluorescein concentrations) indicated that the port remained open, and the interval was not ready for final sampling. In addition, interval pressures measured from within the MP38 casing (i.e., landed pressure or P1) and the formation (i.e., outside pressure or P2) had similar values of 8266.60 kPa and 8268.01 kPa, respectively prior to sampling and 8256.80 kPa and 8258.08 kPa, respectively post-sampling. This indicates that the formation and inside casing are connected and infers that the pumping port is open. Moreover, the fluorescein concentration was measured at 18.47 ppb at the time of sampling while previous concentrations collected by NWMO during purging were <5 ppb; this demonstrates that there was likely mixing of column fluid with the formation water, further indicating that the pumping port remained open. Geofirma notified the NWMO of these observations and it was decided that interval IG_BH03_T_INT_002 would be treated as an ongoing purging interval (interim sample) with an open pumping port and the sampling method was changed. Samples from IG_BH03_T_INT_002 were therefore collected from inside of the MP38 casing with the pumping port left open, with the MOSDAX sample probe positioned approximately 2 m above the pumping port.

Q4 2022 (December)

In Q4 (December) 2022, IG_BH01_T_INT_007 was resampled for noble gas analyses only (no other chemistry samples collected) to verify previous reported concentrations. Only two runs were required to collect sufficient water to collect noble gas samples. Sample collection from IG_BH03_T_INT_021 was requested by NWMO for in-field parameters only. Only one run was required to collect in-field measurements, any remaining sample water was collected in a 250 mL sample bottle to be archived.

During the same quarter (Q4 2022), interval IG_BH06_T_INT_008 was targeted for interim sampling, with a full suite of analyses, however Geofirma's field measurements unexpectedly confirmed high fluorescein concentrations (~100 ppb), therefore it was decided to terminate sampling. Geofirma collected a single 250 mL sample bottle for archive purposes and the remainder of the sample water was discarded into waste buckets containing rinsate water and laboratory standards / solutions for offsite disposal.

3.5 Laboratory Analyses

Samples collected during the monitoring events were shipped/delivered to select analytical laboratories under chain of custody procedures. All samples were transported in rigid-sided coolers with bubble wrap to prevent damage during transport. Except for the noble gas samples, all other samples were

transported on ice to maintain a temperature below 10 degrees C during transport. Noble gas samples were transported in coolers protected with bubble wrap and hand delivered to the lab.

Laboratory analysis of groundwater samples was completed by Bureau Veritas, Isotope Tracer Technologies (IT2), and the University of Ottawa. Archive samples were also collected and delivered to NWMO. A complete list of analytes analyzed by laboratories as part of the monitoring program is provided in Table 6.

Bureau Veritas completed laboratory analyses of the non-isotopic parameters listed, which included listed major elements and metals, trace elements, anions, and nutrients.

Isotope Tracer Technologies Inc. (IT2), of Waterloo, Ontario completed all the listed stable and radioactive isotope analyses, except for ^{36}Cl and ^{129}I .

Analysis for noble gas isotopes, ^{36}Cl and ^{129}I were sent to be completed at the University of Ottawa (UofO). While the UofO was the primary analytical lab, some analyses were subcontracted out to be completed. ^{36}Cl analysis was completed by *Eidgenössische Technische Hochschule* (ETH) Zurich and PRIME Lab at Purdue, and noble gas analyses by the University of Utah.

Table 6 Completed Laboratory Analyses, by Analytical Lab

Analytes	Analytical Lab or Storage
Major and Trace Elements and Metals (Na, K, Ca, Mg, Sr, Li, Si, Al, B, Cu, Ni, Zn, Pb, Cd, As, Se, Bi, U, Cs, Rb, Ba, Cr, Co, Th, Zr)	Bureau Veritas
Total Dissolved Sulphur, Total Dissolved Iron	
Ruthenium (Ru)	
Reactive Silica (SiO ₂)	
Sulphide (S ²⁻) (by zinc acetate ppt)	
Anions (Br, Cl, SO ₄ , PO ₄ , I, NO ₂ , NO ₃)	
pH	
Total Alkalinity as CaCO ₃	
Fluoride (F)	
Total Inorganic Carbon (TIC)	
Carbonate, Bicarbonate (CO ₃ , HCO ₃)	
Total Ammonia (NH ₄ +NH ₃)	
Total Nitrogen	
Total Organic Carbon (TOC)	
Total Phosphorus	
Dissolved Organic Carbon (DOC)	
δ ¹⁸ O, δ ² H, ³ H (enriched, saline sample)	Isotope Tracer Tech. (IT2)
⁸⁷ Sr/ ⁸⁶ Sr	
δ ³⁷ Cl	
δ ¹³ C-DIC	
¹⁴ C-DIC	
¹²⁹ I, ³⁶ Cl	University of Ottawa (with subcontracts to ETH Zurich and the University of Utah for select analysis)
Noble Gases (³ He, ⁴ He, ²⁰ Ne, ²¹ Ne, ²² Ne, ³⁶ Ar, ⁴⁰ Ar, Kr Total, Xe Total)	
Archive	NWMO Ignace Office

4 RESULTS

Analyses of field data and results from the 2022 quarterly monitoring events are presented in the following sections. Groundwater pressures and calculation of hydraulic heads are presented in Section 4.1 and 4.2. Chemistry results from groundwater sampling are presented in Section 4.3.

4.1 Pressure Profile Analysis

4.1.1 Conversion of Absolute Pressure Fluid Profile

The Westbay MOSDAX pressure probe measures absolute pressure in the packer-isolated borehole intervals outside the MP38 casing, which is considered the formation pressure (P_f). Pressures measured by this equipment are total/absolute pressures, expressed in metric (SI) units of kilopascal (kPa), which include the combined pressure of the water column and the atmospheric pressure (P_a). The effect of atmospheric pressure (P_a) was addressed by measuring the P_a at ground surface and subtracting the P_a from the formation pressure. For pressure data presented in this report, the averaged P_a measured at the start and end of a given pressure profile was used to correct all measurements collected during the profile. A separate P_a was used for each quarterly pressure profile at each borehole.

4.1.2 Calculation of Equivalent Freshwater and Environmental Hydraulic Heads

Formation fluid pressures measured in variable-density groundwater systems are commonly expressed as freshwater hydraulic heads and environmental hydraulic heads. Equivalent freshwater hydraulic heads assume a constant fluid density with depth across the entire length of the measured profile, whereas environmental hydraulic heads are determined using a reference formation fluid density profile.

The data required to complete these calculations are depth/elevations of MP38 measurement ports, measured formation fluid pressures, and the reference formation fluid density profile. Hydraulic head (H) is the sum of the elevation head (Z) and the pressure head (ψ).

Equivalent freshwater hydraulic heads are calculated from measured formation pressures and MP system measurement port elevations as:

$$H_f = Z + \psi = Z + \frac{P_f - P_a}{\rho_f g} \quad [1]$$

Where: H_f = equivalent freshwater hydraulic head [m ASL];

Z = elevation of MP pressure measurement port [m ASL];

P_f = formation pressure measured in MP measurement port [Pa or kg/ms²];

P_a = averaged atmospheric pressure measured at ground surface [Pa or kg/ms²];

ρ_f = density of freshwater [1000 kg/m³ at ambient temperatures]; and

g = gravitational acceleration [9.8065 m/s²].

Note: for head calculations, ground surface elevations were assumed to be 430.562 m ASL (IG_BH01), 441.403 m ASL (IG_BH03), 432.29 m ASL (IG_BH05), and 417.74 m ASL (IG_BH06)

Environmental hydraulic heads are determined from calculated freshwater heads and a reference formation fluid density profile as:

$$H_e = H_f - \left(\frac{\rho_f - \rho_a}{\rho_f} \right) (Z - Z_r) \quad [2]$$

Where: H_e = environmental hydraulic head [m ASL]

Z_r = elevation of reference point below which an average fluid density is determined [i.e., top of the groundwater system as represented by ground surface]; and

ρ_a = average density of water between Z and Z_r defined as:

$$\rho_a = \frac{1}{Z_r - Z} \int_Z^{Z_r} \rho(z) dz \quad [3]$$

Fluid density profile functions ($\rho(z)$) can be determined from compilations of measured fluid densities of porewater and groundwater samples from different depths at a given site.

4.1.3 Calculated Hydraulic Head and Vertical Depth Profiles

Calculated equivalent freshwater hydraulic heads from the 2022 monitoring event are plotted in meters above mean sea level (m ASL) with true vertical depths (TVD) below ground surface in Figure 4.

Appendix B provides tables showing the measured formation pressures and calculated equivalent freshwater hydraulic heads from pressure profiling in IG_BH01, IG_BH03, IG_BH05, and IG_BH06. Borehole IG_BH06 was not included in the scope for pressure profiling until the Q2 2022 monitoring event. No calculation of environmental heads was performed in this annual report as fluid density profiles for IG_BH01, IG_BH03, IG_BH05, and IG_BH06 have not yet been determined.

Head profiles in all boreholes, excluding IG_BH03 in Q4 2022, were generally consistent for all 2022 monitoring events and were comparable to profiles measured by Geofirma in 2021. The relatively low-pressure measurements and associated freshwater heads observed at select intervals of the profiles were expected due to ongoing purging, sampling, or post-sampling recovery of selected intervals. The following sections summarize the profiles for each borehole and discuss any notable observations.

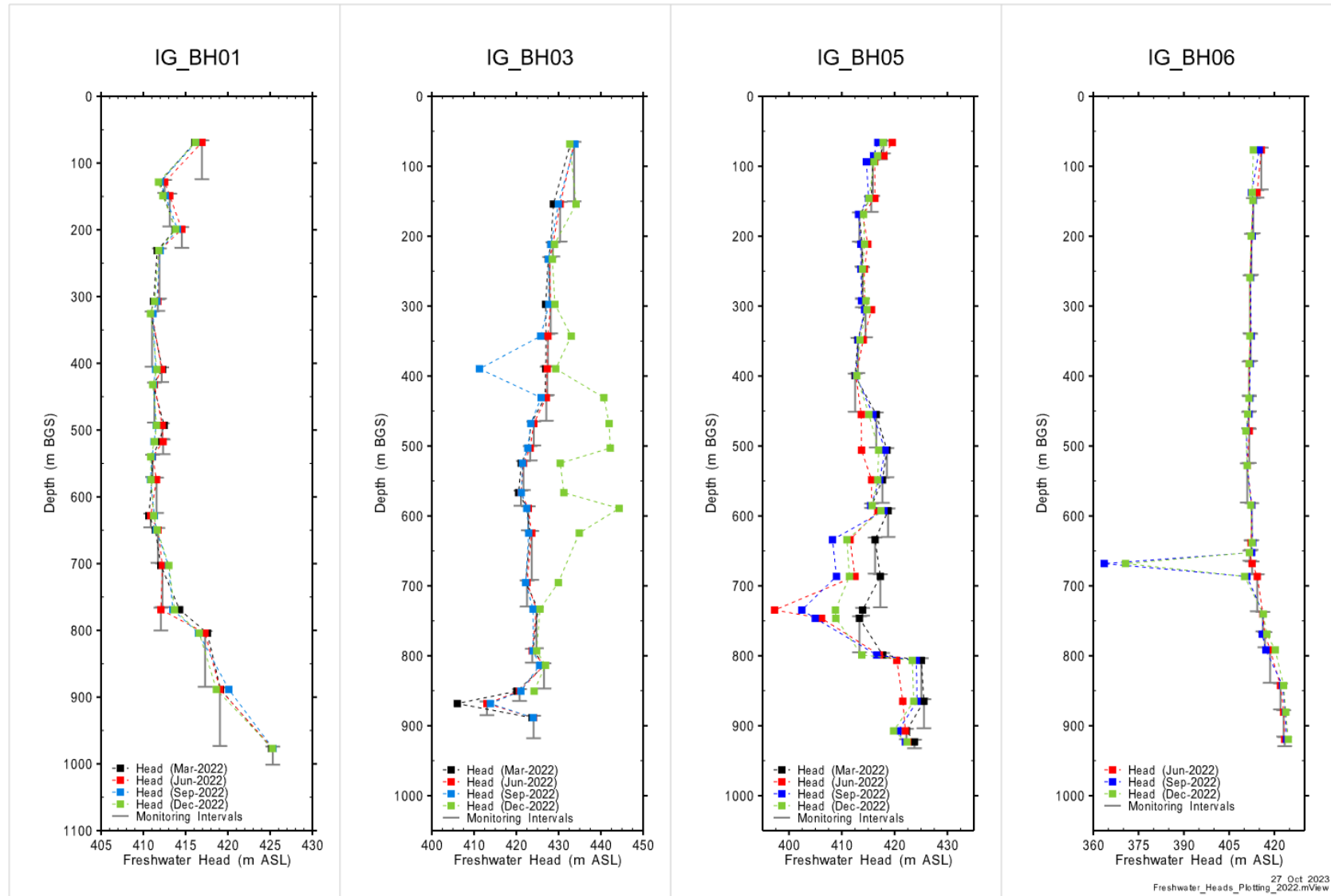


Figure 4 Vertical Depth Profiles of Equivalent Freshwater Hydraulic Heads for IG_BH01, IG_BH03, IG_BH05 and IG_BH06 during 2022 Quarterly Monitoring Events

4.2 Freshwater Heads in Deep Bedrock Boreholes

4.2.1 IG_BH01

Freshwater hydraulic head profiles for IG_BH01 were consistent for all 2022 monitoring events (Figure 4).

The relatively low head and pressures observed in IG_BH01 from intervals 4 (769.06 m BGS) to 7 (628.23 m BGS) in Q1 and Q2 2022 are likely caused by drawdown from the purging of interval 4 in preparation for sampling (sampled in Q1 and Q2 2022), and a slow recovery from pumped conditions of interval 7 back to equilibrium (previously purged and sampled in December 2021).

Similarly, in Q3 and Q4, the relatively low head and pressures from intervals 2 (888.49 m BGS) to 4 (769.06 m BGS) is likely due to the drawdown of interval 2 from purging and sampling in Q3 and Q4, and a slow recovery back to equilibrium after pumping of interval 4.

4.2.2 IG_BH03

Freshwater hydraulic head profiles for IG_BH03 were also generally consistent for all monitoring events, excluding Q4 2022 (Figure 4). The low head and pressures observed in interval 2 (868.28 m BGS) throughout all four quarters is due to the ongoing purging from 2021 to Q2 2022, and subsequent sampling and slow recovery in Q3 and Q4 2022.

A relatively low head and pressure were also observed in interval 15 (389.63 m BGS) of IG_BH03 during the Q3 monitoring event. As there is no record of any opening of pumping port or purging of this interval, this value is considered anomalous.

During Q4 2022 pressure profiling at IG_BH03, Geofirma experienced several challenges with equipment and field conditions, including:

- Winch mechanism alignment problems resulted in a slow, manual probe retrieval.
- Communication problems between the Westbay MAGI control units and the probes through the winch cables at greater depths in the boreholes.
- Erroneous magnetic collar detection signals, requiring multiple attempts to manually land on target ports.
- High turbidity borehole conditions, resulting in buildup of sediment/clay/grease on the winch cable and probes.

Geofirma attempted several troubleshooting techniques, including switching equipment, to mitigate the issues and complete the profile. Geofirma was successful to complete the profile, excluding intervals 1 (888.57 m BGS) and 2 (868.63 m BGS). However, the pressures observed in most intervals during the Q4 pressure profile at IG_BH03 are inconsistent with previous profiles from the borehole. The cause of these inconsistencies is unknown at this time and is being investigated.

4.2.3 IG_BH05

Freshwater hydraulic head profiles in IG_BH05 were generally consistent for all 2022 monitoring events (Figure 4). The low head and pressures observed in IG_BH05 from intervals 4 (806.50 m BGS) to 9 (634.09 m BGS) is likely due to ongoing purging of interval 7 (734.54 m BGS) from March to September 2022, and subsequent sampling and slow recovery in Q3 (September) and Q4 (December) 2022.

Similarly, the relatively low head and pressures observed in interval 5 (798.79 m BGS) in Q4 2022 is likely due to the ongoing purging and sampling of that interval.

4.2.4 IG_BH06

Freshwater hydraulic head profiles were not completed in IG_BH06 during Q1 2022, however were consistent throughout the remaining three (Q2, Q3, Q4) 2022 monitoring events (Figure 4). The relatively low head and pressures observed in IG_BH06 interval 8 (668.15 m BGS) is likely due to the ongoing purging of this interval in preparation for sampling.

4.3 Groundwater Chemistry

Geofirma staff completed a review of all laboratory-reported water chemistry results for samples collected to-date including at least one interim and one final sample from four intervals in IG_BH01, four interim samples and one final sample in IG_BH03 interval 2, two interim and one final sample from IG_BH05 interval 7, and a single interim sample from IG_BH05 interval 5. See above for more details. Unless otherwise noted in the following sections, the water chemistry results are considered acceptable based on Geofirma's review.

Results that are presented in this report include field measurements and laboratory reported values that have not been corrected for drill water contamination/impacts. Correction for drill water contamination is outside of the project's scope of work. Samples collected during the 2022 monitoring events have levels of drill water contamination ranging from approximately 2-50%, based on field-measured fluorescein concentrations. These should be considered when evaluating the data presented in this report. Estimated drill fluid concentrations for each sample is reported in the sample summary table (Appendix A).

Appendix C provides complete tables with all water chemistry results from the 2022 groundwater sampling events and all laboratory reports are found in Appendix E.

4.3.1 Field Measurements

Field parameter measurements were collected by Geofirma field staff as part of groundwater sampling activities during each quarter. A complete table of field parameters and measurements are provided in Appendix C.

The pH field measurements from IG_BH01_T_INT_004 increased from 6.95 in the interim sample to 8.22 for the final sample and pH decreased from 8.80 to 8.48 for samples from IG_BH01_T_INT_002. The pH values recorded for IG_BH03_T_INT_002 ranged from 6.97 to 7.47, with the final sample pH of

7.13. Interval IG_BH05_T_INT_007 pH values increased during purging from 6.73 to the final sample pH of 8.17 and the interim sample from interval IG_BH05_T_INT_005 had a pH value of 7.58.

The electrical conductivity (EC) measurements for BH01_T_INT_004 samples remained consistent ~20 mS/cm for both interim and final sample, whereas for IG_BH01_T_INT_002 samples, EC measurements increased from 14.0 to 35.2 mS/cm. In samples from IG_BH03_T_INT_002, the EC measurements were consistent with values between 39 to 47 mS/cm. Measurements for IG_BH05_T_INT_007 samples showed an increase in EC with ongoing purging, ranging from 5.54 to 17.3 mS/cm, and the sample from IG_BH01_T_INT_005 had a value within this range at 13.3 mS/cm.

Total dissolved solids (TDS) measurements, as measured by the multiparameter probe, ranged from 3.49 to 28.3 g/L. The samples with values below 10 g/L all corresponded to samples collected from partially purged intervals (i.e., interim samples). All final samples with TDS values between 10-100 g/L are categorized as saline groundwater (Freeze & Cherry, 1979).

Colorimetric dissolved oxygen (DO) measurements from most samples were below 1 mg/L and are consistent with the zero or near zero readings from the multiparameter probe. In general, readings from the multiparameter probe are more accurate than the colorimeter readings, as the sample water for the multiparameter probe is analyzed in a flow-through cell with less potential for atmospheric exposure. However, samples IG_BH03_GW013 (2.83 mg/L) and IG_BH05_GW011 (6.52 mg/L) are likely anomalous as they have DO readings above 1 mg/L. For sample IG_BH03_GW013 the flow-through cell seal failed, and therefore the sample was exposed to air. Sample IG_BH05_GW011 had high turbidity, which led to difficulties collecting most parameters, and this may have caused the high DO reading.

Dissolved ferrous iron (Fe^{2+}) was measured in all samples collected from IG_BH01, IG_BH03, and IG_BH05. The measurements from both intervals in IG_BH01 decreased with ongoing purging from 1.18 to 0.27 mg/L and 2.19 to 0.02 mg/L for interval 4 and interval 2 samples, respectively. The Fe^{2+} measured in interval IG_BH03_T_INT_002 samples, increased from 1.29 to 2.07 mg/L with ongoing purging. Samples from IG_BH05_T_int_007 had Fe^{2+} measurements that ranged from 2.73 to 7.50 mg/L, with two of the samples, IG_BH05_GW002 and IG_BH05_GW005, requiring dilution to obtain values. Similarly, sample IG_BH05_GW011, sampled from IG_BH05 interval 5, also required dilution to obtain a reading of 8.50 mg/L. Samples were diluted using distilled water, this introduces uncertainty in these measurements.

Concentrations of dissolved sulphide (S^{2-}) was also measured in all sampled collected from the three boreholes. The measurements were consistent ~0.04 mg/L for BH01_T_INT_004 samples and increased from 0.09 to 0.41 mg/L in IG_BH01_T_INT_002 samples. The S^{2-} concentrations ranged from 0.31 to 0.53 mg/L in IG_BH03_T_INT_002 samples, with no significant trends. Samples from IG_BH05_T_INT_007 had S^{2-} measurements that ranged from 0.05 to 2.10 mg/L, with two of the samples requiring dilution to obtain values. Similarly, sample IG_BH05_GW011, sampled from IG_BH05_T_INT_005, also required dilution to obtain a reading of 1.15 mg/L. Samples IG_BH05_GW002 (2.10 mg/L), IG_BH05_GW005 (0.90), and IG_BH05_GW011 (1.15 mg/L) required dilution to obtain measurements, as precipitation formed when the reagents were added to the sample, interfering the colorimeter readings. Samples were diluted using distilled water (containing unknown amounts of oxygen), and therefore resulting in potential underreporting of sulfide concentrations.

4.3.2 General Chemistry

General chemistry results are summarized in Appendix C, with the associated laboratory report from Bureau Veritas (BV) provided in Appendix E. Discussion of QA sample results, including rinsate and duplicate samples is provided in section 5.3.1.

A charge balance analysis of the major cations and anions for the groundwater samples showed charge balances $< \pm 5\%$ for all samples. The major ion concentrations were converted to milliequivalents, then converted to relative concentrations and plotted on ternary plots to produce Piper diagrams. The Piper diagrams for the three boreholes, IG_BH01, IG_BH03 and IG_BH05 are shown in Figure 5.

All samples from the three boreholes for all monitoring events in 2022 are Ca-Na-Cl type waters with low Mg^{2+} and K^+ concentrations.

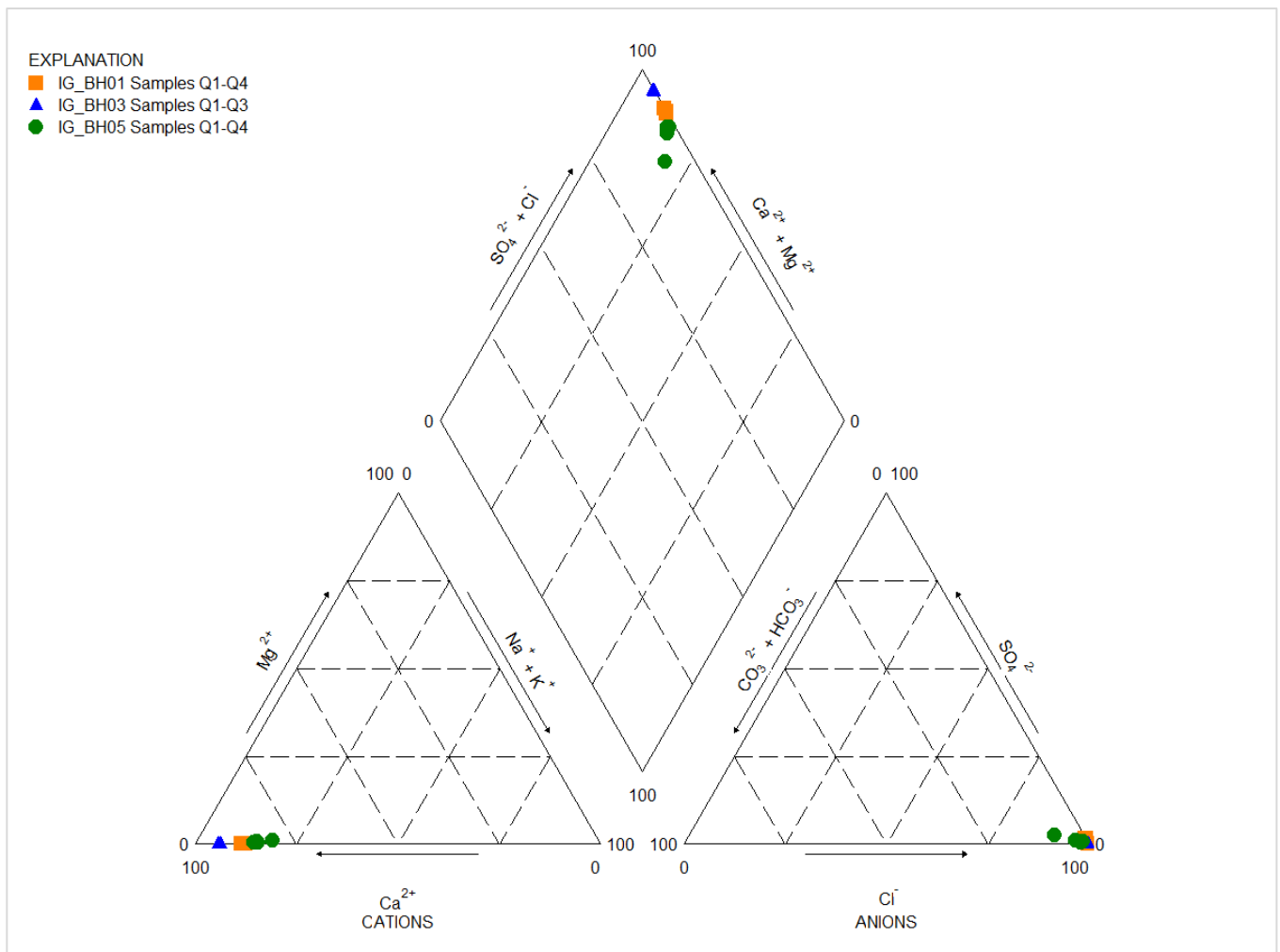


Figure 5 Piper Plot for Groundwater Samples collected in 2022.

4.3.3 Isotopes

Isotope results are summarized in Appendix C, with the associated laboratory reports from the University of Ottawa and IT2 provided in Appendix E. Discussion of QA sample results, including field blank samples and duplicates is provided in section 5.3.2.

Tritium results for IG_BH01, IG_BH03 and IG_BH05 samples from each monitoring event are shown in Figure 6, with reported values below the detection limit (<0.8 TU) plotted at 0.8 TU. Results from IG_BH01_T_INT_004 samples were relatively consistent between sampling rounds, with low tritium concentrations of below detection limit of 0.8 NTU ($\pm 1\sigma$ 0.7) in Q1 and 1.6 NTU ($\pm 1\sigma$ 1.0) in Q2 2022. In comparison, IG_BH01_T_INT_002 sample results showed a slightly more elevated concentration in the sample collected during Q3 2022 (6.0 NTU $\pm 1\sigma$ 0.9), which decreased with purging to below the detection limit in Q4 2022 (0.8 NTU $\pm 1\sigma$ 0.8).

All tritium results from interval IG_BH03_T_INT_002 samples collected in Q1 (1.5 NTU $\pm 1\sigma$ 0.7), Q2 (2.1 NTU $\pm 1\sigma$ 1.0) and Q3 (1.4 NTU $\pm 1\sigma$ 0.7) 2022 show low tritium concentrations and remained relatively consistent each quarter, with no significant trend due to purging observed. The results from interval IG_BH05_T_INT_007 samples show a decreasing trend in tritium concentrations as the interval was purged from 7.2 NTU ($\pm 1\sigma$ 0.9) in Q1 to 1.5 NTU ($\pm 1\sigma$ 0.7) in Q3. Interval IG_BH05_T_INT_005 showed a similar low concentration of 2.3 NTU ($\pm 1\sigma$ 0.8) from the partially purged sample collected in Q4 2022.

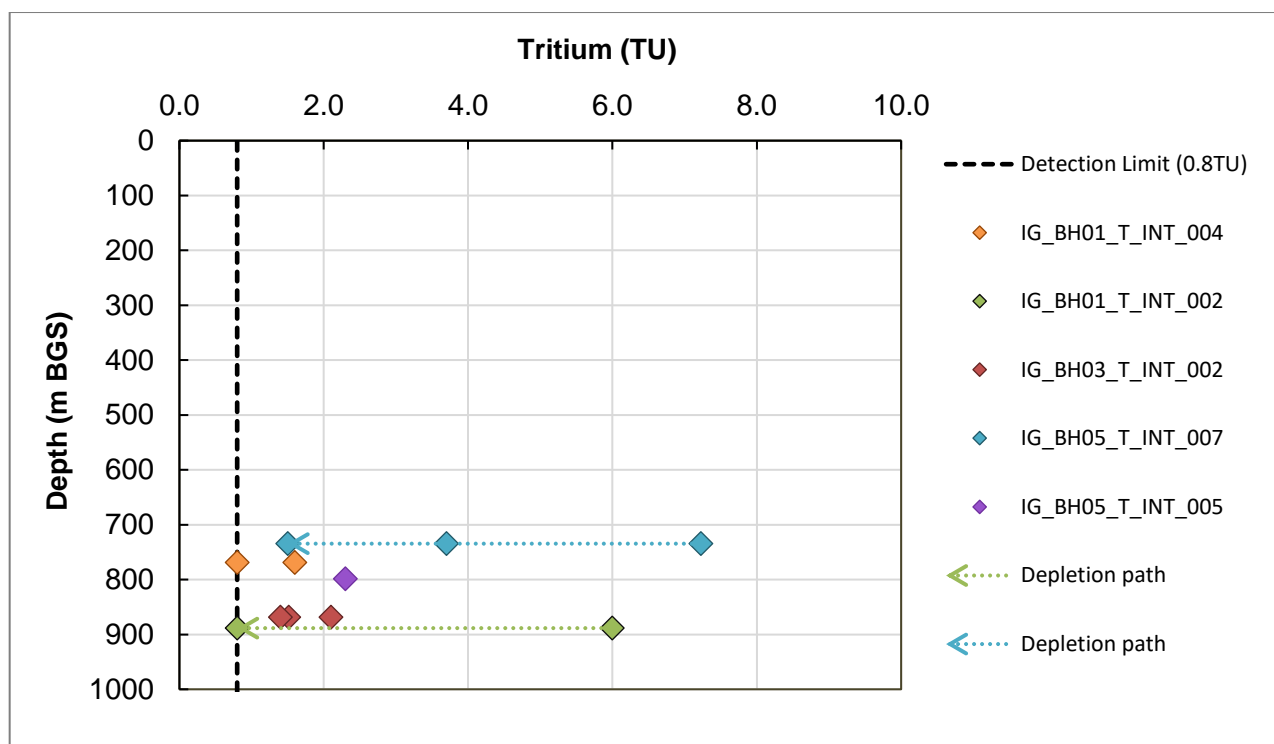


Figure 6 Tritium concentrations in groundwater samples from boreholes IG_BH01, IG_BH03, and IG_BH05 in 2022.

Stable isotope data ($\delta^{18}\text{O}$ and $\delta^2\text{H}$) are summarized in Appendix C and presented in Figure 7. Results show that most samples collected have deuterium excess compared to the global meteoric water level (GMWL), with the equation of $\delta^2\text{H} = 8 \delta^{18}\text{O} + 10\text{‰}$ (Clark, 2015), except for samples IG_BH01_GW035 and IG_BH05_GW001 which fall below the GMWL line, these two samples are the most impacted by drill water with an estimated drill fluid proportion of 30-50%.

Samples collected from IG_BH01_T_INT_004 show consistent results from both sampling rounds completed in Q1 and Q2 2022. Samples from interval IG_BH01_T_INT_002 show values for both $\delta^{18}\text{O}$ and $\delta^2\text{H}$ that depleted during ongoing purging completed between Q3 and Q4 2022. All $\delta^{18}\text{O}$ and $\delta^2\text{H}$ results from interval IG_BH03_T_INT_002 remained consistent throughout each sampling round from Q1 to Q3 2022. The results from interval IG_BH05_T_INT_007 showed a decreasing trend as the interval was purged from Q1 to Q3 2022. Interval IG_BH05_T_INT_005 showed similar depletion levels of $\delta^{18}\text{O}$ and $\delta^2\text{H}$ from the partially purged sample collected in Q4 2022.

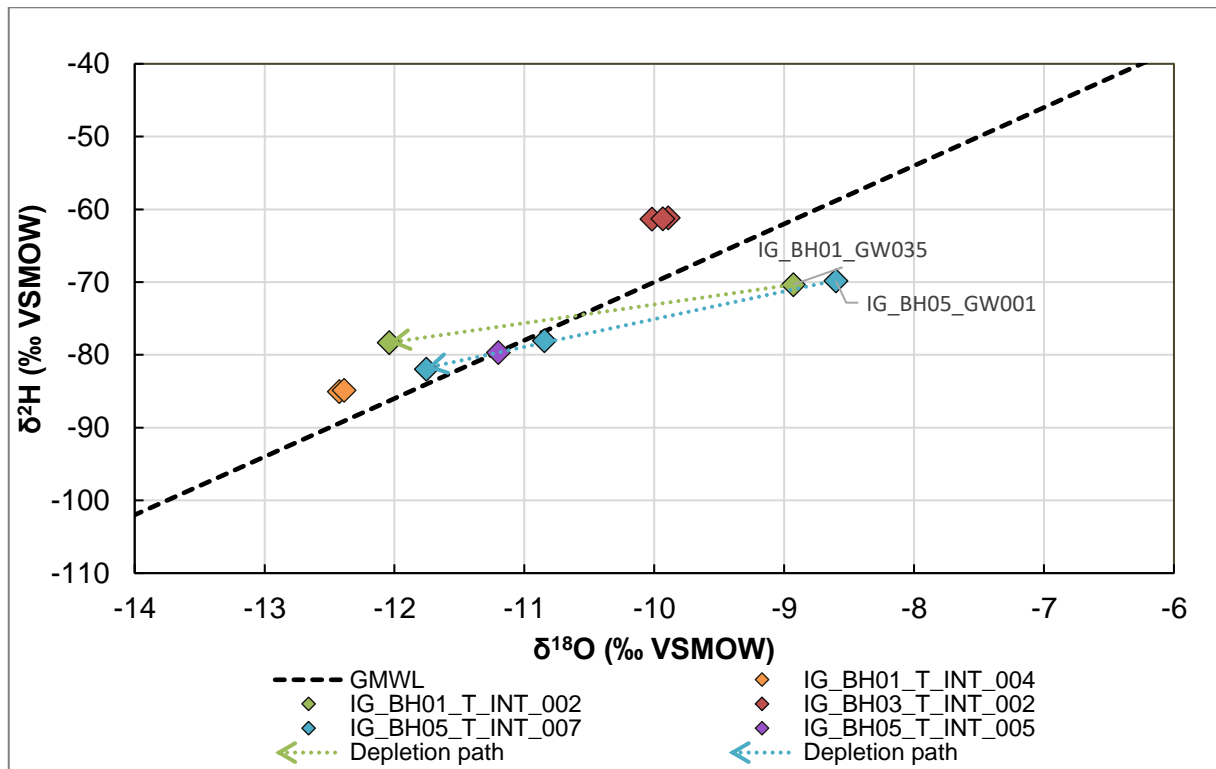


Figure 7 $\delta^{18}\text{O}$ and $\delta^2\text{H}$ values for groundwater samples from boreholes IG_BH01, IG_BH03, and IG_BH05 in 2022. GMWL is the global meteoric water level line, $\delta^2\text{H} = 8 \delta^{18}\text{O} + 10\text{‰}$ (Clark, 2015).

Radiocarbon results are presented in Figure 8, the results are shown as percent modern carbon (pmC). ^{14}C results from IG_BH01_T_INT_004 samples show a slight increase in value from 55 to 68% pmC and a decrease in values from 66 to 48% pmC for IG_BH01_T_INT_002 samples, as more volume was purged. The results from IG_BH03_T_INT_002 were consistently around 50% pmC for all quarters. The ^{14}C results from IG_BH05 intervals show values between 80 - 92% pmC with the values for IG_BH05_T_INT_007 increasing as the purged volume increased. ^{14}C results will need to be corrected

for drill water impacts and interpreted. This interpretation is outside the scope of this report and will be completed by the NWMO.

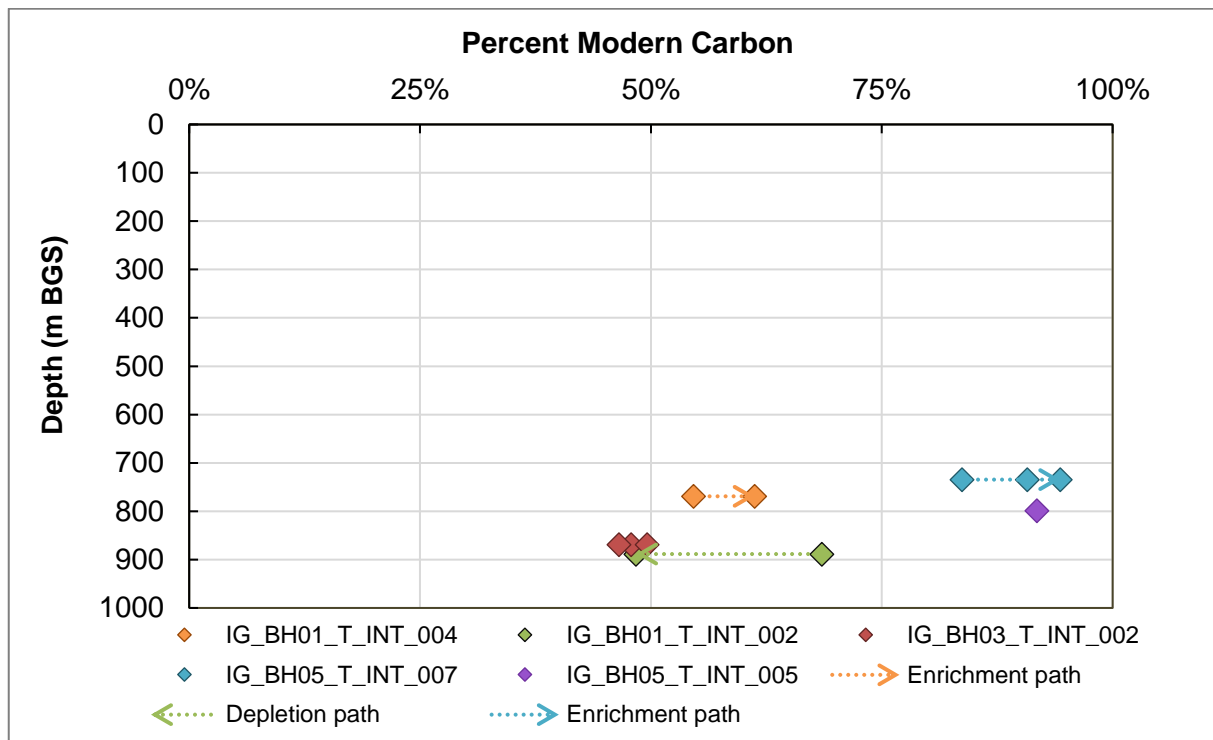


Figure 8 Measured ^{14}C presented as percent modern carbon (pmC) for groundwater samples collected from boreholes IG_BH01, IG_BH03, and IG_BH05 in 2022.

The strontium isotopic ratios ($^{87}\text{Sr}/^{86}\text{Sr}$) in the groundwater samples collected during 2022 are presented in Figure 9. The isotopic ratios for strontium in all samples fall within the range of 0.715 and 0.719. Samples from intervals in IG_BH01 show the isotopic signature becoming less radiogenic with depth. Samples from IG_BH01_T_INT_004 show an increase in radiogenic signature with continued purging, whereas IG_BH01_T_INT_002 samples show slight depletion. Samples from IG_BH05 follows the same trend of decreasing radiogenic signature with depth and as purged volumes increased, between monitoring rounds. Samples from IG_BH03, all collected from the same interval showed a consistent isotopic signature for each round with values between 0.71821 and 0.71828.

Results for $\delta^{37}\text{Cl}$ for groundwater samples collected during 2022 monitoring events were between -0.85‰ to +0.17‰ SMOC (standard marine ocean chloride). These results are consistent with results from previous studies of fluids sourced from crystalline rocks in the Canadian Shield (Stotler, Frape, & Shouakar-Stash, 2010).

The measured ^{36}Cl abundance ratios ($^{36}\text{Cl}/\text{Cl}$) for all groundwater sampled collected in 2022 range from 13.6×10^{-15} to 19.2×10^{-15} and show no notable trends.

The ^{129}I isotope results show similar trends for the three boreholes sampled in 2022, with the concentration of ^{129}I decreasing during purging of a given interval. Sample concentrations ranged from 28 million to 177 million atoms per kilogram.

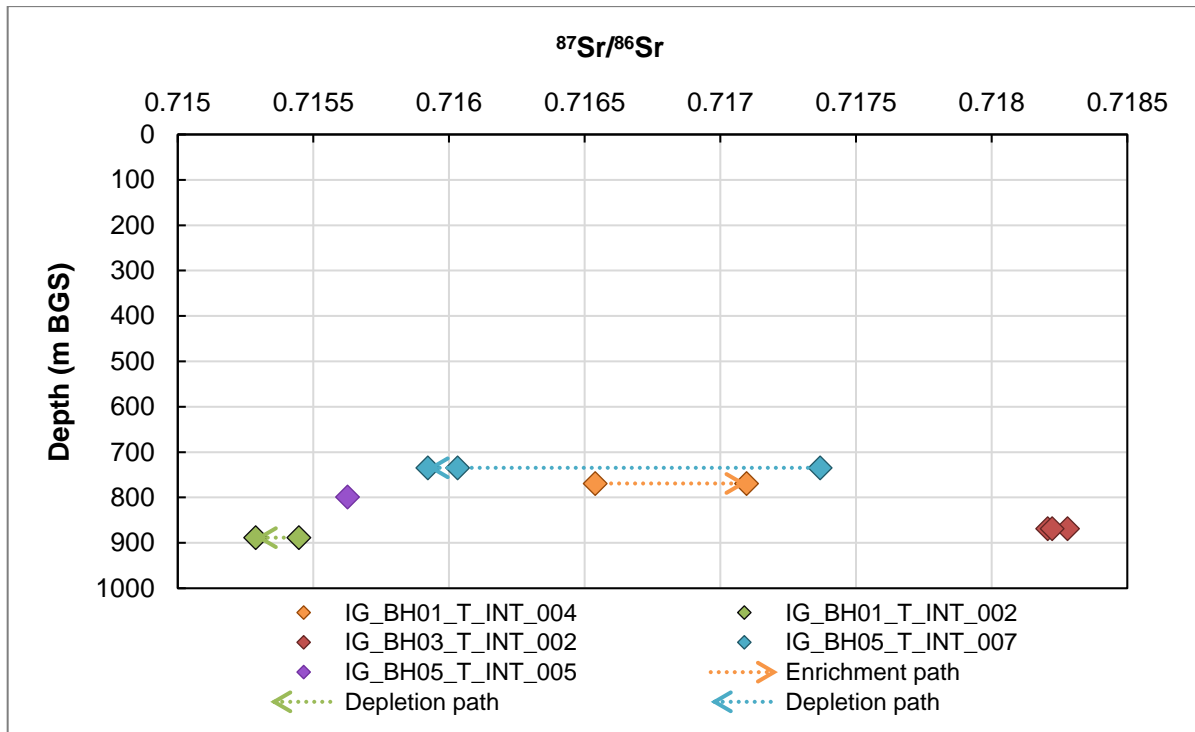


Figure 9 Strontium isotopic ratios ($^{87}\text{Sr}/^{86}\text{Sr}$) for groundwater samples collected from boreholes IG_BH01, IG_BH03, and IG_BH05 in 2022.

4.3.1 Noble Gases

Noble gas results are summarized in Appendix C, with the associated laboratory report from the University of Ottawa in Appendix E.

Figure 10 shows the helium ($x/\text{Ra} = ^3\text{He}/^4\text{He}$ normalized to air), neon ($^{20}\text{Ne}/^{22}\text{Ne}$) and argon ($^{40}\text{Ar}/^{36}\text{Ar}$) isotopic ratio results from the samples collected in 2022. Samples collected from IG_BH01 have x/Ra ratios between 0.02 and 0.07, IG_BH03 samples have ratios between 0.02 and 0.13 and IG_BH05 sample ratios fell between 0.01 and 0.11, these low ratios (≤ 0.1) are indicative of radiogenic He (White, 2015).

Calculated $^{20}\text{Ne}/^{22}\text{Ne}$ ratios results for all samples are between 9.19-11.27 and plot adjacent to the air ratio of 9.8 (Eberhardt, Eugster, & Marti, 1965), indicating little nucleogenic Ne in these samples (White, 2015). The calculated $^{40}\text{Ar}/^{36}\text{Ar}$ ratios show large variation and with values ranging from 403 up to 15,500, all sample ratios plot above the air ratio of 295.50 (Steiger & Jäger, 1977), also indicative of radiogenic Ar (White, 2015). Figures 11, 12 and 13 shows the ratios plotted against each other, the only significant trend observed is the increase in x/Ra and $^{40}\text{Ar}/^{36}\text{Ar}$ ratios and decrease in $^{20}\text{Ne}/^{22}\text{Ne}$ ratios of IG_BH05_T_INT_007 as the interval was purged between March and September 2022.

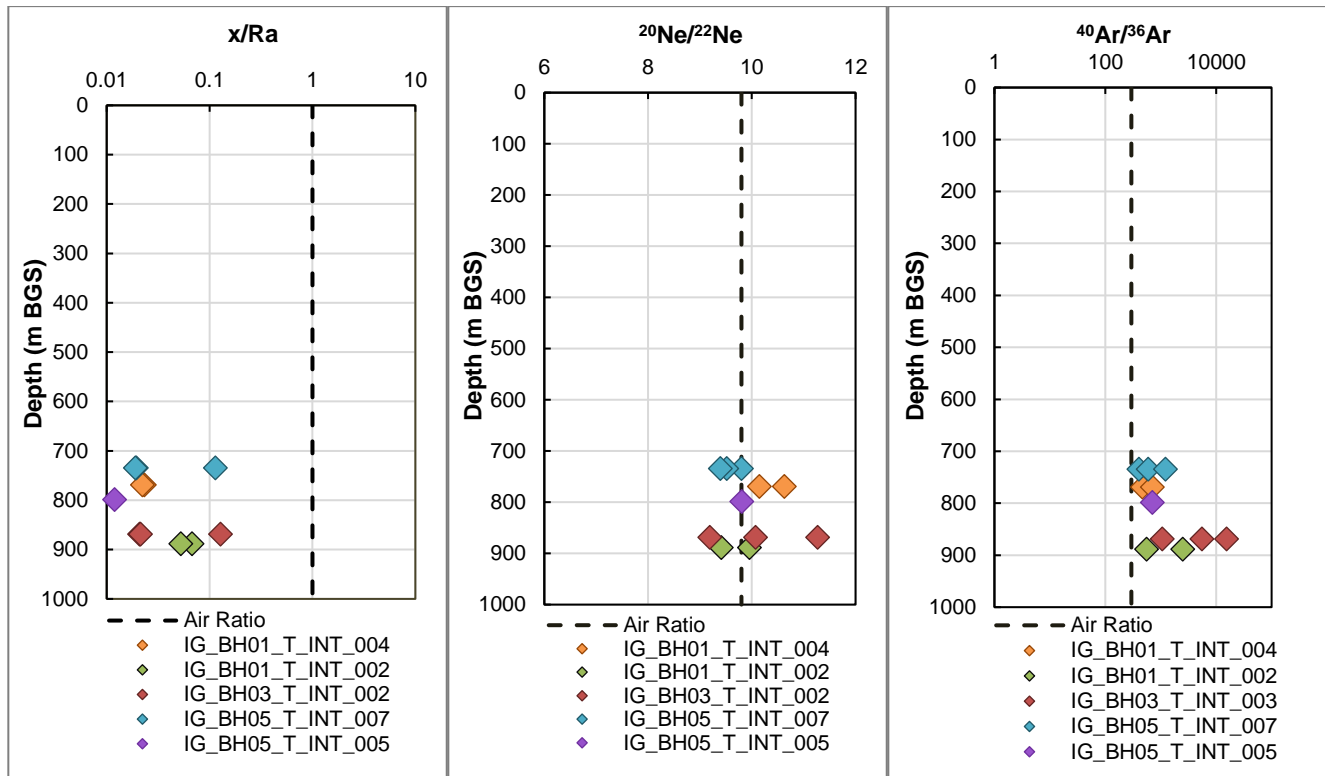


Figure 10 Noble Gas isotopic ratios of groundwater samples collected from boreholes IG_BH01, IG_BH03, and IG_BH05 in 2022.*Air ratios used in figure: $x/Ra = 1$ (normalized to air 1.38×10^{-6}), $^{20}Ne/^{22}Ne = 9.8$ (Eberhardt, Eugster, & Marti, 1965), $^{40}Ar/^{36}Ar = 295.50$ (Steiger & Jäger, 1977)

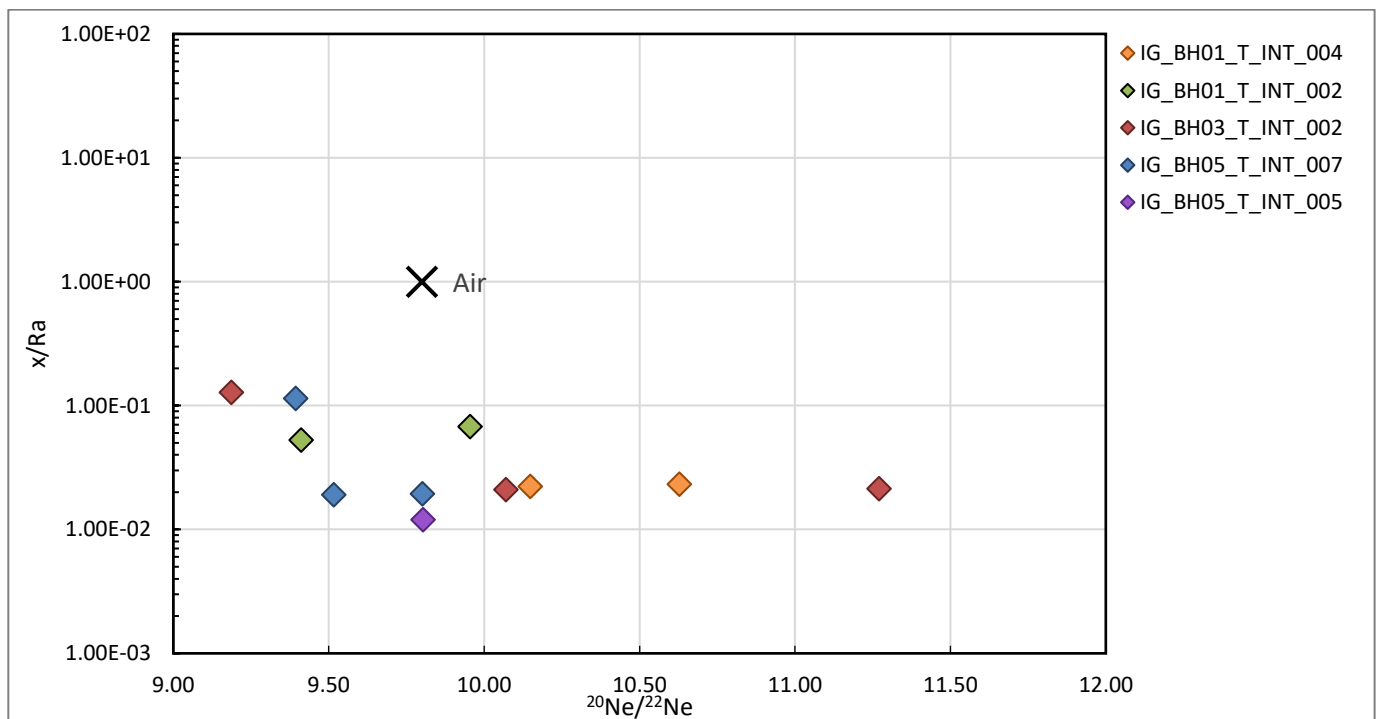


Figure 11 $^{20}Ne/^{22}Ne$ as plotted against x/Ra for all 2022 samples and related air (atmospheric) ratios.

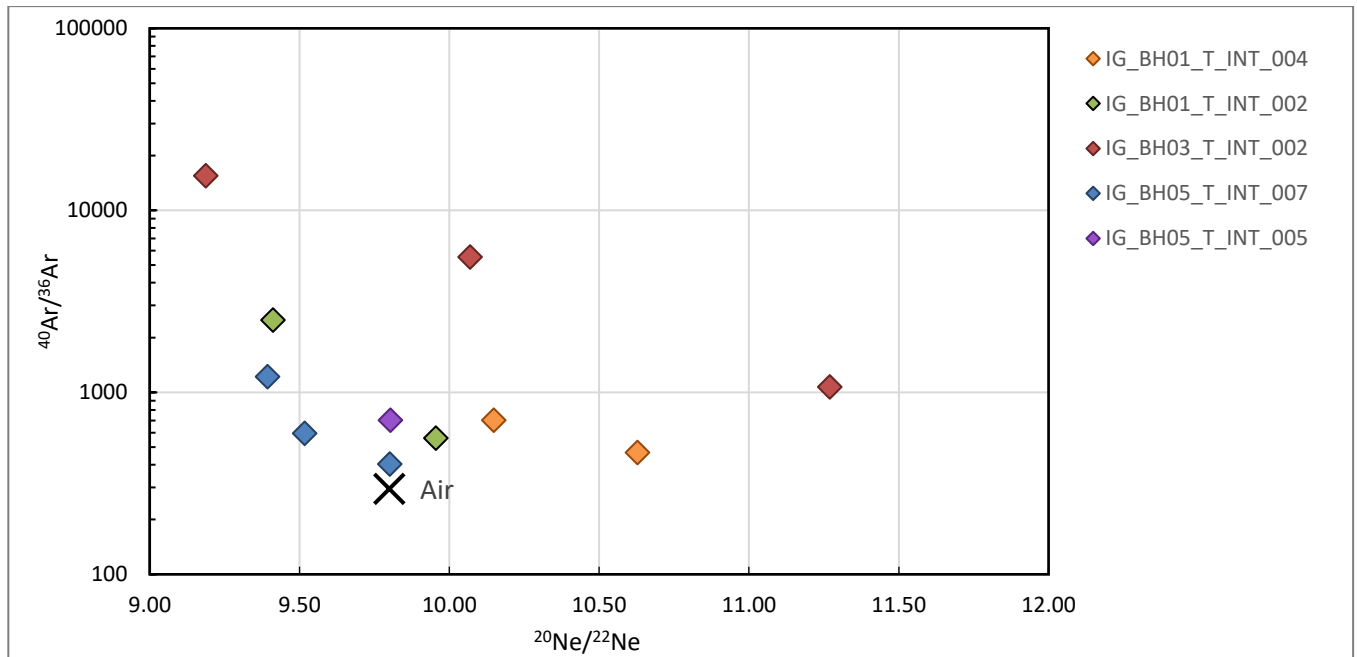


Figure 12 $^{20}\text{Ne}/^{22}\text{Ne}$ as plotted against $^{40}\text{Ar}/^{36}\text{Ar}$ for all 2022 samples and related air (atmospheric) ratios.

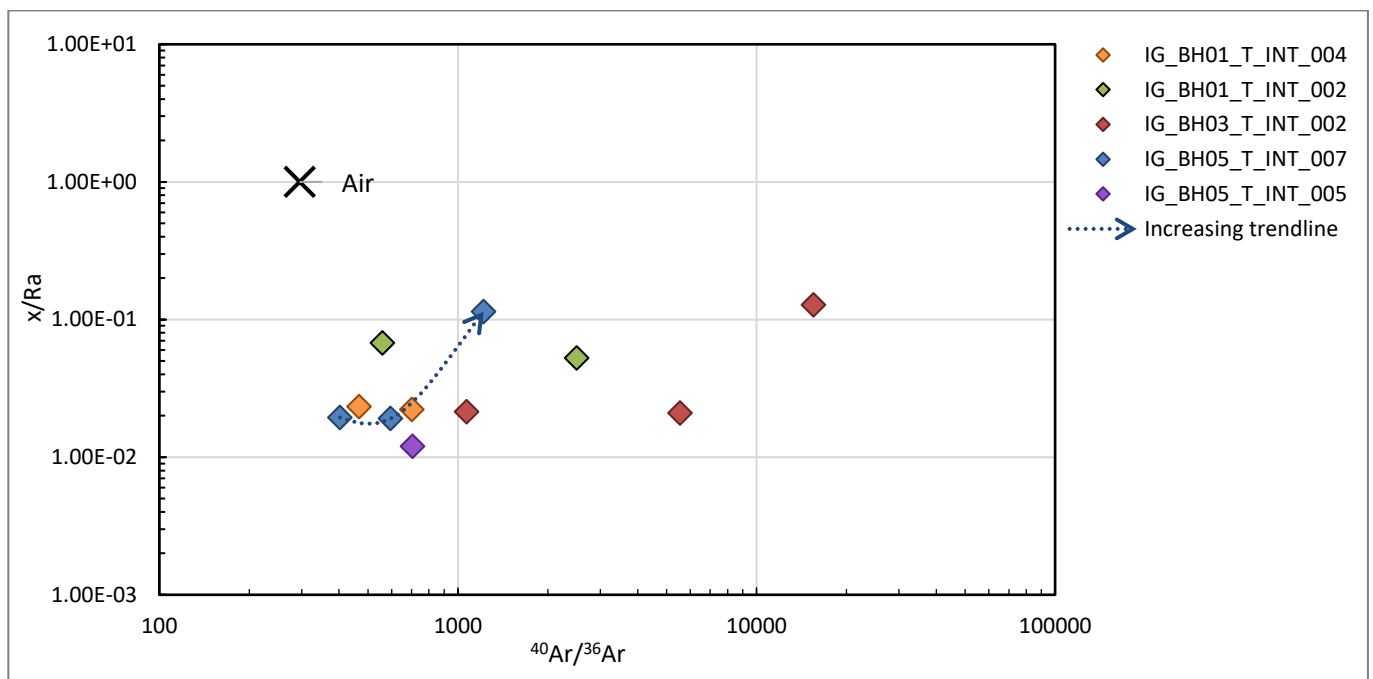


Figure 13 $^{40}\text{Ar}/^{36}\text{Ar}$ as plotted against x/Ra for all 2022 samples and related air (atmospheric) ratios.

5 DATA QUALITY

Overall quality management of the activities performed at each quarterly monitoring event, and represented in this report, are consistent with the Test Plan and the Project Quality Plan.

5.1 In-Field Data Quality Assurance

5.1.1 Field Data Quality Confirmation

Each quarterly monitoring event has a designated DQC workbook. The DQC workbook was completed by field staff each day throughout the monitoring event to ensure quality of data collected, following the data deliverable verification procedures outlined in the Test Plan. The DQC workbook has been submitted to the NWMO separately, as a part of the data deliverable package.

5.1.2 QA Checks During Pressure Profiling

Pressures recorded during each pressure profile are compared to the those recorded during the previous field event. For a given interval, measured formation pressures within 50 kPa of the previous records are considered representative and acceptable. If the value was observed to be out of this acceptable range, Geofirma staff remeasured the interval to confirm the reading and recorded it in the DQC, along with any noteworthy comments.

5.2 Field Data Chemistry

Following field activities each quarter, Geofirma staff reviewed the in-field data parameters and measurements. Most field parameter measurements and field-testing results from the 2022 sampling events were within the anticipated ranges and are comparable to laboratory provided results, where available (e.g. pH and alkalinity). A few minor discrepancies were observed by Geofirma and are summarized below:

- The pH measurements collected in field from IG_BH01 samples during Q2 (8.22), Q3 (8.80) and Q4 (8.48), were slightly above the measurements reported by the laboratory of 6.72, 7.23 and 7.65. These slight discrepancies are likely due to the samples being measured under different conditions. The pH can change due changes in temperature or degassing of CO₂ (Clark, 2015), and therefore the field readings are considered the most representative of in-situ groundwater conditions.
- Field alkalinity measurement collected from IG_BH03_GW016 of 106 mg/L in Q2 was slightly above the laboratory reported measurement of 66 mg/L. Conversely, in Q3 the field alkalinity measurement collected from IG_BH03_GW017 of 18 mg/L was below the laboratory reported measurement of 58 mg/L. The variation observed is likely due to the uncertainty associated with the in-field alkalinity measurement protocol, as the endpoint in this protocol is based on a colour observation which can vary between field staff.
- Measurements for dissolved ferrous iron (Fe²⁺) and dissolved sulphide (S²⁻) required dilution with distilled water for samples IG_BH05_GW002, IG_BH05_GW005, and IG_BH05_GW011 in Q2, Q3 and Q4 respectively, and therefore the reported values have a greater uncertainty than similar measurements collected from non-diluted samples.

- DO measurements for samples IG_BH03_GW013 (2.83 mg/L), IG_BH03_GW019 (3.15 mg/L), and IG_BH05_GW011 (6.52 mg/L) by the multiparameter probe are above the expected range of <1 mg/L. The elevated DO readings are likely due to atmospheric exposure of the sample during measurement. Laboratory samples were collected directly from the Westbay cannisters into laboratory provided bottles on separate runs, therefore there is no concern for atmospheric exposure in these samples.
- Colorimetric field-testing results for dissolved oxygen (DO) for samples IG_BH05_GW001 and IG_BH01_GW036 in Q1 and Q3 respectively, were outside of the anticipated range for groundwater at the site (< 1 mg/L). The associated multiparameter probe measurements of DO for these samples was within the expected range and is a more reliable measurement, with less potential for atmospheric contamination.

5.3 Laboratory Data Quality

As discussed in Section 3.4.5, three types of QA/QC samples, including rinsate blanks, field blanks, and duplicate samples, were collected as part of the groundwater sampling event for laboratory quality assurance (Appendix D).

Pairs of duplicate samples were compared to assess the consistency of analytical results by relative percent difference (RPD) for each analyte where the primary and duplicate sample had reported values above method detection limits. RPD was calculated by the equation below:

- Equation 1: $RPD = \frac{|x_1 - x_2|}{\bar{x}} \times 100\%$

Where:

- x_1 = concentration of original sample
- x_2 = concentration of duplicate sample
- \bar{x} = average concentration of original and duplicate sample

RPD values for homogeneous water samples are generally considered acceptable for laboratory QA if the RPD is less than 30% (MECP, 2004). However, since the uncertainty associated with a value increases dramatically as the result approaches the method detection limit (MDL), the MECP recommends using a duplicate result in RPD calculations only if the average of the two duplicates is greater than five times the MDL (5x MDL) (MECP, 2004). All calculated RPD values can be found in Appendix D.

Geofirma also calculated the charge balance error (CBE) for the general chemistry results from each groundwater sample to assess the accuracy of the geochemical analysis. The charge balance is the comparison of the sum of anions in meq/L with the sum of cations in meq/L in the solution and is expressed as a percentage (Equation 2). A charge balance error of less than $\pm 5\%$ is considered to be acceptable for the purpose of this study (Hounslow, 1995).

- Equation 2: $CBE (\%) = \frac{(\sum C - \sum A)}{(\sum C + \sum A)} \times 100$

Where:

- $\sum C$ = the sum of cations
- $\sum A$ = the sum of anions

5.3.1 General Chemistry

5.3.1.1 Q1 (March) 2022 – General Chemistry Results

No duplicate samples were collected during this sampling round.

The calculated charge-balance error for general chemistry analyses results provided by BV were -3.17%, -0.91%, and 1.37% for IG_BH01_GW032, IG_BH03_GW013, and IG_BH05_GW001 respectively and are within an acceptable range ($\leq \pm 5\%$).

Upon review, it was noted that the concentration of total organic carbon (TOC) and dissolved organic carbon (DOC) in samples IG_BH03_GW013 and IG_BH05_GW001 were higher than expected. Geofirma contacted the lab to confirm the reported values. Bureau Veritas re-analysed the samples and confirmed the original results. In noting the high results, the lab stated there were no discrepancies or concerns with the analysis and had completed an additional diluted run to confirm their original analysis.

Results for the rinsate blank sample IG_BH03_GW014 collected prior to sampling showed all non-detects, except for a low concentration of iodide (I) of 1.3 mg/L. Laboratory reported concentrations of iodide on all primary samples collected during this quarter were non-detects. This demonstrates that the decontamination procedure and sampling equipment had negligible impact on the associated primary groundwater samples.

5.3.1.2 Q2 (June) 2022 – General Chemistry Results

Geofirma compared the BV Laboratory results for the primary sample (IG_BH01_GW033) and the duplicate sample (IG_BH01_GW034). The results are acceptable, showing consistent values for each analyte, except reactive silica (RPD = 77%). As re-analysis was not feasible (due to exceedance of holding times), the reactive silica results for sample IG_BH03_GW033 has been flagged as potentially unreliable, the analysis of the two samples were completed 4 days apart, and therefore could have introduced some variability.

Upon review, it was noted that the chloride concentration of sample IG_BH05_GW002 was slightly below what was expected (3700 mg/L), Geofirma requested that the lab re-analyze the sample to confirm the results. The re-analyzed results reported a higher concentration (5200 mg/L), more in-line with expected concentrations and still within the lab's RPD acceptance criteria for duplicates.

The calculated charge-balance error for general chemistry analyses results provided by BV were 4.29% for IG_BH01_GW033, 2.56% for IG_BH01_GW034, 1.75% for IG_BH03_GW016, and -0.61% for IG_BH05_GW002, all within an acceptable range ($\leq \pm 5\%$).

Results for the rinsate blank sample (IG_BH05_GW003) collected prior to sampling showed mostly non-detects, except for low concentrations of calcium (Ca), sodium (Na), strontium (Sr), and chloride (Cl). The laboratory-reported rinsate concentrations for Cl, Ca, Na, and Sr were orders of magnitude lower than the associated sample concentrations, indicating that the decontamination procedure and sampling equipment had negligible impact on the reported values for the associated primary groundwater samples.

5.3.1.3 Q3 (September) 2022 – General Chemistry Results

Comparison of the BV laboratory results for the primary sample (IG_BH03_GW017) and the duplicate sample (IG_BH01_GW018) generally show consistent results, except for select analyses, including, total Kjeldahl nitrogen (TKN) and total nitrogen. These inconsistencies were noted by Geofirma during a review of the laboratory results. Given that the samples were collected immediately after one-another from the same sampling run, no variation in results was expected. Geofirma requested that Bureau Veritas repeat the TKN analysis of both samples. The repeat analyses reported lower concentrations, more in-line with expected concentrations.

A duplicate sample was also collected for IG_BH05_T_INT_007. Geofirma compared the BV Laboratory results for the primary sample (IG_BH01_GW005) and the duplicate sample (IG_BH01_GW006). The results are acceptable, showing consistent values for each analyte, excluding orthophosphate (P). The RPD value for Orthophosphate is 30%, at the limit of acceptability.

The calculated charge-balance error for general chemistry analyses results provided by BV were 0.48% for IG_BH01_GW035, -1.02% for IG_BH03_GW017, -0.98% for IG_BH03_GW018, -0.64% for IG_BH05_GW005, and 2.26% for IG_BH05_GW006, all within an acceptable range ($<\pm 5\%$).

Results for the rinsate blank sample (IG_BH05_GW007) collected prior to sampling showed mostly non-detects, except for low concentrations of calcium (Ca), sodium (Na), strontium (Sr), and chloride (Cl). The laboratory-reported rinsate concentrations for Cl, Ca, Na, and Sr were orders of magnitude lower than the associated sample concentrations, indicating that the decontamination procedure and sampling equipment had negligible impact on the reported values for the associated primary groundwater samples.

5.3.1.4 Q4 (December) 2022 – General Chemistry Results

Geofirma compared the BV Laboratory results for the primary sample (IG_BH05_GW011) and the duplicate sample (IG_BH05_GW012). The results are acceptable, showing consistent values for each analyte, except reactive silica (RPD = 87%). As re-analysis was not feasible (due to exceedance of holding times), the reactive silica results for this quarter have been flagged as potentially unreliable.

The calculated charge-balance error for general chemistry analyses results provided by BV were 3.66% for IG_BH01_GW036, 0.02% for IG_BH05_GW011, and 0.21% for IG_BH05_GW012, all within an acceptable range ($<\pm 5\%$).

Results for the rinsate blank sample (IG_BH05_GW009) collected prior to sampling showed mostly non-detects, except for low concentrations of calcium (Ca), iron (Fe), magnesium (Mg), sodium (Na), strontium (Sr), and chloride (Cl). The laboratory-reported rinsate concentrations for Cl, Ca, Fe, Mg, Na, and Sr were an order of magnitude lower than the associated sample concentrations, indicating that the decontamination procedure and sampling equipment had negligible impact on the reported values for the associated primary groundwater samples.

5.3.2 Isotopes

Geofirma reviewed the results from IT2 and the University of Ottawa Radiohalide laboratory and compared duplicate samples and evaluated them against the field blanks where applicable. The methodologies, standards and blanks used by the laboratories are included in each report (Appendix E).

Since no duplicate samples were collected during the Q1 2022 sampling round, Geofirma made comparisons with previous samples from 2021 where available (IG_BH03_T_INT_002), further assessment of the isotope results was limited. Results from the Q2, Q3 and Q4 2022 sampling rounds showed consistent values between the primary and the duplicate samples.

Results for all field blank samples collected during each quarter (IG_BH03_GW015, IG_BH05_GW004, IG_BH05_GW008, and IG_BH05_GW010) had tritium concentrations below laboratory detection limits (0.8 TU) and ^{14}C as percent modern carbon at ~40%. The reported values for tritium and ^{14}C are both within the expected range for the blank samples and are below the reported values of the associated primary samples, thereby indicating insignificant atmospheric contamination during sampling, transport, and laboratory analysis.

5.3.3 Noble Gases

Geofirma reviewed the noble gas results from the University of Ottawa Hydrogeochemistry laboratory and compared duplicate samples where applicable. No duplicates were collected in Q1 2022, so assessment of the noble gas results was limited. Results from the Q2, Q3 and Q4 2022 sampling rounds showed consistent values between the primary and the duplicate samples.

The noble gas results from all samples collected in the 2022 quarterly monitoring events were flagged as they showed evidence of variable levels of atmospheric contamination. Corrections for atmospheric contamination should therefore be considered when interpreting these results and further discussions will be had on improving the sampling methodology and collecting field blanks to accommodate for air contamination going forward.

6 DATA DELIVERY

6.1 Data Deliverables

As part of the data delivery schedule prescribed in the project Test Plan, Geofirma provided NWMO with the following items for each quarterly monitoring event:

- Barometric Pressure Data
- Data Quality Confirmation (DQC) Workbook
- Photographs of field activities
- Laboratory data and chain of custody forms
- Completed import templates for data entry into acQuire by NWMO:
 - IMP-15 – BV Groundwater Chemistry Results
 - IMP-15 – IT2 Groundwater Chemistry Results
 - IMP-15 – UofO Groundwater Chemistry Results
 - IMP-22 – Port Pressure Measurements for IG_BH01
 - IMP-22 – Port Pressure Measurements for IG_BH03
 - IMP-22 – Port Pressure Measurements for IG_BH05
 - IMP-22 – Port Pressure Measurements for IG_BH06
 - IMP-DE07 – Groundwater Field Parameter Measurements

In February 2023, the NWMO requested that the data deliveries for each quarter to be split into two (2) separate deliveries to speed up data processing. One delivery for pressure profiling (PP) activities and results and a second delivery for groundwater (GW) sampling activities and results. Table 7 provides a summary of data deliveries submitted to the NWMO by quarterly monitoring event.

Table 7 Data Delivery, by Quarterly Monitoring Event

Monitoring Event	Data Delivery Date	Comments
Q1	19-Jan-23	R0 – Finalized data delivery (PP & GW)
	05-Apr-23	R1 – Revised data delivery (GW)
	31-Oct-23	R1 – Revised data delivery (PP)
Q2	07-Mar-23	R0 – Finalized data delivery (PP)
	05-Apr-23	R0 – Finalized data delivery (GW)
	31-Oct-23	R1 – Revised data delivery (PP)
	18-Jan-24	R2 – Revised data delivery (PP)
	25-Jan-24	R1 – Revised data delivery (GW) - noble gas only
Q3	18-Jul-23	R0 – Finalized data delivery (GW)
	31-Oct-23	R0 – Finalized data delivery (PP)
	18-Jan-24	R1 – Revised data delivery (PP)
	25-Jan-24	R1 – Revised data delivery (GW)

Monitoring Event	Data Delivery Date	Comments
Q4	31-Oct-23	R0 – Finalized data delivery (PP)
	18-Jan-24	R1 – Revised data delivery (PP)
	25-Jan-24	R0 – Finalized data delivery (GW)

7 CONCLUSIONS

Four quarterly monitoring events of Westbay multilevel systems installed in NWMO-owned boreholes were completed by Geofirma Engineering Ltd. during 2022.

- The Q1 monitoring event was completed by Geofirma between March 17-30, 2022, including pressure profiling at IG_BH01, IG_BH03, and IG_BH05 and collection of water samples from IG_BH01_T_INT_004, IG_BH03_T_INT_002, and IG_BH05_T_INT_007. A QA/QC field blank and rinsate sample were also collected during this quarter.
- The Q2 monitoring event was completed by Geofirma between May 27 - June 06, 2022, including pressure profiling at IG_BH01, IG_BH03, IG_BH05, and IG_BH06 and collection of water samples from IG_BH01_T_INT_004, IG_BH03_T_INT_002, and IG_BH05_T_INT_007. A full suite of duplicates, field blanks, and rinsate samples were also collected for IG_BH05_T_INT_007.
- The Q3 monitoring event was completed by Geofirma between September 16 - 29, 2022, including pressure profiling at IG_BH01, IG_BH03, IG_BH05, and IG_BH06 and collection of water samples from IG_BH01_T_INT_002, IG_BH03_T_INT_002, and IG_BH05_T_INT_007. A full suite of duplicates was collected during sampling of IG_BH03_T_INT_002 and IG_BH05_T_INT_007, along with a field blank and rinsate sample.
- The Q4 monitoring event was completed by Geofirma between November 30 - December 14, 2022, including pressure profiling at IG_BH01, IG_BH03, IG_BH05, and IG_BH06 and collection of water samples from IG_BH01_T_INT_002 and IG_BH05_T_INT_005. Archive samples and field measurements were also collected from IG_BH03_T_INT_021 and IG_BH06_T_INT_008. Geofirma re-sampled IG_BH01_T_INT_007 to obtain water for further noble gas analysis. A full suite of duplicates, field blanks, and rinsate samples were also collected during this quarter.

Measured formation pressures and calculated equivalent freshwater heads from IG_BH01, IG_BH03, IG_BH05, and IG_BH06 were generally consistent throughout the year and consistent with previous years, excluding IG_BH03 in Q4 2022. The anomalous pressures and head profile observed in IG_BH03 during Q4 is being investigated but could have been influenced by equipment issues encountered in the field. All other formation pressures that were outside of their typical range were associated with drawdown from ongoing interval purging in preparation for groundwater sampling. Calculation of environmental heads was not completed as fluid density profiles have not been provided to Geofirma by NWMO.

All groundwater water samples collected in each quarter underwent field measurements and were analyzed for a suite of conventional laboratory analyses at Bureau Veritas Laboratories. Isotope and noble gas analysis were completed at the University of Ottawa and Isotope Tracer Technologies (IT2). Results from the water analyses were reviewed by Geofirma to ensure that the results were within an acceptable range and that any quality issues were flagged. In general, the water analyses were within expected ranges, some data concerns were identified and are discussed in sections 5.2 and 5.3. These flagged items include:

- In-field dissolved oxygen (DO) measurements of some samples
- In-field sulfide and ferrous iron measurements due to required dilution of some samples
- Consistency of reactive silica analyses in of samples in Q2 and Q4
- Noble gas analyses of most samples

For each of the flagged concerns, Geofirma contacted the responsible lab to investigate causes, request re-analysis, and discuss solutions to mitigate issues going forward, if required.

These flagged items must be considered when evaluating results. In-field DO, sulfide, and ferrous iron concerns are not pertinent to the final laboratory results. Reactive Silica results for IG_BH01_GW033, IG_BH01_GW034, IG_BH05_GW011, and IG_BH05_GW012 should be flagged as potentially unreliable due to their differing values (Primary vs. Duplicate). Noble gas analysis results require correction due to atmospheric contamination.

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Appendix A

2022 Sample Collection Summary

Appendix A - Sample Collection Summary Table

	Sample ID	Sample Type	Interval ID	Interval Depth (m BGS)	Interval Purge Status	Estimated Proportion of Drill Fluid ¹ (%)	Sample Method	Comments
Q1 (Mar-22)	IG_BH01_GW032	Primary	IG_BH01_T_INT_004	765.77 - 799.95	Ongoing purging	6%	Within MP38 casing	
	IG_BH03_GW013	Primary	IG_BH03_T_INT_002	865.35 - 884.86	Ongoing purging	6%	Within MP38 casing	
	IG_BH03_GW014	Rinsate	--	--	--	--	--	
	IG_BH03_GW015	Field blank	--	--	--	--	--	
	IG_BH05_GW001	Primary	IG_BH05_T_INT_007	731.50 - 742.60	Ongoing purging	38%	Within MP38 casing	
Q2 (Jun-22)	IG_BH01_GW033	Primary	IG_BH01_T_INT_004	765.77 - 799.95	Final Sample	4%	Sampling port (from formation)	
	IG_BH01_GW034	Duplicate						
	IG_BH03_GW016	Primary	IG_BH03_T_INT_002	865.35 - 884.86	Ongoing purging	5%	Within MP38 casing	
	IG_BH05_GW002	Primary	IG_BH05_T_INT_007	731.50 - 742.60	Ongoing purging	5%	Within MP38 casing	
	IG_BH05_GW003	Rinsate	--	--	--	--	--	
	IG_BH05_GW004	Field blank	--	--	--	--	--	
Q3 (Sep-22)	IG_BH01_GW035	Primary	IG_BH01_T_INT_002	885.19 - 972.71	Ongoing purging	49%		
	IG_BH03_GW017	Primary	IG_BH03_T_INT_002	865.35 - 884.86	Final Sample	2%	Sampling port (from formation)	
	IG_BH03_GW018	Duplicate						
	IG_BH05_GW005	Primary	IG_BH05_T_INT_007	731.50 - 742.60	Final Sample	2%	Sampling port (from formation)	
	IG_BH05_GW006	Duplicate						
	IG_BH05_GW007	Rinsate	--	--	--	--	--	
Q4 (Dec-22)	IG_BH05_GW008	Field blank	--	--	--	--	--	
	IG_BH01_GW036	Primary	IG_BH01_T_INT_002	885.19 - 972.71	Ongoing purging	2%	Within MP38 casing	
	IG_BH01_GW028	Primary	IG_BH01_T_INT_007*	624.94 - 645.42	Final Sample	4%	Sampling port (from formation)	Re-sample of INT 007 for missed noble gas analysis only
	IG_BH03_GW019	Primary	IG_BH03_T_INT_021**	65.09 - 150.15	Ongoing Purging	10%	Within MP38 casing	Sample archived - only used for infield measurements
	IG_BH05_GW009	Rinsate	--	--	--	--	--	
	IG_BH05_GW010	Field blank	--	--	--	--	--	
	IG_BH05_GW011	Primary	IG_BH05_T_INT_005	795.80 - 802.70	Ongoing Purging	5%	Within MP38 casing	
	IG_BH05_GW012	Duplicate						
	IG_BH06_GW001	Primary	IG_BH06_T_INT_008**	665.70 - 682.70	Ongoing Purging	100%	Within MP38 casing	Sample archived - only used for infield measurements

*Interval IG_BH01_T_INT_007 was previously purged and sampled in 2021. Geofirma completed re-sampling for missing noble gas analyses during Q4 2022. **No laboratory analyses were required for samples IG_BH03_GW019 and IG_BH06_GW001, they were collected as archive samples to collect in-field parameters only

¹Estimated proportion of drill fluid (%) is based on in-field fluorescein measurements of collected groundwater sample, and assuming the pre-purging drill fluid concentration was at 100% (i.e, 100 ppb fluorescein)

-- = no value measured or information not relevant to sample

Appendix B

**Fluid Pressures, Calculated Pressure Heads and Calculated
Freshwater Heads**

Table B.1: Fluid Pressure, Calculated Pressure Head(Ψ)and Calculated Freshwater Head (H_f) for IG_BH01

Port No.	Port Depth (m BGS)	Mar-22 (Q1)				Jun-22 (Q2)				Sep-22 (Q3)				Dec-22 (Q4)			
		Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m)	Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m)	Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m)	Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m)
1	976.909	9626.15	971.53	5.38	425.18	9623.28	971.66	5.25	425.31	9624.32	971.68	5.23	425.33	9625.42	971.62	5.29	425.27
2	888.486	8699.69	877.05	11.43	419.13	8694.91	876.99	11.50	419.07	8706.01	878.04	10.45	420.11	8693.24	876.56	11.92	418.64
3	804.144	7857.37	791.16	12.99	417.58	7850.58	790.89	13.25	417.31	7843.72	790.11	14.04	416.53	7846.35	790.20	13.94	416.62
4	769.063	7481.15	752.79	16.27	414.29	7455.25	750.58	18.48	412.08	7469.99	752.00	17.07	413.50	7473.55	752.19	16.88	413.69
5	702.896	6810.5	684.40	18.49	412.07	6808.07	684.58	18.31	412.25	6815.89	685.30	17.60	412.96	6818.15	685.35	17.54	413.02
6	649.622	6281.79	630.49	19.13	411.43	6280.52	630.79	18.83	411.73	6279.32	630.58	19.04	411.52	6282.1	630.69	18.93	411.63
7	628.233	6064.43	608.33	19.91	410.65	6062.37	608.54	19.69	410.87	6067.46	608.98	19.26	411.31	6068.36	608.90	19.34	411.22
8	574.258	5538.62	554.71	19.55	411.01	5539.83	555.26	19.00	411.56	5533.57	554.53	19.72	410.84	5536.01	554.61	19.65	410.91
9	540.072	5204.06	520.59	19.48	411.08	5199.95	520.60	19.47	411.09	5200.35	520.56	19.52	411.05	5200.32	520.38	19.69	410.87
10	517.281	4988.27	498.59	18.69	411.87	4988.72	499.06	18.22	412.34	4979.01	497.98	19.30	411.27	4981.26	498.04	19.24	411.32
11	492.89	4754.92	474.79	18.10	412.46	4748.53	474.57	18.32	412.24	4742.27	473.84	19.05	411.52	4744.48	473.90	18.99	411.57
12	432.013	4145.09	412.60	19.41	411.15	4142.35	412.75	19.26	411.30	4142.32	412.66	19.35	411.21	4143.11	412.57	19.44	411.12
13	409.22	3932.47	390.92	18.30	412.26	3927.35	390.83	18.39	412.17	3921.22	390.12	19.10	411.46	3924.29	390.26	18.96	411.60
14	325.543	3098.44	305.87	19.67	410.89	3095.59	306.01	19.53	411.03	3097.57	306.13	19.41	411.15	3096.29	305.82	19.72	410.84
15	307.248	2922.14	287.90	19.35	411.21	2922.85	288.40	18.85	411.71	2922.55	288.28	18.97	411.59	2921.68	288.02	19.23	411.33
16	231.165	2180.28	212.25	18.92	411.64	2178.66	212.51	18.66	411.91	2180.23	212.58	18.58	411.98	2180.37	212.42	18.74	411.82
17	199.17	1887.38	182.38	16.79	413.77	1890.8	183.15	16.02	414.55	1886.63	182.64	16.53	414.04	1886.35	182.44	16.73	413.83
18	148.979	1382.13	130.86	18.12	412.44	1384.61	131.54	17.44	413.12	1380.31	131.01	17.97	412.60	1379.22	130.73	18.25	412.31
19	128.483	1176.48	109.89	18.60	411.96	1177.86	110.45	18.03	412.53	1173.49	109.92	18.56	412.00	1173.12	109.71	18.77	411.79
20	69.091	634.42	54.61	14.48	416.08	638.58	55.46	13.63	416.93	632.33	54.74	14.35	416.21	633.61	54.70	14.39	416.17

Notes for Calculation:	Q1 2022	Q2 2022	Q3 2022	Q4 2022
P_{atm} (average), kPa	98.89	94.70	95.53	97.23
Ground Surface Elevation, mASL	430.562			

Table B.2: Fluid Pressure, Calculated Pressure Head(Ψ)and Calculated Freshwater Head (H_f) for IG_BH03

Port No.	True Port Depth (m BGS)	Mar-22 (Q1)				Jun-22 (Q2)				Sep-22 (Q3)				Dec-22 (Q4) ¹			
		Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m ASL)	Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m ASL)	Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m ASL)	Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m ASL)
1	888.57	8638.46	870.90	17.67	423.73	8637.43	871.25	17.32	424.08	8638.88	871.15	17.42	423.99	--	--	--	--
2	868.28	8265.79	832.89	35.39	406.02	8330.32	839.93	28.35	413.05	8340.75	840.75	27.53	413.87	--	--	--	--
3	850.53	8230.11	829.26	21.27	420.13	8231.68	829.87	20.66	420.75	8237.07	830.18	20.35	421.05	8267.85	833.33	17.20	424.20
4	813.57	7932.42	798.90	14.67	426.73	7926.12	798.71	14.86	426.55	7918.39	797.68	15.89	425.52	7931.7	799.05	14.52	426.89
5	792.89	7702.15	775.42	17.47	423.93	7696.27	775.28	17.61	423.79	7700.32	775.44	17.45	423.96	7708.44	776.29	16.60	424.80
6	733.26	7129.15	716.99	16.27	425.13	7121.02	716.62	16.64	424.76	7115.59	715.82	17.44	423.96	7131.49	717.45	15.81	425.60
7	695.28	6728.33	676.11	19.17	422.24	6726.65	676.40	18.88	422.52	6725.92	676.08	19.20	422.21	6801.65	683.82	11.46	429.94
8	624.5	6044.18	606.35	18.15	423.25	6043.36	606.72	17.78	423.63	6039.04	606.04	18.46	422.94	6156.22	618.00	6.50	434.90
9	589.28	5692.03	570.44	18.84	422.56	5690.22	570.71	18.57	422.83	5689.11	570.36	18.92	422.48	5903.19	592.20	-2.92	444.32
10	566.78	5451.57	545.92	20.86	420.54	5452.54	546.47	20.31	421.10	5455.78	546.56	20.22	421.18	5554.28	556.62	10.16	431.24
11	524.65	5044.58	504.42	20.23	421.17	5045.2	504.94	19.71	421.69	5045.45	504.72	19.93	421.47	5132.75	513.63	11.02	430.39
12	502.91	4848.13	484.38	18.53	422.88	4847.57	484.78	18.13	423.28	4844.47	484.22	18.69	422.72	5035.69	503.74	-0.83	442.23
13	467.93	4510.68	449.97	17.96	423.45	4512.85	450.65	17.28	424.12	4508.31	449.95	17.98	423.42	4690.03	468.49	-0.56	441.96
14	430.9	4180.13	416.27	14.63	426.77	4178.73	416.58	14.32	427.08	4169.08	415.35	15.55	425.86	4314.68	430.21	0.69	440.72
15	389.63	3777.32	375.19	14.44	426.96	3776.13	375.53	14.10	427.30	3621.43	359.51	30.12	411.28	3798.19	377.55	12.08	429.32
16	342.83	3318.85	328.44	14.39	427.01	3318.73	328.88	13.95	427.46	3304.45	327.18	15.65	425.76	3375.21	334.41	8.42	432.99
17	297.42	2872.87	282.96	14.46	426.94	2879.9	284.13	13.29	428.12	2878.23	283.72	13.70	427.70	2892.06	285.14	12.28	429.13
18	232.9	2246.24	219.06	13.84	427.56	2244.74	219.37	13.53	427.87	2244.58	219.11	13.79	427.61	2253.42	220.02	12.88	428.52
19	211.75	2044.48	198.49	13.26	428.14	2044.87	198.98	12.77	428.64	2042.9	198.54	13.21	428.19	2050.79	199.36	12.39	429.01
20	154.03	1484.85	141.42	12.61	428.79	1495.69	142.98	11.05	430.36	1494.05	142.57	11.46	429.94	1535.1	146.77	7.26	434.14
21	68.16	681.85	59.54	8.62	432.78	686.13	60.43	7.73	433.67	690.47	60.63	7.53	433.87	678.36	59.41	8.75	432.65

Notes for Calculation:	Q1 2022	Q2 2022	Q3 2022	Q4 2022
P_{atm} (average), kPa	98.01	93.54	95.92	95.79
Ground Surface Elevation, mASL	441.403			

¹ Values recorded during Q4 2022 at IG_BH03 are flagged and interpreted to not be representative of the in-situ borehole conditions due to equipment issues and poor borehole conditions encountered.

Table B.3: Fluid Pressure, Calculated Pressure Head(Ψ)and Calculated Freshwater Head (H_f) for IG_BH05

Port No.	True Port Depth (m BGS)	Mar-22 (Q1)				Jun-22 (Q2)				Sep-22 (Q3)				Dec-22 (Q4)			
		Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m ASL)	Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m ASL)	Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m ASL)	Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m ASL)
1	923.15	9068.26	914.63	8.52	423.77	9052.29	913.35	9.80	422.49	9047.75	912.90	10.25	422.04	9052.88	913.21	9.94	422.35
2	907.47	8899.54	897.42	10.05	422.24	8894.21	897.23	10.24	422.05	8880.17	895.81	11.66	420.63	8874.17	894.99	12.48	419.81
3	865.06	8516.1	858.32	6.74	425.55	8473.44	854.32	10.74	421.55	8499.94	857.04	8.02	424.27	8495.66	856.39	8.67	423.62
4	806.5	7936.99	799.27	7.23	425.06	7888.1	794.63	11.87	420.42	7924.1	798.32	8.18	424.11	7918.67	797.55	8.95	423.34
5	798.79	7789.62	784.24	14.55	417.74	7780.25	783.63	15.16	417.13	7775.05	783.12	15.67	416.62	7749.31	780.28	18.51	413.78
6	746.43	7232.98	727.48	18.95	413.34	7159.26	720.31	26.12	406.17	7147.49	719.12	27.31	404.98	7187.71	723.01	23.42	408.87
7	734.54	7122.18	716.18	18.36	413.93	6955.54	699.54	35.00	397.29	7005.95	704.69	29.85	402.44	7070.51	711.06	23.48	408.81
8	686.45	6683.67	671.47	14.98	417.31	6633.04	666.65	19.80	412.49	6598.62	663.15	23.30	408.99	6624.8	665.61	20.84	411.45
9	634.09	6160.37	618.10	15.99	416.30	6110.47	613.36	20.73	411.56	6077.73	610.04	24.05	408.24	6106.61	612.77	21.32	410.97
10	592.48	5776.51	578.96	13.52	418.77	5754.25	577.04	15.44	416.85	5765.38	578.19	14.29	418.00	5761.7	577.60	14.88	417.41
11	585.33	5675.67	568.68	16.65	415.64	5671.89	568.64	16.69	415.60	5670.55	568.52	16.81	415.48	5675.17	568.78	16.55	415.74
12	548.51	5334.83	533.92	14.59	417.70	5311.34	531.87	16.64	415.65	5326.12	533.39	15.12	417.17	5324.53	533.02	15.49	416.80
13	505.99	4926.12	492.24	13.75	418.54	4875.51	487.43	18.56	413.73	4919.31	491.91	14.08	418.21	4909.32	490.68	15.31	416.98
14	454.95	4405.82	439.19	15.76	416.53	4374.61	436.35	18.60	413.69	4396.19	438.57	16.38	415.91	4390.72	437.80	17.15	415.14
15	399.56	3823.35	379.79	19.77	412.52	3821.55	379.95	19.61	412.68	3821.49	379.96	19.60	412.69	3824.86	380.09	19.47	412.82
16	348.37	3326.6	329.13	19.24	413.05	3333.08	330.14	18.23	414.06	3324.08	329.24	19.13	413.16	3328.81	329.51	18.86	413.43
17	305.2	2917.5	287.42	17.78	414.51	2925.16	288.55	16.65	415.64	2912.24	287.24	17.96	414.33	2918.53	287.67	17.53	414.76
18	292.42	2786.19	274.03	18.39	413.90	2786.69	274.43	17.99	414.30	2781.05	273.86	18.56	413.73	2791.27	274.70	17.72	414.57
19	246.98	2341.04	228.63	18.35	413.94	2340.66	228.94	18.04	414.25	2334.42	228.32	18.66	413.63	2339.36	228.61	18.37	413.92
20	211.41	1991.1	192.95	18.46	413.83	1998.28	194.03	17.38	414.91	1985.39	192.73	18.68	413.61	1994.18	193.41	18.00	414.29
21	168.82	1568.49	149.85	18.97	413.32	1571.26	150.48	18.34	413.95	1563.48	149.71	19.11	413.18	1574.7	150.64	18.18	414.11
22	145.94	1366.28	129.23	16.71	415.58	1369.42	129.90	16.04	416.25	1357.71	128.72	17.22	415.07	1360.61	128.81	17.13	415.16
23	93.69	856.72	77.27	16.42	415.87	857	77.65	16.04	416.25	841.29	76.06	17.63	414.66	857.59	77.51	16.18	416.11
24	85.09	786.62	70.12	14.97	417.32	789.55	70.77	14.32	417.97	770.35	68.83	16.26	416.03	779.76	69.58	15.51	416.78
25	66	604.75	51.58	14.42	417.87	618.08	53.29	12.71	419.58	591.02	50.54	15.46	416.83	602.85	51.54	14.46	417.83

Notes for Calculation:	Q1 2022	Q2 2022	Q3 2022	Q4 2022
P_{atm} (average), kPa	98.95	95.54	95.40	97.47
Ground Surface Elevation, mASL	432.29			

Table B.4: Fluid Pressure, Calculated Pressure Head(Ψ)and Calculated Freshwater Head (H_f) for IG_BH06

Port No.	True Port Depth (m BGS)	Mar-22 (Q1)				Jun-22 (Q2)				Sep-22 (Q3)				Dec-22 (Q4)			
		Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m ASL)	Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m ASL)	Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m ASL)	Fluid Pressure (kPa)	Ψ (m)	Water Level (m BGS)	H_f (m ASL)
1	919.41	--	--	--	--	9167.46	925.09	-5.68	423.42	9174.47	925.70	-6.29	424.03	9179.38	926.26	-6.85	424.59
2	880.65	--	--	--	--	8784.19	886.00	-5.35	423.09	8790.04	886.50	-5.85	423.59	8791.32	886.69	-6.04	423.78
3	842.46	--	--	--	--	8399.23	846.75	-4.29	422.03	8406.81	847.42	-4.96	422.70	8409.51	847.76	-5.30	423.04
4	791.6	--	--	--	--	7866.67	792.44	-0.84	418.58	7853.76	791.03	0.57	417.17	7883.77	794.14	-2.54	420.28
5	769.09	--	--	--	--	7628.98	768.20	0.89	416.85	7621.21	767.31	1.78	415.96	7635.66	768.84	0.25	417.49
6	740.28	--	--	--	--	7339.97	738.73	1.55	416.19	7342.18	738.86	1.42	416.32	7341.78	738.88	1.40	416.34
7	686.61	--	--	--	--	6795.54	683.21	3.40	414.34	6762.87	679.79	6.82	410.92	6754.55	678.99	7.62	410.12
8	668.15	--	--	--	--	6597.5	663.02	5.13	412.61	6117.97	614.02	54.13	363.61	6186.87	621.11	47.04	370.70
9	652.47	--	--	--	--	6436.79	646.63	5.84	411.90	6443.19	647.19	5.28	412.46	6435.52	646.46	6.01	411.73
10	638.37	--	--	--	--	6302.11	632.90	5.47	412.27	6308.17	633.42	4.95	412.79	6305.82	633.24	5.13	412.61
11	584.64	--	--	--	--	5777.45	579.40	5.24	412.50	5777.91	579.35	5.29	412.45	5774.73	579.08	5.56	412.18
12	528	--	--	--	--	5207.44	521.27	6.73	411.01	5207.98	521.23	6.77	410.97	5207.36	521.22	6.78	410.96
13	478.5	--	--	--	--	4728.46	472.43	6.07	411.67	4720.37	471.51	6.99	410.75	4718.32	471.35	7.15	410.59
14	454.44	--	--	--	--	4490.71	448.18	6.26	411.48	4492.44	448.26	6.18	411.56	4488.08	447.87	6.57	411.17
15	431.77	--	--	--	--	4270.76	425.75	6.02	411.72	4273.13	425.90	5.87	411.87	4269.77	425.61	6.16	411.58
16	382.27	--	--	--	--	3784.37	376.16	6.11	411.63	3788.55	376.48	5.79	411.95	3785.13	376.19	6.08	411.66
17	342.64	--	--	--	--	3400.61	337.02	5.62	412.12	3403.25	337.19	5.45	412.29	3398.76	336.79	5.85	411.89
18	259.3	--	--	--	--	2581.34	253.48	5.82	411.92	2584.21	253.67	5.63	412.11	2581.51	253.46	5.84	411.90
19	199.93	--	--	--	--	2003.89	194.59	5.34	412.40	2007.45	194.86	5.07	412.67	2003.26	194.49	5.44	412.30
20	148.98	--	--	--	--	1510.1	144.24	4.74	413.00	1511.43	144.28	4.70	413.04	1509.35	144.12	4.86	412.88
21	137.63	--	--	--	--	1411.14	134.15	3.48	414.26	1394.23	132.33	5.30	412.44	1395.59	132.52	5.11	412.63
22	76.73	--	--	--	--	827.77	74.66	2.07	415.67	822.01	73.98	2.75	414.99	802.21	72.01	4.72	413.02

Notes for Calculation:	Q1 2022	Q2 2022	Q3 2022	Q4 2022
P_{atm} (average), kPa	--	95.60	96.56	96.00
Ground Surface Elevation, mASL	417.74			

Appendix C

Groundwater Chemistry Results

Borehole ID			IG_BH01					IG_BH03				IG_BH05				IG_BH06	
Sample ID			IG_BH01_GW032	IG_BH01_GW033	IG_BH01_GW035	IG_BH01_GW036	IG_BH01_GW028*	IG_BH03_GW013	IG_BH03_GW016	IG_BH03_GW017	IG_BH03_GW019**	IG_BH05_GW001	IG_BH05_GW002	IG_BH05_GW005	IG_BH05_GW011	IG_BH06_GW001**	
Interval ID (Port Depth m BGS)			IG_BH01_T_INT_004 (769.06)	IG_BH01_T_INT_004 (769.06)	IG_BH01_T_INT_002 (888.49)	IG_BH01_T_INT_002 (888.49)	IG_BH01_T_INT_007 (828.23)	IG_BH03_T_INT_002 (868.28)	IG_BH03_T_INT_002 (868.28)	IG_BH03_T_INT_002 (868.28)	IG_BH03_T_INT_021 (68.16)	IG_BH05_T_INT_007 (734.54)	IG_BH05_T_INT_007 (734.54)	IG_BH05_T_INT_007 (734.54)	IG_BH05_T_INT_005 (798.79)	IG_BH06_T_INT_008 (668.15)	
	Reportable Detection Limit ¹ / Range	Units	Mar-22 (Q1)	Jun-22 (Q2)	Sep-22 (Q3)	Dec-22 (Q4)	Dec-22 (Q4)	Mar-22 (Q1)	Jun-22 (Q2)	Sep-22 (Q3)	Dec-22 (Q4)	Mar-22 (Q1)	Jun-22 (Q2)	Sep-22 (Q3)	Dec-22 (Q4)	Dec-22 (Q4)	
Field Measurements																	
Field Multimeter pH	--	--	6.95	8.22	8.80	8.48	8.08	6.97	7.47	7.13	8.10	6.73	6.98	8.17	7.58	8.34	
Field Multimeter Temperature	-10 to 55	Degrees C	6.36	12.32	12.18	8.19	3.88	5.71	10.04	19.95	3.19	5.99	10.97	11.90	16.78	9.03	
Field Multimeter EC	100	mS/cm	21.4	19.9	14	35.2	17.0	41.2	39.4	46.3	2.9	5.54	13.9	17.3	13	0.873	
Field Multimeter ORP	2,000	mV	43	209	-136	106	-35	61	106	-177	215	40	105	159	188	96	
Field Multimeter DO	50	mg/L	0.00	0.00	0.00	0.00	0.00	2.83	0.00	0.00	3.15	0.00	0.00	0.00	6.52	0.71	
Field Multimeter Turbidity	800	NTU	27.6	56.1	29.9	196.0	14.7	45.8	346	14.8	497.0	7.8	121.0	24.3	646	25.7	
Field Multimeter TDS	130	g/L	13.40	12.40	8.71	21.50	--	25.10	24.0	28.3	1.8	3.49	8.64	10.7	8.27	0.559	
Field Fluorescein	0.4	ppb	5.665	4.092	49.10	1.922	4.095	5.502	4.575	2.065	10.34	37.79	5.430	2.212	4.914	110.9	
Field Alkalinity	10 to 4000	mg/L CaCO3	11	8	18	15.0	--	74.0	106	18.0	44	206	235	180	158	59	
Field Density	SG	--	1.017	1.013	1.012	1.025	1.015	1.035	1.030	1.037	1.006	1.005	1.012	1.011	1.013	1.007	
Field Analy. DO	1.100	mg/L	0.161	0.631	0.631	>1.100	--	>1.100	0.417	0.602	--	>1.100	0.374	0.427	0.234	0.96	
Field Analy. Ferrous	3.00	mg/L	1.18	0.27	2.19	0.02	--	1.29	1.43	2.07	1.79	2.85	7.50*	2.79*	8.90*	0.00	
Field Analy. Sulphide	0.70	mg/L	0.03	0.05	0.09	0.41	--	0.48	0.57	0.31	0.53	0.05	2.10*	0.90*	1.15*	0.04	
Laboratory Measurements - Physicochemical Parameter, Major Anions and Nutrients																	
pH	--	--	7.19	6.72	7.23	7.65	--	6.94	6.86	6.3	--	6.64	6.6	7.27	6.95	--	
Alkalinity-Bicarbonate	1.0	mg/L	9.1	4.7	25	6.2	--	73	66	58	--	220	230	190	150	--	
Alkalinity-Carbonate	1.0	mg/L	<1.0	<1.0	<1.0	<1.0	--	<1.0	<1.0	<1.0	--	<1.0	<1.0	<1.0	<1.0	--	
Alkalinity-Hydroxide	1.0	mg/L	<1.0	<1.0	<1.0	<1.0	--	<1.0	<1.0	<1.0	--	<1.0	<1.0	<1.0	<1.0	--	
Alkalinity-Total	1.0	mg/L	9.1	4.7	25	6.2	--	73	66	58	--	220	230	190	150	--	
Total Ammonia as N (NH4+NH3)	0.05	mg/L	0.069	0.16	0.23	--	0.7	--	0.63	0.63	--	0.074	0.1	--	0.17	--	
Dissolved Bromide (Br)	10.0	mg/L	180	<400	86	290	--	440	390	290	--	40	72	140	140	--	
Dissolved Chloride (Cl)	1.0	mg/L	9900	9000	3300	19000	--	21000	20000	21000	--	1900	5200	6600	7000	--	
Fluoride (F)	0.1	mg/L	0.82	0.97	0.33	0.67	--	0.1	0.13	0.1	--	0.14	0.20	0.27	0.21	--	
Dissolved Iodide (I)	0.1	mg/L	0.57	<2.0	<10	<10	--	<10.0	<2.0	<10	--	<1.0	<10	<10	<10	--	
Nitrate (NO3)	0.1	mg/L	<0.10	<0.10	<0.10	<0.10	--	<0.1	<0.50	<0.10	--	0.16	0.10	<0.10	<0.10	--	
Nitrite (NO2)	0.0	mg/L	<0.010	<0.010	<0.010	<0.010	--	<0.01	<0.050	<0.010	--	0.03	0.02	<0.010	<0.010	--	
Nitrate + Nitrite	1.0	mg/L	<0.10	<0.10	<0.10	<0.10	--	<0.1	<0.50	<0.10	--	0.19	0.12	<0.10	<0.10	--	
Total Kjeldahl Nitrogen (TKN)	0.1	mg/L	<2.0	4.2	2.7	8.2	--	5.8	8.8	4.0	--	<1.0	0.63	1.8	2.2	--	
Total Nitrogen (N)	2.0	mg/L	<2.0	4.2	2.7	8.2	--	5.8	8.8	4.0	--	<1.0	0.75	1.8	2.2	--	
OrthoPhosphate (P)	0.01	mg/L	<0.010	0.013	<0.010	<0.010	--	0.0	<0.010	0.65	--	<0.10	<0.010	<0.010	0.011	--	
Total Phosphorus (Ptot)	0.2	mg/L	<0.10	0.38	<0.10	0.14	--	0.4	<0.10	1.3	--	0.083	<0.10	0.16	0.18	--	
Dissolved Sulphate (SO4)	10.0	mg/L	190	<400	110	<400	--	<40	<400	<10	--	67	55	41	55	--	
Sulphide as S	0.02	mg/L	<0.020	<0.020	<0.020	<0.020	--	<0.02	<0.020	<0.020	--	<0.020	0.45	0.7	<0.020	--	
Dissolved Organic Carbon (DOC)	1.0	mg/L	1.3	0.55	3.1	3.7	--	120.0	110	110	--	200	120	59	66	--	
Total Organic Carbon (TOC)	1.0	mg/L	1.2	1.3	3.4	2.3	--	120.0	110	110	--	190	130	65	76	--	
Total Inorganic Carbon (C)	1.0	mg/L	<1.0	<1.0	<1	<1	--	1.0	2	4.0	--	18	23	36	73	--	
Reactive Silica (SiO2)	0.25	mg/L	34	12	19	83	--	47	41	31	--	14	23	31	7.4	--	
Laboratory Measurements - Metals																	
Dissolved Aluminum (Al)	0.0049	mg/L	<0.025	<0.025	0.012	<0.049	--	<0.025	<0.049	0.026	--	<0.0049	<0.025	0.011	<0.025	--	
Dissolved Arsenic (As)	0.001	mg/L	<0.005	<0.005	<0.001	<0.005	--	<0.005	<0.01	<0.005	--	<0.001	<0.005	<0.001	<0.005	--	
Dissolved Barium (Ba)	0.002	mg/L	0.27	0.31	0.37	0.25	--	0.4	0.35	0.35	--	0.19	0.3	0.31	0.33	--	
Dissolved Bismuth (Bi)	0.001	mg/L	<0.005	<0.005	<0.001	<0.005	--	<0.005	<0.01	<0.005	--	<0.001	<0.005	<0.001	<0.005	--	
Dissolved Boron (B)	0.01	mg/L	0.34	0.33	0.14	0.47	--	0.30	0.32	0.27	--	0.25	0.32	0.31	0.42	--	
Dissolved Cadmium (Cd)	0.00045	mg/L	<0.00045	<0.00045	<0.00009	<0.00009	--	<0.00045	<0.0009	<0.00045	--	<0.00009	<0.00045	<0.00009	<0.00045	--	
Dissolved Calcium (Ca)	1.0	mg/L	4700	4900	2700	8000	--	11000	11000	11000	--	930	2500	3200	3400	--	
Dissolved Cesium (Cs)	0.0002	mg/L	<0.002	<0.002	<0.002	<0.002	--	<0.002	<0.002	<0.002	--	<0.002	<0.002	<0.002	<0.002	--	
Dissolved Chromium (Cr)	0.005	mg/L	<0.025	<0.025	<0.005	<0.05	--	<0.025	<0.050	<0.025	--	<0.005	<0.025	<0.005	<0.025	--	
Dissolved Cobalt (Co)	0.0005	mg/L	<0.0025	<0.0025	<0.005	<0.005	--	<0.0025	<0.005	<0.0025	--	0.0027	<0.0025	<0.0005	<0.0025	--	
Dissolved Copper (Cu)	0.0009	mg/L	<0.0045	<0.0045	<0.0009	<0.009	--	<0.0045	<0.009	<0.0045	--	<0.0009	<0.0045	<0.0009	<0.0045	--	
Dissolved Iron (Fe)	0.02	mg/L	0.08	0.06	0.1	<0.1	--	0.2	0.2	0.1	--	0.0	0.2	0.2	0.19	--	
Dissolved Lead (Pb)	0.0005	mg/L	<0.0025	<0.0025	<0.0005	<0.005	--	<0.0025	<0.005	<0.0025	--	<0.0005	<0.0025	<0.0005	<0.0025	--	
Dissolved Lithium (Li)	0.005	mg/L	0.063	0.058	0.044	0.067	--	0.3	0.26	0.26	--	0.074	0.1	0.059	0.073	--	
Dissolved Magnesium (Mg)	0.05	mg/L	1.0	0.75	2.7	4.3	--	3.7	2.9	3.2	--	6.1	7.5	5.7	11	--	
Dissolved Nickel (Ni)	0.001	mg/L	<0.005	<0.005	0.0027	<0.01	--	0.0	<0.01	0.0051	--	0.0086	<0.005	0.0043	<0.005	--	
Dissolved Potassium (K)	0.2	mg/L	13	19	13	14	--	14	14	12	--	14	19	19	16	--	
Dissolved Rubidium (Rb)	0.0002	mg/L	0.015	0.015	0.055	0.031	--	0.0	0.045	0.044	--	0.02	0.0	0.028	0.022	--	
Total Ruthenium (Ru)	0.002	mg/L	<0.002	<0.002	<0.002	0.00011	--	<0.002	<0.002	<0.002	--	<0.002	<0.002	<0.002	<0.002	--	
Dissolved Selenium (Se)	0.002	mg/L	<0.01	<0.01	<0.002	<0.02	--	<0.01	<0.02	<0.01	--	<0.002	<0.01	<0.002	<0.01	--	
Dissolved Silicon (Si)	0.05	mg/L	3.9	3.2	3.2	4	--	6.1	5.8	5.4	--	10	11.0	12	9.9	--	
Dissolved Sodium (Na)	0.1	mg/L	780	700	420	1300	--	810.0	740	760	--	240	510.0	610	680	--	
Dissolved Strontium (Sr)	0.001	mg/L	61	60	37	140	--	130.0	140	140	--	11	30.0	39	40	--	
Dissolved Sulphur (S)	0.5	mg/L	71	76	36	140	--	<5.0	<5.0	<5	--	11	15	16	17	--	
Dissolved Thorium (Th)	0.002	mg/L	<0.01	<0.01	<0.002	<0.02	--	<0.01	<0.02	<0.01	--	<0.002	<0.01	<0.002	<0.01	--	
Dissolved Uranium (U)	0.0001	mg/L	<0.0005	<0.0005	0.0004	<0.001	--	<0.0005	<0.001	<0.0005	--	0.002	0.0	0.00039	<0.0005	--	
Dissolved Zirconium (Zr)	0.001	mg/L	<0.005	<0.005	<0.001	<0.01	--	<0.005	<0.01	<0.005	--	<0.001	<0.005	<0.001	<0.005	--	
Laboratory Measurements -																	

Appendix D

QA/QC Results and Calculations

Table D.1: Relative Percent Difference (RPD) Calculation

Parameter	Units	RDL	Q2 (June) 2022								Q3 (September) 2022								Q4 (December) 2022								
			IG_BH01_GW033	IG_BH01_GW034	Difference	Average	5 X RDL	RPD %			IG_BH03_GW017	IG_BH03_GW018	Difference	Average	5 X RDL	RPD %			IG_BH05_GW011	IG_BH05_GW012	Difference	Average	5 X RDL	RPD %			
Laboratory Measurements - Physicochemical Parameter, Major Anions and Nutrients																											
Alkalinity-Bicarbonate	mg/L	1.00	4.7	5.7	1	5.2	5	19	58.0	64	6	61	5	10	190.0	200	10	195	5	5	150.0	150	0	150	5	0	
Alkalinity-Carbonate	mg/L	1.00	<1.0	<1.0	--	--	5	--	<1.0	<1.0	--	--	5	--	<1.0	<1.0	--	--	5	--	<1.0	<1.0	--	--	5	--	
Alkalinity-Hydroxide	mg/L	1.00	<1.0	<1.0	--	--	5	--	<1.0	<1.0	--	--	5	--	<1.0	<1.0	--	--	5	--	<1.0	<1.0	--	--	5	--	
Alkalinity-Total	mg/L	1.00	4.70	5.7	1	5.2	5	19	58.00	64	6	61	5	10	190.00	200	10	195	5	5	150.00	150	0	150	5	0	
Total Ammonia as N (NH4+NH3)	mg/L	0.05	--	--	--	0.25	--	--	0.63	0.61	0.02	0.62	0.25	3	0.20	0.21	0.01	0.205	0.25	5	0.17	0.12	0.05	0.145	0.25	--	
Dissolved Bromide (Br)	mg/L	10.00	<400	<400	--	--	50	--	390	390	--	--	50	--	140	140	--	--	50	--	140	140	--	--	50	--	
Dissolved Chloride (Cl)	mg/L	1.00	9.000	9.700	700	9.350	5	7	21.000	21.000	0	21.000	5	0	6.600	6.400	200	6.500	5	3	7.000	7.000	0	7.000	5	0	
Fluoride (F)	mg/L	0.10	0.970	0.92	0.05	0.945	0.5	5	0.100	0.11	0.01	0.105	0.5	10	0.270	0.25	0.02	0.26	0.5	8	0.210	0.22	0.01	0.215	0.5	--	
Dissolved Iodide (I)	mg/L	0.10	<2.0	<2.0	--	--	0.5	--	<10	<10	--	--	0.5	--	<10	<10	--	--	0.5	--	<10	<10	--	--	0.5	--	
Nitrate (NO3)	mg/L	0.10	<0.10	<0.10	--	--	0.5	--	<0.10	<0.10	--	--	0.5	--	<0.10	<0.10	--	--	0.5	--	<0.10	<0.10	--	--	0.5	--	
Nitrite (NO2)	mg/L	0.01	<0.010	<0.010	--	--	0.05	--	<0.010	<0.050	--	--	0.05	--	<0.010	<0.010	--	--	0.05	--	<0.010	<0.010	--	--	0.05	--	
Nitrate + Nitrite	mg/L	0.10	<0.10	<0.10	--	--	0.5	--	<0.10	<0.50	--	--	0.5	--	<0.10	<0.10	--	--	0.5	--	<0.10	<0.10	--	--	0.5	--	
Total Kjeldahl Nitrogen (TKN)	mg/L	1.00	4.2	3.1	1.1	3.65	5	--	4.0	5.9	1.9	4.95	5	--	1.8	2	0.2	1.9	5	--	2.2	3	0.8	2.6	5	--	
Total Nitrogen (N)	mg/L	2.00	4.2	3.1	1.1	3.65	10	--	4	5.9	1.9	4.95	10	--	1.8	2	0.2	1.9	10	--	2.2	3	0.8	2.6	10	--	
Orthophosphate (P)	mg/L	0.01	0.013	0.011	0.002	0.012	0.05	--	0.65	0.88	0.23	0.765	0.05	30	<0.010	0.01	--	0.05	--	0.011	<0.010	--	--	0.05	--		
Total Phosphorus (Ptot)	mg/L	0.10	0.38	0.23	0.15	0.305	0.5	--	1.3	1.2	0.1	1.25	0.5	8	0.16	0.14	0.02	0.15	0.5	--	0.18	0.1	0.08	0.14	0.5	--	
Dissolved Sulphate (SO4)	mg/L	10.00	<400	<400	--	--	50	--	<10	<10	--	--	50	--	41	41	--	50	--	55	59	--	--	50	--		
Sulphide as S	mg/L	0.02	<0.020	<0.020	--	--	0.1	--	<0.020	<0.020	--	--	0.1	--	0.69	0.66	--	0.1	--	<0.020	<0.020	--	--	0.1	--		
Dissolved Organic Carbon (DOC)	mg/L	1.00	0.55	0.51	0.04	0.53	5	8	110	110	0	110	5	0	59	58	1	58.5	5	2	66	65	1	65.5	5	2	
Total Organic Carbon (TOC)	mg/L	1.00	<1	<1	--	--	5	--	4	--	--	--	5	--	36	35	--	5	--	23	23	--	--	5	--		
Total Inorganic Carbon (C)	mg/L	1.00	1.3	1.2	0.1	1.25	5	--	110	110	0	110	5	0	65	65	0	65	5	0	76	76	0	76	5	0	
Reactive Silica (SiO2)	mg/L	0.25	12	27	15	19.5	1.25	77	31	29	2	30	1.25	7	31	27	4	29	1.25	14	7.5	19	11.5	13.25	1.25	67	
Laboratory Measurements - Metals																											
Dissolved Aluminum (Al)	mg/L	0.0049	<0.025	<0.025	--	--	0.0245	--	0.026	0.03	--	--	0.0245	--	0.011	0.011	--	--	0.0245	--	<0.025	<0.025	--	--	0.0245	--	
Dissolved Arsenic (As)	mg/L	0.001	<0.005	<0.005	--	--	0.005	--	<0.005	<0.005	--	--	0.005	--	<0.001	<0.001	--	--	0.005	--	<0.005	<0.005	--	--	0.005	--	
Dissolved Barium (Ba)	mg/L	0.002	0.31	0.34	0.03	0.325	0.01	9	0.35	0.35	0	0.35	0.01	0	0.31	0.31	0	0.31	0.01	0	0.33	0.32	0.01	0.325	0.01	3	
Dissolved Bismuth (Bi)	mg/L	0.001	<0.005	<0.005	--	--	0.005	--	<0.005	<0.005	--	--	0.005	--	<0.001	<0.001	--	--	0.005	--	<0.005	<0.005	--	--	0.005	--	
Dissolved Boron (B)	mg/L	0.01	0.33	0.36	0.03	0.345	0.05	9	0.27	0.28	0.01	0.275	0.05	4	0.31	0.33	0.02	0.32	0.05	6	0.42	0.42	0	0.42	0.05	0	
Dissolved Cadmium (Cd)	mg/L	0.00009	<0.00045	<0.00045	--	--	0.00045	--	<0.00045	<0.00045	--	--	0.00045	--	<0.00009	<0.00009	--	--	0.00045	--	<0.00045	<0.00045	--	--	0.00045	--	
Dissolved Calcium (Ca)	mg/L	1.0	4900	5100	200	5000	5	4	11000	11000	0	11000	0	0	3200	3300	100	3250	5	3	3400	3400	0	3400	5	0	
Dissolved Cesium (Cs)	mg/L	0.0002	<0.001	<0.001	--	--	0.001	--	0.0014	0.0013	--	--	0.001	--	<0.0002	<0.0002	--	--	0.001	--	<0.001	<0.001	--	--	0.001	--	
Dissolved Chromium (Cr)	mg/L	0.005	<0.025	<0.025	--	--	0.025	--	<0.025	<0.025	--	--	0.025	--	<0.005	<0.005	--	--	0.025	--	<0.025	<0.025	--	--	0.025	--	
Dissolved Cobalt (Co)	mg/L	0.0005	<0.0025	<0.0025	--	--	0.0025	--	<0.0025	<0.0025	--	--	0.0025	--	<0.0005	<0.0005	--	--	0.0025	--	<0.0025	<0.0025	--	--	0.0025	--	
Dissolved Copper (Cu)	mg/L	0.0009	<0.0045	<0.0045	--	--	0.0045	--	<0.0045	<0.0045	--	--	0.0045	--	<0.0009	<0.0009	--	--	0.0045	--	<0.0045	<0.0045	--	--	0.0045	--	
Dissolved Iron (Fe)	mg/L	0.02	0.06	0.06	0.01	0.055	0.1	--	1.2	1.2	0	1.2	0.1	0	4.9	5.5	0.6	5.2	0.1	12	13	13	0	13	0.1	0	
Dissolved Lead (Pb)	mg/L	0.0005	<0.0025	<0.0025	--	--	0.0025	--	<0.0025	<0.0025	--	--	0.0025	--	<0.0005	<0.0005	--	--	0.0025	--	<0.0025	<0.0025	--	--	0.0025	--	
Dissolved Lithium (Li)	mg/L	0.005	0.058	0.057	0.001	0.0575	0.025	2	0.26	0.27	0.01	0.265	0.025	4	0.059	0.06	0.001	0.0595	0.025	2	0.073	0.073	0	0.073	0.025	0	
Dissolved Magnesium (Mg)	mg/L	0.05	0.75	0.88	0.13	0.815	0.25	16	3.2	3.4	0.2	3.3	0.25	6	5.7	5.7	0	5.7	0.25	0	11	11	0	11	0.25	0	
Dissolved Nickel (Ni)	mg/L	0.001	<0.005	<0.005	--	--	0.005	--	0.0051	0.0078	--	--	0.005	--	0.0043	0.005	--	--	0.005	--	<0.005	<0.005	--	--	0.005	--	
Dissolved Potassium (K)	mg/L	0.2	13	13	0	13	0	12	12	13	1	12.5	8	8	19	19	0	19	0	16	15	1	15.5	8	6		
Dissolved Rubidium (Rb)	mg/L	0.0002	0.015	0.016	0.001	0.0155	0.001	6	0.044	0.047	0.003	0.0455	0.001	7	0.028	0.028	0	0.028	0.001	0	0.022	0.022	0	0.022	0.001	0	
Total Ruthenium (Ru)	mg/L	0.002	<0.0020	<0.0020	--	--	0.01	--	<0.0020	<0.0020	--	--	0.01	--	<0.0020	<0.0020	--	--	0.01	--	<0.0020	<0.0020	--	--	0.01	--	
Dissolved Selenium (Se)	mg/L	0.002	<0.01	<0.01	--	--	0.01	--	<0.01	<0.01	--	--	0.01	--	<0.002	<0.002	--	--	0.01	--	<0.01	<0.01	--	--	0.01	--	
Dissolved Silicon (Si)	mg/L	0.05	4	4.1	0.1	4.05	0.25	2	5.4	5.4	0	5.4	0.25	0	12	12	0	12	0.25	0	9.9	9.9	0	9.9	0.25	0	
Dissolved Sodium (Na)	mg/L	0.1	700	730	30	715	0.5	4	760	770	10	765	0.5	1	610	620	10	615	0.5	2	680	680	20	670	0.5	3	
Dissolved Strontium (Sr)	mg/L	0.001	60	63	3	61.5	0.005	5	140	140	0	140	0.005	0	39	39	0	39	0.005	0	40	42	2	41	0.005	5	
Dissolved Sulphur (S)	mg/L	0.5	76	76	0	76	2.5	0	<5	<5	--	--	2.5	--	16	19	3	17.5	2.5	17	17	17	0	17	2.5	0	
Dissolved Thorium (Th)	mg/L	0.002	<0.01	<0.01	--	--	0.01	--	<0.01	<0.01	--	--	0.01	--	<0.002	<0.002	--	--	0.01	--	<0.01	<0.01	--	--	0.01	--	
Dissolved Uranium (U)	mg/L	0.0001	<0.0005	<0.0005	--	--	0.0005	--	<0.0005	<0.0005	--	--	0.0005	--	0.00039	0.00042	--	--	0.0005	--	<0.0005	<0.0005	--	--	0.0005	--	
Dissolved Zirconium (Zr)	mg/L	0.001	<0.005	<0.005	--	--	0.005	--	<0.005	<0.005	--	--	0.005	--	<0.001	<0.001	--	--	0.005	--	<0.005	<0.005	--	--	0.005	--	

Legend	
Sample concentration(s) below detection limit so RPD cannot be calculated, or average value below 5X detection limit, or RPD cannot be calculated.	--
Average Value below 5X detection limit	XX
Calculated RPD exceeds 30%	XX
Reported Detection Limit	RDL

Table D.2: Rinstate and Field Blank Sample Results

	Reportable Detection Limit ¹ / Range	Units	Mar-22 (Q1)	Jun-22 (Q2)	Sep-22 (Q3)	Dec-22 (Q4)
Rinstate Sample ID			IG_BH03_GW014	IG_BH05_GW003	IG_BH05_GW007	IG_BH05_GW009
Laboratory Measurements - Physicochemical Parameter, Major Anions and Nutrients						
Dissolved Bromide (Br)	1.0	mg/L	<1.0	<1.0	<1.0	<1.0
Dissolved Chloride (Cl)	1.0	mg/L	<1.0	1.2	13	<1.0
Fluoride (F)	0.1	mg/L	<0.1	<0.1	<0.1	<0.1
Dissolved Iodide (I)	0.1	mg/L	1.3	<0.1	<0.1	<0.1
Nitrate (NO3)	0.1	mg/L	<0.1	<0.1	<0.1	<0.1
Nitrite (NO2)	0.01	mg/L	<0.01	<0.01	<0.01	<0.01
Nitrate + Nitrite	0.1	mg/L	<0.1	<0.1	<0.1	<0.1
OrthoPhosphate (P)	0.01	mg/L	<0.01	<0.01	<0.01	<0.01
Dissolved Sulphate (SO4)	1.0	mg/L	<1.0	<1.0	<1.0	<1.0
Laboratory Measurements - Metals						
Dissolved Aluminum (Al)	0.0049	mg/L	<0.0049	<0.0049	<0.0049	<0.0049
Dissolved Arsenic (As)	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Dissolved Barium (Ba)	0.002	mg/L	<0.002	<0.002	<0.002	<0.002
Dissolved Bismuth (Bi)	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Dissolved Boron (B)	0.01	mg/L	<0.01	<0.01	<0.01	<0.01
Dissolved Cadmium (Cd)	0.00009	mg/L	<0.00009	<0.00009	<0.00009	<0.00009
Dissolved Calcium (Ca)	0.2	mg/L	<0.2	0.48	2.6	1.0
Dissolved Cesium (Cs)	0.0002	mg/L	<0.0002	<0.0002	<0.0002	<0.0002
Dissolved Chromium (Cr)	0.005	mg/L	<0.005	<0.005	<0.005	<0.005
Dissolved Cobalt (Co)	0.0005	mg/L	<0.0005	<0.0005	<0.0005	<0.0005
Dissolved Copper (Cu)	0.0009	mg/L	<0.0009	<0.0009	<0.0009	<0.0009
Dissolved Iron (Fe)	0.02	mg/L	<0.1	<0.02	—	0.04
Dissolved Lead (Pb)	0.0005	mg/L	<0.0005	<0.0005	<0.0005	<0.0005
Dissolved Lithium (Li)	0.005	mg/L	<0.005	<0.005	<0.005	<0.005
Dissolved Magnesium (Mg)	0.05	mg/L	<0.05	<0.05	<0.05	0.1
Dissolved Nickel (Ni)	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Dissolved Potassium (K)	0.2	mg/L	<0.2	<0.2	<0.2	<0.2
Dissolved Rubidium (Rb)	0.0002	mg/L	<0.0002	<0.0002	<0.0002	<0.0002
Dissolved Selenium (Se)	0.002	mg/L	<0.002	<0.002	<0.002	<0.002
Dissolved Silicon (Si)	0.05	mg/L	<0.05	<0.05	<0.05	<0.05
Dissolved Sodium (Na)	0.1	mg/L	<0.1	0.16	0.35	0.3
Dissolved Strontium (Sr)	0.001	mg/L	<0.001	0.006	0.030	0.010
Dissolved Sulphur (S)	0.5	mg/L	<0.5	<0.5	—	<0.5
Dissolved Thorium (Th)	0.002	mg/L	<0.002	<0.002	<0.002	<0.002
Dissolved Uranium (U)	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Dissolved Zirconium (Zr)	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Field Blank Sample ID						
			IG_BH03_GW015	IG_BH05_GW004	IG_BH05_GW008	IG_BH05_GW010
Laboratory Measurements - Isotopes and Radiohalides						
Tritium (3H)	0.8	TU	<0.8	<0.8	<0.8	<0.8
Carbon-13 of DIC (δ13C-DIC)	—	‰ VPDB	-11.1	-11	-11.2	-10.9
Carbon-14 of DIC (14C-DIC)	0.53	pMC (‰)	40.48	38.58	40.68	40.5

— = Not reported or no value measured

¹ Reportable detection limit most commonly used is listed, there are cases where the detection limits were raised due to matrix interference or sample dilution.

Appendix E

Laboratory Reports

**2022 Q1
(March)**

**Attention: Amy Cartier**

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
CANADA K1R 1A2

Your P.O. #: 202031-004
Your Project #: 20-203-1
Site Location: IGNACE, ON
Your C.O.C. #: GFIN-BVL-0005, na

Report Date: 2022/05/10

Report #: R7118336

Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT**BUREAU VERITAS JOB #: C279306****Received: 2022/03/24, 13:44**

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2022/03/28	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	1	N/A	2022/03/29	CAM SOP-00102	APHA 4500-CO2 D
Anions	2	N/A	2022/03/29	CAM SOP-00435	SM 23 4110 B m
Dissolved Organic Carbon (DOC) (3)	1	N/A	2022/05/09	CAM SOP-00446	SM 23 5310 B m
Fluoride	2	2022/03/26	2022/03/28	CAM SOP-00449	SM 23 4500-F C m
Dissolved Metals Analysis by ICPMS	2	2022/03/26	2022/03/30	CAM SOP-00408	EPA 6010D m
Dissolved Metals by ICPMS	1	N/A	2022/03/29	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS	1	N/A	2022/03/30	CAM SOP-00447	EPA 6020B m
Iodide, Thiosulphate, Thiocyanate (1)	2	N/A	2022/03/30	CAL SOP-00057	Dionex #034035 R09 m
Total Extractable Elements by ICP-MS (2, 4)	1	2022/04/13	2022/04/19	STL SOP-00071	MA.200-Mét. 1.2 R5 m
Silica (Reactive) (1)	1	N/A	2022/04/03	AB SOP-00011	EPA370.1 R1978 m
Total Ammonia-N	1	N/A	2022/03/30	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (5)	2	N/A	2022/03/29	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	1	2022/03/26	2022/03/28	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	2	N/A	2022/03/28	CAM SOP-00461	EPA 365.1 m
Sulphide	1	N/A	2022/03/29	CAM SOP-00455	SM 23 4500-S G m
Total Inorganic Carbon (TIC)	1	N/A	2022/03/30	CAM SOP-00433	SM 23 5310 m
Total Kjeldahl Nitrogen in Water	1	2022/03/29	2022/03/31	CAM SOP-00938	OMOE E3516 m
Total Nitrogen (calculated)	1	N/A	2022/03/31	Auto Calc.	
Total Organic Carbon (TOC) (6)	1	N/A	2022/05/09	CAM SOP-00446	SM 23 5310B m
Total Phosphorus (Colourimetric)	1	2022/03/29	2022/03/30	CAM SOP-00407	SM 23 4500 P B H m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.



Your P.O. #: 202031-004
Your Project #: 20-203-1
Site Location: IGNACE, ON
Your C.O.C. #: GFIN-BVL-0005, na

Attention: Amy Cartier

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
CANADA K1R 1A2

Report Date: 2022/05/10

Report #: R7118336

Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BUREAU VERITAS JOB #: C279306

Received: 2022/03/24, 13:44

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

(1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE, Calgary, AB, T2E 6P8

(2) This test was performed by Bureau Veritas Montreal, 889 Montée de Liesse, Ville St-Laurent, QC, H4T 1P5

(3) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.

(4) Non-accredited test method

(5) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

(6) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

Encryption Key

Katherine Szozda

Katherine Szozda
Project Manager
10 May 2022 10:00:53

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Katherine Szozda, Project Manager

Email: Katherine.Szozda@bureauveritas.com

Phone# (613)274-0573 Ext:7063633

=====

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



Bureau Veritas Job #: C279306
Report Date: 2022/05/10

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		SEO811			SEO812			SEO812		
Sampling Date		2022/03/22 10:15			2022/03/22 14:00			2022/03/22 14:00		
COC Number		na			na			na		
	UNITS	IG_BH03_GW014	RDL	QC Batch	IG_BH03_GW013	RDL	QC Batch	IG_BH03_GW013 Lab-Dup	RDL	QC Batch

Calculated Parameters

Bicarb. Alkalinity (calc. as CaCO ₃)	mg/L				73	1.0	7903961			
Carb. Alkalinity (calc. as CaCO ₃)	mg/L				<1.0	1.0	7903961			
Hydrox. Alkalinity (calc. as CaCO ₃)	mg/L				<1.0	1.0	7903961			
Total Nitrogen (N)	mg/L				5.8	5.0	7904166			

Inorganics

Total Ammonia-N	mg/L				0.70	0.050	7909338			
Fluoride (F ⁻)	mg/L	<0.10	0.10	7906077	0.12	0.10	7906077			
Total Inorganic Carbon (C)	mg/L				1	1	7906033	1	1	7906033
Dissolved Iodide	mg/L	1.3	0.10	7916935	<0.10	0.10	7916935			
Total Kjeldahl Nitrogen (TKN)	mg/L				5.8	5.0	7909303			
Dissolved Organic Carbon	mg/L				110	0.80	7980705			
Total Organic Carbon (TOC)	mg/L				120	0.80	7980604			
Orthophosphate (P)	mg/L	<0.010	0.010	7906089	0.027	0.010	7906089			
pH	pH				6.94		7906079			
Total Phosphorus	mg/L				0.39	0.20	7909986			
Reactive Silica (SiO ₂)	mg/L				47	0.25	7920315			
Sulphide	mg/L				<0.020	0.020	7908265			
Alkalinity (Total as CaCO ₃)	mg/L				73	1.0	7906080			
Nitrite (N)	mg/L	<0.010	0.010	7905990	<0.010	0.010	7905990			
Dissolved Chloride (Cl ⁻)	mg/L	<1.0	1.0	7906100	21000	200	7906100	21000	200	7906100
Nitrate (N)	mg/L	<0.10	0.10	7905990	<0.10	0.10	7905990			
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	7905990	<0.10	0.10	7905990			
Dissolved Bromide (Br ⁻)	mg/L	<1.0	1.0	7906100	440	10	7906100	450	10	7906100
Dissolved Sulphate (SO ₄)	mg/L	<1.0	1.0	7906100	<10	10	7906100	<10	10	7906100

Metals

Total Ruthenium (Ru)	ug/L				<2.0	2.0	7947187			
----------------------	------	--	--	--	------	-----	---------	--	--	--

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate



Bureau Veritas Job #: C279306
Report Date: 2022/05/10

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		SEO811		SEO812		
Sampling Date		2022/03/22 10:15		2022/03/22 14:00		
COC Number		na		na		
	UNITS	IG_BH03_GW014	RDL	IG_BH03_GW013	RDL	QC Batch
Metals						
Dissolved Iron (Fe)	mg/L	<0.02	0.02	1.7	0.2	7901847
Dissolved Sulphur (S)	mg/L	<0.5	0.5	<5	5	7901847
Dissolved Aluminum (Al)	ug/L	<4.9	4.9	<25	25	7906085
Dissolved Arsenic (As)	ug/L	<1.0	1.0	<5.0	5.0	7906085
Dissolved Barium (Ba)	ug/L	<2.0	2.0	350	10	7906085
Dissolved Bismuth (Bi)	ug/L	<1.0	1.0	<5.0	5.0	7906085
Dissolved Boron (B)	ug/L	<10	10	300	50	7906085
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	<0.45	0.45	7906085
Dissolved Calcium (Ca)	ug/L	<200	200	11000000	10000	7906085
Dissolved Cesium (Cs)	ug/L	<0.20	0.20	1.3	1.0	7906085
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	<25	25	7906085
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	<2.5	2.5	7906085
Dissolved Copper (Cu)	ug/L	<0.90	0.90	<4.5	4.5	7906085
Dissolved Iron (Fe)	ug/L	<100	100	1500	500	7906085
Dissolved Lead (Pb)	ug/L	<0.50	0.50	<2.5	2.5	7906085
Dissolved Lithium (Li)	ug/L	<5.0	5.0	280	25	7906085
Dissolved Magnesium (Mg)	ug/L	<50	50	3700	250	7906085
Dissolved Nickel (Ni)	ug/L	<1.0	1.0	8.5	5.0	7906085
Dissolved Potassium (K)	ug/L	<200	200	14000	1000	7906085
Dissolved Rubidium (Rb)	ug/L	<0.20	0.20	46	1.0	7906085
Dissolved Selenium (Se)	ug/L	<2.0	2.0	<10	10	7906085
Dissolved Silicon (Si)	ug/L	<50	50	6100	250	7906085
Dissolved Sodium (Na)	ug/L	<100	100	810000	500	7906085
Dissolved Strontium (Sr)	ug/L	<1.0	1.0	130000	5.0	7906085
Dissolved Thorium (Th)	ug/L	<2.0	2.0	<10	10	7906085
Dissolved Uranium (U)	ug/L	<0.10	0.10	<0.50	0.50	7906085
Dissolved Zirconium (Zr)	ug/L	<1.0	1.0	<5.0	5.0	7906085
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						



Bureau Veritas Job #: C279306
Report Date: 2022/05/10

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

TEST SUMMARY

Bureau Veritas ID: SEO811
Sample ID: IG_BH03_GW014
Matrix: Water

Collected: 2022/03/22
Shipped:
Received: 2022/03/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Anions	IC	7906100	N/A	2022/03/29	Lusine Khachatryan
Fluoride	ISE	7906077	2022/03/26	2022/03/28	Surinder Rai
Dissolved Metals Analysis by ICP	ICP	7901847	2022/03/26	2022/03/30	Suban Kanapathipillai
Dissolved Metals by ICPMS	ICP/MS	7906085	N/A	2022/03/29	Prempal Bhatti
Iodide, Thiosulphate, Thiocyanate	IC/EC	7916935	N/A	2022/03/30	Taylor Mullings
Nitrate & Nitrite as Nitrogen in Water	LACH	7905990	N/A	2022/03/29	Samuel Law
Orthophosphate	KONE	7906089	N/A	2022/03/28	Alina Dobreanu

Bureau Veritas ID: SEO812
Sample ID: IG_BH03_GW013
Matrix: Water

Collected: 2022/03/22
Shipped:
Received: 2022/03/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7906080	N/A	2022/03/28	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7903961	N/A	2022/03/29	Automated Statchk
Anions	IC	7906100	N/A	2022/03/29	Lusine Khachatryan
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7980705	N/A	2022/05/09	Anna-Kay Gooden
Fluoride	ISE	7906077	2022/03/26	2022/03/28	Surinder Rai
Dissolved Metals Analysis by ICP	ICP	7901847	2022/03/26	2022/03/30	Suban Kanapathipillai
Dissolved Metals by ICPMS	ICP/MS	7906085	N/A	2022/03/30	Prempal Bhatti
Iodide, Thiosulphate, Thiocyanate	IC/EC	7916935	N/A	2022/03/30	Taylor Mullings
Total Extractable Elements by ICP-MS	ICP/MSMS	7947187	2022/04/13	2022/04/19	Zineb El Ouali
Silica (Reactive)	KONE	7920315	N/A	2022/04/03	Serena Tian
Total Ammonia-N	LACH/NH4	7909338	N/A	2022/03/30	Raiq Kashif
Nitrate & Nitrite as Nitrogen in Water	LACH	7905990	N/A	2022/03/29	Samuel Law
pH	AT	7906079	2022/03/26	2022/03/28	Surinder Rai
Orthophosphate	KONE	7906089	N/A	2022/03/28	Alina Dobreanu
Sulphide	ISE/S	7908265	N/A	2022/03/29	Taslima Aktar
Total Inorganic Carbon (TIC)	TOCV/NDIR	7906033	N/A	2022/03/30	Massarat Jan
Total Kjeldahl Nitrogen in Water	SKAL	7909303	2022/03/29	2022/03/31	Massarat Jan
Total Nitrogen (calculated)	CALC	7904166	N/A	2022/03/31	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	7980604	N/A	2022/05/09	Anna-Kay Gooden
Total Phosphorus (Colourimetric)	LACH/P	7909986	2022/03/29	2022/03/30	Nimarta Singh

Bureau Veritas ID: SEO812 Dup
Sample ID: IG_BH03_GW013
Matrix: Water

Collected: 2022/03/22
Shipped:
Received: 2022/03/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Anions	IC	7906100	N/A	2022/03/29	Lusine Khachatryan
Total Inorganic Carbon (TIC)	TOCV/NDIR	7906033	N/A	2022/03/30	Massarat Jan



Bureau Veritas Job #: C279306
Report Date: 2022/05/10

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

GENERAL COMMENTS

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

Package 1	2.3°C
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Revised Report (2022/05/10): Reworked TOC and DOC analysis per client request
Revised Report (2022/05/06): Sample IDs amended

ANIONS-L: Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Sample SEO812 [IG_BH03_GW013] : Metals Analysis: Due to the sample matrix, the sample required dilution. Detection limits were adjusted accordingly.

Results relate only to the items tested.



Bureau Veritas Job #: C279306
Report Date: 2022/05/10

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

QUALITY ASSURANCE REPORT

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7901847	SUK	Matrix Spike	Dissolved Iron (Fe)	2022/03/30		100	%	80 - 120	
			Dissolved Sulphur (S)	2022/03/30		NC	%	80 - 120	
7901847	SUK	Spiked Blank	Dissolved Iron (Fe)	2022/03/30		101	%	80 - 120	
			Dissolved Sulphur (S)	2022/03/30		102	%	80 - 120	
7901847	SUK	Method Blank	Dissolved Iron (Fe)	2022/03/30	<0.02		mg/L		
			Dissolved Sulphur (S)	2022/03/30	<0.5		mg/L		
7901847	SUK	RPD	Dissolved Iron (Fe)	2022/03/30	NC		%	25	
			Dissolved Sulphur (S)	2022/03/30	0.53		%	25	
7905990	S1L	Matrix Spike	Nitrite (N)	2022/03/29		101	%	80 - 120	
			Nitrate (N)	2022/03/29		101	%	80 - 120	
7905990	S1L	Spiked Blank	Nitrite (N)	2022/03/29		108	%	80 - 120	
			Nitrate (N)	2022/03/29		103	%	80 - 120	
7905990	S1L	Method Blank	Nitrite (N)	2022/03/29	<0.010		mg/L		
			Nitrate (N)	2022/03/29	<0.10		mg/L		
7905990	S1L	RPD	Nitrite (N)	2022/03/29	NC		%	20	
			Nitrate (N)	2022/03/29	1.2		%	20	
7906033	MJ1	Matrix Spike [SEO812-01]	Total Inorganic Carbon (C)	2022/03/30		43 (1)	%	80 - 120	
7906033	MJ1	Spiked Blank	Total Inorganic Carbon (C)	2022/03/30		95	%	80 - 120	
7906033	MJ1	Method Blank	Total Inorganic Carbon (C)	2022/03/30	<1		mg/L		
7906033	MJ1	RPD [SEO812-01]	Total Inorganic Carbon (C)	2022/03/30	0.63		%	20	
7906077	SAU	Matrix Spike	Fluoride (F-)	2022/03/28		102	%	80 - 120	
7906077	SAU	Spiked Blank	Fluoride (F-)	2022/03/28		101	%	80 - 120	
7906077	SAU	Method Blank	Fluoride (F-)	2022/03/28	<0.10		mg/L		
7906077	SAU	RPD	Fluoride (F-)	2022/03/28	3.3		%	20	
7906079	SAU	Spiked Blank	pH	2022/03/28		102	%	98 - 103	
7906079	SAU	RPD	pH	2022/03/28	0.67		%	N/A	
7906080	SAU	Spiked Blank	Alkalinity (Total as CaCO3)	2022/03/28		98	%	85 - 115	
7906080	SAU	Method Blank	Alkalinity (Total as CaCO3)	2022/03/28	<1.0		mg/L		
7906080	SAU	RPD	Alkalinity (Total as CaCO3)	2022/03/28	1.3		%	20	
7906085	PBA	Matrix Spike	Dissolved Aluminum (Al)	2022/03/28		103	%	80 - 120	
			Dissolved Arsenic (As)	2022/03/28		98	%	80 - 120	
			Dissolved Barium (Ba)	2022/03/28		100	%	80 - 120	
			Dissolved Bismuth (Bi)	2022/03/28		100	%	80 - 120	
			Dissolved Boron (B)	2022/03/28		96	%	80 - 120	
			Dissolved Cadmium (Cd)	2022/03/28		101	%	80 - 120	
			Dissolved Calcium (Ca)	2022/03/28		NC	%	80 - 120	
			Dissolved Cesium (Cs)	2022/03/28		102	%	80 - 120	
			Dissolved Chromium (Cr)	2022/03/28		97	%	80 - 120	
			Dissolved Cobalt (Co)	2022/03/28		94	%	80 - 120	
			Dissolved Copper (Cu)	2022/03/28		97	%	80 - 120	
			Dissolved Iron (Fe)	2022/03/28		99	%	80 - 120	
			Dissolved Lead (Pb)	2022/03/28		98	%	80 - 120	
			Dissolved Lithium (Li)	2022/03/28		101	%	80 - 120	
			Dissolved Magnesium (Mg)	2022/03/28		95	%	80 - 120	
			Dissolved Nickel (Ni)	2022/03/28		95	%	80 - 120	
			Dissolved Potassium (K)	2022/03/28		96	%	80 - 120	
			Dissolved Rubidium (Rb)	2022/03/28		99	%	80 - 120	
			Dissolved Selenium (Se)	2022/03/28		101	%	80 - 120	
			Dissolved Silicon (Si)	2022/03/28		105	%	80 - 120	
			Dissolved Sodium (Na)	2022/03/28		NC	%	80 - 120	



Bureau Veritas Job #: C279306
Report Date: 2022/05/10

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7906085	PBA	Spiked Blank	Dissolved Strontium (Sr)	2022/03/28		100	%	80 - 120
			Dissolved Thorium (Th)	2022/03/28		99	%	80 - 120
			Dissolved Uranium (U)	2022/03/28		102	%	80 - 120
			Dissolved Zirconium (Zr)	2022/03/28		105	%	80 - 120
			Dissolved Aluminum (Al)	2022/03/28		101	%	80 - 120
			Dissolved Arsenic (As)	2022/03/28		96	%	80 - 120
			Dissolved Barium (Ba)	2022/03/28		101	%	80 - 120
			Dissolved Bismuth (Bi)	2022/03/28		102	%	80 - 120
			Dissolved Boron (B)	2022/03/28		94	%	80 - 120
			Dissolved Cadmium (Cd)	2022/03/28		100	%	80 - 120
			Dissolved Calcium (Ca)	2022/03/28		103	%	80 - 120
			Dissolved Cesium (Cs)	2022/03/28		100	%	80 - 120
			Dissolved Chromium (Cr)	2022/03/28		96	%	80 - 120
			Dissolved Cobalt (Co)	2022/03/28		93	%	80 - 120
			Dissolved Copper (Cu)	2022/03/28		96	%	80 - 120
			Dissolved Iron (Fe)	2022/03/28		99	%	80 - 120
			Dissolved Lead (Pb)	2022/03/28		97	%	80 - 120
			Dissolved Lithium (Li)	2022/03/28		106	%	80 - 120
			Dissolved Magnesium (Mg)	2022/03/28		96	%	80 - 120
			Dissolved Nickel (Ni)	2022/03/28		94	%	80 - 120
			Dissolved Potassium (K)	2022/03/28		94	%	80 - 120
			Dissolved Rubidium (Rb)	2022/03/28		97	%	80 - 120
			Dissolved Selenium (Se)	2022/03/28		100	%	80 - 120
			Dissolved Silicon (Si)	2022/03/28		100	%	80 - 120
			Dissolved Sodium (Na)	2022/03/28		97	%	80 - 120
			Dissolved Strontium (Sr)	2022/03/28		99	%	80 - 120
			Dissolved Thorium (Th)	2022/03/28		99	%	80 - 120
			Dissolved Uranium (U)	2022/03/28		102	%	80 - 120
			Dissolved Zirconium (Zr)	2022/03/28		102	%	80 - 120
7906085	PBA	Method Blank	Dissolved Aluminum (Al)	2022/03/28	<4.9		ug/L	
			Dissolved Arsenic (As)	2022/03/28	<1.0		ug/L	
			Dissolved Barium (Ba)	2022/03/28	<2.0		ug/L	
			Dissolved Bismuth (Bi)	2022/03/28	<1.0		ug/L	
			Dissolved Boron (B)	2022/03/28	<10		ug/L	
			Dissolved Cadmium (Cd)	2022/03/28	<0.090		ug/L	
			Dissolved Calcium (Ca)	2022/03/28	<200		ug/L	
			Dissolved Cesium (Cs)	2022/03/28	<0.20		ug/L	
			Dissolved Chromium (Cr)	2022/03/28	<5.0		ug/L	
			Dissolved Cobalt (Co)	2022/03/28	<0.50		ug/L	
			Dissolved Copper (Cu)	2022/03/28	<0.90		ug/L	
			Dissolved Iron (Fe)	2022/03/28	<100		ug/L	
			Dissolved Lead (Pb)	2022/03/28	<0.50		ug/L	
			Dissolved Lithium (Li)	2022/03/28	<5.0		ug/L	
			Dissolved Magnesium (Mg)	2022/03/28	<50		ug/L	
			Dissolved Nickel (Ni)	2022/03/28	<1.0		ug/L	
			Dissolved Potassium (K)	2022/03/28	<200		ug/L	
			Dissolved Rubidium (Rb)	2022/03/28	<0.20		ug/L	
			Dissolved Selenium (Se)	2022/03/28	<2.0		ug/L	
			Dissolved Silicon (Si)	2022/03/28	<50		ug/L	



Bureau Veritas Job #: C279306
Report Date: 2022/05/10

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Sodium (Na)	2022/03/28	130, RDL=100		ug/L	
			Dissolved Strontium (Sr)	2022/03/28	<1.0		ug/L	
			Dissolved Thorium (Th)	2022/03/28	<2.0		ug/L	
			Dissolved Uranium (U)	2022/03/28	<0.10		ug/L	
			Dissolved Zirconium (Zr)	2022/03/28	<1.0		ug/L	
7906085	PBA	RPD	Dissolved Arsenic (As)	2022/03/28	NC		%	20
7906089	ADB	Matrix Spike	Orthophosphate (P)	2022/03/28		NC	%	75 - 125
7906089	ADB	Spiked Blank	Orthophosphate (P)	2022/03/28		99	%	80 - 120
7906089	ADB	Method Blank	Orthophosphate (P)	2022/03/28	<0.010		mg/L	
7906089	ADB	RPD	Orthophosphate (P)	2022/03/28	0.74		%	25
7906100	LKH	Matrix Spike [SEO812-01]	Dissolved Chloride (Cl-)	2022/03/29		NC	%	80 - 120
			Dissolved Bromide (Br-)	2022/03/29		NC	%	80 - 120
			Dissolved Sulphate (SO4)	2022/03/29		96	%	80 - 120
7906100	LKH	Spiked Blank	Dissolved Chloride (Cl-)	2022/03/29		100	%	70 - 130
			Dissolved Bromide (Br-)	2022/03/29		98	%	80 - 120
			Dissolved Sulphate (SO4)	2022/03/29		95	%	80 - 120
7906100	LKH	Method Blank	Dissolved Chloride (Cl-)	2022/03/29	<1.0		mg/L	
			Dissolved Bromide (Br-)	2022/03/29	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2022/03/29	<1.0		mg/L	
7906100	LKH	RPD [SEO812-01]	Dissolved Chloride (Cl-)	2022/03/29	0.64		%	20
			Dissolved Bromide (Br-)	2022/03/29	3.6		%	20
			Dissolved Sulphate (SO4)	2022/03/29	NC		%	20
7908265	TAK	Matrix Spike	Sulphide	2022/03/29		92	%	80 - 120
7908265	TAK	Spiked Blank	Sulphide	2022/03/29		92	%	80 - 120
7908265	TAK	Method Blank	Sulphide	2022/03/29	<0.020		mg/L	
7908265	TAK	RPD	Sulphide	2022/03/29	NC		%	20
7909303	MJ1	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2022/03/30		105	%	80 - 120
7909303	MJ1	QC Standard	Total Kjeldahl Nitrogen (TKN)	2022/03/30		94	%	80 - 120
7909303	MJ1	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2022/03/30		102	%	80 - 120
7909303	MJ1	Method Blank	Total Kjeldahl Nitrogen (TKN)	2022/03/30	<0.10		mg/L	
7909303	MJ1	RPD	Total Kjeldahl Nitrogen (TKN)	2022/03/30	19		%	20
7909338	RKF	Matrix Spike	Total Ammonia-N	2022/03/30		98	%	75 - 125
7909338	RKF	Spiked Blank	Total Ammonia-N	2022/03/30		99	%	80 - 120
7909338	RKF	Method Blank	Total Ammonia-N	2022/03/30	<0.050		mg/L	
7909338	RKF	RPD	Total Ammonia-N	2022/03/30	NC		%	20
7909986	NS3	Matrix Spike	Total Phosphorus	2022/03/30		97	%	80 - 120
7909986	NS3	QC Standard	Total Phosphorus	2022/03/30		98	%	80 - 120
7909986	NS3	Spiked Blank	Total Phosphorus	2022/03/30		96	%	80 - 120
7909986	NS3	Method Blank	Total Phosphorus	2022/03/30	<0.020		mg/L	
7909986	NS3	RPD	Total Phosphorus	2022/03/30	1.9		%	20
7916935	TMU	Matrix Spike	Dissolved Iodide	2022/03/30		97	%	80 - 120
7916935	TMU	Spiked Blank	Dissolved Iodide	2022/03/30		101	%	80 - 120
7916935	TMU	Method Blank	Dissolved Iodide	2022/03/30	<0.10		mg/L	
7920315	STI	Matrix Spike	Reactive Silica (SiO2)	2022/04/03		NC	%	80 - 120
7920315	STI	Spiked Blank	Reactive Silica (SiO2)	2022/04/03		104	%	80 - 120
7920315	STI	Method Blank	Reactive Silica (SiO2)	2022/04/03	<0.050		mg/L	
7947187	EBO	Spiked Blank	Total Ruthenium (Ru)	2022/04/19		110	%	70 - 130
			Total Ruthenium (Ru)	2022/04/19		110	%	70 - 130
7947187	EBO	Method Blank	Total Ruthenium (Ru)	2022/04/19	<2.0		ug/L	



Bureau Veritas Job #: C279306
Report Date: 2022/05/10

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Ruthenium (Ru)	2022/04/19	<2.0		ug/L	
7980604	AGD	Matrix Spike	Total Organic Carbon (TOC)	2022/05/09		113	%	80 - 120
7980604	AGD	Spiked Blank	Total Organic Carbon (TOC)	2022/05/09		101	%	80 - 120
7980604	AGD	Method Blank	Total Organic Carbon (TOC)	2022/05/09	<0.40		mg/L	
7980604	AGD	RPD	Total Organic Carbon (TOC)	2022/05/09	2.3		%	20
7980705	AGD	Matrix Spike	Dissolved Organic Carbon	2022/05/09		99	%	80 - 120
7980705	AGD	Spiked Blank	Dissolved Organic Carbon	2022/05/09		103	%	80 - 120
7980705	AGD	Method Blank	Dissolved Organic Carbon	2022/05/09	<0.40		mg/L	
7980705	AGD	RPD	Dissolved Organic Carbon	2022/05/09	3.2		%	20
<p>N/A = Not Applicable</p> <p>Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.</p> <p>Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.</p> <p>QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.</p> <p>Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.</p> <p>Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.</p> <p>NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)</p> <p>NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference $\leq 2 \times$ RDL).</p> <p>(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.</p>								



Bureau Veritas Job #: C279306
Report Date: 2022/05/10

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

VALIDATION SIGNATURE PAGE

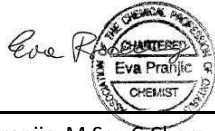
The analytical data and all QC contained in this report were reviewed and validated by:

Anastassia Hamanov, Scientific Specialist



Jonathan Fauvel, B.Sc, Chimiste, Supervisor, Inorganics

Heather Groves, Dip.BioSci, Laboratory Manager – Organic



Ewa Pranjić, M.Sc., C.Chem, Scientific Specialist



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Your P.O. #: 202031-004
 Your Project #: 20-203-1
 Site#: IGNACE, ON
 Your C.O.C. #: GFIM-BVLI_0006

Attention: Amy Cartier

Geofirma Engineering Ltd
 1 Raymond St
 Suite 200
 Ottawa, ON
 CANADA K1R 1A2

Report Date: 2022/06/23
 Report #: R7183161
 Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BUREAU VERITAS JOB #: C283100

Received: 2022/03/29, 16:26

Sample Matrix: Ground Water
 # Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2022/04/01	CAM SOP-00448	SM 23 2320 B m
Alkalinity	1	N/A	2022/04/02	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	2	N/A	2022/04/04	CAM SOP-00102	APHA 4500-CO2 D
Anions	1	N/A	2022/03/31	CAM SOP-00435	SM 23 4110 B m
Anions	1	N/A	2022/04/04	CAM SOP-00435	SM 23 4110 B m
Dissolved Organic Carbon (DOC) (3)	1	N/A	2022/03/31	CAM SOP-00446	SM 23 5310 B m
Dissolved Organic Carbon (DOC) (3)	1	N/A	2022/05/09	CAM SOP-00446	SM 23 5310 B m
Fluoride	1	2022/03/31	2022/04/01	CAM SOP-00449	SM 23 4500-F C m
Fluoride	1	2022/03/31	2022/04/02	CAM SOP-00449	SM 23 4500-F C m
Dissolved Metals Analysis by ICP	2	2022/03/31	2022/04/04	CAM SOP-00408	EPA 6010D m
Dissolved Metals by ICPMS	1	N/A	2022/04/05	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS	1	N/A	2022/04/06	CAM SOP-00447	EPA 6020B m
Iodide, Thiosulphate, Thiocyanate (1)	2	N/A	2022/04/05	CAL SOP-00057	Dionex #034035 R09 m
Total Extractable Elements by ICP-MS (2, 4)	2	2022/04/13	2022/04/19	STL SOP-00071	MA.200-Mét. 1.2 R5 m
Silica (Reactive) (1)	2	N/A	2022/04/03	AB SOP-00011	EPA370.1 R1978 m
Total Ammonia-N	2	N/A	2022/04/02	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (5)	1	N/A	2022/03/31	CAM SOP-00440	SM 23 4500-NO3I/NO2B
Nitrate & Nitrite as Nitrogen in Water (5)	1	N/A	2022/04/04	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	1	2022/03/31	2022/04/01	CAM SOP-00413	SM 4500H+ B m
pH	1	2022/03/31	2022/04/02	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	2	N/A	2022/04/01	CAM SOP-00461	EPA 365.1 m
Sulphide	2	N/A	2022/04/01	CAM SOP-00455	SM 23 4500-S G m
Total Inorganic Carbon (TIC)	2	N/A	2022/04/01	CAM SOP-00433	SM 23 5310 m
Total Kjeldahl Nitrogen in Water	2	2022/04/01	2022/04/04	CAM SOP-00938	OMOE E3516 m
Total Nitrogen (calculated)	2	N/A	2022/04/04	Auto Calc.	
Total Organic Carbon (TOC) (6)	1	N/A	2022/04/04	CAM SOP-00446	SM 23 5310B m
Total Organic Carbon (TOC) (6)	1	N/A	2022/05/09	CAM SOP-00446	SM 23 5310B m
Total Phosphorus (Colourimetric)	2	2022/04/01	2022/04/04	CAM SOP-00407	SM 23 4500 P B H m

Remarks:



Your P.O. #: 202031-004
 Your Project #: 20-203-1
 Site#: IGNACE, ON
 Your C.O.C. #: GFIM-BVLI_0006

Attention: Amy Cartier

Geofirma Engineering Ltd
 1 Raymond St
 Suite 200
 Ottawa, ON
 CANADA K1R 1A2

Report Date: 2022/06/23
 Report #: R7183161
 Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BUREAU VERITAS JOB #: C283100

Received: 2022/03/29, 16:26

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

- (1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE, Calgary, AB, T2E 6P8
- (2) This test was performed by Bureau Veritas Montreal, 889 Montée de Liesse, Ville St-Laurent, QC, H4T 1P5
- (3) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
- (4) Non-accredited test method
- (5) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
- (6) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

Encryption Key

Katherine Szozda
 Project Manager
 23 Jun 2022 17:16:35

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Katherine Szozda, Project Manager

Email: Katherine.Szozda@bureauveritas.com

Phone# (613)274-0573 Ext:7063633

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BUREAU
VERITAS

Bureau Veritas Job #: C283100

Report Date: 2022/06/23

Geofirma Engineering Ltd

Client Project #: 20-203-1

Your P.O. #: 202031-004

Sampler Initials: AC

RESULTS OF ANALYSES OF GROUND WATER

Bureau Veritas ID		SFM862			SFM862			SFM862		
Sampling Date		2022/03/25 10:00			2022/03/25 10:00			2022/03/25 10:00		
COC Number		GFIM-BVLI_0006			GFIM-BVLI_0006			GFIM-BVLI_0006		
	UNITS	IG_BH05_GW001	RDL	QC Batch	IG_BH05_GW001 REPEAT	RDL	QC Batch	IG_BH05_GW001 Lab-Dup	RDL	QC Batch

Calculated Parameters

Bicarb. Alkalinity (calc. as CaCO ₃)	mg/L	220	1.0	7911831						
Carb. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	7911831						
Hydrox. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	7911831						
Total Nitrogen (N)	mg/L	<1.0	1.0	7911832						

Inorganics

Total Ammonia-N	mg/L	0.074	0.050	7917703				<0.050	0.050	7917703
Fluoride (F ⁻)	mg/L	0.14	0.10	7915813				0.13	0.10	7915813
Total Inorganic Carbon (C)	mg/L	18	1	7914816				18	1	7914816
Dissolved Iodide	mg/L	<1.0 (1)	1.0	7925884						
Total Kjeldahl Nitrogen (TKN)	mg/L	<1.0 (2)	1.0	7916428						
Dissolved Organic Carbon	mg/L	200	2.0	7912192	190	2.0	7980705			
Total Organic Carbon (TOC)	mg/L	190	2.0	7917325	200	2.0	7980604			
Orthophosphate (P)	mg/L	<0.10 (2)	0.10	7913436						
pH	pH	6.64		7915815				6.70		7915815
Total Phosphorus	mg/L	0.083	0.040	7917090						
Reactive Silica (SiO ₂)	mg/L	14	0.25	7920315						
Sulphide	mg/L	<0.020	0.020	7916445						
Alkalinity (Total as CaCO ₃)	mg/L	220	1.0	7915818				220	1.0	7915818
Nitrite (N)	mg/L	0.030	0.010	7914468				0.029	0.010	7914468
Dissolved Chloride (Cl ⁻)	mg/L	1900	20	7913443						
Nitrate (N)	mg/L	0.16	0.10	7914468				0.17	0.10	7914468
Nitrate + Nitrite (N)	mg/L	0.19	0.10	7914468				0.19	0.10	7914468
Dissolved Bromide (Br ⁻)	mg/L	40	20	7913443						
Dissolved Sulphate (SO ₄)	mg/L	67	20	7913443						

Metals

Total Ruthenium (Ru)	ug/L	<2.0	2.0	7947187						
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RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

(1) Detection limits raised due to matrix interference.

(2) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.



RESULTS OF ANALYSES OF GROUND WATER

Bureau Veritas ID		SFM863			SFM863		
Sampling Date		2022/03/26 14:40			2022/03/26 14:40		
COC Number		GFIM-BVLI_0006			GFIM-BVLI_0006		
	UNITS	IG_BH01_GW032	RDL	QC Batch	IG_BH01_GW032 Lab-Dup	RDL	QC Batch

Calculated Parameters							
Bicarb. Alkalinity (calc. as CaCO ₃)	mg/L	9.1	1.0	7911831			
Carb. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	7911831			
Hydrox. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	7911831			
Total Nitrogen (N)	mg/L	<2.0	2.0	7911832			
Inorganics							
Total Ammonia-N	mg/L	0.069	0.050	7917703			
Fluoride (F ⁻)	mg/L	0.82	0.10	7915813			
Total Inorganic Carbon (C)	mg/L	<1	1	7914816			
Dissolved Iodide	mg/L	0.57	0.10	7925884	0.58	0.10	7925884
Total Kjeldahl Nitrogen (TKN)	mg/L	<2.0 (1)	2.0	7916428			
Dissolved Organic Carbon	mg/L	1.3	0.40	7912192			
Total Organic Carbon (TOC)	mg/L	1.2	0.40	7917325			
Orthophosphate (P)	mg/L	<0.010	0.010	7914916			
pH	pH	7.19		7915815			
Total Phosphorus	mg/L	<0.10 (1)	0.10	7917090			
Reactive Silica (SiO ₂)	mg/L	24	0.25	7920315			
Sulphide	mg/L	<0.020	0.020	7916445			
Alkalinity (Total as CaCO ₃)	mg/L	9.1	1.0	7915818			
Nitrite (N)	mg/L	<0.010	0.010	7914922			
Dissolved Chloride (Cl ⁻)	mg/L	9900	100	7915975			
Nitrate (N)	mg/L	<0.10	0.10	7914922			
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	7914922			
Dissolved Bromide (Br ⁻)	mg/L	180	5.0	7915975			
Dissolved Sulphate (SO ₄)	mg/L	190	5.0	7915975			
Metals							
Total Ruthenium (Ru)	ug/L	<2.0	2.0	7947187			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate (1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.							



ELEMENTS BY ATOMIC SPECTROSCOPY (GROUND WATER)

Bureau Veritas ID		SFM862			SFM862			SFM863		
Sampling Date		2022/03/25 10:00			2022/03/25 10:00			2022/03/26 14:40		
COC Number		GFIM-BVLI_0006			GFIM-BVLI_0006			GFIM-BVLI_0006		
	UNITS	IG_BH05_GW001	RDL	QC Batch	IG_BH05_GW001 Lab-Dup	RDL	QC Batch	IG_BH01_GW032	RDL	QC Batch

Metals										
Dissolved Iron (Fe)	mg/L	37	0.02	7914747	37	0.02	7914747	0.08	0.02	7914747
Dissolved Sulphur (S)	mg/L	11	0.5	7914747	11	0.5	7914747	71	0.5	7914747
Dissolved Aluminum (Al)	ug/L	<4.9	4.9	7914770				<25	25	7914770
Dissolved Arsenic (As)	ug/L	<1.0	1.0	7914770				<5.0	5.0	7914770
Dissolved Barium (Ba)	ug/L	190	2.0	7914770				270	10	7914770
Dissolved Bismuth (Bi)	ug/L	<1.0	1.0	7914770				<5.0	5.0	7914770
Dissolved Boron (B)	ug/L	250	10	7914770				340	50	7914770
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	7914770				<0.45	0.45	7914770
Dissolved Calcium (Ca)	ug/L	930000	1000	7914770				4700000	10000	7914770
Dissolved Cesium (Cs)	ug/L	<0.20	0.20	7914770				<1.0	1.0	7914770
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	7914770				<25	25	7914770
Dissolved Cobalt (Co)	ug/L	2.7	0.50	7914770				<2.5	2.5	7914770
Dissolved Copper (Cu)	ug/L	<0.90	0.90	7914770				<4.5	4.5	7914770
Dissolved Iron (Fe)	ug/L	37000	100	7914770				<500	500	7914770
Dissolved Lead (Pb)	ug/L	<0.50	0.50	7914770				<2.5	2.5	7914770
Dissolved Lithium (Li)	ug/L	74	5.0	7914770				63	25	7914770
Dissolved Magnesium (Mg)	ug/L	6100	50	7914770				1000	250	7914770
Dissolved Nickel (Ni)	ug/L	8.6	1.0	7914770				<5.0	5.0	7914770
Dissolved Potassium (K)	ug/L	14000	200	7914770				12000	1000	7914770
Dissolved Rubidium (Rb)	ug/L	20	0.20	7914770				15	1.0	7914770
Dissolved Selenium (Se)	ug/L	<2.0	2.0	7914770				<10	10	7914770
Dissolved Silicon (Si)	ug/L	10000	50	7914770				3900	250	7914770
Dissolved Sodium (Na)	ug/L	240000	100	7914770				730000	500	7914770
Dissolved Strontium (Sr)	ug/L	11000	1.0	7914770				61000	5.0	7914770
Dissolved Thorium (Th)	ug/L	<2.0	2.0	7914770				<10	10	7914770
Dissolved Uranium (U)	ug/L	2.0	0.10	7914770				<0.50	0.50	7914770
Dissolved Zirconium (Zr)	ug/L	<1.0	1.0	7914770				<5.0	5.0	7914770

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate



Bureau Veritas Job #: C283100
Report Date: 2022/06/23

Geofirma Engineering Ltd
Client Project #: 20-203-1
Your P.O. #: 202031-004
Sampler Initials: AC

TEST SUMMARY

Bureau Veritas ID: SFM862
Sample ID: IG_BH05_GW001
Matrix: Ground Water

Collected: 2022/03/25
Shipped:
Received: 2022/03/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7915818	N/A	2022/04/01	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7911831	N/A	2022/04/04	Automated Statchk
Anions	IC	7913443	N/A	2022/03/31	Lusine Khachatryan
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7980705	N/A	2022/05/09	Anna-Kay Gooden
Fluoride	ISE	7915813	2022/03/31	2022/04/01	Surinder Rai
Dissolved Metals Analysis by ICP	ICP	7914747	2022/03/31	2022/04/04	Suban Kanapathipillai
Dissolved Metals by ICPMS	ICP/MS	7914770	N/A	2022/04/05	Arefa Dabhad
Iodide, Thiosulphate, Thiocyanate	IC/EC	7925884	N/A	2022/04/05	Taylor Mullings
Total Extractable Elements by ICP-MS	ICP/MSMS	7947187	2022/04/13	2022/04/19	Zineb El Ouali
Silica (Reactive)	KONE	7920315	N/A	2022/04/03	Serena Tian
Total Ammonia-N	LACH/NH4	7917703	N/A	2022/04/02	Amanpreet Sappal
Nitrate & Nitrite as Nitrogen in Water	LACH	7914468	N/A	2022/03/31	Samuel Law
pH	AT	7915815	2022/03/31	2022/04/01	Surinder Rai
Orthophosphate	KONE	7913436	N/A	2022/04/01	Chandra Nandlal
Sulphide	ISE/S	7916445	N/A	2022/04/01	Neil Dassanayake
Total Inorganic Carbon (TIC)	TOCV/NDIR	7914816	N/A	2022/04/01	Anna-Kay Gooden
Total Kjeldahl Nitrogen in Water	SKAL	7916428	2022/04/01	2022/04/04	Massarat Jan
Total Nitrogen (calculated)	CALC	7911832	N/A	2022/04/04	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	7980604	N/A	2022/05/09	Anna-Kay Gooden
Total Phosphorus (Colourimetric)	LACH/P	7917090	2022/04/01	2022/04/04	Shivani Shivani

Bureau Veritas ID: SFM862 Dup
Sample ID: IG_BH05_GW001
Matrix: Ground Water

Collected: 2022/03/25
Shipped:
Received: 2022/03/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7915818	N/A	2022/04/01	Surinder Rai
Fluoride	ISE	7915813	2022/03/31	2022/04/01	Surinder Rai
Dissolved Metals Analysis by ICP	ICP	7914747	2022/03/31	2022/04/04	Suban Kanapathipillai
Total Ammonia-N	LACH/NH4	7917703	N/A	2022/04/02	Amanpreet Sappal
Nitrate & Nitrite as Nitrogen in Water	LACH	7914468	N/A	2022/03/31	Samuel Law
pH	AT	7915815	2022/03/31	2022/04/01	Surinder Rai
Total Inorganic Carbon (TIC)	TOCV/NDIR	7914816	N/A	2022/04/01	Anna-Kay Gooden

Bureau Veritas ID: SFM863
Sample ID: IG_BH01_GW032
Matrix: Ground Water

Collected: 2022/03/26
Shipped:
Received: 2022/03/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7915818	N/A	2022/04/02	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	7911831	N/A	2022/04/04	Automated Statchk
Anions	IC	7915975	N/A	2022/04/04	Lusine Khachatryan
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7912192	N/A	2022/03/31	Anna-Kay Gooden
Fluoride	ISE	7915813	2022/03/31	2022/04/02	Surinder Rai



Bureau Veritas Job #: C283100
Report Date: 2022/06/23

Geofirma Engineering Ltd
Client Project #: 20-203-1
Your P.O. #: 202031-004
Sampler Initials: AC

TEST SUMMARY

Bureau Veritas ID: SFM863
Sample ID: IG_BH01_GW032
Matrix: Ground Water

Collected: 2022/03/26
Shipped:
Received: 2022/03/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals Analysis by ICP	ICP	7914747	2022/03/31	2022/04/04	Suban Kanapathipillai
Dissolved Metals by ICPMS	ICP/MS	7914770	N/A	2022/04/06	Arefa Dabhad
Iodide, Thiosulphate, Thiocyanate	IC/EC	7925884	N/A	2022/04/05	Taylor Mullings
Total Extractable Elements by ICP-MS	ICP/MSMS	7947187	2022/04/13	2022/04/19	Zineb El Ouali
Silica (Reactive)	KONE	7920315	N/A	2022/04/03	Serena Tian
Total Ammonia-N	LACH/NH4	7917703	N/A	2022/04/02	Amanpreet Sappal
Nitrate & Nitrite as Nitrogen in Water	LACH	7914922	N/A	2022/04/04	Samuel Law
pH	AT	7915815	2022/03/31	2022/04/02	Surinder Rai
Orthophosphate	KONE	7914916	N/A	2022/04/01	Chandra Nandlal
Sulphide	ISE/S	7916445	N/A	2022/04/01	Neil Dassanayake
Total Inorganic Carbon (TIC)	TOCV/NDIR	7914816	N/A	2022/04/01	Anna-Kay Gooden
Total Kjeldahl Nitrogen in Water	SKAL	7916428	2022/04/01	2022/04/04	Massarat Jan
Total Nitrogen (calculated)	CALC	7911832	N/A	2022/04/04	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	7917325	N/A	2022/04/04	Anna-Kay Gooden
Total Phosphorus (Colourimetric)	LACH/P	7917090	2022/04/01	2022/04/04	Shivani Shivani

Bureau Veritas ID: SFM863 Dup
Sample ID: IG_BH01_GW032
Matrix: Ground Water

Collected: 2022/03/26
Shipped:
Received: 2022/03/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Iodide, Thiosulphate, Thiocyanate	IC/EC	7925884	N/A	2022/04/05	Taylor Mullings



Bureau Veritas Job #: C283100
Report Date: 2022/06/23

Geofirma Engineering Ltd
Client Project #: 20-203-1
Your P.O. #: 202031-004
Sampler Initials: AC

GENERAL COMMENTS

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

Package 1	1.0°C
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Revised Report (2022/06/23): Report comment amended and reworked results reported

Revised Report (2022/05/10): Reworked TOC and DOC analysis per client request

ANIONS-L: Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Sample SFM862 [IG_BH05_GW001] : Reanalysis for DOC and TOC were performed past sample holding time. This may increase the variability associated with these results. Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample SFM863 [IG_BH01_GW032] : TOC < DOC: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Metals Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

RESULTS OF ANALYSES OF GROUND WATER

Anions: ANIONS-L: Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Results relate only to the items tested.



Bureau Veritas Job #: C283100
Report Date: 2022/06/23

Geofirma Engineering Ltd
Client Project #: 20-203-1
Your P.O. #: 202031-004
Sampler Initials: AC

QUALITY ASSURANCE REPORT

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7912192	AGD		Matrix Spike	Dissolved Organic Carbon	2022/03/31		96	%	80 - 120
7912192	AGD		Spiked Blank	Dissolved Organic Carbon	2022/03/31		100	%	80 - 120
7912192	AGD		Method Blank	Dissolved Organic Carbon	2022/03/31	<0.40		mg/L	
7912192	AGD		RPD	Dissolved Organic Carbon	2022/03/31	8.5		%	20
7913436	C_N		Matrix Spike	Orthophosphate (P)	2022/04/01		104	%	75 - 125
7913436	C_N		Spiked Blank	Orthophosphate (P)	2022/04/01		101	%	80 - 120
7913436	C_N		Method Blank	Orthophosphate (P)	2022/04/01	<0.010		mg/L	
7913436	C_N		RPD	Orthophosphate (P)	2022/04/01	NC		%	25
7913443	LKH		Matrix Spike	Dissolved Chloride (Cl-)	2022/03/31		95	%	80 - 120
				Dissolved Bromide (Br-)	2022/03/31		99	%	80 - 120
				Dissolved Sulphate (SO4)	2022/03/31		96	%	80 - 120
7913443	LKH		Spiked Blank	Dissolved Chloride (Cl-)	2022/03/31		98	%	70 - 130
				Dissolved Bromide (Br-)	2022/03/31		102	%	80 - 120
				Dissolved Sulphate (SO4)	2022/03/31		99	%	80 - 120
7913443	LKH		Method Blank	Dissolved Chloride (Cl-)	2022/03/31	<1.0		mg/L	
				Dissolved Bromide (Br-)	2022/03/31	<1.0		mg/L	
				Dissolved Sulphate (SO4)	2022/03/31	<1.0		mg/L	
7914468	S1L		Matrix Spike [SFM862-01]	Nitrite (N)	2022/03/31		105	%	80 - 120
				Nitrate (N)	2022/03/31		95	%	80 - 120
7914468	S1L		Spiked Blank	Nitrite (N)	2022/03/31		106	%	80 - 120
				Nitrate (N)	2022/03/31		101	%	80 - 120
7914468	S1L		Method Blank	Nitrite (N)	2022/03/31	<0.010		mg/L	
				Nitrate (N)	2022/03/31	<0.10		mg/L	
7914468	S1L		RPD [SFM862-01]	Nitrite (N)	2022/03/31	3.8		%	20
				Nitrate (N)	2022/03/31	1.6		%	20
7914747	SUK		Matrix Spike [SFM862-06]	Dissolved Aluminum (Al)	2022/04/04		104	%	80 - 120
				Dissolved Arsenic (As)	2022/04/04		89	%	80 - 120
				Dissolved Barium (Ba)	2022/04/04		101	%	80 - 120
				Dissolved Boron (B)	2022/04/04		102	%	80 - 120
				Dissolved Cadmium (Cd)	2022/04/04		103	%	80 - 120
				Dissolved Calcium (Ca)	2022/04/04		NC	%	80 - 120
				Dissolved Chromium (Cr)	2022/04/04		99	%	80 - 120
				Dissolved Cobalt (Co)	2022/04/04		100	%	80 - 120
				Dissolved Copper (Cu)	2022/04/04		104	%	80 - 120
				Dissolved Iron (Fe)	2022/04/04		NC	%	80 - 120
				Dissolved Lead (Pb)	2022/04/04		97	%	80 - 120
				Dissolved Magnesium (Mg)	2022/04/04		96	%	80 - 120
				Dissolved Nickel (Ni)	2022/04/04		99	%	80 - 120
				Dissolved Potassium (K)	2022/04/04		NC	%	80 - 120
				Dissolved Selenium (Se)	2022/04/04		101	%	80 - 120
				Dissolved Silicon (Si)	2022/04/04		NC	%	80 - 120
				Dissolved Sodium (Na)	2022/04/04		NC	%	80 - 120
				Dissolved Strontium (Sr)	2022/04/04		120	%	80 - 120
				Dissolved Sulphur (S)	2022/04/04		NC	%	80 - 120
7914747	SUK		Spiked Blank	Dissolved Aluminum (Al)	2022/04/04		101	%	80 - 120
				Dissolved Arsenic (As)	2022/04/04		95	%	80 - 120
				Dissolved Barium (Ba)	2022/04/04		99	%	80 - 120
				Dissolved Boron (B)	2022/04/04		100	%	80 - 120
				Dissolved Cadmium (Cd)	2022/04/04		100	%	80 - 120
				Dissolved Calcium (Ca)	2022/04/04		103	%	80 - 120
				Dissolved Chromium (Cr)	2022/04/04		101	%	80 - 120



Bureau Veritas Job #: C283100
Report Date: 2022/06/23

Geofirma Engineering Ltd
Client Project #: 20-203-1
Your P.O. #: 202031-004
Sampler Initials: AC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7914747	SUK	Method Blank	Dissolved Cobalt (Co)	2022/04/04		99	%	80 - 120
			Dissolved Copper (Cu)	2022/04/04		100	%	80 - 120
			Dissolved Iron (Fe)	2022/04/04		102	%	80 - 120
			Dissolved Lead (Pb)	2022/04/04		100	%	80 - 120
			Dissolved Magnesium (Mg)	2022/04/04		100	%	80 - 120
			Dissolved Nickel (Ni)	2022/04/04		100	%	80 - 120
			Dissolved Potassium (K)	2022/04/04		101	%	80 - 120
			Dissolved Selenium (Se)	2022/04/04		97	%	80 - 120
			Dissolved Silicon (Si)	2022/04/04		100	%	80 - 120
			Dissolved Sodium (Na)	2022/04/04		99	%	80 - 120
			Dissolved Strontium (Sr)	2022/04/04		100	%	80 - 120
			Dissolved Sulphur (S)	2022/04/04		102	%	80 - 120
			Dissolved Aluminum (Al)	2022/04/04	<0.1		mg/L	
			Dissolved Arsenic (As)	2022/04/04	<0.2		mg/L	
			Dissolved Barium (Ba)	2022/04/04	<0.005		mg/L	
			Dissolved Boron (B)	2022/04/04	<0.02		mg/L	
			Dissolved Cadmium (Cd)	2022/04/04	<0.005		mg/L	
			Dissolved Calcium (Ca)	2022/04/04	<0.05		mg/L	
			Dissolved Chromium (Cr)	2022/04/04	<0.01		mg/L	
			Dissolved Cobalt (Co)	2022/04/04	<0.02		mg/L	
			Dissolved Copper (Cu)	2022/04/04	<0.02		mg/L	
			Dissolved Iron (Fe)	2022/04/04	<0.02		mg/L	
			Dissolved Lead (Pb)	2022/04/04	<0.05		mg/L	
			Dissolved Magnesium (Mg)	2022/04/04	<0.05		mg/L	
			Dissolved Nickel (Ni)	2022/04/04	<0.05		mg/L	
7914747	SUK	RPD [SFM862-06]	Dissolved Potassium (K)	2022/04/04	<1		mg/L	
			Dissolved Selenium (Se)	2022/04/04	<0.2		mg/L	
			Dissolved Silicon (Si)	2022/04/04	<0.2		mg/L	
			Dissolved Sodium (Na)	2022/04/04	<0.5		mg/L	
			Dissolved Strontium (Sr)	2022/04/04	<0.005		mg/L	
			Dissolved Sulphur (S)	2022/04/04	<0.5		mg/L	
			Dissolved Aluminum (Al)	2022/04/04	NC		%	25
			Dissolved Arsenic (As)	2022/04/04	NC		%	25
			Dissolved Barium (Ba)	2022/04/04	0.10		%	25
			Dissolved Beryllium (Be)	2022/04/04	NC		%	25
			Dissolved Boron (B)	2022/04/04	0.39		%	25
			Dissolved Cadmium (Cd)	2022/04/04	NC		%	25
			Dissolved Chromium (Cr)	2022/04/04	NC		%	25
			Dissolved Cobalt (Co)	2022/04/04	NC		%	25
			Dissolved Copper (Cu)	2022/04/04	NC		%	25
			Dissolved Iron (Fe)	2022/04/04	0.22		%	25
			Dissolved Lead (Pb)	2022/04/04	NC		%	25
			Dissolved Magnesium (Mg)	2022/04/04	0.30		%	25
			Dissolved Manganese (Mn)	2022/04/04	0.087		%	25
			Dissolved Nickel (Ni)	2022/04/04	NC		%	25
			Dissolved Phosphorus (P)	2022/04/04	NC		%	25
			Dissolved Potassium (K)	2022/04/04	0.070		%	25
			Dissolved Selenium (Se)	2022/04/04	NC		%	25
			Dissolved Silicon (Si)	2022/04/04	0.39		%	25
			Dissolved Silver (Ag)	2022/04/04	NC		%	25
			Dissolved Sodium (Na)	2022/04/04	0.58		%	25



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Geofirma Engineering Ltd
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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7914770	ADA	Matrix Spike	Dissolved Sulphur (S)	2022/04/04	0.53		%	25
			Dissolved Tin (Sn)	2022/04/04	NC		%	25
			Dissolved Titanium (Ti)	2022/04/04	NC		%	25
			Dissolved Vanadium (V)	2022/04/04	NC		%	25
			Dissolved Zinc (Zn)	2022/04/04	0.64		%	25
			Dissolved Aluminum (Al)	2022/04/05		101	%	80 - 120
			Dissolved Arsenic (As)	2022/04/05		100	%	80 - 120
			Dissolved Barium (Ba)	2022/04/05		100	%	80 - 120
			Dissolved Bismuth (Bi)	2022/04/05		94	%	80 - 120
			Dissolved Boron (B)	2022/04/05		94	%	80 - 120
			Dissolved Cadmium (Cd)	2022/04/05		98	%	80 - 120
			Dissolved Calcium (Ca)	2022/04/05		NC	%	80 - 120
			Dissolved Cesium (Cs)	2022/04/05		102	%	80 - 120
			Dissolved Chromium (Cr)	2022/04/05		94	%	80 - 120
			Dissolved Cobalt (Co)	2022/04/05		97	%	80 - 120
			Dissolved Copper (Cu)	2022/04/05		97	%	80 - 120
			Dissolved Iron (Fe)	2022/04/05		98	%	80 - 120
			Dissolved Lead (Pb)	2022/04/05		94	%	80 - 120
			Dissolved Lithium (Li)	2022/04/05		106	%	80 - 120
			Dissolved Magnesium (Mg)	2022/04/05		100	%	80 - 120
			Dissolved Nickel (Ni)	2022/04/05		93	%	80 - 120
			Dissolved Potassium (K)	2022/04/05		103	%	80 - 120
			Dissolved Rubidium (Rb)	2022/04/05		97	%	80 - 120
			Dissolved Selenium (Se)	2022/04/05		101	%	80 - 120
			Dissolved Silicon (Si)	2022/04/05		98	%	80 - 120
			Dissolved Sodium (Na)	2022/04/05		NC	%	80 - 120
7914770	ADA	Spiked Blank	Dissolved Strontium (Sr)	2022/04/05		97	%	80 - 120
			Dissolved Thorium (Th)	2022/04/05		96	%	80 - 120
			Dissolved Uranium (U)	2022/04/05		93	%	80 - 120
			Dissolved Zirconium (Zr)	2022/04/05		105	%	80 - 120
			Dissolved Aluminum (Al)	2022/04/05		100	%	80 - 120
			Dissolved Arsenic (As)	2022/04/05		99	%	80 - 120
			Dissolved Barium (Ba)	2022/04/05		97	%	80 - 120
			Dissolved Bismuth (Bi)	2022/04/05		96	%	80 - 120
			Dissolved Boron (B)	2022/04/05		89	%	80 - 120
			Dissolved Cadmium (Cd)	2022/04/05		97	%	80 - 120
			Dissolved Calcium (Ca)	2022/04/05		100	%	80 - 120
			Dissolved Cesium (Cs)	2022/04/05		99	%	80 - 120
			Dissolved Chromium (Cr)	2022/04/05		94	%	80 - 120
			Dissolved Cobalt (Co)	2022/04/05		101	%	80 - 120
			Dissolved Copper (Cu)	2022/04/05		96	%	80 - 120
			Dissolved Iron (Fe)	2022/04/05		98	%	80 - 120
			Dissolved Lead (Pb)	2022/04/05		96	%	80 - 120
			Dissolved Lithium (Li)	2022/04/05		100	%	80 - 120
			Dissolved Magnesium (Mg)	2022/04/05		100	%	80 - 120
			Dissolved Nickel (Ni)	2022/04/05		96	%	80 - 120
			Dissolved Potassium (K)	2022/04/05		101	%	80 - 120
			Dissolved Rubidium (Rb)	2022/04/05		95	%	80 - 120
			Dissolved Selenium (Se)	2022/04/05		101	%	80 - 120
			Dissolved Silicon (Si)	2022/04/05		98	%	80 - 120
			Dissolved Sodium (Na)	2022/04/05		98	%	80 - 120



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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7914770	ADA	Method Blank	Dissolved Strontium (Sr)	2022/04/05		96	%	80 - 120
			Dissolved Thorium (Th)	2022/04/05		98	%	80 - 120
			Dissolved Uranium (U)	2022/04/05		95	%	80 - 120
			Dissolved Zirconium (Zr)	2022/04/05		100	%	80 - 120
			Dissolved Aluminum (Al)	2022/04/05	<4.9		ug/L	
			Dissolved Arsenic (As)	2022/04/05	<1.0		ug/L	
			Dissolved Barium (Ba)	2022/04/05	<2.0		ug/L	
			Dissolved Bismuth (Bi)	2022/04/05	<1.0		ug/L	
			Dissolved Boron (B)	2022/04/05	<10		ug/L	
			Dissolved Cadmium (Cd)	2022/04/05	<0.090		ug/L	
			Dissolved Calcium (Ca)	2022/04/05	<200		ug/L	
			Dissolved Cesium (Cs)	2022/04/05	<0.20		ug/L	
			Dissolved Chromium (Cr)	2022/04/05	<5.0		ug/L	
			Dissolved Cobalt (Co)	2022/04/05	<0.50		ug/L	
			Dissolved Copper (Cu)	2022/04/05	<0.90		ug/L	
			Dissolved Iron (Fe)	2022/04/05	<100		ug/L	
			Dissolved Lead (Pb)	2022/04/05	<0.50		ug/L	
			Dissolved Lithium (Li)	2022/04/05	<5.0		ug/L	
			Dissolved Magnesium (Mg)	2022/04/05	<50		ug/L	
			Dissolved Nickel (Ni)	2022/04/05	<1.0		ug/L	
			Dissolved Potassium (K)	2022/04/05	<200		ug/L	
			Dissolved Rubidium (Rb)	2022/04/05	<0.20		ug/L	
			Dissolved Selenium (Se)	2022/04/05	<2.0		ug/L	
			Dissolved Silicon (Si)	2022/04/05	<50		ug/L	
			Dissolved Sodium (Na)	2022/04/05	<100		ug/L	
7914770	ADA	RPD	Dissolved Strontium (Sr)	2022/04/05	<1.0		ug/L	
			Dissolved Thorium (Th)	2022/04/05	<2.0		ug/L	
			Dissolved Uranium (U)	2022/04/05	<0.10		ug/L	
			Dissolved Zirconium (Zr)	2022/04/05	<1.0		ug/L	
			Dissolved Arsenic (As)	2022/04/05	NC		%	20
			Dissolved Barium (Ba)	2022/04/05	0.14		%	20
			Dissolved Boron (B)	2022/04/05	13		%	20
			Dissolved Cadmium (Cd)	2022/04/05	NC		%	20
			Dissolved Chromium (Cr)	2022/04/05	NC		%	20
			Dissolved Cobalt (Co)	2022/04/05	NC		%	20
			Dissolved Copper (Cu)	2022/04/05	0.16		%	20
			Dissolved Lead (Pb)	2022/04/05	NC		%	20
7914816	AGD	Matrix Spike [SFM862-01]	Dissolved Nickel (Ni)	2022/04/05	NC		%	20
			Dissolved Selenium (Se)	2022/04/05	NC		%	20
			Dissolved Sodium (Na)	2022/04/05	0.39		%	20
			Dissolved Uranium (U)	2022/04/05	4.0		%	20
			Total Inorganic Carbon (C)	2022/04/01		86	%	80 - 120
			Total Inorganic Carbon (C)	2022/04/01		95	%	80 - 120
			Total Inorganic Carbon (C)	2022/04/01	<1		mg/L	
			Total Inorganic Carbon (C)	2022/04/01	1.1		%	20
			Orthophosphate (P)	2022/04/01		108	%	75 - 125
			Orthophosphate (P)	2022/04/01		100	%	80 - 120
			Orthophosphate (P)	2022/04/01	<0.010		mg/L	
			Orthophosphate (P)	2022/04/01	NC		%	25
7914916	C_N	RPD	Nitrite (N)	2022/04/04		94	%	80 - 120
7914922	S1L	Matrix Spike	Nitrate (N)	2022/04/04		NC	%	80 - 120



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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7914922	S1L	Spiked Blank	Nitrite (N)	2022/04/04		105	%	80 - 120
			Nitrate (N)	2022/04/04		102	%	80 - 120
7914922	S1L	Method Blank	Nitrite (N)	2022/04/04	<0.010		mg/L	
			Nitrate (N)	2022/04/04	<0.10		mg/L	
7914922	S1L	RPD	Nitrate (N)	2022/04/04	0.68		%	20
7915813	SAU	Matrix Spike [SFM862-01]	Fluoride (F-)	2022/04/01		90	%	80 - 120
7915813	SAU	Spiked Blank	Fluoride (F-)	2022/04/01		102	%	80 - 120
7915813	SAU	Method Blank	Fluoride (F-)	2022/04/01	<0.10		mg/L	
7915813	SAU	RPD [SFM862-01]	Fluoride (F-)	2022/04/01	8.9		%	20
7915815	SAU	Spiked Blank	pH	2022/04/01		102	%	98 - 103
7915815	SAU	RPD [SFM862-01]	pH	2022/04/01	0.89		%	N/A
7915818	SAU	Spiked Blank	Alkalinity (Total as CaCO3)	2022/04/01		98	%	85 - 115
7915818	SAU	Method Blank	Alkalinity (Total as CaCO3)	2022/04/01	<1.0		mg/L	
7915818	SAU	RPD [SFM862-01]	Alkalinity (Total as CaCO3)	2022/04/01	3.1		%	20
			p-Alkalinity	2022/04/01	NC		%	20
7915975	LKH	Matrix Spike	Dissolved Chloride (Cl-)	2022/04/04		NC	%	80 - 120
			Dissolved Bromide (Br-)	2022/04/04		102	%	80 - 120
			Dissolved Sulphate (SO4)	2022/04/04		NC	%	80 - 120
7915975	LKH	Spiked Blank	Dissolved Chloride (Cl-)	2022/04/04		98	%	70 - 130
			Dissolved Bromide (Br-)	2022/04/04		102	%	80 - 120
			Dissolved Sulphate (SO4)	2022/04/04		98	%	80 - 120
7915975	LKH	Method Blank	Dissolved Chloride (Cl-)	2022/04/04	<1.0		mg/L	
			Dissolved Bromide (Br-)	2022/04/04	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2022/04/04	<1.0		mg/L	
7915975	LKH	RPD	Dissolved Chloride (Cl-)	2022/04/04	5.8		%	20
			Dissolved Bromide (Br-)	2022/04/04	NC		%	20
			Dissolved Sulphate (SO4)	2022/04/04	9.5		%	20
7916428	MJ1	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2022/04/01		105	%	80 - 120
7916428	MJ1	QC Standard	Total Kjeldahl Nitrogen (TKN)	2022/04/01		99	%	80 - 120
7916428	MJ1	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2022/04/01		101	%	80 - 120
7916428	MJ1	Method Blank	Total Kjeldahl Nitrogen (TKN)	2022/04/01	<0.10		mg/L	
7916428	MJ1	RPD	Total Kjeldahl Nitrogen (TKN)	2022/04/01	NC		%	20
7916445	NYS	Matrix Spike	Sulphide	2022/04/01		91	%	80 - 120
7916445	NYS	Spiked Blank	Sulphide	2022/04/01		98	%	80 - 120
7916445	NYS	Method Blank	Sulphide	2022/04/01	<0.020		mg/L	
7916445	NYS	RPD	Sulphide	2022/04/01	NC		%	20
7917090	SSV	Matrix Spike	Total Phosphorus	2022/04/04		100	%	80 - 120
7917090	SSV	QC Standard	Total Phosphorus	2022/04/04		101	%	80 - 120
7917090	SSV	Spiked Blank	Total Phosphorus	2022/04/04		99	%	80 - 120
7917090	SSV	Method Blank	Total Phosphorus	2022/04/04	<0.020		mg/L	
7917090	SSV	RPD	Total Phosphorus	2022/04/04	1.3		%	20
7917325	AGD	Matrix Spike	Total Organic Carbon (TOC)	2022/04/04		94	%	80 - 120
7917325	AGD	Spiked Blank	Total Organic Carbon (TOC)	2022/04/04		102	%	80 - 120
7917325	AGD	Method Blank	Total Organic Carbon (TOC)	2022/04/04	<0.40		mg/L	
7917325	AGD	RPD	Total Organic Carbon (TOC)	2022/04/04	NC		%	20
7917703	ASP	Matrix Spike [SFM862-08]	Total Ammonia-N	2022/04/02		96	%	75 - 125
7917703	ASP	Spiked Blank	Total Ammonia-N	2022/04/02		98	%	80 - 120
7917703	ASP	Method Blank	Total Ammonia-N	2022/04/02	<0.050		mg/L	
7917703	ASP	RPD [SFM862-08]	Total Ammonia-N	2022/04/02	NC		%	20
7920315	STI	Matrix Spike	Reactive Silica (SiO2)	2022/04/03		NC	%	80 - 120
7920315	STI	Spiked Blank	Reactive Silica (SiO2)	2022/04/03		104	%	80 - 120



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QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7920315	STI	Method Blank	Reactive Silica (SiO ₂)	2022/04/03	<0.050		mg/L	
7925884	TMU	Matrix Spike [SFM863-01]	Dissolved Iodide	2022/04/05		98	%	80 - 120
7925884	TMU	Spiked Blank	Dissolved Iodide	2022/04/05		116	%	80 - 120
7925884	TMU	Method Blank	Dissolved Iodide	2022/04/05	<0.10		mg/L	
7925884	TMU	RPD [SFM863-01]	Dissolved Iodide	2022/04/05	2.9		%	20
7947187	EBO	Spiked Blank	Total Ruthenium (Ru)	2022/04/19		110	%	70 - 130
			Total Ruthenium (Ru)	2022/04/19		110	%	70 - 130
7947187	EBO	Method Blank	Total Ruthenium (Ru)	2022/04/19	<2.0		ug/L	
			Total Ruthenium (Ru)	2022/04/19	<2.0		ug/L	
7980604	AGD	Matrix Spike	Total Organic Carbon (TOC)	2022/05/09		113	%	80 - 120
7980604	AGD	Spiked Blank	Total Organic Carbon (TOC)	2022/05/09		101	%	80 - 120
7980604	AGD	Method Blank	Total Organic Carbon (TOC)	2022/05/09	<0.40		mg/L	
7980604	AGD	RPD	Total Organic Carbon (TOC)	2022/05/09	2.3		%	20
7980705	AGD	Matrix Spike	Dissolved Organic Carbon	2022/05/09		99	%	80 - 120
7980705	AGD	Spiked Blank	Dissolved Organic Carbon	2022/05/09		103	%	80 - 120
7980705	AGD	Method Blank	Dissolved Organic Carbon	2022/05/09	<0.40		mg/L	
7980705	AGD	RPD	Dissolved Organic Carbon	2022/05/09	3.2		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

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

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

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

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

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



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Bureau Veritas Job #: C283100

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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Anastassia Hamanov, Scientific Specialist

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Jonathan Fauvel, B.Sc, Chimiste, Supervisor, Inorganics



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Isotope Analyses for:
Geofirma Engineering LTD

IT² FILE #
220158

2022-08-08

Approved by:

Orfan Shouakar-Stash, PhD
Director

Isotope Tracer Technologies Inc.
608 Weber St. North Unit 3&4,
Waterloo, ON, N2V 1Z5 Tel: 519-886-5555 |
Fax: 519-886-5575
Email: orfan@it2isotopes.com
Website: www.it2isotopes.com



Client: Geofirma Engineering LTD
Address: 1 RAYMOND ST. SUITE 200
 Ottawa, ON. K1R 1A2
Tel.: (613)402-1701/ (514)-730-0961
Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: 220158

Project Number: 20-203-1

#	Client ID	Sample #	Sampling		E ³ H	Result	± 1σ
			Date	Time			
1	IG_BH03_GW013	97364	2022-03-23	11:45-16:30	X	1.5	0.7
2	IG_BH03_GW015	97365	2022-03-23	11:30	X	< 0.8	0.7
3	IG_BH05_GW001	97366	2022-03-25	11:00-16:30	X	7.2	0.9
4	IG_BH01_GW032	97367	3/26/2022 + 3/27/2022	various	X	< 0.8	0.7

E³H ANALYSES

Tritium is reported in Tritium Units.

1TU = 3.221 Picocuries/L per IAEA, 2000 Report.

1TU = 0.11919 Becquerels/L per IAEA, 2000 Report.

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

Isotope Tracer Technologies Inc.

608 Weber St. North Unit 3&4, Waterloo, ON, N2V 1K4

Tel: 519-886-5555 | Fax: 519-886-5575

Email: orfan@it2isotopes.com

Website: www.it2isotopes.com



Client: Geofirma Engineering LTD
Address: 1 RAYMOND ST. SUITE 200
 Ottawa, ON. K1R 1A2
Tel.: (613)402-1701/ (514)-730-0961
Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: 220158
Project Number: 20-203-1

#	Client ID	Sample #	Sampling		$\delta^{18}\text{O}$		Stdev	$\delta^2\text{H}$		Stdev
			Date	Time	H_2O	VSMOW		H_2O	VSMOW	
1	IG_BH03_GW013	97364	2022-03-23	11:45-16:30	X	-10.02	0.02	X	-61.3	0.1
2	IG_BH03_GW015	97365	2022-03-23	11:30	X	-13.26	0.03	X	-88.7	0.2
3	IG_BH05_GW001	97366	2022-03-25	11:00-16:30	X	-8.60	0.04	X	-69.8	0.3
4	IG_BH01_GW032	97367	3/26/2022 + 3/27/2022	various	X	-12.43	0.05	X	-85.0	0.2

^{18}O & ^2H (CRDS)

Instrument Used: Cavity Ring Down Spectroscopy (CRDS)
 CRDS (Model L2130-i) (Picarro, California, USA).

Standard Used:

IT²-12C / IT²-13B / IT²-14B Calibrated with IAEA Standards (V-SMOW, SLAP, and GISP)

Typical Standard deviation:

($^{18}\text{O} \pm 0.1\%$) ($^2\text{H} \pm 1\%$)

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

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Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: 220158

Project Number: 20-203-1

#	Client ID	Sample #	Sampling		$^{87}\text{Sr}/^{86}\text{Sr}$	Result	StdErr (abs)	StdDev (abs)
			Date	Time				
1	IG_BH03_GW013	97364	2022-03-23	11:45-16:30	X	0.71828	5.409E-06	6.755E-05
2	IG_BH03_GW015	97365	2022-03-23	11:30				
3	IG_BH05_GW001	97366	2022-03-25	11:00-16:30	X	0.71737	5.699E-06	7.431E-05
4	IG_BH01_GW032	97367	3/26/2022 + 3/27/2022	various	X	0.71654	5.748E-06	7.964E-05

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

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Tel.: (613)402-1701/ (514)-730-0961
Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: 220158

Project Number: 20-203-1

#	Client ID	Sample #	Sampling		$\delta^{37}\text{Cl}$	Result	Stdv
			Date	Time			
1	IG_BH03_GW013	97364	2022-03-23	11:45-16:30	X	-0.05	0.11
2	IG_BH03_GW015	97365	2022-03-23	11:30			
3	IG_BH05_GW001	97366	2022-03-25	11:00-16:30	X	0.17	0.10
4	IG_BH01_GW032	97367	3/26/2022 + 3/27/2022	various	X	-0.07	0.06

^{37}Cl ANALYSES

Instrument Used:

Isotope Ratio Mass Spectrometry (IRMS) - MAT 253, Thermo Scientific, Germany
 Coupled with an Agilent 6890 Gas Chromatograph (GC)

Standard Used:

SMOC

Typical Standard deviation:

$\pm 0.15\%$

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

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Tel.: (613)402-1701/ (514)-730-0961
Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: 220158
Project Number: 20-203-1

#	Client ID	Sample #	Sampling		$\delta^{13}\text{C}$		Result	Repeat	^{14}C	Result			
			Date	Time	DIC	PDB				DIC	14C yr BP	\pm	F14C
1	IG_BH03_GW013	97364	2022-03-23	11:45-16:30	X	-12.5	-12.6		X	5920	81	0.4785	0.0048
2	IG_BH03_GW015	97365	2022-03-23	11:30	X	-11.1			X	7265	81	0.4048	0.0041
3	IG_BH05_GW001	97366	2022-03-25	11:00-16:30	X	-12.1			X	1430	80	0.8369	0.0083
4	IG_BH01_GW032	97367	3/26/2022 + 3/27/2022	various	X	-15.1			X	4859	81	0.5462	0.0055

^{13}C DIC Analyses

Instrument Used: Finnigan MAT, DeltaPlus XL IRMS, Germany.

Standard Used: IT²-27/IT²-34 /NBS-18/NBS-19

Typical Standard deviation: $\pm 0.2\text{‰}$

^{14}C DIC Analyses

Instrument Used:

AMS (Accelerator Mass Spectrometry)

Standard Used:

OX1: 1.05×10^{-10}

OX2: 1.35×10^{-10}

C6: 1.5×10^{-10}

C7: 0.5×10^{-10}

Typical Standard deviation:

5 to 10% of Standard values listed above

Reporting of Data

In this analysis report, we have followed the conventions recommended by Millard (2014).

Radiocarbon Analysis

Radiocarbon analyses are performed on a 3MV tandem accelerator mass spectrometer built by High Voltage Engineering (HVE).

^{12}C , ^{13}C , $^{14}\text{C}+3$ ions are measured at 2.5 MV terminal voltage with Ar stripping. The fraction modern carbon, F14C, is calculated according to Reimer et al. (2004) as the ratio of the sample $^{14}\text{C}/^{12}\text{C}$ ratio to the standard $^{14}\text{C}/^{12}\text{C}$ ratio (in our case Ox-II) measured in the same data block. Both $^{14}\text{C}/^{12}\text{C}$ ratios are background-corrected and the result is corrected for spectrometer and preparation fractionation using the AMS measured $^{13}\text{C}/^{12}\text{C}$ ratio and is normalized to $\delta^{13}\text{C}$ (PDB). Radiocarbon ages are calculated as $-8033 \ln(\text{F14C})$ and reported in 14C yr BP (BP=AD 1950) as described by Stuiver and Polach (1977). The errors on 14C ages (1σ) are based on counting statistics and $^{14}\text{C}/^{12}\text{C}$ and $^{13}\text{C}/^{12}\text{C}$ variation between data blocks. We do not report $\delta^{13}\text{C}$ as it is measured on the AMS and contains machine fractionation.

D14C (defined as per mil Depletion or Enrichment Relative to Standard Normalized for Isotope Fractionation) are calculated as $(\text{F14C} - 1) \cdot 1000$.

$\Delta^{14}\text{C}$ (defined as age corrected D14C) are calculated as $(\text{F14C} \cdot e^{(1950-y)/8267} - 1) \cdot 1000$, where y = year of measurement.

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

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Tel: 519-886-5555 | Fax: 519-886-5575

Email: orfan@it2isotopes.com

Website: www.it2isotopes.com



SUBMITTER SUMMARY			
Submitter Name:	David Zal	Affiliation:	Research Assistant
Submitter Email:	dzal@uottawa.ca	Street Address:	25 Templeton Street
Submitter Phone:	613-652-5800 ext 8699	City, Province:	Ottawa, Ontario
Principal Investigator Name:	Sean Sterling	Postal Code:	K1N 7N9
Principal Investigator Email:	ssterling@geofirma.com	Country:	Canada
Principal Investigator Phone:	n/a	Date Submitted:	2021-11-19

PROJECT INFORMATION	
Project Title:	n/a
Country:	n/a
Site Name:	Ignace
Collection Date:	n/a

SUBMISSION TIMELINE	
Date samples received (YYYY/MM/DD)	Report date (YYYY/MM/DD)
2022-04-07	2022-07-04

ANALYTICAL NOTES
Unit correction and methodology statement was updated on October 28 2022.

Please note: Unless otherwise specified in the submission form, any remaining sample material will be held for a period of six (6) months, after which time it will be discarded.

CONTACT INFORMATION	
Should you have any questions regarding your data or sample preparation please contact:	
Name:	Barbara Francisco
Email:	balvesfr@uottawa.ca
Phone:	613-562-5800 (6830)

Researchers are asked to report any publications that include data generated at the AEL AMS facility. Publication notifications should be sent to ael-ams@uottawa.ca. Published data should include the unique UO identifier number provided in this analytical report.



Table 1. Analysis Results for Groundwater Samples

uOttawa Number	Submitter's Sample I.D.	Sample Weight (g)	¹²⁷ I Concentration Measured (ppb)	Mass of Iodide Carrier Added (mg)	¹²⁹ I/ ¹²⁷ I Ratio Measured ($\times 10^{-14}$) *		¹²⁹ I Concentration ($\times 10^6$ atoms/g)		Original Ratio (OR) ($\times 10^{-9}$) **	
					Ratio	Standard Deviation	Concentration	Standard Deviation	OR	Standard Deviation
UOH - 4088	IG_BH01_GW032	200.93	743.04	1.98	101.1	4.3	5.09E-02	2.17E-03	1.44E-02	9.48E-04
UOH - 4089	IG_BH03_GW013	198.12	2135.39	1.96	308.7	13.2	1.77E-01	7.53E-03	1.74E-02	1.14E-03
UOH - 4090	IG_BH05_GW001	199.98	143.07	2.01	232.6	9.9	1.13E-01	4.80E-03	1.66E-01	1.09E-02

Note: * $^{129}\text{I}/^{127}\text{I}$ Ratio Measured includes both sample and carrier added.

Note 2: ** $^{129}\text{I}/^{127}\text{I}$ Ratio calculated before added the carrier.

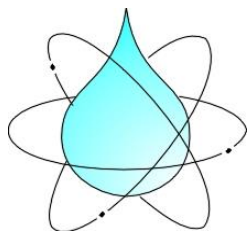


AMS Measurements

The ^{129}I analysis are performed on a 3MV accelerator mass spectrometer (AMS) built by High Voltage Engineering (HVE). $^{129}\text{I}^{+2}$ ions are measured at 2.5 MV terminal voltage Ar stripping. The errors represent 68.3% confidence limits, based on 1 measurement each. These measurements were normalized with respect to ISO-6II in-house reference material for which $^{129}\text{I}/^{127}\text{I} = (5.71 \pm 0.01) \times 10^{-12}$, by calibration with the NIST 3230 I and II standard reference material.

The AMS system background was monitored with our standard NaI blank material and found to be normal.

No background corrections were applied to these data. A NaI blank measured on April 27th, 2022 set of samples yielded a $^{129}\text{I}/^{127}\text{I}$ ratio of $(1.1 \pm 0.2) \times 10^{-14}$.



Hydrogeochemistry Laboratory
Analytical Report - Clark group
University of Ottawa
25 Templeton Street
Ottawa, ON K1N 6N5


Analytical report for:

Geofirma Engineering Ltd.
1 Raymond Street #200
Ottawa, ON K1R 1A2

Sample description

Site	Ignace
Type	Water
Container	Nalgene
Volume	1 L

Analysis

Analyte	^{36}Cl in dissolved Cl
Method	AMS
Facility	Hydrogeochemistry Laboratory, University of Ottawa
Report Approved by	 Ian Clark, P.Geol.

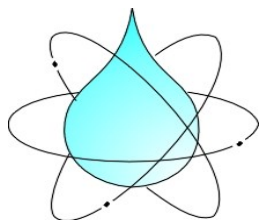
Timeline

Samples received	Analyses completed	Report date
December 09, 2020 (2) March 25, 2021 (2) October 01, 2021 (2) December 13, 2021 (3) April 06, 2022 (3) June 23, 2022 (4)	^{36}Cl	September 20, 2022

Notes

Samples were collected in the field by Geofirma staff. Bottles were received sealed and in good condition. Samples were extracted as Cl^- from solution on an anion exchange column, eluted and precipitated as AgCl target material. AMS analysis was undertaken on a 6 MV tandem accelerator mass spectrometer at ETH Zurich and PRIME Lab, Purdue

Sample	Lab ID	Comment	Cl (mg/L)	³⁶ Cl/Cl final (10 ⁻¹⁵)	±	³⁶ Cl atoms/L (10 ⁶)	±
IG_BH01_GW032	PRIME	prepared at uOttawa	9900	15.2	0.5	2553	84.0
IG_BH03_GW013	PRIME	prepared at uOttawa	21000	15.1	1.2	5379	427.5
IG_BH05_GW001	PRIME	prepared at uOttawa	1900	16.9	1.1	545	35.5




Hydrogeochemistry Laboratory
Analytical Report - Clark group
University of Ottawa
25 Templeton Street
Ottawa, ON K1N 6N5

Analytical report for:

Geofirma Engineering Ltd.
1 Raymond Street #200
Ottawa, ON K1R 1A2

Sample description

Site	Ignace
Type	Noble gas
Container	Nalgene
Volume	Cu tubes
Report Approved by	 Ian Clark, P.Geo.

Analysis

Analyte	Noble gases
Method	Mass spectrometry
Facility	Noble gas laboratory, University of Utah

Timeline

Samples received	Analyses completed	Report date
2022 Q1 and Q2	He, Ne, Ar, Kr, Xe	Rev 0: 2022-10-26 Rev 1: 2023-03-30 Rev 2: 2024-01-04

Notes

Gas extraction from water follows the procedure outlined in Aeschbach-Hertig & Solomon 2013. Please see sheet tab titled "Notes" for further explanation of the noble gas analysis.

Hydrogeochemistry Laboratory
Analytical Report - Clark group

Report prepared for:
 Geofirma Engineering Ltd.

Quarter	Sample ID	Mass g	He3		He4		x/Ra	HeTotal	
			cc/g	±	cc/g	±		cc/g	±
2022 Q1	IG_BH03_GW013	4.3	6.28E-11	6.28E-13	2.17E-03	2.17E-05	0.0209	2.17E-03	2.17E-05
2022 Q1	IG_BH05_GW001	4.5	4.00E-12	4.00E-14	1.49E-04	1.49E-06	0.0194	1.49E-04	1.49E-06
2022 Q1	IG_BH01_GW032	4.5	5.66E-13	5.66E-15	1.76E-05	1.76E-07	0.0232	1.76E-05	1.76E-07
2022 Q2	IG_BH01_GW033	3.6	4.68E-11	4.68E-13	1.52E-03	1.52E-05	0.0222	1.52E-03	1.52E-05
2022 Q2	IG_BH01_GW034	3.1	4.77E-11	4.77E-13	1.62E-03	1.62E-05	0.0213	1.62E-03	1.62E-05
2022 Q2	IG_BH05_GW002	4.7	1.23E-12	1.23E-14	4.67E-05	4.67E-07	0.0190	4.67E-05	4.67E-07
2022 Q2	IG_BH03_GW016	4.6	1.31E-12	1.31E-14	4.45E-05	4.45E-07	0.0213	4.45E-05	4.45E-07

Hydrogeochemistry Laboratory
Analytical Report - Clark group

Report prepared for:
Geofirma Engineering Ltd.

Quarter	Sample ID	Ne20		Ne22		NeTotal		20Ne/22Ne	Ar36
		cc/g	±	cc/g	±	cc/g	±		
2022 Q1	IG_BH03_GW013	2.57E-07	7.71E-09	2.55E-08	7.65E-10	2.82E-07	8.47E-09	10.070	7.02E-07
2022 Q1	IG_BH05_GW001	1.49E-07	4.46E-09	1.52E-08	4.55E-10	1.64E-07	4.91E-09	9.801	1.05E-06
2022 Q1	IG_BH01_GW032	1.25E-07	3.74E-09	1.17E-08	3.52E-10	1.36E-07	4.09E-09	10.628	5.44E-07
2022 Q2	IG_BH01_GW033	2.71E-06	8.13E-08	2.67E-07	8.01E-09	2.98E-06	8.93E-08	10.149	3.76E-06
2022 Q2	IG_BH01_GW034	3.72E-06	1.11E-07	3.76E-07	1.13E-08	4.09E-06	1.23E-07	9.890	5.82E-06
2022 Q2	IG_BH05_GW002	1.10E-07	3.31E-09	1.16E-08	3.48E-10	1.22E-07	3.66E-09	9.517	5.79E-07
2022 Q2	IG_BH03_GW016	8.91E-08	2.67E-09	7.91E-09	2.37E-10	9.70E-08	2.91E-09	11.270	4.64E-07

Hydrogeochemistry Laboratory
Analytical Report - Clark group

Report prepared for:
Geofirma Engineering Ltd.

Quarter	Sample ID	Ar40	ArTotal		36Ar/40Ar	KrTotal		XeTotal	
			<i>cc/g</i>	\pm		<i>cc/g</i>	\pm	<i>cc/g</i>	\pm
2022 Q1	IG_BH03_GW013	3.90E-03	3.90E-03	1.17E-04	1.80E-04	4.99E-08	2.50E-09	7.64E-09	3.82E-10
2022 Q1	IG_BH05_GW001	4.23E-04	4.24E-04	1.27E-05	2.48E-03	7.97E-08	3.99E-09	1.24E-08	6.21E-10
2022 Q1	IG_BH01_GW032	2.54E-04	2.55E-04	7.65E-06	2.14E-03	4.27E-08	2.13E-09	6.68E-09	3.34E-10
2022 Q2	IG_BH01_GW033	2.64E-03	2.64E-03	7.93E-05	1.42E-03	1.76E-07	8.82E-09	1.76E-08	8.79E-10
2022 Q2	IG_BH01_GW034	3.30E-03	3.31E-03	9.93E-05	1.76E-03	2.52E-07	1.26E-08	2.29E-08	1.14E-09
2022 Q2	IG_BH05_GW002	3.44E-04	3.44E-04	1.03E-05	1.68E-03	4.72E-08	2.36E-09	7.72E-09	3.86E-10
2022 Q2	IG_BH03_GW016	4.99E-04	4.99E-04	1.50E-05	9.31E-04	2.69E-08	1.35E-09	4.32E-09	2.16E-10

cc/g - cc of noble gas at STP per gram of sample solution

± - analytical uncertainty, as cc/g

xRa - $^3\text{He}/^4\text{He}$ ratio in sample normalized to the ratio in Air ($1.38\text{E}-6$)

Noble Gas Analysis

Gas extraction from water follows the procedure outlined in *Aeschbach-Hertig & Solomon 2013*. This involves gas extraction from copper tube water samples under vacuum by water vapour sweep into a stainless steel gas flask. The extracted gases are let into a sample preparation line and cryogenically separated. For light noble gases (He and Ne), standards and samples are introduced into an ultra-high vacuum preparation system where bulk (N_2 , O_2) and trace gases (CO_2 , Ar) are removed using liquid N_2 charcoal traps and two SAES getters, followed by analysis on a Thermo Scientific Helix SFT Noble Gas Mass Spectrometer. Internal standards using precise aliquots from a tank of clean dry atmospheric air are run each morning and during analysis to measure instrument drift and sensitivity. Internal standards of air equilibrated water (AEW) are also run as internal checks on the water extraction procedure and analyses. Following purification, He is separated from Ne using a He cooled cryo trap that cycles down to 5K, before releasing He at 28K and Ne at 70K. He and Ne are introduced separately into the Helix SFT operating under static vacuum. Each analysis undergoes a mass peak center, followed by separate integrations on each mass peak. These integrations generate a linear regression used to calculate peak intensity at time zero (when the sample was released into the mass spectrometer). For Ar, Kr and Xe, gases, residual water vapour was removed cryogenically prior to gettering of reactive gases and cryogenic separation of Kr and Xe from Ar. Abundance analysis was done by quadrupole mass spectrometry at the University of Utah Noble Gas Lab.

References:

Aeschbach-Hertig W., Solomon D.K. (2013) Noble Gas Thermometry in Groundwater Hydrology. In: Burnard P. (eds) The Noble Gases as Geochemical Tracers. Advances in Isotope Geochemistry. Springer, Berlin, Heidelberg

**2022 Q2
(June)**



Your P.O. #: 202031-004
 Your Project #: 20-203-1
 Site Location: IGNACE, ON
 Your C.O.C. #: GFIM_BVL_007

Attention: Amy Cartier

Geofirma Engineering Ltd
 1 Raymond St
 Suite 200
 Ottawa, ON
 CANADA K1R 1A2

Report Date: 2022/07/12

Report #: R7207110

Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BUREAU VERITAS JOB #: C2F0223

Received: 2022/06/01, 16:01

Sample Matrix: Water
 # Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2022/06/07	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	1	N/A	2022/06/08	CAM SOP-00102	APHA 4500-CO2 D
Anions	2	N/A	2022/06/06	CAM SOP-00435	SM 23 4110 B m
Dissolved Organic Carbon (DOC) (3)	1	N/A	2022/06/06	CAM SOP-00446	SM 23 5310 B m
Fluoride	2	2022/06/03	2022/06/07	CAM SOP-00449	SM 23 4500-F C m
Dissolved Metals Analysis by ICP	2	2022/06/06	2022/06/08	CAM SOP-00408	EPA 6010D m
Dissolved Metals by ICPMS	2	N/A	2022/06/08	CAM SOP-00447	EPA 6020B m
Iodide, Thiosulphate, Thiocyanate (1)	2	N/A	2022/06/09	CAL SOP-00057	Dionex #034035 R09 m
Total Extractable Elements by ICP-MS (2, 4)	1	2022/06/23	2022/06/23	STL SOP-00071	MA.200-Mét. 1.2 R5 m
Silica (Reactive) (1)	1	N/A	2022/06/09	AB SOP-00011	EPA370.1 R1978 m
Total Ammonia-N	1	N/A	2022/06/04	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (5)	2	N/A	2022/06/03	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	1	2022/06/03	2022/06/07	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	2	N/A	2022/06/08	CAM SOP-00461	EPA 365.1 m
Sulphide	1	N/A	2022/06/06	CAM SOP-00455	SM 23 4500-S G m
Total Inorganic Carbon (TIC)	1	N/A	2022/06/07	CAM SOP-00433	SM 23 5310 m
Total Kjeldahl Nitrogen in Water	1	2022/06/03	2022/06/06	CAM SOP-00938	OMOE E3516 m
Total Nitrogen (calculated)	1	N/A	2022/06/07	Auto Calc.	
Total Organic Carbon (TOC) (6)	1	N/A	2022/06/06	CAM SOP-00446	SM 23 5310B m
Total Phosphorus (Colourimetric)	1	2022/06/06	2022/06/09	CAM SOP-00407	SM 23 4500 P B H m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.



Your P.O. #: 202031-004
Your Project #: 20-203-1
Site Location: IGNACE, ON
Your C.O.C. #: GFIM_BVL_007

Attention: Amy Cartier

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
CANADA K1R 1A2

Report Date: 2022/07/12
Report #: R7207110
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BUREAU VERITAS JOB #: C2F0223

Received: 2022/06/01, 16:01

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

- (1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE, Calgary, AB, T2E 6P8
- (2) This test was performed by Bureau Veritas Montreal, 889 Montée de Liesse, Ville St-Laurent, QC, H4T 1P5
- (3) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
- (4) Non-accredited test method
- (5) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
- (6) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

Encryption Key

Katherine Szozda
Project Manager
12 Jul 2022 15:10:23

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Katherine Szozda, Project Manager

Email: Katherine.Szozda@bureauveritas.com

Phone# (613)274-0573 Ext:7063633

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Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



Bureau Veritas Job #: C2F0223
Report Date: 2022/07/12

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		SUB548			SUB548			SUB549		
Sampling Date		2022/05/29 12:30			2022/05/29 12:30			2022/05/29 09:50		
COC Number		GFIM_BVL_007			GFIM_BVL_007			GFIM_BVL_007		
	UNITS	IG_BH05_GW002	RDL	QC Batch	IG_BH05_GW002 Lab-Dup	RDL	QC Batch	IG_BH05_GW003	RDL	QC Batch

Calculated Parameters

Bicarb. Alkalinity (calc. as CaCO ₃)	mg/L	230	1.0	8029689						
Carb. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	8029689						
Hydrox. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	8029689						
Total Nitrogen (N)	mg/L	0.75	0.10	8030719						

Inorganics

Total Ammonia-N	mg/L	0.10	0.050	8032558						
Fluoride (F ⁻)	mg/L	0.20	0.10	8032680				<0.10	0.10	8032680
Total Inorganic Carbon (C)	mg/L	23	1	8035828	25	1	8035828			
Dissolved Iodide	mg/L	4.0	2.0	8049904				<0.10	0.10	8049904
Total Kjeldahl Nitrogen (TKN)	mg/L	0.63	0.10	8032542						
Dissolved Organic Carbon	mg/L	120	0.80	8031517						
Total Organic Carbon (TOC)	mg/L	130	0.80	8032536						
Orthophosphate (P)	mg/L	<0.010	0.010	8031704				<0.010	0.010	8031704
pH	pH	6.61		8032691						
Total Phosphorus	mg/L	<0.10 (1)	0.10	8035251						
Reactive Silica (SiO ₂)	mg/L	23	0.25	8049905						
Sulphide	mg/L	0.45	0.020	8035176						
Alkalinity (Total as CaCO ₃)	mg/L	230	1.0	8032686						
Nitrite (N)	mg/L	0.020	0.010	8031525				<0.010	0.010	8031525
Dissolved Chloride (Cl ⁻)	mg/L	5200 (2)	50	8089921				1.2	1.0	8032241
Nitrate (N)	mg/L	0.10	0.10	8031525				<0.10	0.10	8031525
Nitrate + Nitrite (N)	mg/L	0.12	0.10	8031525				<0.10	0.10	8031525
Dissolved Bromide (Br ⁻)	mg/L	72 (2)	20	8032241				<1.0	1.0	8032241
Dissolved Sulphate (SO ₄)	mg/L	55 (2)	20	8032241				<1.0	1.0	8032241

Metals

Total Ruthenium (Ru)	ug/L	<2.0	2.0	8082082						
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RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

(2) ANIONS-L: Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.



Bureau Veritas Job #: C2F0223
Report Date: 2022/07/12

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		SUB549		
Sampling Date		2022/05/29 09:50		
COC Number		GFIM_BVL_007		
	UNITS	IG_BH05_GW003 Lab-Dup	RDL	QC Batch

Inorganics				
Dissolved Chloride (Cl-)	mg/L	1.2	1.0	8032241
Dissolved Bromide (Br-)	mg/L	<1.0	1.0	8032241
Dissolved Sulphate (SO4)	mg/L	<1.0	1.0	8032241
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				
Lab-Dup = Laboratory Initiated Duplicate				



ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		SUB548			SUB548			SUB549		
Sampling Date		2022/05/29 12:30			2022/05/29 12:30			2022/05/29 09:50		
COC Number		GFIM_BVL_007			GFIM_BVL_007			GFIM_BVL_007		
	UNITS	IG_BH05_GW002	RDL	QC Batch	IG_BH05_GW002 Lab-Dup	RDL	QC Batch	IG_BH05_GW003	RDL	QC Batch

Metals										
Dissolved Iron (Fe)	mg/L	14	0.02	8036421	14	0.02	8036421	<0.02	0.02	8036421
Dissolved Sulphur (S)	mg/L	15	0.5	8036421	13	0.5	8036421	<0.5	0.5	8036421
Dissolved Aluminum (Al)	ug/L	<25	25	8036447				<4.9	4.9	8036447
Dissolved Arsenic (As)	ug/L	<5.0	5.0	8036447				<1.0	1.0	8036447
Dissolved Barium (Ba)	ug/L	320	10	8036447				<2.0	2.0	8036447
Dissolved Bismuth (Bi)	ug/L	<5.0	5.0	8036447				<1.0	1.0	8036447
Dissolved Boron (B)	ug/L	320	50	8036447				<10	10	8036447
Dissolved Cadmium (Cd)	ug/L	<0.45	0.45	8036447				<0.090	0.090	8036447
Dissolved Calcium (Ca)	ug/L	2500000	2000	8036447				480	200	8036447
Dissolved Cesium (Cs)	ug/L	<1.0	1.0	8036447				<0.20	0.20	8036447
Dissolved Chromium (Cr)	ug/L	<25	25	8036447				<5.0	5.0	8036447
Dissolved Cobalt (Co)	ug/L	<2.5	2.5	8036447				<0.50	0.50	8036447
Dissolved Copper (Cu)	ug/L	<4.5	4.5	8036447				<0.90	0.90	8036447
Dissolved Iron (Fe)	ug/L	14000	500	8036447				<100	100	8036447
Dissolved Lead (Pb)	ug/L	<2.5	2.5	8036447				<0.50	0.50	8036447
Dissolved Lithium (Li)	ug/L	81	25	8036447				<5.0	5.0	8036447
Dissolved Magnesium (Mg)	ug/L	7500	250	8036447				<50	50	8036447
Dissolved Nickel (Ni)	ug/L	<5.0	5.0	8036447				<1.0	1.0	8036447
Dissolved Potassium (K)	ug/L	19000	1000	8036447				<200	200	8036447
Dissolved Rubidium (Rb)	ug/L	31	1.0	8036447				<0.20	0.20	8036447
Dissolved Selenium (Se)	ug/L	<10	10	8036447				<2.0	2.0	8036447
Dissolved Silicon (Si)	ug/L	11000	250	8036447				<50	50	8036447
Dissolved Sodium (Na)	ug/L	510000	500	8036447				160	100	8036447
Dissolved Strontium (Sr)	ug/L	30000	5.0	8036447				5.6	1.0	8036447
Dissolved Thorium (Th)	ug/L	<10	10	8036447				<2.0	2.0	8036447
Dissolved Uranium (U)	ug/L	0.50	0.50	8036447				<0.10	0.10	8036447
Dissolved Zirconium (Zr)	ug/L	<5.0	5.0	8036447				<1.0	1.0	8036447

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate



Bureau Veritas Job #: C2F0223

Report Date: 2022/07/12

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE, ON

Your P.O. #: 202031-004

Sampler Initials: AC

TEST SUMMARY

Bureau Veritas ID: SUB548
Sample ID: IG_BH05_GW002
Matrix: Water

Collected: 2022/05/29
Shipped:
Received: 2022/06/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8032686	N/A	2022/06/07	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	8029689	N/A	2022/06/08	Automated Statchk
Anions	IC	8032241	N/A	2022/06/06	Lusine Khachatryan
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8031517	N/A	2022/06/06	Anna-Kay Gooden
Fluoride	ISE	8032680	2022/06/03	2022/06/07	Surinder Rai
Dissolved Metals Analysis by ICP	ICP	8036421	2022/06/06	2022/06/08	Indira HarryPaul
Dissolved Metals by ICPMS	ICP/MS	8036447	N/A	2022/06/08	Nan Raykha
Iodide, Thiosulphate, Thiocyanate	IC/EC	8049904	N/A	2022/06/09	Kathleen Dalton
Total Extractable Elements by ICP-MS	ICP/MSMS	8082082	2022/06/23	2022/06/23	Brandon Kinnear
Silica (Reactive)	KONE	8049905	N/A	2022/06/09	Fadia Mostafa
Total Ammonia-N	LACH/NH4	8032558	N/A	2022/06/04	Amanpreet Sappal
Nitrate & Nitrite as Nitrogen in Water	LACH	8031525	N/A	2022/06/03	Samuel Law
pH	AT	8032691	2022/06/03	2022/06/07	Surinder Rai
Orthophosphate	KONE	8031704	N/A	2022/06/08	Chandra Nandlal
Sulphide	ISE/S	8035176	N/A	2022/06/06	Taslina Aktar
Total Inorganic Carbon (TIC)	TOCV/NDIR	8035828	N/A	2022/06/07	Anna-Kay Gooden
Total Kjeldahl Nitrogen in Water	SKAL	8032542	2022/06/03	2022/06/06	Rajni Tyagi
Total Nitrogen (calculated)	CALC	8030719	N/A	2022/06/07	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	8032536	N/A	2022/06/06	Anna-Kay Gooden
Total Phosphorus (Colourimetric)	LACH/P	8035251	2022/06/06	2022/06/09	Shivani Shivani

Bureau Veritas ID: SUB548 Dup
Sample ID: IG_BH05_GW002
Matrix: Water

Collected: 2022/05/29
Shipped:
Received: 2022/06/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals Analysis by ICP	ICP	8036421	2022/06/06	2022/06/08	Indira HarryPaul
Total Inorganic Carbon (TIC)	TOCV/NDIR	8035828	N/A	2022/06/07	Anna-Kay Gooden

Bureau Veritas ID: SUB549
Sample ID: IG_BH05_GW003
Matrix: Water

Collected: 2022/05/29
Shipped:
Received: 2022/06/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Anions	IC	8032241	N/A	2022/06/06	Lusine Khachatryan
Fluoride	ISE	8032680	2022/06/03	2022/06/07	Surinder Rai
Dissolved Metals Analysis by ICP	ICP	8036421	2022/06/06	2022/06/08	Indira HarryPaul
Dissolved Metals by ICPMS	ICP/MS	8036447	N/A	2022/06/08	Nan Raykha
Iodide, Thiosulphate, Thiocyanate	IC/EC	8049904	N/A	2022/06/09	Kathleen Dalton
Nitrate & Nitrite as Nitrogen in Water	LACH	8031525	N/A	2022/06/03	Samuel Law
Orthophosphate	KONE	8031704	N/A	2022/06/08	Chandra Nandlal



Bureau Veritas Job #: C2F0223
Report Date: 2022/07/12

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

TEST SUMMARY

Bureau Veritas ID: SUB549 Dup
Sample ID: IG_BH05_GW003
Matrix: Water

Collected: 2022/05/29
Shipped:
Received: 2022/06/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Anions	IC	8032241	N/A	2022/06/06	Lusine Khachatryan



Bureau Veritas Job #: C2F0223
Report Date: 2022/07/12

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

GENERAL COMMENTS

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

Package 1	5.3°C
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Revised Report (2022/07/12): Chloride analysis reworked per client request

Sample SUB548 [IG_BH05_GW002] : Metal Analysis: Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
ANIONS-L: Chloride re-analysis was performed on a different bottle (part 06), from the original reported result (bottle part 01). Chloride re-analysis result was confirmed by reanalysis, and was within our RPD acceptance criteria for duplicates.

Sample SUB548, Anions: Test repeated.

Results relate only to the items tested.



Bureau Veritas Job #: C2F0223

Report Date: 2022/07/12

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE, ON

Your P.O. #: 202031-004

Sampler Initials: AC

QUALITY ASSURANCE REPORT

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8031517	AGD		Matrix Spike	Dissolved Organic Carbon	2022/06/04		98	%	80 - 120
8031517	AGD		Spiked Blank	Dissolved Organic Carbon	2022/06/04		99	%	80 - 120
8031517	AGD		Method Blank	Dissolved Organic Carbon	2022/06/04	<0.40		mg/L	
8031517	AGD		RPD	Dissolved Organic Carbon	2022/06/04	1.1		%	20
8031525	S1L		Matrix Spike	Nitrite (N)	2022/06/03		101	%	80 - 120
				Nitrate (N)	2022/06/03		NC	%	80 - 120
8031525	S1L		Spiked Blank	Nitrite (N)	2022/06/03		105	%	80 - 120
				Nitrate (N)	2022/06/03		104	%	80 - 120
8031525	S1L		Method Blank	Nitrite (N)	2022/06/03	<0.010		mg/L	
				Nitrate (N)	2022/06/03	<0.10		mg/L	
8031525	S1L		RPD	Nitrite (N)	2022/06/03	NC		%	20
				Nitrate (N)	2022/06/03	0.25		%	20
8031704	C_N		Matrix Spike	Orthophosphate (P)	2022/06/08		110	%	75 - 125
8031704	C_N		Spiked Blank	Orthophosphate (P)	2022/06/08		97	%	80 - 120
8031704	C_N		Method Blank	Orthophosphate (P)	2022/06/08	<0.010		mg/L	
8031704	C_N		RPD	Orthophosphate (P)	2022/06/08	NC		%	25
8032241	LKH		Matrix Spike [SUB549-01]	Dissolved Chloride (Cl-)	2022/06/06		98	%	80 - 120
				Dissolved Bromide (Br-)	2022/06/06		100	%	80 - 120
				Dissolved Sulphate (SO4)	2022/06/06		101	%	80 - 120
8032241	LKH		Spiked Blank	Dissolved Chloride (Cl-)	2022/06/06		98	%	70 - 130
				Dissolved Bromide (Br-)	2022/06/06		100	%	80 - 120
				Dissolved Sulphate (SO4)	2022/06/06		100	%	80 - 120
8032241	LKH		Method Blank	Dissolved Chloride (Cl-)	2022/06/06	<1.0		mg/L	
				Dissolved Bromide (Br-)	2022/06/06	<1.0		mg/L	
				Dissolved Sulphate (SO4)	2022/06/06	<1.0		mg/L	
8032241	LKH		RPD [SUB549-01]	Dissolved Chloride (Cl-)	2022/06/06	1.1		%	20
				Dissolved Bromide (Br-)	2022/06/06	NC		%	20
				Dissolved Sulphate (SO4)	2022/06/06	NC		%	20
8032536	AGD		Matrix Spike	Total Organic Carbon (TOC)	2022/06/06		92	%	80 - 120
8032536	AGD		Spiked Blank	Total Organic Carbon (TOC)	2022/06/06		94	%	80 - 120
8032536	AGD		Method Blank	Total Organic Carbon (TOC)	2022/06/06	<0.40		mg/L	
8032536	AGD		RPD	Total Organic Carbon (TOC)	2022/06/06	1.9		%	20
8032542	RTY		Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2022/06/06		NC	%	80 - 120
8032542	RTY		QC Standard	Total Kjeldahl Nitrogen (TKN)	2022/06/06		100	%	80 - 120
8032542	RTY		Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2022/06/06		92	%	80 - 120
8032542	RTY		Method Blank	Total Kjeldahl Nitrogen (TKN)	2022/06/06	<0.10		mg/L	
8032542	RTY		RPD	Total Kjeldahl Nitrogen (TKN)	2022/06/06	0 (1)		%	20
8032558	ASP		Matrix Spike	Total Ammonia-N	2022/06/04		97	%	75 - 125
8032558	ASP		Spiked Blank	Total Ammonia-N	2022/06/04		100	%	80 - 120
8032558	ASP		Method Blank	Total Ammonia-N	2022/06/04	<0.050		mg/L	
8032558	ASP		RPD	Total Ammonia-N	2022/06/04	13		%	20
8032680	SAU		Matrix Spike	Fluoride (F-)	2022/06/07		110	%	80 - 120
8032680	SAU		Spiked Blank	Fluoride (F-)	2022/06/07		96	%	80 - 120
8032680	SAU		Method Blank	Fluoride (F-)	2022/06/07	<0.10		mg/L	
8032680	SAU		RPD	Fluoride (F-)	2022/06/07	8.4		%	20
8032686	SAU		Spiked Blank	Alkalinity (Total as CaCO3)	2022/06/07		97	%	85 - 115
8032686	SAU		Method Blank	Alkalinity (Total as CaCO3)	2022/06/07	<1.0		mg/L	
8032686	SAU		RPD	Alkalinity (Total as CaCO3)	2022/06/07	0.18		%	20
8032691	SAU		Spiked Blank	pH	2022/06/07		102	%	98 - 103
8032691	SAU		RPD	pH	2022/06/07	0.0018		%	N/A



Bureau Veritas Job #: C2F0223
Report Date: 2022/07/12

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8035176	TAK	Matrix Spike	Sulphide	2022/06/06		89	%	80 - 120
8035176	TAK	Spiked Blank	Sulphide	2022/06/06		95	%	80 - 120
8035176	TAK	Method Blank	Sulphide	2022/06/06	<0.020		mg/L	
8035176	TAK	RPD	Sulphide	2022/06/06	NC		%	20
8035251	SSV	Matrix Spike	Total Phosphorus	2022/06/09		97	%	80 - 120
8035251	SSV	QC Standard	Total Phosphorus	2022/06/09		97	%	80 - 120
8035251	SSV	Spiked Blank	Total Phosphorus	2022/06/09		99	%	80 - 120
8035251	SSV	Method Blank	Total Phosphorus	2022/06/09	<0.020		mg/L	
8035828	AGD	Matrix Spike [SUB548-01]	Total Inorganic Carbon (C)	2022/06/07		83	%	80 - 120
8035828	AGD	Spiked Blank	Total Inorganic Carbon (C)	2022/06/07		97	%	80 - 120
8035828	AGD	Method Blank	Total Inorganic Carbon (C)	2022/06/07	<1		mg/L	
8035828	AGD	RPD [SUB548-01]	Total Inorganic Carbon (C)	2022/06/07	8.1		%	20
8036421	IHP	Matrix Spike [SUB548-05]	Dissolved Iron (Fe)	2022/06/08		NC	%	80 - 120
			Dissolved Sulphur (S)	2022/06/08		NC	%	80 - 120
8036421	IHP	Spiked Blank	Dissolved Iron (Fe)	2022/06/08		102	%	80 - 120
			Dissolved Sulphur (S)	2022/06/08		99	%	80 - 120
8036421	IHP	Method Blank	Dissolved Iron (Fe)	2022/06/08	<0.02		mg/L	
			Dissolved Sulphur (S)	2022/06/08	<0.5		mg/L	
8036421	IHP	RPD [SUB548-05]	Dissolved Iron (Fe)	2022/06/08	0.074		%	25
			Dissolved Sulphur (S)	2022/06/08	9.9		%	25
8036447	N_R	Matrix Spike	Dissolved Aluminum (Al)	2022/06/07		NC	%	80 - 120
			Dissolved Arsenic (As)	2022/06/07		102	%	80 - 120
			Dissolved Barium (Ba)	2022/06/07		105	%	80 - 120
			Dissolved Bismuth (Bi)	2022/06/07		96	%	80 - 120
			Dissolved Boron (B)	2022/06/07		106	%	80 - 120
			Dissolved Cadmium (Cd)	2022/06/07		103	%	80 - 120
			Dissolved Calcium (Ca)	2022/06/07		NC	%	80 - 120
			Dissolved Cesium (Cs)	2022/06/07		108	%	80 - 120
			Dissolved Chromium (Cr)	2022/06/07		96	%	80 - 120
			Dissolved Cobalt (Co)	2022/06/07		100	%	80 - 120
			Dissolved Copper (Cu)	2022/06/07		103	%	80 - 120
			Dissolved Iron (Fe)	2022/06/07		97	%	80 - 120
			Dissolved Lead (Pb)	2022/06/07		97	%	80 - 120
			Dissolved Lithium (Li)	2022/06/07		103	%	80 - 120
			Dissolved Magnesium (Mg)	2022/06/07		97	%	80 - 120
			Dissolved Nickel (Ni)	2022/06/07		96	%	80 - 120
			Dissolved Potassium (K)	2022/06/07		103	%	80 - 120
			Dissolved Rubidium (Rb)	2022/06/07		103	%	80 - 120
			Dissolved Selenium (Se)	2022/06/07		100	%	80 - 120
			Dissolved Silicon (Si)	2022/06/07		95	%	80 - 120
			Dissolved Sodium (Na)	2022/06/07		NC	%	80 - 120
			Dissolved Strontium (Sr)	2022/06/07		100	%	80 - 120
			Dissolved Thorium (Th)	2022/06/07		97	%	80 - 120
			Dissolved Uranium (U)	2022/06/07		95	%	80 - 120
			Dissolved Zirconium (Zr)	2022/06/07		109	%	80 - 120
8036447	N_R	Spiked Blank	Dissolved Aluminum (Al)	2022/06/07		92	%	80 - 120
			Dissolved Arsenic (As)	2022/06/07		98	%	80 - 120
			Dissolved Barium (Ba)	2022/06/07		105	%	80 - 120
			Dissolved Bismuth (Bi)	2022/06/07		93	%	80 - 120
			Dissolved Boron (B)	2022/06/07		99	%	80 - 120



Bureau Veritas Job #: C2F0223
Report Date: 2022/07/12

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Cadmium (Cd)	2022/06/07		98	%	80 - 120
			Dissolved Calcium (Ca)	2022/06/07		96	%	80 - 120
			Dissolved Cesium (Cs)	2022/06/07		108	%	80 - 120
			Dissolved Chromium (Cr)	2022/06/07		93	%	80 - 120
			Dissolved Cobalt (Co)	2022/06/07		95	%	80 - 120
			Dissolved Copper (Cu)	2022/06/07		98	%	80 - 120
			Dissolved Iron (Fe)	2022/06/07		96	%	80 - 120
			Dissolved Lead (Pb)	2022/06/07		95	%	80 - 120
			Dissolved Lithium (Li)	2022/06/07		102	%	80 - 120
			Dissolved Magnesium (Mg)	2022/06/07		93	%	80 - 120
			Dissolved Nickel (Ni)	2022/06/07		93	%	80 - 120
			Dissolved Potassium (K)	2022/06/07		98	%	80 - 120
			Dissolved Rubidium (Rb)	2022/06/07		99	%	80 - 120
			Dissolved Selenium (Se)	2022/06/07		98	%	80 - 120
			Dissolved Silicon (Si)	2022/06/07		93	%	80 - 120
			Dissolved Sodium (Na)	2022/06/07		92	%	80 - 120
			Dissolved Strontium (Sr)	2022/06/07		98	%	80 - 120
			Dissolved Thorium (Th)	2022/06/07		93	%	80 - 120
			Dissolved Uranium (U)	2022/06/07		91	%	80 - 120
			Dissolved Zirconium (Zr)	2022/06/07		103	%	80 - 120
8036447	N_R	Method Blank	Dissolved Aluminum (Al)	2022/06/07	<4.9		ug/L	
			Dissolved Arsenic (As)	2022/06/07	<1.0		ug/L	
			Dissolved Barium (Ba)	2022/06/07	<2.0		ug/L	
			Dissolved Bismuth (Bi)	2022/06/07	<1.0		ug/L	
			Dissolved Boron (B)	2022/06/07	<10		ug/L	
			Dissolved Cadmium (Cd)	2022/06/07	<0.090		ug/L	
			Dissolved Calcium (Ca)	2022/06/07	<200		ug/L	
			Dissolved Cesium (Cs)	2022/06/07	<0.20		ug/L	
			Dissolved Chromium (Cr)	2022/06/07	<5.0		ug/L	
			Dissolved Cobalt (Co)	2022/06/07	<0.50		ug/L	
			Dissolved Copper (Cu)	2022/06/07	<0.90		ug/L	
			Dissolved Iron (Fe)	2022/06/07	<100		ug/L	
			Dissolved Lead (Pb)	2022/06/07	<0.50		ug/L	
			Dissolved Lithium (Li)	2022/06/07	<5.0		ug/L	
			Dissolved Magnesium (Mg)	2022/06/07	<50		ug/L	
			Dissolved Nickel (Ni)	2022/06/07	<1.0		ug/L	
			Dissolved Potassium (K)	2022/06/07	<200		ug/L	
			Dissolved Rubidium (Rb)	2022/06/07	<0.20		ug/L	
			Dissolved Selenium (Se)	2022/06/07	<2.0		ug/L	
			Dissolved Silicon (Si)	2022/06/07	<50		ug/L	
			Dissolved Sodium (Na)	2022/06/07	<100		ug/L	
			Dissolved Strontium (Sr)	2022/06/07	<1.0		ug/L	
			Dissolved Thorium (Th)	2022/06/07	<2.0		ug/L	
			Dissolved Uranium (U)	2022/06/07	<0.10		ug/L	
			Dissolved Zirconium (Zr)	2022/06/07	<1.0		ug/L	
8049904	KD9	Matrix Spike	Dissolved Iodide	2022/06/09		1010 (2)	%	80 - 120
8049904	KD9	Spiked Blank	Dissolved Iodide	2022/06/09		106	%	80 - 120
8049904	KD9	Method Blank	Dissolved Iodide	2022/06/09	<0.10		mg/L	
8049905	FM0	Matrix Spike	Reactive Silica (SiO2)	2022/06/09		117	%	80 - 120
8049905	FM0	Spiked Blank	Reactive Silica (SiO2)	2022/06/09		100	%	80 - 120



Bureau Veritas Job #: C2F0223

Report Date: 2022/07/12

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE, ON

Your P.O. #: 202031-004

Sampler Initials: AC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8049905	FM0	Method Blank	Reactive Silica (SiO ₂)	2022/06/09	<0.050		mg/L	
8082082	BKI	Spiked Blank	Total Ruthenium (Ru)	2022/06/23		103	%	70 - 130
8082082	BKI	Method Blank	Total Ruthenium (Ru)	2022/06/23	<2.0		ug/L	
8082082	BKI	RPD	Total Ruthenium (Ru)	2022/06/23	NC		%	30
8089921	LKH	Matrix Spike	Dissolved Chloride (Cl ⁻)	2022/07/05		98	%	80 - 120
8089921	LKH	Spiked Blank	Dissolved Chloride (Cl ⁻)	2022/07/05		98	%	70 - 130
8089921	LKH	Method Blank	Dissolved Chloride (Cl ⁻)	2022/07/05	<1.0		mg/L	

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

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

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

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

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

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

(1) TKN < NH₄: Both values fall within acceptable RPD limits for duplicates and are likely equivalent.

(2) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



Bureau Veritas Job #: C2F0223
Report Date: 2022/07/12

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Cristina Carriere

Cristina Carriere, Senior Scientific Specialist

Ewa Pranjić



Ewa Pranjić, M.Sc., C.Chem, Scientific Specialist

Sze Yeung Fock

Sze Yeung Fock, B.Sc., Scientific Specialist

Zineb

Zineb El Ouali

Membre OCQ#2021-051

Zineb El Ouali, Analyst 1

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Your P.O. #: 202031-004
 Your Project #: 20-203-1
 Site Location: IGNACE, ON
 Your C.O.C. #: GFIM_BVL_0008

Attention: Amy Cartier

Geofirma Engineering Ltd
 1 Raymond St
 Suite 200
 Ottawa, ON
 CANADA K1R 1A2

Report Date: 2022/06/29

Report #: R7191190

Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2F6327

Received: 2022/06/07, 14:02

Sample Matrix: Water
 # Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	3	N/A	2022/06/10	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	3	N/A	2022/06/13	CAM SOP-00102	APHA 4500-CO2 D
Anions	3	N/A	2022/06/10	CAM SOP-00435	SM 23 4110 B m
Dissolved Organic Carbon (DOC) (3)	3	N/A	2022/06/09	CAM SOP-00446	SM 23 5310 B m
Fluoride	3	2022/06/09	2022/06/10	CAM SOP-00449	SM 23 4500-F C m
Dissolved Metals Analysis by ICP	3	2022/06/09	2022/06/14	CAM SOP-00408	EPA 6010D m
Dissolved Metals by ICPMS	3	N/A	2022/06/13	CAM SOP-00447	EPA 6020B m
Iodide, Thiosulphate, Thiocyanate (1)	3	N/A	2022/06/12	CAL SOP-00057	Dionex #034035 R09 m
Total Extractable Elements by ICP-MS (2, 4)	3	2022/06/23	2022/06/23	STL SOP-00071	MA.200-Mét. 1.2 R5 m
Silica (Reactive) (1)	1	N/A	2022/06/11	AB SOP-00011	EPA370.1 R1978 m
Silica (Reactive) (1)	2	N/A	2022/06/15	AB SOP-00011	EPA370.1 R1978 m
Nitrate & Nitrite as Nitrogen in Water (5)	3	N/A	2022/06/09	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	3	2022/06/09	2022/06/10	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	3	N/A	2022/06/09	CAM SOP-00461	EPA 365.1 m
Sulphide	3	N/A	2022/06/09	CAM SOP-00455	SM 23 4500-S G m
Total Inorganic Carbon (TIC)	3	N/A	2022/06/09	CAM SOP-00433	SM 23 5310 m
Total Kjeldahl Nitrogen in Water	3	2022/06/08	2022/06/09	CAM SOP-00938	OMOE E3516 m
Total Nitrogen (calculated)	3	N/A	2022/06/09	Auto Calc.	
Total Organic Carbon (TOC) (6)	3	N/A	2022/06/10	CAM SOP-00446	SM 23 5310B m
Total Phosphorus (Colourimetric)	3	2022/06/24	2022/06/24	CAM SOP-00407	SM 23 4500 P B H m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.



Your P.O. #: 202031-004
 Your Project #: 20-203-1
 Site Location: IGNACE, ON
 Your C.O.C. #: GFIM_BVL_0008

Attention: Amy Cartier

Geofirma Engineering Ltd
 1 Raymond St
 Suite 200
 Ottawa, ON
 CANADA K1R 1A2

Report Date: 2022/06/29
 Report #: R7191190
 Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2F6327

Received: 2022/06/07, 14:02

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

- (1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE, Calgary, AB, T2E 6P8
- (2) This test was performed by Bureau Veritas Montreal, 889 Montée de Liesse, Ville St-Laurent, QC, H4T 1P5
- (3) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
- (4) Non-accredited test method
- (5) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
- (6) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

Encryption Key



**AUTHORIZED REPORT
 RAPPORT AUTORISÉ**

Bureau Veritas
 29 Jun 2022 14:30:24

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Katherine Szozda, Project Manager
 Email: Katherine.Szozda@bureauveritas.com
 Phone# (613)274-0573 Ext:7063633

=====

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Bureau Veritas Job #: C2F6327
Report Date: 2022/06/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		SVK328			SVK328			SVK329		
Sampling Date		2022/06/02 15:25			2022/06/02 15:25			2022/06/04 15:25		
COC Number		GFIM_BVL_0008			GFIM_BVL_0008			GFIM_BVL_0008		
	UNITS	IG_BH03_GW016	RDL	QC Batch	IG_BH03_GW016 Lab-Dup	RDL	QC Batch	IG_BH01_GW033	RDL	QC Batch

Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO ₃)	mg/L	66	1.0	8040466				4.7	1.0	8040466
Carb. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	8040466				<1.0	1.0	8040466
Hydrox. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	8040466				<1.0	1.0	8040466
Total Nitrogen (N)	mg/L	8.8	5.0	8040615				4.2	2.0	8040615
Inorganics										
Fluoride (F ⁻)	mg/L	0.13	0.10	8043737	0.14	0.10	8043737	0.97	0.10	8043737
Total Inorganic Carbon (C)	mg/L	2	1	8042809	1	1	8042809	<1	1	8042809
Dissolved Iodide	mg/L	<2.0	2.0	8056888	<2.0	2.0	8056888	<2.0	2.0	8056888
Total Kjeldahl Nitrogen (TKN)	mg/L	8.8	5.0	8040710				4.2	2.0	8040710
Dissolved Organic Carbon	mg/L	110	0.80	8040199				0.55	0.40	8040199
Total Organic Carbon (TOC)	mg/L	110	0.80	8043985				1.3	0.40	8043985
Orthophosphate (P)	mg/L	<0.010	0.010	8042224				0.013	0.010	8042224
pH	pH	6.86		8043738	7.02		8043738	6.72		8043738
Total Phosphorus	mg/L	<0.10 (1)	0.10	8073404				0.38	0.10	8072834
Reactive Silica (SiO ₂)	mg/L	41 (2)	0.50	8056889				12	0.25	8056889
Sulphide	mg/L	<0.020	0.020	8041084				<0.020	0.020	8041084
Alkalinity (Total as CaCO ₃)	mg/L	66	1.0	8043739	68	1.0	8043739	4.7	1.0	8043739
Nitrite (N)	mg/L	<0.050	0.050	8042228				<0.010	0.010	8042228
Dissolved Chloride (Cl ⁻)	mg/L	20000	400	8044213				9000	400	8044213
Nitrate (N)	mg/L	<0.50	0.50	8042228				<0.10	0.10	8042228
Nitrate + Nitrite (N)	mg/L	<0.50	0.50	8042228				<0.10	0.10	8042228
Dissolved Bromide (Br ⁻)	mg/L	<400	400	8044213				<400	400	8044213
Dissolved Sulphate (SO ₄)	mg/L	<400	400	8044213				<400	400	8044213
Metals										
Total Ruthenium (Ru)	ug/L	<2.0	2.0	8082082				<2.0	2.0	8082082
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate (1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly. (2) Duplicate exceeds acceptance criteria due to sample matrix. Reanalysis yields similar results.										



Bureau Veritas Job #: C2F6327
Report Date: 2022/06/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		SVK329			SVK330			SVK330		
Sampling Date		2022/06/04 15:25			2022/06/04 12:00			2022/06/04 12:00		
COC Number		GFIM_BVL_0008			GFIM_BVL_0008			GFIM_BVL_0008		
	UNITS	IG_BH01_GW033 Lab-Dup	RDL	QC Batch	IG_BH01_GW034	RDL	QC Batch	IG_BH01_GW034 Lab-Dup	RDL	QC Batch

Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO ₃)	mg/L				5.7	1.0	8040466			
Carb. Alkalinity (calc. as CaCO ₃)	mg/L				<1.0	1.0	8040466			
Hydrox. Alkalinity (calc. as CaCO ₃)	mg/L				<1.0	1.0	8040466			
Total Nitrogen (N)	mg/L				3.1	1.0	8040615			
Inorganics										
Fluoride (F ⁻)	mg/L				0.92	0.10	8043737			
Total Inorganic Carbon (C)	mg/L				<1	1	8042809			
Dissolved Iodide	mg/L				<2.0	2.0	8056888			
Total Kjeldahl Nitrogen (TKN)	mg/L				3.1	1.0	8040710			
Dissolved Organic Carbon	mg/L				0.51	0.40	8040199			
Total Organic Carbon (TOC)	mg/L				1.2	0.40	8043985			
Orthophosphate (P)	mg/L	0.011	0.010	8042224	0.011	0.010	8042224			
pH	pH				6.74		8043738			
Total Phosphorus	mg/L				0.23	0.10	8072834			
Reactive Silica (SiO ₂)	mg/L				27	0.25	8056890			
Sulphide	mg/L				<0.020	0.020	8041084			
Alkalinity (Total as CaCO ₃)	mg/L				5.7	1.0	8043739			
Nitrite (N)	mg/L				<0.010	0.010	8042228			
Dissolved Chloride (Cl ⁻)	mg/L				9700	400	8044213			
Nitrate (N)	mg/L				<0.10	0.10	8042228			
Nitrate + Nitrite (N)	mg/L				<0.10	0.10	8042228			
Dissolved Bromide (Br ⁻)	mg/L				<400	400	8044213			
Dissolved Sulphate (SO ₄)	mg/L				<400	400	8044213			
Metals										
Total Ruthenium (Ru)	ug/L				<2.0	2.0	8082082	<2.0	2.0	8082082
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate										



Bureau Veritas Job #: C2F6327
Report Date: 2022/06/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		SVK328		SVK329	SVK330		
Sampling Date		2022/06/02 15:25		2022/06/04 15:25	2022/06/04 12:00		
COC Number		GFIM_BVL_0008		GFIM_BVL_0008	GFIM_BVL_0008		
	UNITS	IG_BH03_GW016	RDL	IG_BH01_GW033	IG_BH01_GW034	RDL	QC Batch
Metals							
Dissolved Iron (Fe)	mg/L	0.9	0.2	0.06	0.05	0.02	8040784
Dissolved Sulphur (S)	mg/L	<5	5	76	76	0.5	8040784
Dissolved Aluminum (Al)	ug/L	<49	49	<25	<25	25	8043311
Dissolved Arsenic (As)	ug/L	<10	10	<5.0	<5.0	5.0	8043311
Dissolved Barium (Ba)	ug/L	350	20	310	340	10	8043311
Dissolved Bismuth (Bi)	ug/L	<10	10	<5.0	<5.0	5.0	8043311
Dissolved Boron (B)	ug/L	320	100	330	360	50	8043311
Dissolved Cadmium (Cd)	ug/L	<0.90	0.90	<0.45	<0.45	0.45	8043311
Dissolved Calcium (Ca)	ug/L	11000000	10000	4900000	5100000	10000	8043311
Dissolved Cesium (Cs)	ug/L	<2.0	2.0	<1.0	<1.0	1.0	8043311
Dissolved Chromium (Cr)	ug/L	<50	50	<25	<25	25	8043311
Dissolved Cobalt (Co)	ug/L	<5.0	5.0	<2.5	<2.5	2.5	8043311
Dissolved Copper (Cu)	ug/L	<9.0	9.0	<4.5	<4.5	4.5	8043311
Dissolved Iron (Fe)	ug/L	<1000	1000	<500	<500	500	8043311
Dissolved Lead (Pb)	ug/L	<5.0	5.0	<2.5	<2.5	2.5	8043311
Dissolved Lithium (Li)	ug/L	260	50	58	57	25	8043311
Dissolved Magnesium (Mg)	ug/L	2900	500	750	880	250	8043311
Dissolved Nickel (Ni)	ug/L	<10	10	<5.0	<5.0	5.0	8043311
Dissolved Potassium (K)	ug/L	14000	2000	13000	13000	1000	8043311
Dissolved Rubidium (Rb)	ug/L	45	2.0	15	16	1.0	8043311
Dissolved Selenium (Se)	ug/L	<20	20	<10	<10	10	8043311
Dissolved Silicon (Si)	ug/L	5800	500	4000	4100	250	8043311
Dissolved Sodium (Na)	ug/L	740000	1000	700000	730000	500	8043311
Dissolved Strontium (Sr)	ug/L	140000	10	60000	63000	5.0	8043311
Dissolved Thorium (Th)	ug/L	<20	20	<10	<10	10	8043311
Dissolved Uranium (U)	ug/L	<1.0	1.0	<0.50	<0.50	0.50	8043311
Dissolved Zirconium (Zr)	ug/L	<10	10	<5.0	<5.0	5.0	8043311
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							



Bureau Veritas Job #: C2F6327
Report Date: 2022/06/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

TEST SUMMARY

Bureau Veritas ID: SVK328
Sample ID: IG_BH03_GW016
Matrix: Water

Collected: 2022/06/02
Shipped:
Received: 2022/06/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8043739	N/A	2022/06/10	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	8040466	N/A	2022/06/13	Automated Statchk
Anions	IC	8044213	N/A	2022/06/10	Surleen Kaur Romana
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8040199	N/A	2022/06/09	Anna-Kay Gooden
Fluoride	ISE	8043737	2022/06/09	2022/06/10	Surinder Rai
Dissolved Metals Analysis by ICP	ICP	8040784	2022/06/09	2022/06/14	Suban Kanapathipillai
Dissolved Metals by ICPMS	ICP/MS	8043311	N/A	2022/06/13	Rupinder Gill
Iodide, Thiosulphate, Thiocyanate	IC/EC	8056888	N/A	2022/06/12	Karen Graham
Total Extractable Elements by ICP-MS	ICP/MSMS	8082082	2022/06/23	2022/06/23	Brandon Kinnear
Silica (Reactive)	KONE	8056889	N/A	2022/06/15	Fadia Mostafa
Nitrate & Nitrite as Nitrogen in Water	LACH	8042228	N/A	2022/06/09	Samuel Law
pH	AT	8043738	2022/06/09	2022/06/10	Surinder Rai
Orthophosphate	KONE	8042224	N/A	2022/06/09	Chandra Nandlal
Sulphide	ISE/S	8041084	N/A	2022/06/09	Taslina Aktar
Total Inorganic Carbon (TIC)	TOCV/NDIR	8042809	N/A	2022/06/09	Anna-Kay Gooden
Total Kjeldahl Nitrogen in Water	SKAL	8040710	2022/06/08	2022/06/09	Rajni Tyagi
Total Nitrogen (calculated)	CALC	8040615	N/A	2022/06/09	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	8043985	N/A	2022/06/10	Anna-Kay Gooden
Total Phosphorus (Colourimetric)	LACH/P	8073404	2022/06/24	2022/06/24	Shivani Shivani

Bureau Veritas ID: SVK328 Dup
Sample ID: IG_BH03_GW016
Matrix: Water

Collected: 2022/06/02
Shipped:
Received: 2022/06/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8043739	N/A	2022/06/10	Surinder Rai
Fluoride	ISE	8043737	2022/06/09	2022/06/10	Surinder Rai
Iodide, Thiosulphate, Thiocyanate	IC/EC	8056888	N/A	2022/06/12	Karen Graham
pH	AT	8043738	2022/06/09	2022/06/10	Surinder Rai
Total Inorganic Carbon (TIC)	TOCV/NDIR	8042809	N/A	2022/06/09	Anna-Kay Gooden

Bureau Veritas ID: SVK329
Sample ID: IG_BH01_GW033
Matrix: Water

Collected: 2022/06/04
Shipped:
Received: 2022/06/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8043739	N/A	2022/06/10	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	8040466	N/A	2022/06/13	Automated Statchk
Anions	IC	8044213	N/A	2022/06/10	Surleen Kaur Romana
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8040199	N/A	2022/06/09	Anna-Kay Gooden
Fluoride	ISE	8043737	2022/06/09	2022/06/10	Surinder Rai
Dissolved Metals Analysis by ICP	ICP	8040784	2022/06/09	2022/06/14	Suban Kanapathipillai
Dissolved Metals by ICPMS	ICP/MS	8043311	N/A	2022/06/13	Rupinder Gill



Bureau Veritas Job #: C2F6327

Report Date: 2022/06/29

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE, ON

Your P.O. #: 202031-004

Sampler Initials: AC

TEST SUMMARY

Bureau Veritas ID: SVK329
Sample ID: IG_BH01_GW033
Matrix: Water

Collected: 2022/06/04
Shipped:
Received: 2022/06/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Iodide, Thiosulphate, Thiocyanate	IC/EC	8056888	N/A	2022/06/12	Karen Graham
Total Extractable Elements by ICP-MS	ICP/MSMS	8082082	2022/06/23	2022/06/23	Brandon Kinnear
Silica (Reactive)	KONE	8056889	N/A	2022/06/15	Fadia Mostafa
Nitrate & Nitrite as Nitrogen in Water	LACH	8042228	N/A	2022/06/09	Samuel Law
pH	AT	8043738	2022/06/09	2022/06/10	Surinder Rai
Orthophosphate	KONE	8042224	N/A	2022/06/09	Chandra Nandlal
Sulphide	ISE/S	8041084	N/A	2022/06/09	Taslina Aktar
Total Inorganic Carbon (TIC)	TOCV/NDIR	8042809	N/A	2022/06/09	Anna-Kay Gooden
Total Kjeldahl Nitrogen in Water	SKAL	8040710	2022/06/08	2022/06/09	Rajni Tyagi
Total Nitrogen (calculated)	CALC	8040615	N/A	2022/06/09	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	8043985	N/A	2022/06/10	Anna-Kay Gooden
Total Phosphorus (Colourimetric)	LACH/P	8072834	2022/06/24	2022/06/24	Shivani Shivani

Bureau Veritas ID: SVK329 Dup
Sample ID: IG_BH01_GW033
Matrix: Water

Collected: 2022/06/04
Shipped:
Received: 2022/06/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Orthophosphate	KONE	8042224	N/A	2022/06/09	Chandra Nandlal

Bureau Veritas ID: SVK330
Sample ID: IG_BH01_GW034
Matrix: Water

Collected: 2022/06/04
Shipped:
Received: 2022/06/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8043739	N/A	2022/06/10	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	8040466	N/A	2022/06/13	Automated Statchk
Anions	IC	8044213	N/A	2022/06/10	Surleen Kaur Romana
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8040199	N/A	2022/06/09	Anna-Kay Gooden
Fluoride	ISE	8043737	2022/06/09	2022/06/10	Surinder Rai
Dissolved Metals Analysis by ICP	ICP	8040784	2022/06/09	2022/06/14	Suban Kanapathipillai
Dissolved Metals by ICPMS	ICP/MS	8043311	N/A	2022/06/13	Rupinder Gill
Iodide, Thiosulphate, Thiocyanate	IC/EC	8056888	N/A	2022/06/12	Karen Graham
Total Extractable Elements by ICP-MS	ICP/MSMS	8082082	2022/06/23	2022/06/23	Brandon Kinnear
Silica (Reactive)	KONE	8056890	N/A	2022/06/11	Fadia Mostafa
Nitrate & Nitrite as Nitrogen in Water	LACH	8042228	N/A	2022/06/09	Samuel Law
pH	AT	8043738	2022/06/09	2022/06/10	Surinder Rai
Orthophosphate	KONE	8042224	N/A	2022/06/09	Chandra Nandlal
Sulphide	ISE/S	8041084	N/A	2022/06/09	Taslina Aktar
Total Inorganic Carbon (TIC)	TOCV/NDIR	8042809	N/A	2022/06/09	Anna-Kay Gooden
Total Kjeldahl Nitrogen in Water	SKAL	8040710	2022/06/08	2022/06/09	Rajni Tyagi
Total Nitrogen (calculated)	CALC	8040615	N/A	2022/06/09	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	8043985	N/A	2022/06/10	Anna-Kay Gooden



Bureau Veritas Job #: C2F6327
Report Date: 2022/06/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

TEST SUMMARY

Bureau Veritas ID: SVK330
Sample ID: IG_BH01_GW034
Matrix: Water

Collected: 2022/06/04
Shipped:
Received: 2022/06/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Phosphorus (Colourimetric)	LACH/P	8072834	2022/06/24	2022/06/24	Shivani Shivani

Bureau Veritas ID: SVK330 Dup
Sample ID: IG_BH01_GW034
Matrix: Water

Collected: 2022/06/04
Shipped:
Received: 2022/06/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Extractable Elements by ICP-MS	ICP/MSMS	8082082	2022/06/23	2022/06/23	Brandon Kinnear



GENERAL COMMENTS

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

Package 1	7.3°C
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ANIONS-L: Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

TP-COLOR-L : Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Sample SVK328 [IG_BH03_GW016] : Nitrite/Nitrate: Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Metals Analysis: Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Metals Analysis: Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Sample SVK329 [IG_BH01_GW033] : Metals Analysis: Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Sample SVK330 [IG_BH01_GW034] : Metals Analysis: Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

RESULTS OF ANALYSES OF WATER

Sample SVK328 [IG_BH03_GW016] Iodide, Thiosulphate, Thiocyanate: Detection limits raised due to matrix interference.

Sample SVK329 [IG_BH01_GW033] Iodide, Thiosulphate, Thiocyanate: Detection limits raised due to matrix interference.

Sample SVK330 [IG_BH01_GW034] Iodide, Thiosulphate, Thiocyanate: Detection limits raised due to matrix interference.

Results relate only to the items tested.



Bureau Veritas Job #: C2F6327

Report Date: 2022/06/29

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE, ON

Your P.O. #: 202031-004

Sampler Initials: AC

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8040199	AGD	Matrix Spike	Dissolved Organic Carbon	2022/06/09		91	%	80 - 120
8040199	AGD	Spiked Blank	Dissolved Organic Carbon	2022/06/09		95	%	80 - 120
8040199	AGD	Method Blank	Dissolved Organic Carbon	2022/06/09	<0.40		mg/L	
8040199	AGD	RPD	Dissolved Organic Carbon	2022/06/09	0.68		%	20
8040710	RTY	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2022/06/09		NC	%	80 - 120
8040710	RTY	QC Standard	Total Kjeldahl Nitrogen (TKN)	2022/06/09		101	%	80 - 120
8040710	RTY	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2022/06/09		103	%	80 - 120
8040710	RTY	Method Blank	Total Kjeldahl Nitrogen (TKN)	2022/06/09	<0.10		mg/L	
8040710	RTY	RPD	Total Kjeldahl Nitrogen (TKN)	2022/06/09	0.85		%	20
8040784	SUK	Matrix Spike	Dissolved Iron (Fe)	2022/06/14		97	%	80 - 120
			Dissolved Sulphur (S)	2022/06/14		NC	%	80 - 120
8040784	SUK	Spiked Blank	Dissolved Iron (Fe)	2022/06/14		101	%	80 - 120
			Dissolved Sulphur (S)	2022/06/14		98	%	80 - 120
8040784	SUK	Method Blank	Dissolved Iron (Fe)	2022/06/14	<0.02		mg/L	
			Dissolved Sulphur (S)	2022/06/14	<0.5		mg/L	
8041084	TAK	Matrix Spike	Sulphide	2022/06/09		90	%	80 - 120
8041084	TAK	Spiked Blank	Sulphide	2022/06/09		93	%	80 - 120
8041084	TAK	Method Blank	Sulphide	2022/06/09	<0.020		mg/L	
8041084	TAK	RPD	Sulphide	2022/06/09	NC		%	20
8042224	C_N	Matrix Spike [SVK329-01]	Orthophosphate (P)	2022/06/09		123	%	75 - 125
8042224	C_N	Spiked Blank	Orthophosphate (P)	2022/06/09		99	%	80 - 120
8042224	C_N	Method Blank	Orthophosphate (P)	2022/06/09	<0.010		mg/L	
8042224	C_N	RPD [SVK329-01]	Orthophosphate (P)	2022/06/09	17		%	25
8042228	S1L	Matrix Spike	Nitrite (N)	2022/06/09		104	%	80 - 120
			Nitrate (N)	2022/06/09		NC	%	80 - 120
8042228	S1L	Spiked Blank	Nitrite (N)	2022/06/09		106	%	80 - 120
			Nitrate (N)	2022/06/09		100	%	80 - 120
8042228	S1L	Method Blank	Nitrite (N)	2022/06/09	<0.010		mg/L	
			Nitrate (N)	2022/06/09	<0.10		mg/L	
8042228	S1L	RPD	Nitrate (N)	2022/06/09	0.81		%	20
8042809	AGD	Matrix Spike [SVK328-01]	Total Inorganic Carbon (C)	2022/06/09		94	%	80 - 120
8042809	AGD	Spiked Blank	Total Inorganic Carbon (C)	2022/06/09		98	%	80 - 120
8042809	AGD	Method Blank	Total Inorganic Carbon (C)	2022/06/09	<1		mg/L	
8042809	AGD	RPD [SVK328-01]	Total Inorganic Carbon (C)	2022/06/09	5.2		%	20
8043311	RG4	Matrix Spike	Dissolved Aluminum (Al)	2022/06/13		103	%	80 - 120
			Dissolved Arsenic (As)	2022/06/13		102	%	80 - 120
			Dissolved Barium (Ba)	2022/06/13		102	%	80 - 120
			Dissolved Bismuth (Bi)	2022/06/13		94	%	80 - 120
			Dissolved Boron (B)	2022/06/13		107	%	80 - 120
			Dissolved Cadmium (Cd)	2022/06/13		102	%	80 - 120
			Dissolved Calcium (Ca)	2022/06/13		NC	%	80 - 120
			Dissolved Cesium (Cs)	2022/06/13		104	%	80 - 120
			Dissolved Chromium (Cr)	2022/06/13		102	%	80 - 120
			Dissolved Cobalt (Co)	2022/06/13		101	%	80 - 120
			Dissolved Copper (Cu)	2022/06/13		101	%	80 - 120
			Dissolved Iron (Fe)	2022/06/13		102	%	80 - 120
			Dissolved Lead (Pb)	2022/06/13		94	%	80 - 120
			Dissolved Lithium (Li)	2022/06/13		100	%	80 - 120
			Dissolved Magnesium (Mg)	2022/06/13		102	%	80 - 120
			Dissolved Nickel (Ni)	2022/06/13		100	%	80 - 120



Bureau Veritas Job #: C2F6327
Report Date: 2022/06/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8043311	RG4	Spiked Blank	Dissolved Potassium (K)	2022/06/13		106	%	80 - 120
			Dissolved Rubidium (Rb)	2022/06/13		101	%	80 - 120
			Dissolved Selenium (Se)	2022/06/13		101	%	80 - 120
			Dissolved Silicon (Si)	2022/06/13		105	%	80 - 120
			Dissolved Sodium (Na)	2022/06/13		NC	%	80 - 120
			Dissolved Strontium (Sr)	2022/06/13		102	%	80 - 120
			Dissolved Thorium (Th)	2022/06/13		99	%	80 - 120
			Dissolved Uranium (U)	2022/06/13		99	%	80 - 120
			Dissolved Zirconium (Zr)	2022/06/13		107	%	80 - 120
			Dissolved Aluminum (Al)	2022/06/13		99	%	80 - 120
			Dissolved Arsenic (As)	2022/06/13		98	%	80 - 120
			Dissolved Barium (Ba)	2022/06/13		98	%	80 - 120
			Dissolved Bismuth (Bi)	2022/06/13		95	%	80 - 120
			Dissolved Boron (B)	2022/06/13		99	%	80 - 120
			Dissolved Cadmium (Cd)	2022/06/13		98	%	80 - 120
			Dissolved Calcium (Ca)	2022/06/13		100	%	80 - 120
			Dissolved Cesium (Cs)	2022/06/13		101	%	80 - 120
			Dissolved Chromium (Cr)	2022/06/13		97	%	80 - 120
			Dissolved Cobalt (Co)	2022/06/13		98	%	80 - 120
			Dissolved Copper (Cu)	2022/06/13		96	%	80 - 120
			Dissolved Iron (Fe)	2022/06/13		99	%	80 - 120
			Dissolved Lead (Pb)	2022/06/13		95	%	80 - 120
			Dissolved Lithium (Li)	2022/06/13		100	%	80 - 120
			Dissolved Magnesium (Mg)	2022/06/13		96	%	80 - 120
			Dissolved Nickel (Ni)	2022/06/13		96	%	80 - 120
			Dissolved Potassium (K)	2022/06/13		99	%	80 - 120
			Dissolved Rubidium (Rb)	2022/06/13		96	%	80 - 120
			Dissolved Selenium (Se)	2022/06/13		99	%	80 - 120
			Dissolved Silicon (Si)	2022/06/13		99	%	80 - 120
			Dissolved Sodium (Na)	2022/06/13		95	%	80 - 120
			Dissolved Strontium (Sr)	2022/06/13		98	%	80 - 120
			Dissolved Thorium (Th)	2022/06/13		98	%	80 - 120
			Dissolved Uranium (U)	2022/06/13		99	%	80 - 120
			Dissolved Zirconium (Zr)	2022/06/13		99	%	80 - 120
8043311	RG4	Method Blank	Dissolved Aluminum (Al)	2022/06/13	<4.9		ug/L	
			Dissolved Arsenic (As)	2022/06/13	<1.0		ug/L	
			Dissolved Barium (Ba)	2022/06/13	<2.0		ug/L	
			Dissolved Bismuth (Bi)	2022/06/13	<1.0		ug/L	
			Dissolved Boron (B)	2022/06/13	<10		ug/L	
			Dissolved Cadmium (Cd)	2022/06/13	<0.090		ug/L	
			Dissolved Calcium (Ca)	2022/06/13	<200		ug/L	
			Dissolved Cesium (Cs)	2022/06/13	<0.20		ug/L	
			Dissolved Chromium (Cr)	2022/06/13	<5.0		ug/L	
			Dissolved Cobalt (Co)	2022/06/13	<0.50		ug/L	
			Dissolved Copper (Cu)	2022/06/13	<0.90		ug/L	
			Dissolved Iron (Fe)	2022/06/13	<100		ug/L	
			Dissolved Lead (Pb)	2022/06/13	<0.50		ug/L	
			Dissolved Lithium (Li)	2022/06/13	<5.0		ug/L	
			Dissolved Magnesium (Mg)	2022/06/13	<50		ug/L	
			Dissolved Nickel (Ni)	2022/06/13	<1.0		ug/L	



Bureau Veritas Job #: C2F6327
Report Date: 2022/06/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8043311	RG4	RPD	Dissolved Potassium (K)	2022/06/13	<200		ug/L	
			Dissolved Rubidium (Rb)	2022/06/13	<0.20		ug/L	
			Dissolved Selenium (Se)	2022/06/13	<2.0		ug/L	
			Dissolved Silicon (Si)	2022/06/13	<50		ug/L	
			Dissolved Sodium (Na)	2022/06/13	<100		ug/L	
			Dissolved Strontium (Sr)	2022/06/13	<1.0		ug/L	
			Dissolved Thorium (Th)	2022/06/13	<2.0		ug/L	
			Dissolved Uranium (U)	2022/06/13	<0.10		ug/L	
			Dissolved Zirconium (Zr)	2022/06/13	<1.0		ug/L	
			Dissolved Aluminum (Al)	2022/06/13	4.5		%	20
			Dissolved Arsenic (As)	2022/06/13	NC		%	20
			Dissolved Barium (Ba)	2022/06/13	3.8		%	20
			Dissolved Bismuth (Bi)	2022/06/13	NC		%	20
			Dissolved Boron (B)	2022/06/13	1.8		%	20
			Dissolved Cadmium (Cd)	2022/06/13	NC		%	20
			Dissolved Calcium (Ca)	2022/06/13	0.44		%	20
			Dissolved Chromium (Cr)	2022/06/13	NC		%	20
			Dissolved Cobalt (Co)	2022/06/13	NC		%	20
			Dissolved Copper (Cu)	2022/06/13	1.8		%	20
			Dissolved Iron (Fe)	2022/06/13	NC		%	20
			Dissolved Lead (Pb)	2022/06/13	NC		%	20
			Dissolved Lithium (Li)	2022/06/13	NC		%	20
			Dissolved Magnesium (Mg)	2022/06/13	0.64		%	20
			Dissolved Nickel (Ni)	2022/06/13	NC		%	20
			Dissolved Potassium (K)	2022/06/13	1.8		%	20
			Dissolved Selenium (Se)	2022/06/13	NC		%	20
			Dissolved Silicon (Si)	2022/06/13	0.14		%	20
			Dissolved Sodium (Na)	2022/06/13	0.81		%	20
			Dissolved Strontium (Sr)	2022/06/13	1.5		%	20
			Dissolved Uranium (U)	2022/06/13	8.4		%	20
			Dissolved Zirconium (Zr)	2022/06/13	NC		%	20
8043737	SAU	Matrix Spike [SVK328-01]	Fluoride (F-)	2022/06/10		33 (1)	%	80 - 120
8043737	SAU	Spiked Blank	Fluoride (F-)	2022/06/10		104	%	80 - 120
8043737	SAU	Method Blank	Fluoride (F-)	2022/06/10	<0.10		mg/L	
8043737	SAU	RPD [SVK328-01]	Fluoride (F-)	2022/06/10	6.7		%	20
8043738	SAU	Spiked Blank	pH	2022/06/10		102	%	98 - 103
8043738	SAU	RPD [SVK328-01]	pH	2022/06/10	2.3		%	N/A
8043739	SAU	Spiked Blank	Alkalinity (Total as CaCO ₃)	2022/06/10		95	%	85 - 115
8043739	SAU	Method Blank	Alkalinity (Total as CaCO ₃)	2022/06/10	<1.0		mg/L	
8043739	SAU	RPD [SVK328-01]	Alkalinity (Total as CaCO ₃)	2022/06/10	4.1		%	20
8043985	AGD	Matrix Spike	Total Organic Carbon (TOC)	2022/06/10		NC	%	80 - 120
8043985	AGD	Spiked Blank	Total Organic Carbon (TOC)	2022/06/10		97	%	80 - 120
8043985	AGD	Method Blank	Total Organic Carbon (TOC)	2022/06/10	<0.40		mg/L	
8043985	AGD	RPD	Total Organic Carbon (TOC)	2022/06/10	0.95		%	20
8044213	SUR	Matrix Spike	Dissolved Chloride (Cl-)	2022/06/10		90	%	80 - 120
			Dissolved Bromide (Br-)	2022/06/10		91	%	80 - 120
			Dissolved Sulphate (SO ₄)	2022/06/10		92	%	80 - 120
			Dissolved Chloride (Cl-)	2022/06/10		94	%	70 - 130
			Dissolved Bromide (Br-)	2022/06/10		96	%	80 - 120
			Dissolved Sulphate (SO ₄)	2022/06/10		97	%	80 - 120



Bureau Veritas Job #: C2F6327

Report Date: 2022/06/29

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE, ON

Your P.O. #: 202031-004

Sampler Initials: AC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8044213	SUR	Method Blank	Dissolved Chloride (Cl-)	2022/06/10	<1.0		mg/L	
			Dissolved Bromide (Br-)	2022/06/10	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2022/06/10	<1.0		mg/L	
8044213	SUR	RPD	Dissolved Bromide (Br-)	2022/06/10	NC		%	20
8056888	KGR	Matrix Spike [SVK328-01]	Dissolved Iodide	2022/06/12		118	%	80 - 120
8056888	KGR	Spiked Blank	Dissolved Iodide	2022/06/12		110	%	80 - 120
8056888	KGR	Method Blank	Dissolved Iodide	2022/06/12	<0.10		mg/L	
8056888	KGR	RPD [SVK328-01]	Dissolved Iodide	2022/06/12	NC		%	20
8056889	FM0	Matrix Spike [SVK328-02]	Reactive Silica (SiO2)	2022/06/15		NC	%	80 - 120
8056889	FM0	Spiked Blank	Reactive Silica (SiO2)	2022/06/15		100	%	80 - 120
8056889	FM0	Method Blank	Reactive Silica (SiO2)	2022/06/15	<0.050		mg/L	
8056890	FM0	Matrix Spike	Reactive Silica (SiO2)	2022/06/11		113	%	80 - 120
8056890	FM0	Spiked Blank	Reactive Silica (SiO2)	2022/06/11		100	%	80 - 120
8056890	FM0	Method Blank	Reactive Silica (SiO2)	2022/06/11	<0.050		mg/L	
8072834	SSV	Matrix Spike	Total Phosphorus	2022/06/24		98	%	80 - 120
8072834	SSV	QC Standard	Total Phosphorus	2022/06/24		104	%	80 - 120
8072834	SSV	Spiked Blank	Total Phosphorus	2022/06/24		101	%	80 - 120
8072834	SSV	Method Blank	Total Phosphorus	2022/06/24	<0.020		mg/L	
8072834	SSV	RPD	Total Phosphorus	2022/06/24	2.0		%	20
8073404	SSV	Matrix Spike	Total Phosphorus	2022/06/24		99	%	80 - 120
8073404	SSV	QC Standard	Total Phosphorus	2022/06/24		100	%	80 - 120
8073404	SSV	Spiked Blank	Total Phosphorus	2022/06/24		96	%	80 - 120
8073404	SSV	Method Blank	Total Phosphorus	2022/06/24	<0.020		mg/L	
8073404	SSV	RPD	Total Phosphorus	2022/06/24	2.1		%	20
8082082	BKI	Spiked Blank	Total Ruthenium (Ru)	2022/06/23		103	%	70 - 130
8082082	BKI	Method Blank	Total Ruthenium (Ru)	2022/06/23	<2.0		ug/L	
8082082	BKI	RPD [SVK330-04]	Total Ruthenium (Ru)	2022/06/23	NC		%	30

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

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

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

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

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

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

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



BUREAU
VERITAS

Bureau Veritas Job #: C2F6327
Report Date: 2022/06/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Anastassia Hamanov, Scientific Specialist

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Zineb El Ouali

Membre OCQ#2021-051

Zineb El Ouali, Analyst 1



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Logiciel Propriétaire de Bureau Veritas

Automated Statchk

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



Isotope Analyses for:
Geofirma Engineering LTD

IT² FILE #
220237

2023-01-19

Approved by:

Orfan Shouakar-Stash, PhD
Director

Isotope Tracer Technologies Inc.

608 Weber St. North Unit 3&4,

Waterloo, ON, N2V 1Z5 Tel: 519-886-5555 |

Fax: 519-886-5575

Email: orfan@it2isotopes.com

Website: www.it2isotopes.com



Client: Geofirma Engineering LTD
Address: 1 RAYMOND ST. SUITE 200
 Ottawa, ON. K1R 1A2
Tel.: (613)402-1701/ (514)-730-0961
Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: 220237
Project Number: 20-203-1

#	Client ID	Sample #	Sampling		E ³ H	Result	± 1σ	Repeat	± 1σ
			Date	Time		TU		TU	
1	IG_BH05_GW002	99471	2022-05-29/30	various	X	3.7	1.1		
2	IG_BH05_GW004	99472	2022-05-30	12:35	X	1.9	1.1	<0.8	0.9
3	IG_BH03_GW016	99473	2022-06-2/3	various	X	2.1	1.0		
4	IG_BH01_GW033	99474	2022-06-4/5/6	various	X	1.6	1.0		
5	IG_BH01_GW034	99475	2022-06-4/5/6	various	X	1.6	1.0		

Repeated on Dec. 2, 2022

E³H ANALYSES

Tritium is reported in Tritium Units.

1TU = 3.221 Picocuries/L per IAEA, 2000 Report.

1TU = 0.11919 Becquerels/L per IAEA, 2000 Report.

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

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Website: www.it2isotopes.com



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Address: 1 RAYMOND ST. SUITE 200
 Ottawa, ON. K1R 1A2
Tel.: (613)402-1701/ (514)-730-0961
Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: 220237
Project Number: 20-203-1

#	Client ID	Sample #	Sampling		$\delta^{18}\text{O}$		Stdv	$\delta^2\text{H}$		Stdv
			Date	Time	H_2O	VSMOW		H_2O	VSMOW	
1	IG_BH05_GW002	99471	2022-05-29/30	various	X	-10.85	0.02	X	-78.0	0.2
2	IG_BH05_GW004	99472	2022-05-30	12:35	X	-13.18	0.04	X	-88.7	0.3
3	IG_BH03_GW016	99473	2022-06-2/3	various	X	-9.89	0.03	X	-61.2	0.2
4	IG_BH01_GW033	99474	2022-06-4/5/6	various	X	-12.39	0.02	X	-84.9	0.3
5	IG_BH01_GW034	99475	2022-06-4/5/6	various	X	-12.38	0.05	X	-85.2	0.2

^{18}O & ^2H (CRDS)

Instrument Used: Cavity Ring Down Spectroscopy (CRDS)
 CRDS (Model L2130-i) (Picarro, California, USA).

Standard Used:

IT²-12C / IT²-13B / IT²-14B Calibrated with IAEA Standards (V-SMOW, SLAP, and GISP)

Typical Standard deviation:

($^{18}\text{O} \pm 0.1\text{‰}$) ($^2\text{H} \pm 1\text{‰}$)

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

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Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: **220237**
Project Number: **20-203-1**

#	Client ID	Sample #	Sampling		$^{87}\text{Sr}/^{86}\text{Sr}$	Result	StdErr (abs)	StdDev (abs)	Repeat	StdErr (abs)	StdDev (abs)
			Date	Time							
1	IG_BH05_GW002	99471	2022-05-29/30	various	X	0.71603	4.829E-06	5.992E-05			
2	IG_BH05_GW004	99472	2022-05-30	12:35							
3	IG_BH03_GW016	99473	2022-06-2/3	various	X	0.71821	5.291E-06	6.524E-05			
4	IG_BH01_GW033	99474	2022-06-4/5/6	various	X	0.71710	5.496E-06	6.908E-05	0.71711	6.213E-06	8.219E-05
5	IG_BH01_GW034	99475	2022-06-4/5/6	various	X	0.71701	4.045E-06	5.117E-05			

$^{87}\text{Sr}/^{86}\text{Sr}$ ANALYSES

Instrument Used:

Thermal Ionization Mass Spectrometry (TIMS), TI-Box, spectromat, Germany

Standard Used:

NIST-987

Typical Standard deviation:

± 0.0001

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

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Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: 220237
Project Number: 20-203-1

#	Client ID	Sample #	Sampling		$\delta^{37}\text{Cl}$	Result	Stdv
			Date	Time			
1	IG_BH05_GW002	99471	2022-05-29/30	various	X	-0.22	0.12
2	IG_BH05_GW004	99472	2022-05-30	12:35			
3	IG_BH03_GW016	99473	2022-06-2/3	various	X	-0.13	0.10
4	IG_BH01_GW033	99474	2022-06-4/5/6	various	X	-0.30	0.08
5	IG_BH01_GW034	99475	2022-06-4/5/6	various	X	-0.17	0.13

^{37}Cl ANALYSES

Instrument Used:

Isotope Ratio Mass Spectrometry (IRMS) - MAT 253, Thermo Scientific, Germany
 Coupled with an Agilent 6890 Gas Chromatograph (GC)

Standard Used:

SMOC

Typical Standard deviation:

$\pm 0.15\%$

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

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 Attn.: Chris Morgan/Amy Cartier
 E-mail: cmorgan@geofirma.com
 E-mail: acartier@geofirma.com

File Number: **220237**
 Project Number: **20-203-1**

#	Client ID	Sample #	Sampling		$\delta^{13}\text{C}$	Result	Repeat	^{14}C	Result			
			Date	Time	DIC	PDB		DIC	^{14}C yr BP	\pm	F14C	\pm
1	IG_BH05_GW002	99471	2022-05-29/30	various	X	-24.2		X	780	28	0.9075	0.0032
2	IG_BH05_GW004	99472	2022-05-30	12:35	X	-11.0		X	7651	30	0.3858	0.0015
3	IG_BH03_GW016	99473	2022-06-2/3	various	X	-18.5	-18.6	X	5632	31	0.4960	0.0019
4	IG_BH01_GW033	99474	2022-06-4/5/6	various	X	-13.1		X	3940	32	0.6124	0.0024
5	IG_BH01_GW034	99475	2022-06-4/5/6	various	X	-13.8		X	3534	31	0.6441	0.0025

^{13}C DIC Analyses

Instrument Used: Finnigan MAT, DeltaPlus XL IRMS, Germany.

Standard Used: $\text{IT}^2\text{-27/IT}^2\text{-34/ NBS-18/NBS-19}$

Typical Standard deviation: $\pm 0.2 \%$

^{14}C DIC Analyses

Instrument Used:
 AMS (Accelerator Mass Spectrometry)

Standard Used:

OX1: 1.05×10^{-10}

OX2: 1.35×10^{-10}

C6: 1.5×10^{-10}

C7: 0.5×10^{-10}

Typical Standard deviation:

5 to 10% of Standard values listed above

Reporting of Data

In this analysis report, we have followed the conventions recommended by Millard (2014).

Radiocarbon Analysis

Radiocarbon analyses are performed on a 3MV tandem accelerator mass spectrometer built by High Voltage Engineering (HVE).

^{12}C , ^{13}C , $^{14}\text{C}+3$ ions are measured at 2.5 MV terminal voltage with Ar stripping. The fraction modern carbon, F14C, is calculated according to Reimer et al. (2004) as the ratio of the sample $^{14}\text{C}/^{12}\text{C}$ ratio to the standard $^{14}\text{C}/^{12}\text{C}$ ratio (in our case Ox-II) measured in the same data block. Both $^{14}\text{C}/^{12}\text{C}$ ratios are background-corrected and the result is corrected for spectrometer and preparation fractionation using the AMS measured $^{13}\text{C}/^{12}\text{C}$ ratio and is normalized to $\delta^{13}\text{C}$ (PDB). Radiocarbon ages are calculated as $-8033 \ln(\text{F14C})$ and reported in ^{14}C yr BP (BP=AD 1950) as described by Stuiver and Polach (1977). The errors on ^{14}C ages (1σ) are based on counting statistics and $^{14}\text{C}/^{12}\text{C}$ and $^{13}\text{C}/^{12}\text{C}$ variation between data blocks. We do not report $\delta^{13}\text{C}$ as it is measured on the AMS and contains machine fractionation.

D14C (defined as per mil Depletion or Enrichment Relative to Standard Normalized for Isotope Fractionation) are calculated as $(\text{F14C} - 1) \cdot 1000$.

$\Delta^{14}\text{C}$ (defined as age corrected D14C) are calculated as $(\text{F14C} \cdot e^{(1950-y)/8267} - 1) \cdot 1000$, where y = year of measurement.

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

Isotope Tracer Technologies Inc.

608 Weber St. North Unit 3&4, Waterloo, ON, N2V 1K4

Tel: 519-886-5555 | Fax: 519-886-5575

Email: orfan@it2isotopes.com

Website: www.it2isotopes.com

SUBMITTER SUMMARY			
Submitter Name:	David Zal	Affiliation:	Research Assistant
Submitter Email:	dzal@uottawa.ca	Street Address:	25 Templeton Street
Submitter Phone:	613-652-5800 ext 8699	City, Province:	Ottawa, Ontario
Principal Investigator Name:	Sean Sterling	Postal Code:	K1N 7N9
Principal Investigator Email:	ssterling@geofirma.com	Country:	Canada
Principal Investigator Phone:	n/a	Date Submitted:	2021-11-19

PROJECT INFORMATION	
Project Title:	n/a
Country:	n/a
Site Name:	Ignace
Collection Date:	n/a

SUBMISSION TIMELINE	
Date samples received (YYYY/MM/DD)	Report date (YYYY/MM/DD)
2022-06-23	2022-10-28

ANALYTICAL NOTES	

Please note: Unless otherwise specified in the submission form, any remaining sample material will be held for a period of six (6) months, after which time it will be discarded.

CONTACT INFORMATION	
Should you have any questions regarding your data or sample preparation please contact:	
Name:	Barbara Francisco
Email:	balvesfr@uottawa.ca
Phone:	613-562-5800 (6830)

Researchers are asked to report any publications that include data generated at the AEL AMS facility. Publication notifications should be sent to ael-ams@uottawa.ca . Published data should include the unique UO identifier number provided in this analytical report.

**Table 1. Analysis Results for Water Samples**

uOttawa Number	Submitter's Sample I.D.	Sample Weight (g)	¹²⁷ I Concentration Measured (ppb)	Mass of Iodide Carrier Added (mg)	¹²⁹ I/ ¹²⁷ I Ratio Measured ($\times 10^{-14}$) *		¹²⁹ I Concentration ($\times 10^6$ atoms/g)		Original Ratio (OR) ($\times 10^{-9}$) **	
					Ratio	Standard Deviation	Concentration	Standard Deviation	OR	Standard Deviation
UOH-4103	IG_BH05_GW002	209.53	367.33	1.99	1.18E+02	8.26E+00	5.53E-02	3.86E-03	3.17E-02	2.72E-03
UOH-4104	IG_BH03_GW016	205.07	1705.11	1.99	3.13E+02	1.12E+01	1.69E-01	6.07E-03	2.09E-02	1.29E-03
UOH-4105	IG_BH01_GW034	202.02	722.03	1.99	8.72E+01	3.86E+00	4.37E-02	1.93E-03	1.28E-02	8.51E-04
UOH-4106	IG_BH01_GW033	206.01	760.74	1.99	9.71E+01	4.05E+00	4.80E-02	2.00E-03	1.33E-02	8.65E-04

Note: * $^{129}\text{I}/^{127}\text{I}$ Ratio Measured includes both sample and carrier added.

Note 2: ** $^{129}\text{I}/^{127}\text{I}$ Ratio calculated before added the carrier.

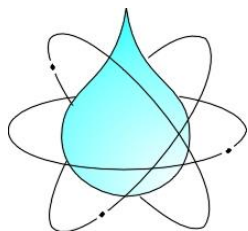


AMS Measurements

The ^{129}I analysis are performed on a 3MV accelerator mass spectrometer (AMS) built by High Voltage Engineering (HVE). $^{129}\text{I}^{+2}$ ions are measured at 2.5 MV terminal voltage Ar stripping. The errors represent 68.3% confidence limits, based on 1 measurement each. These measurements were normalized with respect to ISO-6II in-house reference material for which $^{129}\text{I}/^{127}\text{I} = (5.71 \pm 0.01) \times 10^{-12}$, by calibration with the NIST 3230 I and II standard reference material.

The AMS system background was monitored with our standard NaI blank material and found to be normal.

No background corrections were applied to these data. A NaI blank measured on October 8th, 2022 set of samples yielded a $^{129}\text{I}/^{127}\text{I}$ ratio of $(1.5 \pm 0.2) \times 10^{-14}$.



Hydrogeochemistry Laboratory
Analytical Report - Clark group
University of Ottawa
25 Templeton Street
Ottawa, ON K1N 6N5


Analytical report for:

Geofirma Engineering Ltd.
1 Raymond Street #200
Ottawa, ON K1R 1A2

Sample description

Site	Ignace
Type	Water
Container	Nalgene
Volume	1 L

Analysis

Analyte	^{36}Cl in dissolved Cl
Method	AMS
Facility	Hydrogeochemistry Laboratory, University of Ottawa
Report Approved by	 Ian Clark, P.Geol.

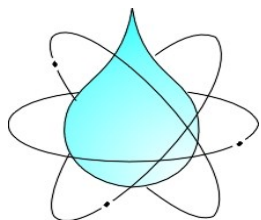
Timeline

Samples received	Analyses completed	Report date
December 09, 2020 (2) March 25, 2021 (2) October 01, 2021 (2) December 13, 2021 (3) April 06, 2022 (3) June 23, 2022 (4)	36Cl	September 20, 2022

Notes

Samples were collected in the field by Geofirma staff. Bottles were received sealed and in good condition. Samples were extracted as Cl^- from solution on an anion exchange column, eluted and precipitated as AgCl target material. AMS analysis was undertaken on a 6 MV tandem accelerator mass spectrometer at ETH Zurich and PRIME Lab, Purdue

Sample	Lab ID	Comment	Cl (mg/L)	$^{36}\text{Cl}/\text{Cl}$ final (10^{-15})	\pm	^{36}Cl atoms/L (10^6)	\pm
IG_BH01_GW033	PRIME	prepared at uOttawa	9000	15.0	0.4	2290	61.1
IG_BH01_GW034	PRIME	prepared at uOttawa	9700	14.0	2.3	2304	378.5
IG_BH03_GW016	PRIME	prepared at uOttawa	20000	16.7	1.0	5666	339.3
IG_BH05_GW002	PRIME	prepared at uOttawa	5200	13.6	0.4	1200	35.3




Hydrogeochemistry Laboratory
Analytical Report - Clark group
University of Ottawa
25 Templeton Street
Ottawa, ON K1N 6N5

Analytical report for:

Geofirma Engineering Ltd.
1 Raymond Street #200
Ottawa, ON K1R 1A2

Sample description

Site	Ignace
Type	Noble gas
Container	Nalgene
Volume	Cu tubes
Report Approved by	 Ian Clark, P.Geo.

Analysis

Analyte	Noble gases
Method	Mass spectrometry
Facility	Noble gas laboratory, University of Utah

Timeline

Samples received	Analyses completed	Report date
2022 Q1 and Q2	He, Ne, Ar, Kr, Xe	Rev 0: 2022-10-26 Rev 1: 2023-03-30 Rev 2: 2024-01-04

Notes

Gas extraction from water follows the procedure outlined in Aeschbach-Hertig & Solomon 2013. Please see sheet tab titled "Notes" for further explanation of the noble gas analysis.

Hydrogeochemistry Laboratory
Analytical Report - Clark group

Report prepared for:
 Geofirma Engineering Ltd.

Quarter	Sample ID	Mass g	He3		He4		x/Ra	HeTotal	
			cc/g	±	cc/g	±		cc/g	±
2022 Q1	IG_BH03_GW013	4.3	6.28E-11	6.28E-13	2.17E-03	2.17E-05	0.0209	2.17E-03	2.17E-05
2022 Q1	IG_BH05_GW001	4.5	4.00E-12	4.00E-14	1.49E-04	1.49E-06	0.0194	1.49E-04	1.49E-06
2022 Q1	IG_BH01_GW032	4.5	5.66E-13	5.66E-15	1.76E-05	1.76E-07	0.0232	1.76E-05	1.76E-07
2022 Q2	IG_BH01_GW033	3.6	4.68E-11	4.68E-13	1.52E-03	1.52E-05	0.0222	1.52E-03	1.52E-05
2022 Q2	IG_BH01_GW034	3.1	4.77E-11	4.77E-13	1.62E-03	1.62E-05	0.0213	1.62E-03	1.62E-05
2022 Q2	IG_BH05_GW002	4.7	1.23E-12	1.23E-14	4.67E-05	4.67E-07	0.0190	4.67E-05	4.67E-07
2022 Q2	IG_BH03_GW016	4.6	1.31E-12	1.31E-14	4.45E-05	4.45E-07	0.0213	4.45E-05	4.45E-07

Hydrogeochemistry Laboratory
Analytical Report - Clark group

Report prepared for:
Geofirma Engineering Ltd.

Quarter	Sample ID	Ne20		Ne22		NeTotal		20Ne/22Ne	Ar36
		cc/g	±	cc/g	±	cc/g	±		
2022 Q1	IG_BH03_GW013	2.57E-07	7.71E-09	2.55E-08	7.65E-10	2.82E-07	8.47E-09	10.070	7.02E-07
2022 Q1	IG_BH05_GW001	1.49E-07	4.46E-09	1.52E-08	4.55E-10	1.64E-07	4.91E-09	9.801	1.05E-06
2022 Q1	IG_BH01_GW032	1.25E-07	3.74E-09	1.17E-08	3.52E-10	1.36E-07	4.09E-09	10.628	5.44E-07
2022 Q2	IG_BH01_GW033	2.71E-06	8.13E-08	2.67E-07	8.01E-09	2.98E-06	8.93E-08	10.149	3.76E-06
2022 Q2	IG_BH01_GW034	3.72E-06	1.11E-07	3.76E-07	1.13E-08	4.09E-06	1.23E-07	9.890	5.82E-06
2022 Q2	IG_BH05_GW002	1.10E-07	3.31E-09	1.16E-08	3.48E-10	1.22E-07	3.66E-09	9.517	5.79E-07
2022 Q2	IG_BH03_GW016	8.91E-08	2.67E-09	7.91E-09	2.37E-10	9.70E-08	2.91E-09	11.270	4.64E-07

Hydrogeochemistry Laboratory
Analytical Report - Clark group

Report prepared for:
 Geofirma Engineering Ltd.

Quarter	Sample ID	Ar40	ArTotal		36Ar/40Ar	KrTotal		XeTotal	
			<i>cc/g</i>	\pm		<i>cc/g</i>	\pm	<i>cc/g</i>	\pm
2022 Q1	IG_BH03_GW013	3.90E-03	3.90E-03	1.17E-04	1.80E-04	4.99E-08	2.50E-09	7.64E-09	3.82E-10
2022 Q1	IG_BH05_GW001	4.23E-04	4.24E-04	1.27E-05	2.48E-03	7.97E-08	3.99E-09	1.24E-08	6.21E-10
2022 Q1	IG_BH01_GW032	2.54E-04	2.55E-04	7.65E-06	2.14E-03	4.27E-08	2.13E-09	6.68E-09	3.34E-10
2022 Q2	IG_BH01_GW033	2.64E-03	2.64E-03	7.93E-05	1.42E-03	1.76E-07	8.82E-09	1.76E-08	8.79E-10
2022 Q2	IG_BH01_GW034	3.30E-03	3.31E-03	9.93E-05	1.76E-03	2.52E-07	1.26E-08	2.29E-08	1.14E-09
2022 Q2	IG_BH05_GW002	3.44E-04	3.44E-04	1.03E-05	1.68E-03	4.72E-08	2.36E-09	7.72E-09	3.86E-10
2022 Q2	IG_BH03_GW016	4.99E-04	4.99E-04	1.50E-05	9.31E-04	2.69E-08	1.35E-09	4.32E-09	2.16E-10

cc/g - cc of noble gas at STP per gram of sample solution

± - analytical uncertainty, as cc/g

xRa - $^3\text{He}/^4\text{He}$ ratio in sample normalized to the ratio in Air ($1.38\text{E}-6$)

Noble Gas Analysis

Gas extraction from water follows the procedure outlined in *Aeschbach-Hertig & Solomon 2013*. This involves gas extraction from copper tube water samples under vacuum by water vapour sweep into a stainless steel gas flask. The extracted gases are let into a sample preparation line and cryogenically separated. For light noble gases (He and Ne), standards and samples are introduced into an ultra-high vacuum preparation system where bulk (N_2 , O_2) and trace gases (CO_2 , Ar) are removed using liquid N_2 charcoal traps and two SAES getters, followed by analysis on a Thermo Scientific Helix SFT Noble Gas Mass Spectrometer. Internal standards using precise aliquots from a tank of clean dry atmospheric air are run each morning and during analysis to measure instrument drift and sensitivity. Internal standards of air equilibrated water (AEW) are also run as internal checks on the water extraction procedure and analyses. Following purification, He is separated from Ne using a He cooled cryo trap that cycles down to 5K, before releasing He at 28K and Ne at 70K. He and Ne are introduced separately into the Helix SFT operating under static vacuum. Each analysis undergoes a mass peak center, followed by separate integrations on each mass peak. These integrations generate a linear regression used to calculate peak intensity at time zero (when the sample was released into the mass spectrometer). For Ar, Kr and Xe, gases, residual water vapour was removed cryogenically prior to gettering of reactive gases and cryogenic separation of Kr and Xe from Ar. Abundance analysis was done by quadrupole mass spectrometry at the University of Utah Noble Gas Lab.

References:

Aeschbach-Hertig W., Solomon D.K. (2013) Noble Gas Thermometry in Groundwater Hydrology. In: Burnard P. (eds) The Noble Gases as Geochemical Tracers. Advances in Isotope Geochemistry. Springer, Berlin, Heidelberg

**2022 Q3
(September)**



Your P.O. #: 202031-004
Your Project #: 20-203-1
Site Location: IGNACE

Attention: Amy Cartier

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
CANADA K1R 1A2

Report Date: 2022/11/25
Report #: R7404044
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BUREAU VERITAS JOB #: C2R5589

Received: 2022/09/22, 11:12

Sample Matrix: Ground Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	2	N/A	2022/09/27	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	1	N/A	2022/09/27	CAM SOP-00102	APHA 4500-CO2 D
Carbonate, Bicarbonate and Hydroxide	1	N/A	2022/09/28	CAM SOP-00102	APHA 4500-CO2 D
Anions	2	N/A	2022/09/28	CAM SOP-00435	SM 23 4110 B m
Dissolved Organic Carbon (DOC) (3)	2	N/A	2022/09/26	CAM SOP-00446	SM 23 5310 B m
Fluoride	1	2022/09/24	2022/09/27	CAM SOP-00449	SM 23 4500-F C m
Fluoride	1	2022/09/26	2022/09/27	CAM SOP-00449	SM 23 4500-F C m
Dissolved Metals Analysis by ICP	2	2022/09/26	2022/09/28	CAM SOP-00408	EPA 6010D m
Dissolved Metals by ICPMS	2	N/A	2022/09/27	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICP	2	2022/09/27	2022/09/29	CAM SOP-00408	EPA 6010D m
Iodide, Thiosulphate, Thiocyanate (1)	2	N/A	2022/09/30	CAL SOP-00057	Dionex #034035 R09 m
Total Extractable Elements by ICP-MS (2, 4)	2	2022/10/21	2022/10/26	STL SOP-00071	MA.200–Mét. 1.2 R5 m
Silica (Reactive) (1)	2	N/A	2022/09/30	AB SOP-00011	EPA370.1 R1978 m
Total Ammonia-N	2	N/A	2022/09/27	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (5)	1	N/A	2022/09/26	CAM SOP-00440	SM 23 4500-NO3I/NO2B
Nitrate & Nitrite as Nitrogen in Water (5)	1	N/A	2022/09/28	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	1	2022/09/24	2022/09/27	CAM SOP-00413	SM 4500H+ B m
pH	1	2022/09/26	2022/09/27	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	1	N/A	2022/09/26	CAM SOP-00461	EPA 365.1 m
Orthophosphate	1	N/A	2022/09/28	CAM SOP-00461	EPA 365.1 m
Sulphide	2	N/A	2022/09/26	CAM SOP-00455	SM 23 4500-S G m
Total Inorganic Carbon (TIC)	2	N/A	2022/09/28	CAM SOP-00433	SM 23 5310 m
Total Kjeldahl Nitrogen in Water	1	2022/11/18	2022/11/18	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	1	2022/11/21	2022/11/22	CAM SOP-00938	OMOE E3516 m
Total Nitrogen (calculated)	1	N/A	2022/09/28	Auto Calc.	
Total Nitrogen (calculated)	1	N/A	2022/09/29	Auto Calc.	
Total Organic Carbon (TOC) (6)	2	N/A	2022/09/28	CAM SOP-00446	SM 23 5310B m
Total Phosphorus (Colourimetric)	1	2022/09/26	2022/09/28	CAM SOP-00407	SM 23 4500-P I
Total Phosphorus (Colourimetric)	1	2022/09/26	2022/09/29	CAM SOP-00407	SM 23 4500-P I



Your P.O. #: 202031-004
Your Project #: 20-203-1
Site Location: IGNACE

Attention: Amy Cartier

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
CANADA K1R 1A2

Report Date: 2022/11/25
Report #: R7404044
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BUREAU VERITAS JOB #: C2R5589

Received: 2022/09/22, 11:12

Remarks:

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All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

- (1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE, Calgary, AB, T2E 6P8
- (2) This test was performed by Bureau Veritas Montreal, 889 Montée de Liesse, Ville St-Laurent, QC, H4T 1P5
- (3) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
- (4) Non-accredited test method
- (5) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
- (6) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.



Your P.O. #: 202031-004
Your Project #: 20-203-1
Site Location: IGNACE

Attention: Amy Cartier

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
CANADA K1R 1A2

Report Date: 2022/11/25
Report #: R7404044
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BUREAU VERITAS JOB #: C2R5589

Received: 2022/09/22, 11:12

Encryption Key

Katherine Szozda
Project Manager
25 Nov 2022 14:50:50

Please direct all questions regarding this Certificate of Analysis to:

Katherine Szozda, Project Manager
Email: Katherine.Szozda@bureauveritas.com
Phone# (613)274-0573 Ext:7063633

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Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



Bureau Veritas Job #: C2R5589
Report Date: 2022/11/25

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-004
Sampler Initials: MD

RESULTS OF ANALYSES OF GROUND WATER

Bureau Veritas ID		TUY161			TUY161			TUY162		
Sampling Date		2022/09/20			2022/09/20			2022/09/20		
	UNITS	IG_BH03_GW017	RDL	QC Batch	IG_BH03_GW017 Lab-Dup	RDL	QC Batch	IG_BH03_GW018	RDL	QC Batch

Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO ₃)	mg/L	58	1.0	8244079				64	1.0	8244079
Carb. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	8244079				<1.0	1.0	8244079
Hydrox. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	8244079				<1.0	1.0	8244079
Total Nitrogen (N)	mg/L	4.0	2.0	8244236				5.9	5.0	8244236
Inorganics										
Total Ammonia-N	mg/L	0.63	0.050	8247760				0.61	0.050	8247760
Fluoride (F ⁻)	mg/L	0.10	0.10	8247892				0.11	0.10	8245864
Total Inorganic Carbon (C)	mg/L	4	1	8249575	4	1	8249575	4	1	8249575
Dissolved Iodide	mg/L	<10 (1)	10	8262296				<10 (1)	10	8262296
Total Kjeldahl Nitrogen (TKN)	mg/L	4.0	2.0	8354415				5.9	5.0	8352019
Dissolved Organic Carbon	mg/L	110	2.0	8246984				110	2.0	8246984
Total Organic Carbon (TOC)	mg/L	110	2.0	8247251				110	2.0	8247251
Orthophosphate (P)	mg/L	0.65	0.010	8247777				0.88	0.010	8245557
pH	pH	6.32		8247907				6.71		8245866
Total Phosphorus	mg/L	1.3	0.020	8248571				1.2	0.020	8248571
Reactive Silica (SiO ₂)	mg/L	31	0.55	8258950				29	0.55	8258950
Sulphide	mg/L	<0.020	0.020	8247011				<0.020	0.020	8247011
Alkalinity (Total as CaCO ₃)	mg/L	58	1.0	8247905				64	1.0	8245860
Nitrite (N)	mg/L	<0.010	0.010	8248432				<0.050	0.050	8245848
Dissolved Chloride (Cl ⁻)	mg/L	21000	200	8251949	20000	200	8251949	21000	200	8251949
Nitrate (N)	mg/L	<0.10	0.10	8248432				<0.50	0.50	8245848
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8248432				<0.50	0.50	8245848
Dissolved Bromide (Br ⁻)	mg/L	390	10	8251949	390	10	8251949	390	10	8251949
Dissolved Sulphate (SO ₄)	mg/L	<10	10	8251949	<10	10	8251949	<10	10	8251949
Metals										
Total Ruthenium (Ru)	ug/L	<2.0	2.0	8310346				<2.0	2.0	8310346
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate (1) Detection limits raised due to matrix interference.										



Bureau Veritas Job #: C2R5589

Report Date: 2022/11/25

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE

Your P.O. #: 202031-004

Sampler Initials: MD

ELEMENTS BY ATOMIC SPECTROSCOPY (GROUND WATER)

Bureau Veritas ID		TUY161	TUY162		
Sampling Date		2022/09/20	2022/09/20		
	UNITS	IG_BH03_GW017	IG_BH03_GW018	RDL	QC Batch
Metals					
Dissolved Iron (Fe)	mg/L	1.2	1.2	0.2	8248066
Total Iron (Fe)	mg/L	0.32	<0.02	0.02	8252050
Dissolved Sulphur (S)	mg/L	<5	<5	5	8248066
Total Sulphur (S)	mg/L	0.6	11	0.5	8252050
Dissolved Aluminum (Al)	ug/L	26	30	25	8248122
Dissolved Arsenic (As)	ug/L	<5.0	<5.0	5.0	8248122
Dissolved Barium (Ba)	ug/L	350	350	10	8248122
Dissolved Bismuth (Bi)	ug/L	<5.0	<5.0	5.0	8248122
Dissolved Boron (B)	ug/L	270	280	50	8248122
Dissolved Cadmium (Cd)	ug/L	<0.45	<0.45	0.45	8248122
Dissolved Calcium (Ca)	ug/L	11000000	11000000	10000	8248122
Dissolved Cesium (Cs)	ug/L	1.4	1.3	1.0	8248122
Dissolved Chromium (Cr)	ug/L	<25	<25	25	8248122
Dissolved Cobalt (Co)	ug/L	<2.5	<2.5	2.5	8248122
Dissolved Copper (Cu)	ug/L	<4.5	<4.5	4.5	8248122
Dissolved Iron (Fe)	ug/L	1200	1200	500	8248122
Dissolved Lead (Pb)	ug/L	<2.5	<2.5	2.5	8248122
Dissolved Lithium (Li)	ug/L	260	270	25	8248122
Dissolved Magnesium (Mg)	ug/L	3200	3400	250	8248122
Dissolved Nickel (Ni)	ug/L	5.1	7.8	5.0	8248122
Dissolved Potassium (K)	ug/L	12000	13000	1000	8248122
Dissolved Rubidium (Rb)	ug/L	44	47	1.0	8248122
Dissolved Selenium (Se)	ug/L	<10	<10	10	8248122
Dissolved Silicon (Si)	ug/L	5400	5400	250	8248122
Dissolved Sodium (Na)	ug/L	760000	770000	500	8248122
Dissolved Strontium (Sr)	ug/L	140000	140000	5.0	8248122
Dissolved Thorium (Th)	ug/L	<10	<10	10	8248122
Dissolved Uranium (U)	ug/L	<0.50	<0.50	0.50	8248122
Dissolved Zirconium (Zr)	ug/L	<5.0	<5.0	5.0	8248122
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					



Bureau Veritas Job #: C2R5589

Report Date: 2022/11/25

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE

Your P.O. #: 202031-004

Sampler Initials: MD

TEST SUMMARY

Bureau Veritas ID: TUY161
Sample ID: IG_BH03_GW017
Matrix: Ground Water

Collected: 2022/09/20
Shipped:
Received: 2022/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8247905	N/A	2022/09/27	Kien Tran
Carbonate, Bicarbonate and Hydroxide	CALC	8244079	N/A	2022/09/28	Automated Statchk
Anions	IC	8251949	N/A	2022/09/28	Lusine Khachatryan
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8246984	N/A	2022/09/26	Nimarta Singh
Fluoride	ISE	8247892	2022/09/26	2022/09/27	Kien Tran
Dissolved Metals Analysis by ICP	ICP	8248066	2022/09/26	2022/09/28	Thuy Linh Nguyen
Dissolved Metals by ICPMS	ICP/MS	8248122	N/A	2022/09/27	Arefa Dabhad
Total Metals Analysis by ICP	ICP	8252050	2022/09/27	2022/09/29	Indira HarryPaul
Iodide, Thiosulphate, Thiocyanate	IC/EC	8262296	N/A	2022/09/30	Kanwardeep Brar
Total Extractable Elements by ICP-MS	ICP/MSMS	8310346	2022/10/21	2022/10/26	Sinhuja Thambiyah
Silica (Reactive)	KONE	8258950	N/A	2022/09/30	Shanna McKort
Total Ammonia-N	LACH/NH4	8247760	N/A	2022/09/27	Anna-Kay Gooden
Nitrate & Nitrite as Nitrogen in Water	LACH	8248432	N/A	2022/09/28	Chandra Nandlal
pH	AT	8247907	2022/09/26	2022/09/27	Kien Tran
Orthophosphate	KONE	8247777	N/A	2022/09/28	Samuel Law
Sulphide	ISE/S	8247011	N/A	2022/09/26	Taslina Aktar
Total Inorganic Carbon (TIC)	TOCV/NDIR	8249575	N/A	2022/09/28	Nimarta Singh
Total Kjeldahl Nitrogen in Water	SKAL	8354415	2022/11/18	2022/11/18	Rajni Tyagi
Total Nitrogen (calculated)	CALC	8244236	N/A	2022/09/29	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	8247251	N/A	2022/09/28	Nimarta Singh
Total Phosphorus (Colourimetric)	SKAL/P	8248571	2022/09/26	2022/09/29	Shivani Shivani

Bureau Veritas ID: TUY161 Dup
Sample ID: IG_BH03_GW017
Matrix: Ground Water

Collected: 2022/09/20
Shipped:
Received: 2022/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Anions	IC	8251949	N/A	2022/09/28	Lusine Khachatryan
Total Inorganic Carbon (TIC)	TOCV/NDIR	8249575	N/A	2022/09/28	Nimarta Singh

Bureau Veritas ID: TUY162
Sample ID: IG_BH03_GW018
Matrix: Ground Water

Collected: 2022/09/20
Shipped:
Received: 2022/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8245860	N/A	2022/09/27	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	8244079	N/A	2022/09/27	Automated Statchk
Anions	IC	8251949	N/A	2022/09/28	Lusine Khachatryan
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8246984	N/A	2022/09/26	Nimarta Singh
Fluoride	ISE	8245864	2022/09/24	2022/09/27	Surinder Rai
Dissolved Metals Analysis by ICP	ICP	8248066	2022/09/26	2022/09/28	Thuy Linh Nguyen
Dissolved Metals by ICPMS	ICP/MS	8248122	N/A	2022/09/27	Arefa Dabhad
Total Metals Analysis by ICP	ICP	8252050	2022/09/27	2022/09/29	Indira HarryPaul



Bureau Veritas Job #: C2R5589
Report Date: 2022/11/25

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-004
Sampler Initials: MD

TEST SUMMARY

Bureau Veritas ID: TUY162
Sample ID: IG_BH03_GW018
Matrix: Ground Water

Collected: 2022/09/20
Shipped:
Received: 2022/09/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Iodide, Thiosulphate, Thiocyanate	IC/EC	8262296	N/A	2022/09/30	Kanwardeep Brar
Total Extractable Elements by ICP-MS	ICP/MSMS	8310346	2022/10/21	2022/10/26	Sinhuja Thambiayah
Silica (Reactive)	KONE	8258950	N/A	2022/09/30	Shanna McKort
Total Ammonia-N	LACH/NH4	8247760	N/A	2022/09/27	Anna-Kay Gooden
Nitrate & Nitrite as Nitrogen in Water	LACH	8245848	N/A	2022/09/26	Chandra Nandlal
pH	AT	8245866	2022/09/24	2022/09/27	Surinder Rai
Orthophosphate	KONE	8245557	N/A	2022/09/26	Samuel Law
Sulphide	ISE/S	8247011	N/A	2022/09/26	Taslina Aktar
Total Inorganic Carbon (TIC)	TOCV/NDIR	8249575	N/A	2022/09/28	Nimarta Singh
Total Kjeldahl Nitrogen in Water	SKAL	8352019	2022/11/21	2022/11/22	Jency Sara Johnson
Total Nitrogen (calculated)	CALC	8244236	N/A	2022/09/28	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	8247251	N/A	2022/09/28	Nimarta Singh
Total Phosphorus (Colourimetric)	SKAL/P	8248571	2022/09/26	2022/09/28	Shivani Shivani



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GENERAL COMMENTS

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

Package 1	3.0°C
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Revised Report (2022/11/25): After investigation and re-analyzing IG_BH03_GW018, total kjeldahl nitrogen value amended

Sample TUY161 [IG_BH03_GW017] : Metals Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Sample TUY162 [IG_BH03_GW018] : Nitrite/Nitrate: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Metals Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

RESULTS OF ANALYSES OF GROUND WATER

Sample TUY161 [IG_BH03_GW017] Iodide, Thiosulphate, Thiocyanate: Detection limits raised due to matrix interference.

Sample TUY162 [IG_BH03_GW018] Iodide, Thiosulphate, Thiocyanate: Detection limits raised due to matrix interference.

Results relate only to the items tested.



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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8245557	S1L	Matrix Spike	Orthophosphate (P)	2022/09/26		109	%	75 - 125
8245557	S1L	Spiked Blank	Orthophosphate (P)	2022/09/26		100	%	80 - 120
8245557	S1L	Method Blank	Orthophosphate (P)	2022/09/26	<0.010		mg/L	
8245557	S1L	RPD	Orthophosphate (P)	2022/09/26	NC		%	25
8245848	C_N	Matrix Spike	Nitrite (N)	2022/09/26		105	%	80 - 120
			Nitrate (N)	2022/09/26		96	%	80 - 120
8245848	C_N	Spiked Blank	Nitrite (N)	2022/09/26		102	%	80 - 120
			Nitrate (N)	2022/09/26		93	%	80 - 120
8245848	C_N	Method Blank	Nitrite (N)	2022/09/26	<0.010		mg/L	
			Nitrate (N)	2022/09/26	<0.10		mg/L	
8245848	C_N	RPD	Nitrite (N)	2022/09/26	NC		%	20
			Nitrate (N)	2022/09/26	0.43		%	20
8245860	SAU	Spiked Blank	Alkalinity (Total as CaCO ₃)	2022/09/27		95	%	85 - 115
8245860	SAU	Method Blank	Alkalinity (Total as CaCO ₃)	2022/09/27	<1.0		mg/L	
8245860	SAU	RPD	Alkalinity (Total as CaCO ₃)	2022/09/27	3.3		%	20
8245864	SAU	Matrix Spike	Fluoride (F-)	2022/09/27		94	%	80 - 120
8245864	SAU	Spiked Blank	Fluoride (F-)	2022/09/27		102	%	80 - 120
8245864	SAU	Method Blank	Fluoride (F-)	2022/09/27	<0.10		mg/L	
8245864	SAU	RPD	Fluoride (F-)	2022/09/27	NC		%	20
8245866	SAU	Spiked Blank	pH	2022/09/27		102	%	98 - 103
8245866	SAU	RPD	pH	2022/09/27	0.18		%	N/A
8246984	NS3	Matrix Spike	Dissolved Organic Carbon	2022/09/26		96	%	80 - 120
8246984	NS3	Spiked Blank	Dissolved Organic Carbon	2022/09/26		96	%	80 - 120
8246984	NS3	Method Blank	Dissolved Organic Carbon	2022/09/26	<0.40		mg/L	
8246984	NS3	RPD	Dissolved Organic Carbon	2022/09/26	0.52		%	20
8247011	TAK	Matrix Spike	Sulphide	2022/09/26		88	%	80 - 120
8247011	TAK	Spiked Blank	Sulphide	2022/09/26		92	%	80 - 120
8247011	TAK	Method Blank	Sulphide	2022/09/26	<0.020		mg/L	
8247011	TAK	RPD	Sulphide	2022/09/26	NC		%	20
8247251	NS3	Matrix Spike	Total Organic Carbon (TOC)	2022/09/28		95	%	80 - 120
8247251	NS3	Spiked Blank	Total Organic Carbon (TOC)	2022/09/28		96	%	80 - 120
8247251	NS3	Method Blank	Total Organic Carbon (TOC)	2022/09/28	<0.40		mg/L	
8247251	NS3	RPD	Total Organic Carbon (TOC)	2022/09/28	1.3		%	20
8247760	AGD	Matrix Spike	Total Ammonia-N	2022/09/27		98	%	75 - 125
8247760	AGD	Spiked Blank	Total Ammonia-N	2022/09/27		101	%	80 - 120
8247760	AGD	Method Blank	Total Ammonia-N	2022/09/27	<0.050		mg/L	
8247760	AGD	RPD	Total Ammonia-N	2022/09/27	NC		%	20
8247777	S1L	Matrix Spike	Orthophosphate (P)	2022/09/28		NC	%	75 - 125
8247777	S1L	Spiked Blank	Orthophosphate (P)	2022/09/28		98	%	80 - 120
8247777	S1L	Method Blank	Orthophosphate (P)	2022/09/28	<0.010		mg/L	
8247777	S1L	RPD	Orthophosphate (P)	2022/09/28	3.0		%	25
8247892	KIT	Matrix Spike	Fluoride (F-)	2022/09/27		83	%	80 - 120
8247892	KIT	Spiked Blank	Fluoride (F-)	2022/09/27		102	%	80 - 120
8247892	KIT	Method Blank	Fluoride (F-)	2022/09/27	<0.10		mg/L	
8247892	KIT	RPD	Fluoride (F-)	2022/09/27	0.95		%	20
8247905	KIT	Spiked Blank	Alkalinity (Total as CaCO ₃)	2022/09/27		93	%	85 - 115
8247905	KIT	Method Blank	Alkalinity (Total as CaCO ₃)	2022/09/27	<1.0		mg/L	
8247905	KIT	RPD	Alkalinity (Total as CaCO ₃)	2022/09/27	0.45		%	20
8247907	KIT	Spiked Blank	pH	2022/09/27		102	%	98 - 103
8247907	KIT	RPD	pH	2022/09/27	0.68		%	N/A



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Sampler Initials: MD

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8248066	TLG	Matrix Spike	Dissolved Iron (Fe)	2022/09/27		102	%	80 - 120
			Dissolved Sulphur (S)	2022/09/27		NC	%	80 - 120
8248066	TLG	Spiked Blank	Dissolved Iron (Fe)	2022/09/27		105	%	80 - 120
			Dissolved Sulphur (S)	2022/09/27		101	%	80 - 120
8248066	TLG	Method Blank	Dissolved Iron (Fe)	2022/09/28	<0.02		mg/L	
			Dissolved Sulphur (S)	2022/09/28	<0.5		mg/L	
8248122	ADA	Matrix Spike	Dissolved Aluminum (Al)	2022/09/27		102	%	80 - 120
			Dissolved Arsenic (As)	2022/09/27		102	%	80 - 120
			Dissolved Barium (Ba)	2022/09/27		102	%	80 - 120
			Dissolved Bismuth (Bi)	2022/09/27		102	%	80 - 120
			Dissolved Boron (B)	2022/09/27		96	%	80 - 120
			Dissolved Cadmium (Cd)	2022/09/27		103	%	80 - 120
			Dissolved Calcium (Ca)	2022/09/27		NC	%	80 - 120
			Dissolved Cesium (Cs)	2022/09/27		104	%	80 - 120
			Dissolved Chromium (Cr)	2022/09/27		99	%	80 - 120
			Dissolved Cobalt (Co)	2022/09/27		102	%	80 - 120
			Dissolved Copper (Cu)	2022/09/27		96	%	80 - 120
			Dissolved Iron (Fe)	2022/09/27		104	%	80 - 120
			Dissolved Lead (Pb)	2022/09/27		100	%	80 - 120
			Dissolved Lithium (Li)	2022/09/27		110	%	80 - 120
			Dissolved Magnesium (Mg)	2022/09/27		NC	%	80 - 120
			Dissolved Nickel (Ni)	2022/09/27		99	%	80 - 120
			Dissolved Potassium (K)	2022/09/27		108	%	80 - 120
			Dissolved Rubidium (Rb)	2022/09/27		102	%	80 - 120
			Dissolved Selenium (Se)	2022/09/27		102	%	80 - 120
			Dissolved Silicon (Si)	2022/09/27		101	%	80 - 120
			Dissolved Sodium (Na)	2022/09/27		104	%	80 - 120
			Dissolved Strontium (Sr)	2022/09/27		NC	%	80 - 120
			Dissolved Thorium (Th)	2022/09/27		100	%	80 - 120
			Dissolved Uranium (U)	2022/09/27		101	%	80 - 120
			Dissolved Zirconium (Zr)	2022/09/27		107	%	80 - 120
8248122	ADA	Spiked Blank	Dissolved Aluminum (Al)	2022/09/27		103	%	80 - 120
			Dissolved Arsenic (As)	2022/09/27		101	%	80 - 120
			Dissolved Barium (Ba)	2022/09/27		103	%	80 - 120
			Dissolved Bismuth (Bi)	2022/09/27		99	%	80 - 120
			Dissolved Boron (B)	2022/09/27		97	%	80 - 120
			Dissolved Cadmium (Cd)	2022/09/27		102	%	80 - 120
			Dissolved Calcium (Ca)	2022/09/27		101	%	80 - 120
			Dissolved Cesium (Cs)	2022/09/27		104	%	80 - 120
			Dissolved Chromium (Cr)	2022/09/27		98	%	80 - 120
			Dissolved Cobalt (Co)	2022/09/27		102	%	80 - 120
			Dissolved Copper (Cu)	2022/09/27		100	%	80 - 120
			Dissolved Iron (Fe)	2022/09/27		104	%	80 - 120
			Dissolved Lead (Pb)	2022/09/27		100	%	80 - 120
			Dissolved Lithium (Li)	2022/09/27		110	%	80 - 120
			Dissolved Magnesium (Mg)	2022/09/27		108	%	80 - 120
			Dissolved Nickel (Ni)	2022/09/27		102	%	80 - 120
			Dissolved Potassium (K)	2022/09/27		104	%	80 - 120
			Dissolved Rubidium (Rb)	2022/09/27		102	%	80 - 120
			Dissolved Selenium (Se)	2022/09/27		101	%	80 - 120



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Sampler Initials: MD

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8248122	ADA	Method Blank	Dissolved Silicon (Si)	2022/09/27		102	%	80 - 120
			Dissolved Sodium (Na)	2022/09/27		105	%	80 - 120
			Dissolved Strontium (Sr)	2022/09/27		101	%	80 - 120
			Dissolved Thorium (Th)	2022/09/27		101	%	80 - 120
			Dissolved Uranium (U)	2022/09/27		101	%	80 - 120
			Dissolved Zirconium (Zr)	2022/09/27		105	%	80 - 120
			Dissolved Aluminum (Al)	2022/09/27	<4.9		ug/L	
			Dissolved Arsenic (As)	2022/09/27	<1.0		ug/L	
			Dissolved Barium (Ba)	2022/09/27	<2.0		ug/L	
			Dissolved Bismuth (Bi)	2022/09/27	<1.0		ug/L	
			Dissolved Boron (B)	2022/09/27	<10		ug/L	
			Dissolved Cadmium (Cd)	2022/09/27	<0.090		ug/L	
			Dissolved Calcium (Ca)	2022/09/27	<200		ug/L	
			Dissolved Cesium (Cs)	2022/09/27	<0.20		ug/L	
			Dissolved Chromium (Cr)	2022/09/27	<5.0		ug/L	
			Dissolved Cobalt (Co)	2022/09/27	<0.50		ug/L	
			Dissolved Copper (Cu)	2022/09/27	<0.90		ug/L	
			Dissolved Iron (Fe)	2022/09/27	<100		ug/L	
			Dissolved Lead (Pb)	2022/09/27	<0.50		ug/L	
			Dissolved Lithium (Li)	2022/09/27	<5.0		ug/L	
			Dissolved Magnesium (Mg)	2022/09/27	<50		ug/L	
			Dissolved Nickel (Ni)	2022/09/27	<1.0		ug/L	
			Dissolved Potassium (K)	2022/09/27	<200		ug/L	
			Dissolved Rubidium (Rb)	2022/09/27	<0.20		ug/L	
			Dissolved Selenium (Se)	2022/09/27	<2.0		ug/L	
			Dissolved Silicon (Si)	2022/09/27	<50		ug/L	
			Dissolved Sodium (Na)	2022/09/27	<100		ug/L	
			Dissolved Strontium (Sr)	2022/09/27	<1.0		ug/L	
			Dissolved Thorium (Th)	2022/09/27	<2.0		ug/L	
			Dissolved Uranium (U)	2022/09/27	<0.10		ug/L	
			Dissolved Zirconium (Zr)	2022/09/27	<1.0		ug/L	
8248122	ADA	RPD	Dissolved Iron (Fe)	2022/09/27	2.6		%	20
			Dissolved Lead (Pb)	2022/09/27	NC		%	20
8248432	C_N	Matrix Spike	Nitrite (N)	2022/09/28		108	%	80 - 120
			Nitrate (N)	2022/09/28		107	%	80 - 120
8248432	C_N	Spiked Blank	Nitrite (N)	2022/09/28		104	%	80 - 120
			Nitrate (N)	2022/09/28		103	%	80 - 120
8248432	C_N	Method Blank	Nitrite (N)	2022/09/28	<0.010		mg/L	
			Nitrate (N)	2022/09/28	<0.10		mg/L	
8248432	C_N	RPD	Nitrite (N)	2022/09/28	NC		%	20
			Nitrate (N)	2022/09/28	0.17		%	20
8248571	SSV	Matrix Spike	Total Phosphorus	2022/09/28		99	%	80 - 120
8248571	SSV	QC Standard	Total Phosphorus	2022/09/28		97	%	80 - 120
8248571	SSV	Spiked Blank	Total Phosphorus	2022/09/28		101	%	80 - 120
8248571	SSV	Method Blank	Total Phosphorus	2022/09/28	<0.020		mg/L	
8248571	SSV	RPD	Total Phosphorus	2022/09/28	2.0		%	20
8249575	NS3	Matrix Spike [TUY161-01]	Total Inorganic Carbon (C)	2022/09/28		37 (1)	%	80 - 120
8249575	NS3	Spiked Blank	Total Inorganic Carbon (C)	2022/09/28		96	%	80 - 120
8249575	NS3	Method Blank	Total Inorganic Carbon (C)	2022/09/28	<1		mg/L	
8249575	NS3	RPD [TUY161-01]	Total Inorganic Carbon (C)	2022/09/28	0.44		%	20



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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8251949	LKH	Matrix Spike [TUY161-01]	Dissolved Chloride (Cl-)	2022/09/28		NC	%	80 - 120
			Dissolved Bromide (Br-)	2022/09/28		NC	%	80 - 120
			Dissolved Sulphate (SO4)	2022/09/28		103	%	80 - 120
8251949	LKH	Spiked Blank	Dissolved Chloride (Cl-)	2022/09/28		100	%	70 - 130
			Dissolved Bromide (Br-)	2022/09/28		103	%	80 - 120
			Dissolved Sulphate (SO4)	2022/09/28		103	%	80 - 120
8251949	LKH	Method Blank	Dissolved Chloride (Cl-)	2022/09/28	<1.0		mg/L	
			Dissolved Bromide (Br-)	2022/09/28	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2022/09/28	<1.0		mg/L	
8251949	LKH	RPD [TUY161-01]	Dissolved Chloride (Cl-)	2022/09/28	0.54		%	20
			Dissolved Bromide (Br-)	2022/09/28	0.033		%	20
			Dissolved Sulphate (SO4)	2022/09/28	NC		%	20
8252050	IHP	Matrix Spike	Total Iron (Fe)	2022/09/29		NC	%	80 - 120
			Total Sulphur (S)	2022/09/29		NC	%	80 - 120
8252050	IHP	Spiked Blank	Total Iron (Fe)	2022/09/29		98	%	80 - 120
			Total Sulphur (S)	2022/09/29		98	%	80 - 120
8252050	IHP	Method Blank	Total Iron (Fe)	2022/09/29	<0.02		mg/L	
			Total Sulphur (S)	2022/09/29	<0.5		mg/L	
8252050	IHP	RPD	Total Iron (Fe)	2022/09/29	1.9		%	25
8258950	éH2	Matrix Spike	Reactive Silica (SiO2)	2022/09/30		104	%	80 - 120
8258950	éH2	Spiked Blank	Reactive Silica (SiO2)	2022/09/30		107	%	80 - 120
8258950	éH2	Method Blank	Reactive Silica (SiO2)	2022/09/30	<0.050		mg/L	
8262296	KDB	Matrix Spike	Dissolved Iodide	2022/09/30		102	%	80 - 120
8262296	KDB	Spiked Blank	Dissolved Iodide	2022/09/30		101	%	80 - 120
8262296	KDB	Method Blank	Dissolved Iodide	2022/09/30	<0.10		mg/L	
8262296	KDB	RPD	Dissolved Iodide	2022/09/30	NC		%	20
8310346	ST5	Spiked Blank	Total Ruthenium (Ru)	2022/10/26		94	%	70 - 130
8310346	ST5	Method Blank	Total Ruthenium (Ru)	2022/10/26	<2.0		ug/L	
8310346	ST5	RPD	Total Ruthenium (Ru)	2022/10/26	NC		%	30
8352019	JJH	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2022/11/21		102	%	80 - 120
8352019	JJH	QC Standard	Total Kjeldahl Nitrogen (TKN)	2022/11/21		94	%	80 - 120
8352019	JJH	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2022/11/21		97	%	80 - 120
8352019	JJH	Method Blank	Total Kjeldahl Nitrogen (TKN)	2022/11/21	<0.10		mg/L	
8352019	JJH	RPD	Total Kjeldahl Nitrogen (TKN)	2022/11/21	10		%	20
8354415	RTY	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2022/11/18		NC	%	80 - 120
8354415	RTY	QC Standard	Total Kjeldahl Nitrogen (TKN)	2022/11/18		90	%	80 - 120
8354415	RTY	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2022/11/18		94	%	80 - 120
8354415	RTY	Method Blank	Total Kjeldahl Nitrogen (TKN)	2022/11/18	<0.10		mg/L	



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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC									
Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits	
8354415	RTY	RPD	Total Kjeldahl Nitrogen (TKN)	2022/11/18	10		%	20	
N/A = Not Applicable									
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.									
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.									
QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.									
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.									
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.									
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)									
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).									
(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.									



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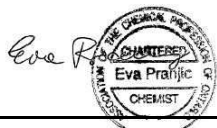
VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Anastassia Hamanov, Scientific Specialist



Jonathan Fauvel, B.Sc., Chimiste, Supervisor, Inorganics



Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Suwan (Sze Yeung) Fock, B.Sc., Scientific Specialist



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Your P.O. #: 202031-004
 Your Project #: 20-203-1
 Site Location: IGNACE, ON
 Your C.O.C. #: N/A

Attention: Amy Cartier

Geofirma Engineering Ltd
 1 Raymond St
 Suite 200
 Ottawa, ON
 CANADA K1R 1A2

Report Date: 2022/11/17
 Report #: R7392002
 Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BUREAU VERITAS JOB #: C2S0594

Received: 2022/09/27, 16:24

Sample Matrix: Water
 # Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	3	N/A	2022/10/01	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	3	N/A	2022/10/03	CAM SOP-00102	APHA 4500-CO2 D
Anions	4	N/A	2022/09/30	CAM SOP-00435	SM 23 4110 B m
Dissolved Organic Carbon (DOC) (3)	3	N/A	2022/09/29	CAM SOP-00446	SM 23 5310 B m
Fluoride	4	2022/09/29	2022/10/01	CAM SOP-00449	SM 23 4500-F C m
Dissolved Metals Analysis by ICP	3	2022/10/01	2022/10/04	CAM SOP-00408	EPA 6010D m
Dissolved Metals by ICPMS	3	N/A	2022/10/04	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS	1	N/A	2022/09/30	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICP	1	2022/10/05	2022/10/05	CAM SOP-00408	EPA 6010D m
Iodide, Thiosulphate, Thiocyanate (1)	4	N/A	2022/10/06	CAL SOP-00057	Dionex #034035 R09 m
Total Extractable Elements by ICP-MS (2, 4)	3	2022/10/21	2022/10/26	STL SOP-00071	MA.200–Mét. 1.2 R5 m
Silica (Reactive) (1)	3	N/A	2022/10/11	AB SOP-00011	EPA370.1 R1978 m
Total Ammonia-N	3	N/A	2022/10/01	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (5)	4	N/A	2022/09/30	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	3	2022/09/29	2022/10/01	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	4	N/A	2022/10/04	CAM SOP-00461	EPA 365.1 m
Sulphide	3	N/A	2022/09/30	CAM SOP-00455	SM 23 4500-S G m
Total Inorganic Carbon (TIC)	3	N/A	2022/09/30	CAM SOP-00433	SM 23 5310 m
Total Kjeldahl Nitrogen in Water	2	2022/09/29	2022/10/03	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	1	2022/09/30	2022/10/04	CAM SOP-00938	OMOE E3516 m
Total Nitrogen (calculated)	2	N/A	2022/10/03	Auto Calc.	
Total Nitrogen (calculated)	1	N/A	2022/10/04	Auto Calc.	
Total Organic Carbon (TOC) (6)	3	N/A	2022/09/30	CAM SOP-00446	SM 23 5310B m
Total Phosphorus (Colourimetric)	2	2022/09/29	2022/09/30	CAM SOP-00407	SM 23 4500-P I
Total Phosphorus (Colourimetric)	1	2022/09/30	2022/10/05	CAM SOP-00407	SM 23 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.



Your P.O. #: 202031-004
Your Project #: 20-203-1
Site Location: IGNACE, ON
Your C.O.C. #: N/A

Attention: Amy Cartier

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
CANADA K1R 1A2

Report Date: 2022/11/17
Report #: R7392002
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BUREAU VERITAS JOB #: C2S0594

Received: 2022/09/27, 16:24

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

- (1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE, Calgary, AB, T2E 6P8
- (2) This test was performed by Bureau Veritas Montreal., 889 Montée de Liesse, Ville St-Laurent, QC, H4T 1P5
- (3) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
- (4) Non-accredited test method
- (5) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
- (6) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

Encryption Key

Katherine Szozda
Project Manager
17 Nov 2022 11:38:53

Please direct all questions regarding this Certificate of Analysis to:

Katherine Szozda, Project Manager
Email: Katherine.Szozda@bureauveritas.com
Phone# (613)274-0573 Ext:7063633

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Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



Bureau Veritas Job #: C2S0594
Report Date: 2022/11/17

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		TWA661			TWA661			TWA662		
Sampling Date		2022/09/24 13:15			2022/09/24 13:15			2022/09/24 14:45		
COC Number		N/A			N/A			N/A		
	UNITS	IG_BH01_GW035	RDL	QC Batch	IG_BH01_GW035 Lab-Dup	RDL	QC Batch	IG_BH05_GW005	RDL	QC Batch

Calculated Parameters

Bicarb. Alkalinity (calc. as CaCO ₃)	mg/L	25	1.0	8252623				190	1.0	8252623
Carb. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	8252623				<1.0	1.0	8252623
Hydrox. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	8252623				<1.0	1.0	8252623
Total Nitrogen (N)	mg/L	2.7	2.0	8253009				1.8	1.0	8253009

Inorganics

Total Ammonia-N	mg/L	0.16	0.050	8258034				0.20	0.050	8258034
Fluoride (F ⁻)	mg/L	0.33	0.10	8256544				0.27	0.10	8256544
Total Inorganic Carbon (C)	mg/L	5	1	8257869				36	1	8257869
Dissolved Iodide	mg/L	<10	10	8276412				<10	10	8276412
Total Kjeldahl Nitrogen (TKN)	mg/L	2.7	2.0	8257373				1.8	1.0	8255555
Dissolved Organic Carbon	mg/L	3.1	0.40	8254331				59	0.40	8254331
Total Organic Carbon (TOC)	mg/L	3.4	0.40	8258051				65	0.40	8258051
Orthophosphate (P)	mg/L	<0.010	0.010	8258674				<0.010	0.010	8258674
pH	pH	7.23		8256546				7.27		8256546
Total Phosphorus	mg/L	<0.10 (1)	0.10	8257365				0.16	0.10	8255922
Reactive Silica (SiO ₂)	mg/L	19	0.25	8276849				31	0.25	8276861
Sulphide	mg/L	<0.020	0.020	8256184				0.69	0.020	8256184
Alkalinity (Total as CaCO ₃)	mg/L	25	1.0	8256545				190	1.0	8256545
Nitrite (N)	mg/L	<0.010	0.010	8255727	<0.010	0.010	8255727	<0.010	0.010	8255727
Chloride (Cl ⁻)	mg/L	5300	50	8257256				6600	50	8257256
Nitrate (N)	mg/L	<0.10	0.10	8255727	<0.10	0.10	8255727	<0.10	0.10	8255727
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8255727	<0.10	0.10	8255727	<0.10	0.10	8255727
Bromide (Br ⁻)	mg/L	86	5.0	8257256				140	5.0	8257256
Sulphate (SO ₄)	mg/L	110	5.0	8257256				41	5.0	8257256

Metals

Total Ruthenium (Ru)	ug/L	<2.0	2.0	8310547				<2.0	2.0	8310547
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RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.



Bureau Veritas Job #: C2S0594
Report Date: 2022/11/17

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		TWA662			TWA663			TWA663		
Sampling Date		2022/09/24 14:45			2022/09/24 14:45			2022/09/24 14:45		
COC Number		N/A			N/A			N/A		
	UNITS	IG_BH05_GW005 Lab-Dup	RDL	QC Batch	IG_BH05_GW006	RDL	QC Batch	IG_BH05_GW006 Lab-Dup	RDL	QC Batch

Calculated Parameters

Bicarb. Alkalinity (calc. as CaCO ₃)	mg/L				200	1.0	8252623			
Carb. Alkalinity (calc. as CaCO ₃)	mg/L				<1.0	1.0	8252623			
Hydrox. Alkalinity (calc. as CaCO ₃)	mg/L				<1.0	1.0	8252623			
Total Nitrogen (N)	mg/L				2.0	1.0	8253009			

Inorganics

Total Ammonia-N	mg/L				0.21	0.050	8258034			
Fluoride (F ⁻)	mg/L				0.25	0.10	8256544	0.24	0.10	8256544
Total Inorganic Carbon (C)	mg/L	36	1	8257869	35	1	8257869			
Dissolved Iodide	mg/L				<10	10	8276412			
Total Kjeldahl Nitrogen (TKN)	mg/L				2.0	1.0	8255555			
Dissolved Organic Carbon	mg/L				58	0.40	8254331			
Total Organic Carbon (TOC)	mg/L				65	0.40	8258051	65	0.40	8258051
Orthophosphate (P)	mg/L				0.010	0.010	8258674			
pH	pH				7.24		8256546	7.27		8256546
Total Phosphorus	mg/L				0.14	0.10	8255922			
Reactive Silica (SiO ₂)	mg/L				27	0.25	8276849			
Sulphide	mg/L				0.66	0.020	8256184			
Alkalinity (Total as CaCO ₃)	mg/L				200	1.0	8256545	190	1.0	8256545
Nitrite (N)	mg/L				<0.010	0.010	8255727			
Chloride (Cl ⁻)	mg/L	6600	50	8257256	6400	50	8257256			
Nitrate (N)	mg/L				<0.10	0.10	8255727			
Nitrate + Nitrite (N)	mg/L				<0.10	0.10	8255727			
Bromide (Br ⁻)	mg/L	140	5.0	8257256	140	5.0	8257256			
Sulphate (SO ₄)	mg/L	42	5.0	8257256	41	5.0	8257256			

Metals

Total Ruthenium (Ru)	ug/L				<2.0	2.0	8310547			
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RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate



RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		TWA664		
Sampling Date		2022/09/24 08:30		
COC Number		N/A		
	UNITS	IG_BH05_GW007	RDL	QC Batch
Inorganics				
Fluoride (F-)	mg/L	<0.10	0.10	8256544
Dissolved Iodide	mg/L	<0.10	0.10	8276412
Orthophosphate (P)	mg/L	<0.010	0.010	8258674
Nitrite (N)	mg/L	<0.010	0.010	8255727
Chloride (Cl-)	mg/L	13	1.0	8257256
Nitrate (N)	mg/L	<0.10	0.10	8255727
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8255727
Bromide (Br-)	mg/L	<1.0	1.0	8257256
Sulphate (SO4)	mg/L	<1.0	1.0	8257256
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		TWA661		TWA662			TWA662		
Sampling Date		2022/09/24 13:15		2022/09/24 14:45			2022/09/24 14:45		
COC Number		N/A		N/A			N/A		
	UNITS	IG_BH01_GW035	RDL	IG_BH05_GW005	RDL	QC Batch	IG_BH05_GW005 Lab-Dup	RDL	QC Batch
Metals									
Dissolved Iron (Fe)	mg/L	2.0	0.02	4.9	0.02	8259282	4.9	0.02	8259282
Dissolved Sulphur (S)	mg/L	36	0.5	16	0.5	8259282	18	0.5	8259282
Dissolved Aluminum (Al)	ug/L	12	4.9	11	4.9	8259273			
Dissolved Arsenic (As)	ug/L	<1.0	1.0	<1.0	1.0	8259273			
Dissolved Barium (Ba)	ug/L	370	2.0	310	2.0	8259273			
Dissolved Bismuth (Bi)	ug/L	<1.0	1.0	<1.0	1.0	8259273			
Dissolved Boron (B)	ug/L	140	10	310	10	8259273			
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	<0.090	0.090	8259273			
Dissolved Calcium (Ca)	ug/L	2700000	2000	3200000	2000	8259273			
Dissolved Cesium (Cs)	ug/L	0.40	0.20	<0.20	0.20	8259273			
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	<5.0	5.0	8259273			
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	<0.50	0.50	8259273			
Dissolved Copper (Cu)	ug/L	<0.90	0.90	<0.90	0.90	8259273			
Dissolved Iron (Fe)	ug/L	2200	100	5500	100	8259273			
Dissolved Lead (Pb)	ug/L	<0.50	0.50	<0.50	0.50	8259273			
Dissolved Lithium (Li)	ug/L	44	5.0	59	5.0	8259273			
Dissolved Magnesium (Mg)	ug/L	2700	50	5700	50	8259273			
Dissolved Nickel (Ni)	ug/L	2.7	1.0	4.3	1.0	8259273			
Dissolved Potassium (K)	ug/L	19000	200	19000	200	8259273			
Dissolved Rubidium (Rb)	ug/L	55	0.20	28	0.20	8259273			
Dissolved Selenium (Se)	ug/L	<2.0	2.0	<2.0	2.0	8259273			
Dissolved Silicon (Si)	ug/L	3200	50	12000	50	8259273			
Dissolved Sodium (Na)	ug/L	420000	100	610000	500	8259273			
Dissolved Strontium (Sr)	ug/L	37000	1.0	39000	1.0	8259273			
Dissolved Thorium (Th)	ug/L	<2.0	2.0	<2.0	2.0	8259273			
Dissolved Uranium (U)	ug/L	3.4	0.10	0.39	0.10	8259273			
Dissolved Zirconium (Zr)	ug/L	<1.0	1.0	<1.0	1.0	8259273			
RDL = Reportable Detection Limit									
QC Batch = Quality Control Batch									
Lab-Dup = Laboratory Initiated Duplicate									



ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		TWA663			TWA664		
Sampling Date		2022/09/24 14:45			2022/09/24 08:30		
COC Number		N/A			N/A		
	UNITS	IG_BH05_GW006	RDL	QC Batch	IG_BH05_GW007	RDL	QC Batch
Metals							
Dissolved Iron (Fe)	mg/L	5.5	0.02	8259282			
Total Iron (Fe)	mg/L				0.03	0.02	8265229
Dissolved Sulphur (S)	mg/L	19	0.5	8259282			
Total Sulphur (S)	mg/L				<0.5	0.5	8265229
Dissolved Aluminum (Al)	ug/L	11	4.9	8259273	<4.9	4.9	8257522
Dissolved Arsenic (As)	ug/L	<1.0	1.0	8259273	<1.0	1.0	8257522
Dissolved Barium (Ba)	ug/L	310	2.0	8259273	<2.0	2.0	8257522
Dissolved Bismuth (Bi)	ug/L	<1.0	1.0	8259273	<1.0	1.0	8257522
Dissolved Boron (B)	ug/L	330	10	8259273	<10	10	8257522
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	8259273	<0.090	0.090	8257522
Dissolved Calcium (Ca)	ug/L	3300000	2000	8259273	2600	200	8257522
Dissolved Cesium (Cs)	ug/L	<0.20	0.20	8259273	<0.20	0.20	8257522
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	8259273	<5.0	5.0	8257522
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	8259273	<0.50	0.50	8257522
Dissolved Copper (Cu)	ug/L	<0.90	0.90	8259273	<0.90	0.90	8257522
Dissolved Iron (Fe)	ug/L	6100	100	8259273	<100	100	8257522
Dissolved Lead (Pb)	ug/L	<0.50	0.50	8259273	<0.50	0.50	8257522
Dissolved Lithium (Li)	ug/L	60	5.0	8259273	<5.0	5.0	8257522
Dissolved Magnesium (Mg)	ug/L	5700	50	8259273	<50	50	8257522
Dissolved Nickel (Ni)	ug/L	5.0	1.0	8259273	<1.0	1.0	8257522
Dissolved Potassium (K)	ug/L	19000	200	8259273	<200	200	8257522
Dissolved Rubidium (Rb)	ug/L	28	0.20	8259273	<0.20	0.20	8257522
Dissolved Selenium (Se)	ug/L	<2.0	2.0	8259273	<2.0	2.0	8257522
Dissolved Silicon (Si)	ug/L	12000	50	8259273	<50	50	8257522
Dissolved Sodium (Na)	ug/L	620000	500	8259273	350	100	8257522
Dissolved Strontium (Sr)	ug/L	39000	1.0	8259273	30	1.0	8257522
Dissolved Thorium (Th)	ug/L	<2.0	2.0	8259273	<2.0	2.0	8257522
Dissolved Uranium (U)	ug/L	0.42	0.10	8259273	<0.10	0.10	8257522
Dissolved Zirconium (Zr)	ug/L	<1.0	1.0	8259273	<1.0	1.0	8257522
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							



Bureau Veritas Job #: C2S0594

Report Date: 2022/11/17

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE, ON

Your P.O. #: 202031-004

TEST SUMMARY

Bureau Veritas ID: TWA661
Sample ID: IG_BH01_GW035
Matrix: Water

Collected: 2022/09/24
Shipped:
Received: 2022/09/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8256545	N/A	2022/10/01	Kien Tran
Carbonate, Bicarbonate and Hydroxide	CALC	8252623	N/A	2022/10/03	Automated Statchk
Anions	IC	8257256	N/A	2022/09/30	Lusine Khachatryan
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8254331	N/A	2022/09/29	Nimarta Singh
Fluoride	ISE	8256544	2022/09/29	2022/10/01	Kien Tran
Dissolved Metals Analysis by ICP	ICP	8259282	2022/10/01	2022/10/04	Thuy Linh Nguyen
Dissolved Metals by ICPMS	ICP/MS	8259273	N/A	2022/10/04	Arefa Dabhad
Iodide, Thiosulphate, Thiocyanate	IC/EC	8276412	N/A	2022/10/06	Taylor Mullings
Total Extractable Elements by ICP-MS	ICP/MSMS	8310547	2022/10/21	2022/10/26	Zineb El Ouali
Silica (Reactive)	KONE	8276849	N/A	2022/10/11	Shanna McKort
Total Ammonia-N	LACH/NH4	8258034	N/A	2022/10/01	Amanpreet Sappal
Nitrate & Nitrite as Nitrogen in Water	LACH	8255727	N/A	2022/09/30	Chandra Nandlal
pH	AT	8256546	2022/09/29	2022/10/01	Kien Tran
Orthophosphate	KONE	8258674	N/A	2022/10/04	Samuel Law
Sulphide	ISE/S	8256184	N/A	2022/09/30	Taslina Aktar
Total Inorganic Carbon (TIC)	TOCV/NDIR	8257869	N/A	2022/09/30	Nimarta Singh
Total Kjeldahl Nitrogen in Water	SKAL	8257373	2022/09/30	2022/10/04	Massarat Jan
Total Nitrogen (calculated)	CALC	8253009	N/A	2022/10/04	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	8258051	N/A	2022/09/30	Nimarta Singh
Total Phosphorus (Colourimetric)	SKAL/P	8257365	2022/09/30	2022/10/05	Sachi Patel

Bureau Veritas ID: TWA661 Dup
Sample ID: IG_BH01_GW035
Matrix: Water

Collected: 2022/09/24
Shipped:
Received: 2022/09/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate & Nitrite as Nitrogen in Water	LACH	8255727	N/A	2022/09/30	Chandra Nandlal

Bureau Veritas ID: TWA662
Sample ID: IG_BH05_GW005
Matrix: Water

Collected: 2022/09/24
Shipped:
Received: 2022/09/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8256545	N/A	2022/10/01	Kien Tran
Carbonate, Bicarbonate and Hydroxide	CALC	8252623	N/A	2022/10/03	Automated Statchk
Anions	IC	8257256	N/A	2022/09/30	Lusine Khachatryan
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8254331	N/A	2022/09/29	Nimarta Singh
Fluoride	ISE	8256544	2022/09/29	2022/10/01	Kien Tran
Dissolved Metals Analysis by ICP	ICP	8259282	2022/10/01	2022/10/04	Thuy Linh Nguyen
Dissolved Metals by ICPMS	ICP/MS	8259273	N/A	2022/10/04	Arefa Dabhad
Iodide, Thiosulphate, Thiocyanate	IC/EC	8276412	N/A	2022/10/06	Taylor Mullings
Total Extractable Elements by ICP-MS	ICP/MSMS	8310547	2022/10/21	2022/10/26	Zineb El Ouali
Silica (Reactive)	KONE	8276861	N/A	2022/10/11	Shanna McKort
Total Ammonia-N	LACH/NH4	8258034	N/A	2022/10/01	Amanpreet Sappal



Bureau Veritas Job #: C2S0594

Report Date: 2022/11/17

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE, ON

Your P.O. #: 202031-004

TEST SUMMARY

Bureau Veritas ID: TWA662
Sample ID: IG_BH05_GW005
Matrix: Water

Collected: 2022/09/24
Shipped:
Received: 2022/09/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate & Nitrite as Nitrogen in Water	LACH	8255727	N/A	2022/09/30	Chandra Nandlal
pH	AT	8256546	2022/09/29	2022/10/01	Kien Tran
Orthophosphate	KONE	8258674	N/A	2022/10/04	Samuel Law
Sulphide	ISE/S	8256184	N/A	2022/09/30	Taslina Aktar
Total Inorganic Carbon (TIC)	TOCV/NDIR	8257869	N/A	2022/09/30	Nimarta Singh
Total Kjeldahl Nitrogen in Water	SKAL	8255555	2022/09/29	2022/10/03	Massarat Jan
Total Nitrogen (calculated)	CALC	8253009	N/A	2022/10/03	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	8258051	N/A	2022/09/30	Nimarta Singh
Total Phosphorus (Colourimetric)	SKAL/P	8255922	2022/09/29	2022/09/30	Shivani Shivani

Bureau Veritas ID: TWA662 Dup
Sample ID: IG_BH05_GW005
Matrix: Water

Collected: 2022/09/24
Shipped:
Received: 2022/09/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Anions	IC	8257256	N/A	2022/09/30	Lusine Khachatryan
Dissolved Metals Analysis by ICP	ICP	8259282	2022/10/01	2022/10/04	Thuy Linh Nguyen
Total Inorganic Carbon (TIC)	TOCV/NDIR	8257869	N/A	2022/09/30	Nimarta Singh

Bureau Veritas ID: TWA663
Sample ID: IG_BH05_GW006
Matrix: Water

Collected: 2022/09/24
Shipped:
Received: 2022/09/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8256545	N/A	2022/10/01	Kien Tran
Carbonate, Bicarbonate and Hydroxide	CALC	8252623	N/A	2022/10/03	Automated Statchk
Anions	IC	8257256	N/A	2022/09/30	Lusine Khachatryan
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8254331	N/A	2022/09/29	Nimarta Singh
Fluoride	ISE	8256544	2022/09/29	2022/10/01	Kien Tran
Dissolved Metals Analysis by ICP	ICP	8259282	2022/10/01	2022/10/04	Thuy Linh Nguyen
Dissolved Metals by ICPMS	ICP/MS	8259273	N/A	2022/10/04	Arefa Dabhad
Iodide, Thiosulphate, Thiocyanate	IC/EC	8276412	N/A	2022/10/06	Taylor Mullings
Total Extractable Elements by ICP-MS	ICP/MSMS	8310547	2022/10/21	2022/10/26	Zineb El Ouali
Silica (Reactive)	KONE	8276849	N/A	2022/10/11	Shanna McKort
Total Ammonia-N	LACH/NH4	8258034	N/A	2022/10/01	Amanpreet Sappal
Nitrate & Nitrite as Nitrogen in Water	LACH	8255727	N/A	2022/09/30	Chandra Nandlal
pH	AT	8256546	2022/09/29	2022/10/01	Kien Tran
Orthophosphate	KONE	8258674	N/A	2022/10/04	Samuel Law
Sulphide	ISE/S	8256184	N/A	2022/09/30	Taslina Aktar
Total Inorganic Carbon (TIC)	TOCV/NDIR	8257869	N/A	2022/09/30	Nimarta Singh
Total Kjeldahl Nitrogen in Water	SKAL	8255555	2022/09/29	2022/10/03	Massarat Jan
Total Nitrogen (calculated)	CALC	8253009	N/A	2022/10/03	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	8258051	N/A	2022/09/30	Nimarta Singh
Total Phosphorus (Colourimetric)	SKAL/P	8255922	2022/09/29	2022/09/30	Shivani Shivani



Bureau Veritas Job #: C2S0594
Report Date: 2022/11/17

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004

TEST SUMMARY

Bureau Veritas ID: TWA663 Dup
Sample ID: IG_BH05_GW006
Matrix: Water

Collected: 2022/09/24
Shipped:
Received: 2022/09/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8256545	N/A	2022/10/01	Kien Tran
Fluoride	ISE	8256544	2022/09/29	2022/10/01	Kien Tran
pH	AT	8256546	2022/09/29	2022/10/01	Kien Tran
Total Organic Carbon (TOC)	TOCV/NDIR	8258051	N/A	2022/09/30	Nimarta Singh

Bureau Veritas ID: TWA664
Sample ID: IG_BH05_GW007
Matrix: Water

Collected: 2022/09/24
Shipped:
Received: 2022/09/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Anions	IC	8257256	N/A	2022/09/30	Lusine Khachatryan
Fluoride	ISE	8256544	2022/09/29	2022/10/01	Kien Tran
Dissolved Metals by ICPMS	ICP/MS	8257522	N/A	2022/09/30	Nan Raykha
Total Metals Analysis by ICP	ICP	8265229	2022/10/05	2022/10/05	Archana Patel
Iodide, Thiosulphate, Thiocyanate	IC/EC	8276412	N/A	2022/10/06	Taylor Mullings
Nitrate & Nitrite as Nitrogen in Water	LACH	8255727	N/A	2022/09/30	Chandra Nandlal
Orthophosphate	KONE	8258674	N/A	2022/10/04	Samuel Law



GENERAL COMMENTS

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

Package 1	1.3°C
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Revised Report (2022/11/17): Sample IDs revised.

Report revised [2022/15/11]: Sample ids revised.

RESULTS OF ANALYSES OF WATER

Sample TWA661 [IG_BH01_GW035] Iodide, Thiosulphate, Thiocyanate: Detection limits raised due to matrix interference.

Sample TWA662 [IG_BH05_GW005] Iodide, Thiosulphate, Thiocyanate: Detection limits raised due to matrix interference.

Sample TWA663 [IG_BH05_GW006] Iodide, Thiosulphate, Thiocyanate: Detection limits raised due to matrix interference.

Results relate only to the items tested.



Bureau Veritas Job #: C2S0594

Report Date: 2022/11/17

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE, ON

Your P.O. #: 202031-004

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8254331	NS3	Matrix Spike	Dissolved Organic Carbon	2022/09/29		97	%	80 - 120
8254331	NS3	Spiked Blank	Dissolved Organic Carbon	2022/09/29		97	%	80 - 120
8254331	NS3	Method Blank	Dissolved Organic Carbon	2022/09/29	<0.40		mg/L	
8254331	NS3	RPD	Dissolved Organic Carbon	2022/09/29	0.012		%	20
8255555	MJ1	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2022/09/30		112	%	80 - 120
8255555	MJ1	QC Standard	Total Kjeldahl Nitrogen (TKN)	2022/09/30		92	%	80 - 120
8255555	MJ1	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2022/09/30		92	%	80 - 120
8255555	MJ1	Method Blank	Total Kjeldahl Nitrogen (TKN)	2022/09/30	<0.10		mg/L	
8255555	MJ1	RPD	Total Kjeldahl Nitrogen (TKN)	2022/09/30	NC (1)		%	20
8255727	C_N	Matrix Spike [TWA661-01]	Nitrite (N)	2022/09/30		108	%	80 - 120
			Nitrate (N)	2022/09/30		101	%	80 - 120
8255727	C_N	Spiked Blank	Nitrite (N)	2022/09/30		104	%	80 - 120
			Nitrate (N)	2022/09/30		98	%	80 - 120
8255727	C_N	Method Blank	Nitrite (N)	2022/09/30	<0.010		mg/L	
			Nitrate (N)	2022/09/30	<0.10		mg/L	
8255727	C_N	RPD [TWA661-01]	Nitrite (N)	2022/09/30	NC		%	20
			Nitrate (N)	2022/09/30	NC		%	20
8255922	SSV	Matrix Spike	Total Phosphorus	2022/09/30		102	%	80 - 120
8255922	SSV	QC Standard	Total Phosphorus	2022/09/30		118	%	80 - 120
8255922	SSV	Spiked Blank	Total Phosphorus	2022/09/30		103	%	80 - 120
8255922	SSV	Method Blank	Total Phosphorus	2022/09/30	<0.020		mg/L	
8255922	SSV	RPD	Total Phosphorus	2022/09/30	5.1		%	20
8256184	TAK	Matrix Spike	Sulphide	2022/09/30		92	%	80 - 120
8256184	TAK	Spiked Blank	Sulphide	2022/09/30		92	%	80 - 120
8256184	TAK	Method Blank	Sulphide	2022/09/30	<0.020		mg/L	
8256184	TAK	RPD	Sulphide	2022/09/30	NC		%	20
8256544	KIT	Matrix Spike [TWA663-01]	Fluoride (F-)	2022/10/01		66 (2)	%	80 - 120
8256544	KIT	Spiked Blank	Fluoride (F-)	2022/10/01		102	%	80 - 120
8256544	KIT	Method Blank	Fluoride (F-)	2022/10/01	<0.10		mg/L	
8256544	KIT	RPD [TWA663-01]	Fluoride (F-)	2022/10/01	1.5		%	20
8256545	KIT	Spiked Blank	Alkalinity (Total as CaCO3)	2022/10/01		91	%	85 - 115
8256545	KIT	Method Blank	Alkalinity (Total as CaCO3)	2022/10/01	<1.0		mg/L	
8256545	KIT	RPD [TWA663-01]	Alkalinity (Total as CaCO3)	2022/10/01	6.5		%	20
8256546	KIT	Spiked Blank	pH	2022/10/01		102	%	98 - 103
8256546	KIT	RPD [TWA663-01]	pH	2022/10/01	0.43		%	N/A
8257256	LKH	Matrix Spike [TWA662-01]	Chloride (Cl-)	2022/09/30		NC	%	80 - 120
			Bromide (Br-)	2022/09/30		NC	%	80 - 120
			Sulphate (SO4)	2022/09/30		101	%	80 - 120
8257256	LKH	Spiked Blank	Chloride (Cl-)	2022/09/30		98	%	70 - 130
			Bromide (Br-)	2022/09/30		100	%	80 - 120
			Sulphate (SO4)	2022/09/30		101	%	80 - 120
8257256	LKH	Method Blank	Chloride (Cl-)	2022/09/30	<1.0		mg/L	
			Bromide (Br-)	2022/09/30	<1.0		mg/L	
			Sulphate (SO4)	2022/09/30	<1.0		mg/L	
8257256	LKH	RPD [TWA662-01]	Chloride (Cl-)	2022/09/30	0.049		%	20
			Bromide (Br-)	2022/09/30	0.39		%	20
			Sulphate (SO4)	2022/09/30	2.2		%	20
8257365	SPC	Matrix Spike	Total Phosphorus	2022/10/04		102	%	80 - 120



Bureau Veritas Job #: C2S0594

Report Date: 2022/11/17

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE, ON

Your P.O. #: 202031-004

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8257365	SPC	QC Standard	Total Phosphorus	2022/10/04		97	%	80 - 120
8257365	SPC	Spiked Blank	Total Phosphorus	2022/10/04		101	%	80 - 120
8257365	SPC	Method Blank	Total Phosphorus	2022/10/04	<0.020		mg/L	
8257365	SPC	RPD	Total Phosphorus	2022/10/04	0.90		%	20
8257373	MJ1	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2022/10/03		101	%	80 - 120
8257373	MJ1	QC Standard	Total Kjeldahl Nitrogen (TKN)	2022/10/03		97	%	80 - 120
8257373	MJ1	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2022/10/03		94	%	80 - 120
8257373	MJ1	Method Blank	Total Kjeldahl Nitrogen (TKN)	2022/10/03	<0.10		mg/L	
8257373	MJ1	RPD	Total Kjeldahl Nitrogen (TKN)	2022/10/03	5.1		%	20
8257522	N_R	Matrix Spike	Dissolved Aluminum (Al)	2022/09/30		103	%	80 - 120
			Dissolved Arsenic (As)	2022/09/30		103	%	80 - 120
			Dissolved Barium (Ba)	2022/09/30		104	%	80 - 120
			Dissolved Bismuth (Bi)	2022/09/30		98	%	80 - 120
			Dissolved Boron (B)	2022/09/30		95	%	80 - 120
			Dissolved Cadmium (Cd)	2022/09/30		105	%	80 - 120
			Dissolved Calcium (Ca)	2022/09/30		NC	%	80 - 120
			Dissolved Cesium (Cs)	2022/09/30		105	%	80 - 120
			Dissolved Chromium (Cr)	2022/09/30		102	%	80 - 120
			Dissolved Cobalt (Co)	2022/09/30		100	%	80 - 120
			Dissolved Copper (Cu)	2022/09/30		101	%	80 - 120
			Dissolved Iron (Fe)	2022/09/30		102	%	80 - 120
			Dissolved Lead (Pb)	2022/09/30		98	%	80 - 120
			Dissolved Lithium (Li)	2022/09/30		103	%	80 - 120
			Dissolved Magnesium (Mg)	2022/09/30		NC	%	80 - 120
			Dissolved Nickel (Ni)	2022/09/30		95	%	80 - 120
			Dissolved Potassium (K)	2022/09/30		105	%	80 - 120
			Dissolved Rubidium (Rb)	2022/09/30		103	%	80 - 120
			Dissolved Selenium (Se)	2022/09/30		99	%	80 - 120
			Dissolved Silicon (Si)	2022/09/30		101	%	80 - 120
			Dissolved Sodium (Na)	2022/09/30		102	%	80 - 120
			Dissolved Strontium (Sr)	2022/09/30		100	%	80 - 120
			Dissolved Thorium (Th)	2022/09/30		97	%	80 - 120
			Dissolved Uranium (U)	2022/09/30		97	%	80 - 120
			Dissolved Zirconium (Zr)	2022/09/30		107	%	80 - 120
8257522	N_R	Spiked Blank	Dissolved Aluminum (Al)	2022/09/30		100	%	80 - 120
			Dissolved Arsenic (As)	2022/09/30		102	%	80 - 120
			Dissolved Barium (Ba)	2022/09/30		101	%	80 - 120
			Dissolved Bismuth (Bi)	2022/09/30		96	%	80 - 120
			Dissolved Boron (B)	2022/09/30		94	%	80 - 120
			Dissolved Cadmium (Cd)	2022/09/30		102	%	80 - 120
			Dissolved Calcium (Ca)	2022/09/30		98	%	80 - 120
			Dissolved Cesium (Cs)	2022/09/30		102	%	80 - 120
			Dissolved Chromium (Cr)	2022/09/30		101	%	80 - 120
			Dissolved Cobalt (Co)	2022/09/30		100	%	80 - 120
			Dissolved Copper (Cu)	2022/09/30		98	%	80 - 120
			Dissolved Iron (Fe)	2022/09/30		102	%	80 - 120
			Dissolved Lead (Pb)	2022/09/30		97	%	80 - 120
			Dissolved Lithium (Li)	2022/09/30		102	%	80 - 120
			Dissolved Magnesium (Mg)	2022/09/30		102	%	80 - 120
			Dissolved Nickel (Ni)	2022/09/30		95	%	80 - 120
			Dissolved Potassium (K)	2022/09/30		103	%	80 - 120



QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8257522	N_R	Method Blank	Dissolved Rubidium (Rb)	2022/09/30		101	%	80 - 120
			Dissolved Selenium (Se)	2022/09/30		99	%	80 - 120
			Dissolved Silicon (Si)	2022/09/30		100	%	80 - 120
			Dissolved Sodium (Na)	2022/09/30		100	%	80 - 120
			Dissolved Strontium (Sr)	2022/09/30		99	%	80 - 120
			Dissolved Thorium (Th)	2022/09/30		94	%	80 - 120
			Dissolved Uranium (U)	2022/09/30		94	%	80 - 120
			Dissolved Zirconium (Zr)	2022/09/30		102	%	80 - 120
			Dissolved Aluminum (Al)	2022/09/30	<4.9		ug/L	
			Dissolved Arsenic (As)	2022/09/30	<1.0		ug/L	
			Dissolved Barium (Ba)	2022/09/30	<2.0		ug/L	
			Dissolved Bismuth (Bi)	2022/09/30	<1.0		ug/L	
			Dissolved Boron (B)	2022/09/30	<10		ug/L	
			Dissolved Cadmium (Cd)	2022/09/30	<0.090		ug/L	
			Dissolved Calcium (Ca)	2022/09/30	<200		ug/L	
			Dissolved Cesium (Cs)	2022/09/30	<0.20		ug/L	
			Dissolved Chromium (Cr)	2022/09/30	<5.0		ug/L	
			Dissolved Cobalt (Co)	2022/09/30	<0.50		ug/L	
			Dissolved Copper (Cu)	2022/09/30	<0.90		ug/L	
			Dissolved Iron (Fe)	2022/09/30	<100		ug/L	
			Dissolved Lead (Pb)	2022/09/30	<0.50		ug/L	
			Dissolved Lithium (Li)	2022/09/30	<5.0		ug/L	
			Dissolved Magnesium (Mg)	2022/09/30	<50		ug/L	
			Dissolved Nickel (Ni)	2022/09/30	<1.0		ug/L	
			Dissolved Potassium (K)	2022/09/30	<200		ug/L	
			Dissolved Rubidium (Rb)	2022/09/30	<0.20		ug/L	
			Dissolved Selenium (Se)	2022/09/30	<2.0		ug/L	
			Dissolved Silicon (Si)	2022/09/30	<50		ug/L	
			Dissolved Sodium (Na)	2022/09/30	<100		ug/L	
			Dissolved Strontium (Sr)	2022/09/30	<1.0		ug/L	
			Dissolved Thorium (Th)	2022/09/30	<2.0		ug/L	
			Dissolved Uranium (U)	2022/09/30	<0.10		ug/L	
			Dissolved Zirconium (Zr)	2022/09/30	<1.0		ug/L	
8257869	NS3	Matrix Spike [TWA662-01]	Total Inorganic Carbon (C)	2022/09/30		47 (2)	%	80 - 120
8257869	NS3	Spiked Blank	Total Inorganic Carbon (C)	2022/09/30		94	%	80 - 120
8257869	NS3	Method Blank	Total Inorganic Carbon (C)	2022/09/30	<1		mg/L	
8257869	NS3	RPD [TWA662-01]	Total Inorganic Carbon (C)	2022/09/30	0.28		%	20
8258034	ASP	Matrix Spike	Total Ammonia-N	2022/10/01		94	%	75 - 125
8258034	ASP	Spiked Blank	Total Ammonia-N	2022/10/01		98	%	80 - 120
8258034	ASP	Method Blank	Total Ammonia-N	2022/10/01	<0.050		mg/L	
8258034	ASP	RPD	Total Ammonia-N	2022/10/01	NC		%	20
8258051	NS3	Matrix Spike [TWA663-07]	Total Organic Carbon (TOC)	2022/09/30		NC	%	80 - 120
8258051	NS3	Spiked Blank	Total Organic Carbon (TOC)	2022/09/30		99	%	80 - 120
8258051	NS3	Method Blank	Total Organic Carbon (TOC)	2022/09/30	<0.40		mg/L	
8258051	NS3	RPD [TWA663-07]	Total Organic Carbon (TOC)	2022/09/30	0.52		%	20
8258674	S1L	Matrix Spike	Orthophosphate (P)	2022/10/04		110	%	75 - 125
8258674	S1L	Spiked Blank	Orthophosphate (P)	2022/10/04		101	%	80 - 120
8258674	S1L	Method Blank	Orthophosphate (P)	2022/10/04	<0.010		mg/L	
8258674	S1L	RPD	Orthophosphate (P)	2022/10/04	NC		%	25



Bureau Veritas Job #: C2S0594
Report Date: 2022/11/17

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC	Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8259273	ADA	Matrix Spike		Dissolved Aluminum (Al)	2022/10/03		101	%	80 - 120
				Dissolved Arsenic (As)	2022/10/03		101	%	80 - 120
				Dissolved Barium (Ba)	2022/10/03		101	%	80 - 120
				Dissolved Bismuth (Bi)	2022/10/03		98	%	80 - 120
				Dissolved Boron (B)	2022/10/03		93	%	80 - 120
				Dissolved Cadmium (Cd)	2022/10/03		99	%	80 - 120
				Dissolved Calcium (Ca)	2022/10/03		NC	%	80 - 120
				Dissolved Cesium (Cs)	2022/10/03		101	%	80 - 120
				Dissolved Chromium (Cr)	2022/10/03		93	%	80 - 120
				Dissolved Cobalt (Co)	2022/10/03		102	%	80 - 120
				Dissolved Copper (Cu)	2022/10/03		97	%	80 - 120
				Dissolved Iron (Fe)	2022/10/03		102	%	80 - 120
				Dissolved Lead (Pb)	2022/10/03		102	%	80 - 120
				Dissolved Lithium (Li)	2022/10/03		108	%	80 - 120
				Dissolved Magnesium (Mg)	2022/10/03		105	%	80 - 120
				Dissolved Nickel (Ni)	2022/10/03		95	%	80 - 120
				Dissolved Potassium (K)	2022/10/03		104	%	80 - 120
				Dissolved Rubidium (Rb)	2022/10/03		100	%	80 - 120
				Dissolved Selenium (Se)	2022/10/03		101	%	80 - 120
				Dissolved Silicon (Si)	2022/10/03		99	%	80 - 120
				Dissolved Sodium (Na)	2022/10/03		102	%	80 - 120
				Dissolved Strontium (Sr)	2022/10/03		95	%	80 - 120
				Dissolved Thorium (Th)	2022/10/03		97	%	80 - 120
				Dissolved Uranium (U)	2022/10/03		101	%	80 - 120
				Dissolved Zirconium (Zr)	2022/10/03		98	%	80 - 120
8259273	ADA	Spiked Blank		Dissolved Aluminum (Al)	2022/10/03		99	%	80 - 120
				Dissolved Arsenic (As)	2022/10/03		98	%	80 - 120
				Dissolved Barium (Ba)	2022/10/03		100	%	80 - 120
				Dissolved Bismuth (Bi)	2022/10/03		96	%	80 - 120
				Dissolved Boron (B)	2022/10/03		87	%	80 - 120
				Dissolved Cadmium (Cd)	2022/10/03		97	%	80 - 120
				Dissolved Calcium (Ca)	2022/10/03		99	%	80 - 120
				Dissolved Cesium (Cs)	2022/10/03		100	%	80 - 120
				Dissolved Chromium (Cr)	2022/10/03		89	%	80 - 120
				Dissolved Cobalt (Co)	2022/10/03		98	%	80 - 120
				Dissolved Copper (Cu)	2022/10/03		97	%	80 - 120
				Dissolved Iron (Fe)	2022/10/03		99	%	80 - 120
				Dissolved Lead (Pb)	2022/10/03		101	%	80 - 120
				Dissolved Lithium (Li)	2022/10/03		98	%	80 - 120
				Dissolved Magnesium (Mg)	2022/10/03		99	%	80 - 120
				Dissolved Nickel (Ni)	2022/10/03		92	%	80 - 120
				Dissolved Potassium (K)	2022/10/03		99	%	80 - 120
				Dissolved Rubidium (Rb)	2022/10/03		96	%	80 - 120
				Dissolved Selenium (Se)	2022/10/03		100	%	80 - 120
				Dissolved Silicon (Si)	2022/10/03		95	%	80 - 120
				Dissolved Sodium (Na)	2022/10/03		103	%	80 - 120
				Dissolved Strontium (Sr)	2022/10/03		92	%	80 - 120
				Dissolved Thorium (Th)	2022/10/03		93	%	80 - 120
				Dissolved Uranium (U)	2022/10/03		100	%	80 - 120
				Dissolved Zirconium (Zr)	2022/10/03		96	%	80 - 120
8259273	ADA	Method Blank		Dissolved Aluminum (Al)	2022/10/03	<4.9		ug/L	



Bureau Veritas Job #: C2S0594
Report Date: 2022/11/17

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Arsenic (As)	2022/10/03	<1.0		ug/L	
			Dissolved Barium (Ba)	2022/10/03	<2.0		ug/L	
			Dissolved Bismuth (Bi)	2022/10/03	<1.0		ug/L	
			Dissolved Boron (B)	2022/10/03	<10		ug/L	
			Dissolved Cadmium (Cd)	2022/10/03	<0.090		ug/L	
			Dissolved Calcium (Ca)	2022/10/03	<200		ug/L	
			Dissolved Cesium (Cs)	2022/10/03	<0.20		ug/L	
			Dissolved Chromium (Cr)	2022/10/03	<5.0		ug/L	
			Dissolved Cobalt (Co)	2022/10/03	<0.50		ug/L	
			Dissolved Copper (Cu)	2022/10/03	<0.90		ug/L	
			Dissolved Iron (Fe)	2022/10/03	<100		ug/L	
			Dissolved Lead (Pb)	2022/10/03	<0.50		ug/L	
			Dissolved Lithium (Li)	2022/10/03	<5.0		ug/L	
			Dissolved Magnesium (Mg)	2022/10/03	<50		ug/L	
			Dissolved Nickel (Ni)	2022/10/03	<1.0		ug/L	
			Dissolved Potassium (K)	2022/10/03	<200		ug/L	
			Dissolved Rubidium (Rb)	2022/10/03	<0.20		ug/L	
			Dissolved Selenium (Se)	2022/10/03	<2.0		ug/L	
			Dissolved Silicon (Si)	2022/10/03	<50		ug/L	
			Dissolved Sodium (Na)	2022/10/03	<100		ug/L	
			Dissolved Strontium (Sr)	2022/10/03	<1.0		ug/L	
			Dissolved Thorium (Th)	2022/10/03	<2.0		ug/L	
			Dissolved Uranium (U)	2022/10/03	<0.10		ug/L	
			Dissolved Zirconium (Zr)	2022/10/03	<1.0		ug/L	
8259273	ADA	RPD	Dissolved Lead (Pb)	2022/10/03	NC		%	20
8259282	TLG	Matrix Spike [TWA662-05]	Dissolved Iron (Fe)	2022/10/04		87	%	80 - 120
			Dissolved Sulphur (S)	2022/10/04		NC	%	80 - 120
8259282	TLG	Spiked Blank	Dissolved Iron (Fe)	2022/10/04		96	%	80 - 120
			Dissolved Sulphur (S)	2022/10/04		95	%	80 - 120
8259282	TLG	Method Blank	Dissolved Iron (Fe)	2022/10/04	<0.02		mg/L	
			Dissolved Sulphur (S)	2022/10/04	<0.5		mg/L	
8259282	TLG	RPD [TWA662-05]	Dissolved Iron (Fe)	2022/10/04	0.37		%	25
			Dissolved Sulphur (S)	2022/10/04	12		%	25
8265229	APT	Matrix Spike	Total Iron (Fe)	2022/10/05		103	%	80 - 120
			Total Sulphur (S)	2022/10/05		NC	%	80 - 120
8265229	APT	Spiked Blank	Total Iron (Fe)	2022/10/05		102	%	80 - 120
			Total Sulphur (S)	2022/10/05		99	%	80 - 120
8265229	APT	Method Blank	Total Iron (Fe)	2022/10/05	<0.02		mg/L	
			Total Sulphur (S)	2022/10/05	<0.5		mg/L	
8265229	APT	RPD	Total Iron (Fe)	2022/10/05	2.4		%	25
8276412	TMU	Matrix Spike	Dissolved Iodide	2022/10/06		87	%	80 - 120
8276412	TMU	Spiked Blank	Dissolved Iodide	2022/10/06		102	%	80 - 120
8276412	TMU	Method Blank	Dissolved Iodide	2022/10/06	<0.10		mg/L	
8276412	TMU	RPD	Dissolved Iodide	2022/10/06	NC		%	20
8276849	éH2	Matrix Spike	Reactive Silica (SiO2)	2022/10/11		NC	%	80 - 120
8276849	éH2	Spiked Blank	Reactive Silica (SiO2)	2022/10/11		101	%	80 - 120
8276849	éH2	Method Blank	Reactive Silica (SiO2)	2022/10/11	<0.050		mg/L	
			Reactive Silica (SiO2)	2022/10/11	0.53		%	20
8276861	éH2	Matrix Spike	Reactive Silica (SiO2)	2022/10/11		103	%	80 - 120
8276861	éH2	Spiked Blank	Reactive Silica (SiO2)	2022/10/11		104	%	80 - 120



Bureau Veritas Job #: C2S0594

Report Date: 2022/11/17

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE, ON

Your P.O. #: 202031-004

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8276861	éH2	Method Blank	Reactive Silica (SiO2)	2022/10/11	<0.050		mg/L	
8276861	éH2	RPD	Reactive Silica (SiO2)	2022/10/11	1.9		%	20
8310547	ZEO	Spiked Blank	Total Ruthenium (Ru)	2022/10/22		93	%	70 - 130
8310547	ZEO	Method Blank	Total Ruthenium (Ru)	2022/10/22	<2.0		ug/L	

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

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

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

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

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

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

(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

(2) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



BUREAU
VERITAS

Bureau Veritas Job #: C2S0594

Report Date: 2022/11/17

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE, ON

Your P.O. #: 202031-004

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Cristina Carriere, Senior Scientific Specialist

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Jonathan Fauvel, B.Sc, Chimiste, Supervisor, Inorganics

Sandy Yuan, M.Sc., QP, Scientific Specialist



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Isotope Analyses for:
Geofirma Engineering LTD

IT² FILE #
220901

2023-03-24

Approved by:

Orfan Shouakar-Stash, PhD
Director

Isotope Tracer Technologies Inc.
608 Weber St. North Unit 3&4,
Waterloo, ON, N2V 1Z5 Tel: 519-886-5555 |
Fax: 519-886-5575
Email: orfan@it2isotopes.com
Website: www.it2isotopes.com



Client: Geofirma Engineering LTD
Address: 1 RAYMOND ST. SUITE 200
 Ottawa, ON. K1R 1A2
Tel.: (613)402-1701/ (514)-730-0961
Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: 220901
Project Number: 20-203-1

#	Client ID	Sample #	Sampling		E ³ H	Result	± 1σ	δ ¹⁸ O	Aver	Stdv	δ ² H	Aver	Stdv
			Date	Time									
						TU		H ₂ O	VSMOW		H ₂ O	VSMOW	
1	IG_BH03_GW017	120785	2022-09-21	various	X	1.4	0.7	X	-9.93	0.01	X	-61.3	0.2
2	IG_BH03_GW018	120786	2022-09-21	various	X	1.2	0.8	X	-9.88	0.04	X	-61.2	0.1
3	IG_BH01_GW035	120787	2022-09-24	various	X	6.0	0.9	X	-8.93	0.04	X	-70.3	0.1
4	IG_BH05_GW005	120788	2022-09-26	various	X	1.5	0.7	X	-11.75	0.04	X	-82.0	0.1
5	IG_BH05_GW006	120789	2022-09-26	various	X	2.1	0.8	X	-11.85	0.03	X	-82.2	0.1
6	IG_BH05_GW008	120790	2022-09-25	8:45	X	< 0.8	0.7						

¹⁸O & ²H (CRDS)

Instrument Used: Cavity Ring Down Spectroscopy (CRDS)

CRDS (Model L2130-i) (Picarro, California, USA).

Standard Used:

IT2-12C / IT2-13B / IT2-14B Calibrated with IAEA Standards (V-SMOW, SLAP, and GISP)

Typical Standard deviation:

(¹⁸O ± 0.1‰) (²H ± 1‰)

E³H ANALYSES

Tritium is reported in Tritium Units.

1TU = 3.221 Picocuries/L per IAEA, 2000 Report.

1TU = 0.11919 Becquerels/L per IAEA, 2000 Report.

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

Isotope Tracer Technologies Inc.

608 Weber St. North Unit 3&4, Waterloo, ON, N2V 1K4

Tel: 519-886-5555 | Fax: 519-886-5575

Email: orfan@it2isotopes.com

Website: www.it2isotopes.com



Client: Geofirma Engineering LTD
Address: 1 RAYMOND ST. SUITE 200
 Ottawa, ON. K1R 1A2
Tel.: (613)402-1701/ (514)-730-0961
Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: 220901
Project Number: 20-203-1

#	Client ID	Sample #	Sampling		$^{87}\text{Sr}/^{86}\text{Sr}$	Result	StdErr (abs)	StdDev (abs)	$\delta^{37}\text{Cl}$	Result	Stdv
			Date	Time							
1	IG_BH03_GW017	120785	2022-09-21	various	X	0.71822	5.912E-06	7.572E-05	X	-0.25	0.11
2	IG_BH03_GW018	120786	2022-09-21	various	X	0.71815	4.508E-06	5.612E-05	X	-0.23	0.09
3	IG_BH01_GW035	120787	2022-09-24	various	X	0.71545	7.025E-06	8.718E-05	X	-0.26	0.08
4	IG_BH05_GW005	120788	2022-09-26	various	X	0.71592	5.796E-06	8.073E-05	X	-0.06	0.06
5	IG_BH05_GW006	120789	2022-09-26	various	X	0.71581	5.264E-06	6.512E-05	X	-0.03	0.10
6	IG_BH05_GW008	120790	2022-09-25	8:45							

$^{87}\text{Sr}/^{86}\text{Sr}$ ANALYSES

Instrument Used:

Thermal Ionization Mass Spectrometry (TIMS), TI-Box, spectromat, Germany

Standard Used:

NIST-987

Typical Standard deviation:

± 0.0001

^{37}Cl ANALYSES

Instrument Used:

Isotope Ratio Mass Spectrometry (IRMS) - MAT 253, Thermo Scientific, Germany

Coupled with an Agilent 6890 Gas Chromatograph (GC)

Standard Used:

SMOC

Typical Standard deviation:

$\pm 0.15\%$

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

Isotope Tracer Technologies Inc.

608 Weber St. North Unit 3&4, Waterloo, ON, N2V 1K4

Tel: 519-886-5555 | Fax: 519-886-5575

Email: orfan@it2isotopes.com

Website: www.it2isotopes.com



Client: Geofirma Engineering LTD
Address: 1 RAYMOND ST. SUITE 200
 Ottawa, ON. K1R 1A2
Tel.: (613)402-1701/ (514)-730-0961
Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: 220901
Project Number: 20-203-1

#	Client ID	Sample #	Sampling		$\delta^{13}\text{C}$	Result	Repeat	^{14}C	Result			
			Date	Time	DIC	PDB		DIC	^{14}C yr BP	\pm	F14C	\pm
1	IG_BH03_GW017	120785	2022-09-21	various	X	-24	-24.1	X	6145	60	0.4653	0.0035
2	IG_BH03_GW018	120786	2022-09-21	various	X	-23.6		X	5805	58	0.4855	0.0035
3	IG_BH01_GW035	120787	2022-09-24	various	X	-12.2		X	3036	53	0.6852	0.0046
4	IG_BH05_GW005	120788	2022-09-26	various	X	-24.3		X	469	57	0.9433	0.0067
5	IG_BH05_GW006	120789	2022-09-26	various	X	-24.3	-23.8	X	697	57	0.9169	0.0065
6	IG_BH05_GW008	120790	2022-09-25	8:45	X	-11.2		X	7226	59	0.4068	0.0030

^{13}C DIC Analyses

Instrument Used: Finnigan MAT, DeltaPlus XL IRMS, Germany.

Standard Used:

IT²-27

IT²-34

NBS-18

NBS-19

Typical Standard deviation: $\pm 0.2\%$

^{14}C DIC Analyses

Instrument Used:

AMS (Accelerator Mass Spectrometry)

Standard Used:

OX1: 1.05×10^{-10}

OX2: 1.35×10^{-10}

C6: 1.5×10^{-10}

C7: 0.5×10^{-10}

Typical Standard deviation:

5 to 10% of Standard values listed above

Reporting of Data

In this analysis report, we have followed the conventions recommended by Millard (2014).

Radiocarbon Analysis

Radiocarbon analyses are performed on a 3MV tandem accelerator mass spectrometer built by High Voltage Engineering (HVE).

^{12}C , ^{13}C , $^{14}\text{C}+3$ ions are measured at 2.5 MV terminal voltage with Ar stripping. The fraction modern carbon, F14C, is calculated according to Reimer et al. (2004) as the ratio of the sample $^{14}\text{C}/^{12}\text{C}$ ratio to the standard $^{14}\text{C}/^{12}\text{C}$ ratio (in our case Ox-II) measured in the same data block. Both $^{14}\text{C}/^{12}\text{C}$ ratios are background-corrected and the result is corrected for spectrometer and preparation fractionation using the AMS measured $^{13}\text{C}/^{12}\text{C}$ ratio and is normalized to $\delta^{13}\text{C}$ (PDB). Radiocarbon ages are calculated as $-8033 \ln(\text{F14C})$ and reported in ^{14}C yr BP (BP=AD 1950) as described by Stuiver and Polach (1977). The errors on ^{14}C ages (1σ) are based on counting statistics and $^{14}\text{C}/^{12}\text{C}$ and $^{13}\text{C}/^{12}\text{C}$ variation between data blocks. We do not report $\delta^{13}\text{C}$ as it is measured on the AMS and contains machine fractionation.

D14C (defined as per mil Depletion or Enrichment Relative to Standard Normalized for Isotope Fractionation) are calculated as $(\text{F14C} - 1) \cdot 1000$.

$\Delta^{14}\text{C}$ (defined as age corrected D14C) are calculated as $(\text{F14C} \cdot e^{(1950-y)/8267} - 1) \cdot 1000$, where y = year of measurement.

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

Isotope Tracer Technologies Inc.

608 Weber St. North Unit 3&4, Waterloo, ON, N2V 1K4

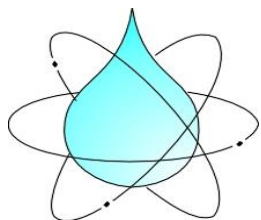
Tel: 519-886-5555 | Fax: 519-886-5575

Email: orfan@it2isotopes.com

Website: www.it2isotopes.com

608 Weber St. N – Unit 3 – Waterloo – Ontario – N2V 1K4 – Canada

Tel: 519-886-5555 – Fax: 519-886-5575 – E-mail: info@it2isotopes.com – www.it2isotopes.com



Hydrogeochemistry Laboratory
Analytical Report - Clark group
University of Ottawa
25 Templeton Street
Ottawa, ON K1N 6N5


Analytical report for:

Geofirma Engineering Ltd.
1 Raymond Street #200
Ottawa, ON K1R 1A2

Sample description

Site	Ignace
Type	Water
Container	Nalgene
Volume	1L

Analysis

Analyte	^{129}I
Method	^{129}I extraction to AgI and AMS analysis
Facility	Hydrogeochemistry Laboratory, University of Ottawa
Report Approved by	 Ian Clark, P.Geo.

Timeline

Samples received	Analyses completed	Report date
September 2022	^{129}I	March 1, 2023

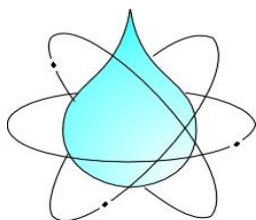
Sample	UofO #	Date Sampled	Sample Weight (g)	¹²⁷ I Concentration Measured (ppb)	Mass of Iodide Carrier Added (mg)	¹²⁹ I/ ¹²⁷ I Ratio Measured ($\times 10^{-14}$) *		¹²⁹ I Concentration ($\times 10^6$ atoms/g)		Original Ratio ($\times 10^{-09}$) **	
						Ratio	Standard Deviation	Concentration	Standard Deviation	OR	Standard Deviation
IG_BH03_GW017	UOH 4202	Sept. 21, 2022	200.82	467.80	2.16	2.95E+02	1.84E+01	1.57E-01	9.83E-03	7.07E-02	5.67E-03
IG_BH03_GW018	UOH 4203	Sept. 21, 2022	200.93	516.33	2.16	2.34E+02	1.59E+01	1.25E-01	8.49E-03	5.12E-02	4.31E-03
IG_BH01_GW035	UOH 4204	Sept. 24, 2022	210.58	209.59	2.16	2.26E+02	1.41E+01	1.12E-01	7.03E-03	1.13E-01	9.04E-03
IG_BH05_GW005	UOH 4205	Sept. 27, 2022	204.30	283.15	2.16	8.24E+01	5.16E+00	4.25E-02	2.66E-03	3.16E-02	2.53E-03
IG_BH05_GW006	UOH 4206	Sept. 27, 2022	201.48	304.46	2.16	9.98E+01	6.25E+00	5.23E-02	3.27E-03	3.62E-02	2.90E-03

Note: * $^{129}\text{I}/^{127}\text{I}$ Ratio Measured includes both sample and carrier added.

Note 2: ** $^{129}\text{I}/^{127}\text{I}$ Ratio calculated before added the carrier.

AMS Measurements

The ^{129}I analysis are performed on a 3MV accelerator mass spectrometer (AMS) built by High Voltage Engineering (HVE). $^{129}\text{I}^{+2}$ ions are measured at 2.5 MV terminal voltage Ar stripping. The errors represent 68.3% confidence limits, based on 1 measurement each. These measurements were normalized with respect to ISO-6II in-house reference material for which $^{129}\text{I}/^{127}\text{I} = (5.71 \pm 0.01) \times 10^{-12}$, by calibration with the NIST 3230 I and II standard reference material. The AMS system background was monitored with our standard NaI blank material and found to be normal. No background corrections were applied to these data. A NaI blank measured on February 09, 2023 set of samples yielded a $^{129}\text{I}/^{127}\text{I}$ ratio of $(1.4 \pm 0.4) \times 10^{-14}$.



Hydrogeochemistry Laboratory
Analytical Report - Clark group
University of Ottawa
25 Templeton Street
Ottawa, ON K1N 6N5


Analytical report for:

Geofirma Engineering Ltd.
1 Raymond Street #200
Ottawa, ON K1R 1A2

Sample description

Site	Ignace
Type	Water
Container	Nalgene
Volume	1 L

Analysis

Analyte	^{36}Cl in dissolved Cl
Method	AMS
Facility	Hydrogeochemistry Laboratory, University of Ottawa
Report Approved by	 Ian Clark, P.Geo.

Timeline

Samples received	Analyses completed	Report date
October 04, 2022 (5), 2022 Q3 December 20, 2022 (3), 2022 Q4	^{36}Cl	April 27, 2023

Notes

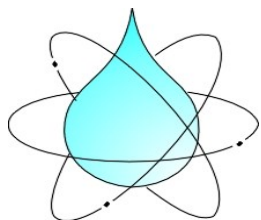
Samples were collected in the field by Geofirma staff. Bottles were received sealed and in good condition. Samples were extracted as Cl^- from solution on an anion exchange column, eluted and precipitated as AgCl target material. AMS analysis was undertaken on a 6 MV tandem accelerator mass spectrometer at PRIME Lab, Purdue.

Hydrogeochemistry Laboratory
Analytical Report - Clark group

Report prepared for:
 Geofirma Engineering Ltd.

Sample	Lab ID	Comment	Cl (mg/L)	³⁶ Cl/Cl final (10 ⁻¹⁵)	±	³⁶ Cl atoms/L (10 ⁶)	±
IG_BH03_GW017	PRIME	prepared at uOttawa	21000	19.2	1.3	6834	464
IG_BH03_GW018	PRIME	prepared at uOttawa	21000	18.1	2.5	6440	881
IG_BH01_GW035	PRIME	prepared at uOttawa	5300	17.2	1.2	1543	108
IG_BH05_GW005	PRIME	prepared at uOttawa	6600	18.6	1.4	2079	155
IG_BH05_GW006	PRIME	prepared at uOttawa	6400	17.5	1.3	1902	142

April 27, 2023




Hydrogeochemistry Laboratory
Analytical Report - Clark group
University of Ottawa
25 Templeton Street
Ottawa, ON K1N 6N5

Analytical report for:

Geofirma Engineering Ltd.
1 Raymond Street #200
Ottawa, ON K1R 1A2

Sample description

Site	Ignace
Type	Noble gas
Container	Cu tubes
Volume	
Report Approved by	 Ian Clark, P.Geo.

Analysis

Analyte	Noble gases
Method	Mass spectrometry
Facility	Noble gas laboratory, University of Utah

Timeline

Samples received	Analyses completed	Report date
2022 Q3 and Q4	He, Ne, Ar, Kr, Xe	Rev 0: 2023-06-19 Rev 1: 2024-01-08

Notes

Gas extraction from water follows the procedure outlined in Aeschbach-Hertig & Solomon 2013. Please see sheet tab titled "Notes" for further explanation of the noble gas analysis.

Hydrogeochemistry Laboratory
Analytical Report - Clark group

Report prepared for:
Geofirma Engineering Ltd.

Quarter	Sample ID	Mass g	He3		He4		x/Ra	HeTotal	
			cc/g	±	cc/g	±		cc/g	±
2022 Q3	IG_BH03_GW017	10.7	5.39E-11	5.39E-13	3.05E-04	3.05E-06	0.128	3.05E-04	3.05E-06
2022 Q3	IG_BH03_GW018	10.2	4.87E-12	4.87E-14	2.83E-04	2.83E-06	0.012	2.83E-04	2.83E-06
2022 Q3	IG_BH01_GW035	11.1	2.80E-11	2.80E-13	3.00E-04	3.00E-06	0.068	3.00E-04	3.00E-06
2022 Q3	IG_BH05_GW005	13.0	4.01E-11	4.01E-13	2.54E-04	2.54E-06	0.114	2.54E-04	2.54E-06
2022 Q3	IG_BH05_GW006	11.5	4.26E-11	4.26E-13	2.88E-04	2.88E-06	0.107	2.88E-04	2.88E-06
2022 Q4	IG_BH01_GW028	10.1	1.67E-11	1.67E-13	3.33E-04	3.33E-06	0.036	3.33E-04	3.33E-06
2022 Q4	IG_BH01_GW036	9.8	2.39E-11	2.39E-13	3.29E-04	3.29E-06	0.053	3.29E-04	3.29E-06
2022 Q4	IG_BH05_GW011	9.9	2.26E-12	2.26E-14	1.36E-04	1.36E-06	0.012	1.36E-04	1.36E-06
2022 Q4	IG_BH05_GW012	11.1	4.87E-11	4.87E-13	2.99E-04	2.99E-06	0.118	2.99E-04	2.99E-06

Quarter	Sample ID	Mass g	Ne20		Ne22		NeTotal		20Ne/22Ne
			cc/g	±	cc/g	±	cc/g	±	
2022 Q3	IG_BH03_GW017	10.7	6.56E-08	1.97E-09	7.14E-09	2.14E-10	7.27E-08	2.18E-09	9.19
2022 Q3	IG_BH03_GW018	10.2	7.84E-08	2.35E-09	7.79E-09	2.34E-10	8.62E-08	2.59E-09	10.07
2022 Q3	IG_BH01_GW035	11.1	6.57E-07	1.97E-08	6.59E-08	1.98E-09	7.22E-07	2.17E-08	9.96
2022 Q3	IG_BH05_GW005	13.0	3.69E-07	1.11E-08	3.93E-08	1.18E-09	4.08E-07	1.22E-08	9.39
2022 Q3	IG_BH05_GW006	11.5	4.62E-07	1.39E-08	5.02E-08	1.51E-09	5.13E-07	1.54E-08	9.22
2022 Q4	IG_BH01_GW028	10.1	3.53E-08	1.06E-09	3.55E-09	1.06E-10	3.89E-08	1.17E-09	9.96
2022 Q4	IG_BH01_GW036	9.8	5.50E-08	1.65E-09	5.85E-09	1.75E-10	6.09E-08	1.83E-09	9.41
2022 Q4	IG_BH05_GW011	9.9	7.86E-08	2.36E-09	8.01E-09	2.40E-10	8.66E-08	2.60E-09	9.80
2022 Q4	IG_BH05_GW012	11.1	1.48E-07	4.43E-09	1.53E-08	4.60E-10	1.63E-07	4.89E-09	9.63

Quarter	Sample ID	Mass g	Ar36		Ar40		ArTotal		36Ar/40Ar
			cc/g	±	cc/g	±	cc/g	±	
2022 Q3	IG_BH03_GW017	10.7	1.43E-07	4.29E-09	2.22E-03	6.66E-05	2.22E-03	6.66E-05	6.45E-05
2022 Q3	IG_BH03_GW018	10.2	1.54E-07	4.62E-09	7.39E-04	2.22E-05	7.39E-04	2.22E-05	2.09E-04
2022 Q3	IG_BH01_GW035	11.1	1.38E-06	4.15E-08	7.73E-04	2.32E-05	7.75E-04	2.32E-05	1.79E-03
2022 Q3	IG_BH05_GW005	13.0	1.11E-06	3.32E-08	1.35E-03	4.06E-05	1.36E-03	4.07E-05	8.18E-04
2022 Q3	IG_BH05_GW006	11.5	1.06E-06	3.18E-08	1.36E-03	4.08E-05	1.36E-03	4.08E-05	7.79E-04
2022 Q4	IG_BH01_GW028	10.1	5.13E-07	1.54E-08	6.43E-04	1.93E-05	6.43E-04	1.93E-05	7.99E-04
2022 Q4	IG_BH01_GW036	9.8	4.90E-07	1.47E-08	1.22E-03	3.67E-05	1.22E-03	3.67E-05	4.01E-04
2022 Q4	IG_BH05_GW011	9.9	5.49E-07	1.65E-08	3.86E-04	1.16E-05	3.87E-04	1.16E-05	1.42E-03
2022 Q4	IG_BH05_GW012	11.1	5.81E-07	1.74E-08	1.25E-03	3.75E-05	1.25E-03	3.75E-05	4.65E-04

Hydrogeochemistry Laboratory
Analytical Report - Clark group

Report prepared for:
 Geofirma Engineering Ltd.

Quarter	Sample ID	Mass g	KrTotal		XeTotal	
			<i>cc/g</i>	<i>±</i>	<i>cc/g</i>	<i>±</i>
2022 Q3	IG_BH03_GW017	10.7	1.94E-08	9.71E-10	3.46E-09	1.73E-10
2022 Q3	IG_BH03_GW018	10.2	1.25E-08	6.24E-10	2.59E-09	1.30E-10
2022 Q3	IG_BH01_GW035	11.1	6.41E-08	3.20E-09	8.21E-09	4.10E-10
2022 Q3	IG_BH05_GW005	13.0	4.56E-08	2.28E-09	7.87E-09	3.94E-10
2022 Q3	IG_BH05_GW006	11.5	5.11E-08	2.56E-09	7.88E-09	3.94E-10
2022 Q4	IG_BH01_GW028	10.1	4.65E-08	2.32E-09	8.35E-09	4.18E-10
2022 Q4	IG_BH01_GW036	9.8	3.19E-08	1.59E-09	5.27E-09	2.63E-10
2022 Q4	IG_BH05_GW011	9.9	3.66E-08	1.83E-09	6.02E-09	3.01E-10
2022 Q4	IG_BH05_GW012	11.1	5.51E-08	2.76E-09	8.35E-09	4.18E-10

cc/g - cc of noble gas at STP per gram of sample solution

± - analytical uncertainty, as cc/g

xRa - $3\text{He}/4\text{He}$ ratio in sample normalized to the ratio in Air ($1.38\text{E}-6$)

Noble Gas Analysis

Gas extraction from water follows the procedure outlined in *Aeschbach-Hertig & Solomon 2013*. This involves gas extraction from copper tube water samples under vacuum by water vapour sweep into a stainless steel gas flask. The extracted gases are let into a sample preparation line and cryogenically separated. For light noble gases (He and Ne), standards and samples are introduced into an ultra-high vacuum preparation system where bulk (N_2 , O_2) and trace gases (CO_2 , Ar) are removed using liquid N_2 charcoal traps and two SAES getters, followed by analysis on a Thermo Scientific Helix SFT Noble Gas Mass Spectrometer. Internal standards using precise aliquots from a tank of clean dry atmospheric air are run each morning and during analysis to measure instrument drift and sensitivity. Internal standards of air equilibrated water (AEW) are also run as internal checks on the water extraction procedure and analyses. Following purification, He is separated from Ne using a He cooled cryo trap that cycles down to 5K, before releasing He at 28K and Ne at 70K. He and Ne are introduced separately into the Helix SFT operating under static vacuum. Each analysis undergoes a mass peak center, followed by separate integrations on each mass peak. These integrations generate a linear regression used to calculate peak intensity at time zero (when the sample was released into the mass spectrometer). For Ar, Kr and Xe, gases, residual water vapour was removed cryogenically prior to gettering of reactive gases and cryogenic separation of Kr and Xe from Ar. Abundance analysis was done by quadrupole mass spectrometry at the University of Utah Noble Gas Lab.

References:

Aeschbach-Hertig W., Solomon D.K. (2013) Noble Gas Thermometry in Groundwater Hydrology. In: Burnard P. (eds) The Noble Gases as

**2022 Q4
(December)**



Your P.O. #: 202031-000
Your Project #: 20-203-1
Site Location: IGNACE
Your C.O.C. #: n/a

Attention: Amy Cartier

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
CANADA K1R 1A2

Report Date: 2022/12/21
Report #: R7440291
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2AA404

Received: 2022/12/07, 14:10

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Anions	1	N/A	2022/12/13	CAM SOP-00435	SM 23 4110 B m
Fluoride	1	2022/12/10	2022/12/12	CAM SOP-00449	SM 23 4500-F C m
Dissolved Metals Analysis by ICP	1	2022/12/10	2022/12/13	CAM SOP-00408	EPA 6010D m
Dissolved Metals by ICPMS	1	N/A	2022/12/14	CAM SOP-00447	EPA 6020B m
Iodide, Thiosulphate, Thiocyanate (1)	1	N/A	2022/12/20	CAL SOP-00057	Dionex #034035 R09 m
Nitrate & Nitrite as Nitrogen in Water (2)	1	N/A	2022/12/13	CAM SOP-00440	SM 23 4500-NO3I/NO2B
Orthophosphate	1	N/A	2022/12/13	CAM SOP-00461	SM 23 4500-P E m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

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Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

(1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE, Calgary, AB, T2E 6P8

(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.



Your P.O. #: 202031-000
Your Project #: 20-203-1
Site Location: IGNACE
Your C.O.C. #: n/a

Attention: Amy Cartier

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
CANADA K1R 1A2

Report Date: 2022/12/21
Report #: R7440291
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2AA404

Received: 2022/12/07, 14:10

Encryption Key



**AUTHORIZED REPORT
RAPPORT AUTORISÉ**

Bureau Veritas

21 Dec 2022 19:56:22

Please direct all questions regarding this Certificate of Analysis to:

Katherine Szozda, Project Manager

Email: Katherine.Szozda@bureauveritas.com

Phone# (613)274-0573 Ext:7063633

=====

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Bureau Veritas Job #: C2AA404
Report Date: 2022/12/21

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-000
Sampler Initials: A.C

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		UNI123			UNI123		
Sampling Date		2022/12/04 12:00			2022/12/04 12:00		
COC Number		n/a			n/a		
	UNITS	IG_BH05_GW009	RDL	QC Batch	IG_BH05_GW009 Lab-Dup	RDL	QC Batch

Inorganics							
Fluoride (F-)	mg/L	<0.10	0.10	8396736			
Dissolved Iodide	mg/L	<0.10	0.10	8417750	<0.10	0.10	8417750
Orthophosphate (P)	mg/L	<0.010	0.010	8395869			
Nitrite (N)	mg/L	<0.010	0.010	8395819			
Dissolved Chloride (Cl-)	mg/L	<1.0	1.0	8395861			
Nitrate (N)	mg/L	<0.10	0.10	8395819			
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8395819			
Dissolved Bromide (Br-)	mg/L	<1.0	1.0	8395861			
Dissolved Sulphate (SO4)	mg/L	<1.0	1.0	8395861			
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							



Bureau Veritas Job #: C2AA404

Report Date: 2022/12/21

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE

Your P.O. #: 202031-000

Sampler Initials: A.C

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		UNI123			UNI123		
Sampling Date		2022/12/04 12:00			2022/12/04 12:00		
COC Number		n/a			n/a		
	UNITS	IG_BH05_GW009	RDL	QC Batch	IG_BH05_GW009 Lab-Dup	RDL	QC Batch

Metals							
Dissolved Iron (Fe)	mg/L	0.04	0.02	8396512	<0.02	0.02	8396512
Dissolved Sulphur (S)	mg/L	<0.5	0.5	8396512	<0.5	0.5	8396512
Dissolved Aluminum (Al)	ug/L	<4.9	4.9	8398373			
Dissolved Arsenic (As)	ug/L	<1.0	1.0	8398373			
Dissolved Barium (Ba)	ug/L	<2.0	2.0	8398373			
Dissolved Bismuth (Bi)	ug/L	<1.0	1.0	8398373			
Dissolved Boron (B)	ug/L	<10	10	8398373			
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	8398373			
Dissolved Calcium (Ca)	ug/L	1000	200	8398373			
Dissolved Cesium (Cs)	ug/L	<0.20	0.20	8398373			
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	8398373			
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	8398373			
Dissolved Copper (Cu)	ug/L	<0.90	0.90	8398373			
Dissolved Lead (Pb)	ug/L	<0.50	0.50	8398373			
Dissolved Lithium (Li)	ug/L	<5.0	5.0	8398373			
Dissolved Magnesium (Mg)	ug/L	53	50	8398373			
Dissolved Nickel (Ni)	ug/L	<1.0	1.0	8398373			
Dissolved Potassium (K)	ug/L	<200	200	8398373			
Dissolved Rubidium (Rb)	ug/L	<0.20	0.20	8398373			
Dissolved Selenium (Se)	ug/L	<2.0	2.0	8398373			
Dissolved Silicon (Si)	ug/L	<50	50	8398373			
Dissolved Sodium (Na)	ug/L	250	100	8398373			
Dissolved Strontium (Sr)	ug/L	10	1.0	8398373			
Dissolved Thorium (Th)	ug/L	<2.0	2.0	8398373			
Dissolved Uranium (U)	ug/L	<0.10	0.10	8398373			
Dissolved Zirconium (Zr)	ug/L	<1.0	1.0	8398373			

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate



Bureau Veritas Job #: C2AA404
Report Date: 2022/12/21

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-000
Sampler Initials: A.C

TEST SUMMARY

Bureau Veritas ID: UNI123
Sample ID: IG_BH05_GW009
Matrix: Water

Collected: 2022/12/04
Shipped:
Received: 2022/12/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Anions	IC	8395861	N/A	2022/12/13	Lusine Khachatryan
Fluoride	ISE	8396736	2022/12/10	2022/12/12	Kien Tran
Dissolved Metals Analysis by ICP	ICP	8396512	2022/12/10	2022/12/13	Thuy Linh Nguyen
Dissolved Metals by ICPMS	ICP/MS	8398373	N/A	2022/12/14	Nan Raykha
Iodide, Thiosulphate, Thiocyanate	IC/EC	8417750	N/A	2022/12/20	Kanwardeep Brar
Nitrate & Nitrite as Nitrogen in Water	LACH	8395819	N/A	2022/12/13	Chandra Nandlal
Orthophosphate	KONE	8395869	N/A	2022/12/13	Alina Dobreanu

Bureau Veritas ID: UNI123 Dup
Sample ID: IG_BH05_GW009
Matrix: Water

Collected: 2022/12/04
Shipped:
Received: 2022/12/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals Analysis by ICP	ICP	8396512	2022/12/10	2022/12/13	Thuy Linh Nguyen
Iodide, Thiosulphate, Thiocyanate	IC/EC	8417750	N/A	2022/12/20	Kanwardeep Brar



Bureau Veritas Job #: C2AA404
Report Date: 2022/12/21

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-000
Sampler Initials: A.C

GENERAL COMMENTS

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

Package 1	-2.0°C
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Results relate only to the items tested.



Bureau Veritas Job #: C2AA404

Report Date: 2022/12/21

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE

Your P.O. #: 202031-000

Sampler Initials: A.C

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8395819	C_N	Matrix Spike	Nitrite (N)	2022/12/13		93	%	80 - 120
			Nitrate (N)	2022/12/13		103	%	80 - 120
8395819	C_N	Spiked Blank	Nitrite (N)	2022/12/13		107	%	80 - 120
			Nitrate (N)	2022/12/13		99	%	80 - 120
8395819	C_N	Method Blank	Nitrite (N)	2022/12/13	<0.010		mg/L	
			Nitrate (N)	2022/12/13	<0.10		mg/L	
8395819	C_N	RPD	Nitrite (N)	2022/12/13	NC		%	20
			Nitrate (N)	2022/12/13	1.4		%	20
8395861	LKH	Matrix Spike	Dissolved Chloride (Cl-)	2022/12/13		100	%	80 - 120
			Dissolved Bromide (Br-)	2022/12/13		101	%	80 - 120
			Dissolved Sulphate (SO4)	2022/12/13		101	%	80 - 120
8395861	LKH	Spiked Blank	Dissolved Chloride (Cl-)	2022/12/13		100	%	70 - 130
			Dissolved Bromide (Br-)	2022/12/13		102	%	80 - 120
			Dissolved Sulphate (SO4)	2022/12/13		102	%	80 - 120
8395861	LKH	Method Blank	Dissolved Chloride (Cl-)	2022/12/13	<1.0		mg/L	
			Dissolved Bromide (Br-)	2022/12/13	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2022/12/13	<1.0		mg/L	
8395861	LKH	RPD	Dissolved Chloride (Cl-)	2022/12/13	0.25		%	20
			Dissolved Bromide (Br-)	2022/12/13	NC		%	20
			Dissolved Sulphate (SO4)	2022/12/13	2.1		%	20
8395869	ADB	Matrix Spike	Orthophosphate (P)	2022/12/13		92	%	75 - 125
8395869	ADB	Spiked Blank	Orthophosphate (P)	2022/12/13		99	%	80 - 120
8395869	ADB	Method Blank	Orthophosphate (P)	2022/12/13	<0.010		mg/L	
8395869	ADB	RPD	Orthophosphate (P)	2022/12/13	NC		%	20
8396512	TLG	Matrix Spike [UNI123-02]	Dissolved Iron (Fe)	2022/12/13		101	%	80 - 120
			Dissolved Sulphur (S)	2022/12/13		97	%	80 - 120
8396512	TLG	Spiked Blank	Dissolved Iron (Fe)	2022/12/13		102	%	80 - 120
			Dissolved Sulphur (S)	2022/12/13		102	%	80 - 120
8396512	TLG	Method Blank	Dissolved Iron (Fe)	2022/12/13	<0.02		mg/L	
			Dissolved Sulphur (S)	2022/12/13	<0.5		mg/L	
8396512	TLG	RPD [UNI123-02]	Dissolved Iron (Fe)	2022/12/13	NC		%	25
			Dissolved Sulphur (S)	2022/12/13	NC		%	25
8396736	KIT	Matrix Spike	Fluoride (F-)	2022/12/12		97	%	80 - 120
8396736	KIT	Spiked Blank	Fluoride (F-)	2022/12/12		102	%	80 - 120
8396736	KIT	Method Blank	Fluoride (F-)	2022/12/12	<0.10		mg/L	
8396736	KIT	RPD	Fluoride (F-)	2022/12/12	5.2		%	20
8398373	N_R	Matrix Spike	Dissolved Aluminum (Al)	2022/12/14		98	%	80 - 120
			Dissolved Arsenic (As)	2022/12/14		104	%	80 - 120
			Dissolved Barium (Ba)	2022/12/14		100	%	80 - 120
			Dissolved Bismuth (Bi)	2022/12/14		100	%	80 - 120
			Dissolved Boron (B)	2022/12/14		104	%	80 - 120
			Dissolved Cadmium (Cd)	2022/12/14		99	%	80 - 120
			Dissolved Calcium (Ca)	2022/12/14		97	%	80 - 120
			Dissolved Cesium (Cs)	2022/12/14		100	%	80 - 120
			Dissolved Chromium (Cr)	2022/12/14		100	%	80 - 120
			Dissolved Cobalt (Co)	2022/12/14		101	%	80 - 120
			Dissolved Copper (Cu)	2022/12/14		101	%	80 - 120
			Dissolved Lead (Pb)	2022/12/14		100	%	80 - 120
			Dissolved Lithium (Li)	2022/12/14		102	%	80 - 120
			Dissolved Magnesium (Mg)	2022/12/14		96	%	80 - 120



Bureau Veritas Job #: C2AA404
Report Date: 2022/12/21

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-000
Sampler Initials: A.C

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8398373	N_R	Spiked Blank	Dissolved Nickel (Ni)	2022/12/14		99	%	80 - 120
			Dissolved Potassium (K)	2022/12/14		101	%	80 - 120
			Dissolved Rubidium (Rb)	2022/12/14		100	%	80 - 120
			Dissolved Selenium (Se)	2022/12/14		103	%	80 - 120
			Dissolved Silicon (Si)	2022/12/14		100	%	80 - 120
			Dissolved Sodium (Na)	2022/12/14		98	%	80 - 120
			Dissolved Strontium (Sr)	2022/12/14		99	%	80 - 120
			Dissolved Thorium (Th)	2022/12/14		99	%	80 - 120
			Dissolved Uranium (U)	2022/12/14		100	%	80 - 120
			Dissolved Zirconium (Zr)	2022/12/14		102	%	80 - 120
			Dissolved Aluminum (Al)	2022/12/14		97	%	80 - 120
			Dissolved Arsenic (As)	2022/12/14		102	%	80 - 120
			Dissolved Barium (Ba)	2022/12/14		100	%	80 - 120
			Dissolved Bismuth (Bi)	2022/12/14		98	%	80 - 120
			Dissolved Boron (B)	2022/12/14		103	%	80 - 120
			Dissolved Cadmium (Cd)	2022/12/14		98	%	80 - 120
			Dissolved Calcium (Ca)	2022/12/14		98	%	80 - 120
			Dissolved Cesium (Cs)	2022/12/14		102	%	80 - 120
			Dissolved Chromium (Cr)	2022/12/14		98	%	80 - 120
			Dissolved Cobalt (Co)	2022/12/14		100	%	80 - 120
			Dissolved Copper (Cu)	2022/12/14		102	%	80 - 120
			Dissolved Lead (Pb)	2022/12/14		98	%	80 - 120
			Dissolved Lithium (Li)	2022/12/14		101	%	80 - 120
			Dissolved Magnesium (Mg)	2022/12/14		95	%	80 - 120
			Dissolved Nickel (Ni)	2022/12/14		99	%	80 - 120
			Dissolved Potassium (K)	2022/12/14		102	%	80 - 120
			Dissolved Rubidium (Rb)	2022/12/14		100	%	80 - 120
			Dissolved Selenium (Se)	2022/12/14		102	%	80 - 120
			Dissolved Silicon (Si)	2022/12/14		97	%	80 - 120
			Dissolved Sodium (Na)	2022/12/14		95	%	80 - 120
			Dissolved Strontium (Sr)	2022/12/14		98	%	80 - 120
			Dissolved Thorium (Th)	2022/12/14		97	%	80 - 120
			Dissolved Uranium (U)	2022/12/14		98	%	80 - 120
			Dissolved Zirconium (Zr)	2022/12/14		102	%	80 - 120
8398373	N_R	Method Blank	Dissolved Aluminum (Al)	2022/12/14	<4.9		ug/L	
			Dissolved Arsenic (As)	2022/12/14	<1.0		ug/L	
			Dissolved Barium (Ba)	2022/12/14	<2.0		ug/L	
			Dissolved Bismuth (Bi)	2022/12/14	<1.0		ug/L	
			Dissolved Boron (B)	2022/12/14	<10		ug/L	
			Dissolved Cadmium (Cd)	2022/12/14	<0.090		ug/L	
			Dissolved Calcium (Ca)	2022/12/14	<200		ug/L	
			Dissolved Cesium (Cs)	2022/12/14	<0.20		ug/L	
			Dissolved Chromium (Cr)	2022/12/14	<5.0		ug/L	
			Dissolved Cobalt (Co)	2022/12/14	<0.50		ug/L	
			Dissolved Copper (Cu)	2022/12/14	<0.90		ug/L	
			Dissolved Lead (Pb)	2022/12/14	<0.50		ug/L	
			Dissolved Lithium (Li)	2022/12/14	<5.0		ug/L	
			Dissolved Magnesium (Mg)	2022/12/14	<50		ug/L	
			Dissolved Nickel (Ni)	2022/12/14	<1.0		ug/L	
			Dissolved Potassium (K)	2022/12/14	<200		ug/L	



Bureau Veritas Job #: C2AA404

Report Date: 2022/12/21

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE

Your P.O. #: 202031-000

Sampler Initials: A.C

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8398373	N_R	RPD	Dissolved Rubidium (Rb)	2022/12/14	<0.20		ug/L	
			Dissolved Selenium (Se)	2022/12/14	<2.0		ug/L	
			Dissolved Silicon (Si)	2022/12/14	<50		ug/L	
			Dissolved Sodium (Na)	2022/12/14	<100		ug/L	
			Dissolved Strontium (Sr)	2022/12/14	<1.0		ug/L	
			Dissolved Thorium (Th)	2022/12/14	<2.0		ug/L	
			Dissolved Uranium (U)	2022/12/14	<0.10		ug/L	
			Dissolved Zirconium (Zr)	2022/12/14	<1.0		ug/L	
			Dissolved Aluminum (Al)	2022/12/14	NC		%	20
			Dissolved Arsenic (As)	2022/12/14	NC		%	20
			Dissolved Barium (Ba)	2022/12/14	0.25		%	20
			Dissolved Bismuth (Bi)	2022/12/14	NC		%	20
			Dissolved Boron (B)	2022/12/14	NC		%	20
			Dissolved Cadmium (Cd)	2022/12/14	NC		%	20
			Dissolved Calcium (Ca)	2022/12/14	3.1		%	20
			Dissolved Chromium (Cr)	2022/12/14	1.2		%	20
			Dissolved Cobalt (Co)	2022/12/14	NC		%	20
			Dissolved Copper (Cu)	2022/12/14	NC		%	20
			Dissolved Lead (Pb)	2022/12/14	NC		%	20
			Dissolved Lithium (Li)	2022/12/14	NC		%	20
			Dissolved Magnesium (Mg)	2022/12/14	0.46		%	20
			Dissolved Nickel (Ni)	2022/12/14	5.6		%	20
			Dissolved Potassium (K)	2022/12/14	3.0		%	20
			Dissolved Selenium (Se)	2022/12/14	NC		%	20
			Dissolved Silicon (Si)	2022/12/14	3.6		%	20
			Dissolved Sodium (Na)	2022/12/14	0.91		%	20
			Dissolved Strontium (Sr)	2022/12/14	0.66		%	20
			Dissolved Uranium (U)	2022/12/14	1.7		%	20
			Dissolved Zirconium (Zr)	2022/12/14	NC		%	20
8417750	KDB	Matrix Spike	Dissolved Iodide	2022/12/20		95	%	80 - 120
8417750	KDB	Spiked Blank	Dissolved Iodide	2022/12/20		101	%	80 - 120
8417750	KDB	Method Blank	Dissolved Iodide	2022/12/20	<0.10		mg/L	
8417750	KDB	RPD [UNI123-01]	Dissolved Iodide	2022/12/20	NC		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

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

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

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



Bureau Veritas Job #: C2AA404
Report Date: 2022/12/21

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-000
Sampler Initials: A.C

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Anastassia Hamanov, Scientific Specialist



Bureau Veritas Proprietary Software
Logiciel Propriétaire de Bureau Veritas

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Attention: Amy Cartier

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
CANADA K1R 1A2

Your P.O. #: 202031-004
Your Project #: 20-203-1
Site Location: IGNACE
Your C.O.C. #: n/a

Report Date: 2022/12/29
Report #: R7447218
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2A1573

Received: 2022/12/13, 14:19

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2022/12/20	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	1	N/A	2022/12/20	CAM SOP-00102	APHA 4500-CO2 D
Anions	1	N/A	2022/12/19	CAM SOP-00435	SM 23 4110 B m
Dissolved Organic Carbon (DOC) (2)	1	N/A	2022/12/17	CAM SOP-00446	SM 23 5310 B m
Fluoride	1	2022/12/19	2022/12/20	CAM SOP-00449	SM 23 4500-F C m
Dissolved Metals Analysis by ICP	1	2022/12/17	2022/12/19	CAM SOP-00408	EPA 6010D m
Dissolved Metals by ICPMS	1	N/A	2022/12/20	CAM SOP-00447	EPA 6020B m
Iodide, Thiosulphate, Thiocyanate (1)	1	N/A	2022/12/20	CAL SOP-00057	Dionex #034035 R09 m
Silica (Reactive) (1)	1	N/A	2022/12/23	AB SOP-00011	EPA370.1 R1978 m
Total Ammonia-N	1	N/A	2022/12/17	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (3)	1	N/A	2022/12/20	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	1	2022/12/19	2022/12/20	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	1	N/A	2022/12/19	CAM SOP-00461	SM 23 4500-P E m
Sulphide	1	N/A	2022/12/20	CAM SOP-00455	SM 23 4500-S G m
Total Inorganic Carbon (TIC)	1	N/A	2022/12/19	CAM SOP-00433	SM 23 5310 m
Total Kjeldahl Nitrogen in Water	1	2022/12/16	2022/12/20	CAM SOP-00938	OMOE E3516 m
Total Nitrogen (calculated)	1	N/A	2022/12/20	Auto Calc.	
Total Organic Carbon (TOC) (4)	1	N/A	2022/12/17	CAM SOP-00446	SM 23 5310B m
Total Phosphorus (Colourimetric)	1	2022/12/16	2022/12/19	CAM SOP-00407	SM 23 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or



Your P.O. #: 202031-004
Your Project #: 20-203-1
Site Location: IGNACE
Your C.O.C. #: n/a

Attention: Amy Cartier

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
CANADA K1R 1A2

Report Date: 2022/12/29

Report #: R7447218

Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2AI573

Received: 2022/12/13, 14:19

implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

- (1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE, Calgary, AB, T2E 6P8
- (2) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
- (3) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
- (4) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

Encryption Key



Bureau Veritas

29 Dec 2022 15:10:23

Please direct all questions regarding this Certificate of Analysis to:

Katherine Szozda, Project Manager

Email: Katherine.Szozda@bureauveritas.com

Phone# (613)274-0573 Ext:7063633

=====

This report has been generated and distributed using a secure automated process.

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

Total Cover Pages : 2

Page 2 of 11

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvna.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.



RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		UPE695		
Sampling Date		2022/12/10 13:30		
COC Number		n/a		
	UNITS	IG_BH01_GW036	RDL	QC Batch
Calculated Parameters				
Bicarb. Alkalinity (calc. as CaCO ₃)	mg/L	6.2	1.0	8405850
Carb. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	8405850
Hydrox. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	8405850
Total Nitrogen (N)	mg/L	8.2	5.0	8406663
Inorganics				
Total Ammonia-N	mg/L	0.23	0.050	8409593
Fluoride (F ⁻)	mg/L	0.67	0.10	8411282
Total Inorganic Carbon (C)	mg/L	<1	1	8409471
Dissolved Iodide	mg/L	<10 (1)	10	8417750
Total Kjeldahl Nitrogen (TKN)	mg/L	8.2	5.0	8408969
Dissolved Organic Carbon	mg/L	3.7	0.40	8408507
Total Organic Carbon (TOC)	mg/L	2.3	0.40	8408741
Orthophosphate (P)	mg/L	<0.010	0.010	8410517
pH	pH	7.65		8411277
Total Phosphorus	mg/L	0.14	0.10	8408543
Reactive Silica (SiO ₂)	mg/L	83	0.55	8423382
Sulphide	mg/L	<0.020	0.020	8411837
Alkalinity (Total as CaCO ₃)	mg/L	6.2	1.0	8411281
Nitrite (N)	mg/L	<0.010	0.010	8409553
Dissolved Chloride (Cl ⁻)	mg/L	19000	100	8408770
Nitrate (N)	mg/L	<0.10	0.10	8409553
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8409553
Dissolved Bromide (Br ⁻)	mg/L	290 (2)	100	8408770
Dissolved Sulphate (SO ₄)	mg/L	390 (2)	100	8408770
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				
(1) Detection limits raised due to matrix interference.				
(2) Due to high concentrations of the target analyte (Cl), sample required dilution. Detection limits were adjusted accordingly.				



Bureau Veritas Job #: C2A1573
Report Date: 2022/12/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-004
Sampler Initials: A.C

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		UPE695	UPE695		
Sampling Date		2022/12/10 13:30	2022/12/10 13:30		
COC Number		n/a	n/a		
	UNITS	IG_BH01_GW036	IG_BH01_GW036 Lab-Dup	RDL	QC Batch
Metals					
Dissolved Iron (Fe)	mg/L	0.10	0.08	0.02	8410519
Dissolved Sulphur (S)	mg/L	140	140	0.5	8410519
Dissolved Aluminum (Al)	ug/L	<49	<49	49	8410119
Dissolved Arsenic (As)	ug/L	<10	<10	10	8410119
Dissolved Barium (Ba)	ug/L	250	240	20	8410119
Dissolved Bismuth (Bi)	ug/L	<10	<10	10	8410119
Dissolved Boron (B)	ug/L	470	480	100	8410119
Dissolved Cadmium (Cd)	ug/L	<0.90	<0.90	0.90	8410119
Dissolved Calcium (Ca)	ug/L	9000000	9400000	10000	8410119
Dissolved Cesium (Cs)	ug/L	<2.0	<2.0	2.0	8410119
Dissolved Chromium (Cr)	ug/L	<50	<50	50	8410119
Dissolved Cobalt (Co)	ug/L	<5.0	<5.0	5.0	8410119
Dissolved Copper (Cu)	ug/L	<9.0	<9.0	9.0	8410119
Dissolved Iron (Fe)	ug/L	<1000	<1000	1000	8410119
Dissolved Lead (Pb)	ug/L	<5.0	<5.0	5.0	8410119
Dissolved Lithium (Li)	ug/L	67	65	50	8410119
Dissolved Magnesium (Mg)	ug/L	4300	4300	500	8410119
Dissolved Nickel (Ni)	ug/L	<10	<10	10	8410119
Dissolved Potassium (K)	ug/L	13000	13000	2000	8410119
Dissolved Rubidium (Rb)	ug/L	31	32	2.0	8410119
Dissolved Selenium (Se)	ug/L	<20	<20	20	8410119
Dissolved Silicon (Si)	ug/L	3200	3300	500	8410119
Dissolved Sodium (Na)	ug/L	1300000	1300000	1000	8410119
Dissolved Strontium (Sr)	ug/L	120000	120000	10	8410119
Dissolved Thorium (Th)	ug/L	<20	<20	20	8410119
Dissolved Uranium (U)	ug/L	<1.0	<1.0	1.0	8410119
Dissolved Zirconium (Zr)	ug/L	<10	<10	10	8410119
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate					



Bureau Veritas Job #: C2A1573
Report Date: 2022/12/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-004
Sampler Initials: A.C

TEST SUMMARY

Bureau Veritas ID: UPE695
Sample ID: IG_BH01_GW036
Matrix: Water

Collected: 2022/12/10
Shipped:
Received: 2022/12/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8411281	N/A	2022/12/20	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	8405850	N/A	2022/12/20	Automated Statchk
Anions	IC	8408770	N/A	2022/12/19	Lusine Khachatryan
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8408507	N/A	2022/12/17	Gyulshen Idriz
Fluoride	ISE	8411282	2022/12/19	2022/12/20	Surinder Rai
Dissolved Metals Analysis by ICP	ICP	8410519	2022/12/17	2022/12/19	Thuy Linh Nguyen
Dissolved Metals by ICPMS	ICP/MS	8410119	N/A	2022/12/20	Nan Raykha
Iodide, Thiosulphate, Thiocyanate	IC/EC	8417750	N/A	2022/12/20	Kanwardeep Brar
Silica (Reactive)	KONE	8423382	N/A	2022/12/23	Ana Katrina Cariaga
Total Ammonia-N	LACH/NH4	8409593	N/A	2022/12/17	Amanpreet Sappal
Nitrate & Nitrite as Nitrogen in Water	LACH	8409553	N/A	2022/12/20	Chandra Nandlal
pH	AT	8411277	2022/12/19	2022/12/20	Surinder Rai
Orthophosphate	KONE	8410517	N/A	2022/12/19	Alina Dobreanu
Sulphide	ISE/S	8411837	N/A	2022/12/20	Taslina Aktar
Total Inorganic Carbon (TIC)	TOCV/NDIR	8409471	N/A	2022/12/19	Gyulshen Idriz
Total Kjeldahl Nitrogen in Water	SKAL	8408969	2022/12/16	2022/12/20	Rajni Tyagi
Total Nitrogen (calculated)	CALC	8406663	N/A	2022/12/20	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	8408741	N/A	2022/12/17	Gyulshen Idriz
Total Phosphorus (Colourimetric)	SKAL/P	8408543	2022/12/16	2022/12/19	Sachi Patel

Bureau Veritas ID: UPE695 Dup
Sample ID: IG_BH01_GW036
Matrix: Water

Collected: 2022/12/10
Shipped:
Received: 2022/12/13

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals Analysis by ICP	ICP	8410519	2022/12/17	2022/12/19	Thuy Linh Nguyen
Dissolved Metals by ICPMS	ICP/MS	8410119	N/A	2022/12/20	Nan Raykha



Bureau Veritas Job #: C2AI573
Report Date: 2022/12/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-004
Sampler Initials: A.C

GENERAL COMMENTS

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

Package 1	1.0°C
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Sample UPE695 [IG_BH01_GW036] : Metals Analysis: Due to the sample matrix, the sample required dilution. Detection limits were adjusted accordingly.

Result for DOC is greater than TOC. The results have been confirmed by reanalysis.

Results relate only to the items tested.



Bureau Veritas Job #: C2AI573
Report Date: 2022/12/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-004
Sampler Initials: A.C

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8408507	GID	Matrix Spike	Dissolved Organic Carbon	2022/12/17		95	%	80 - 120
8408507	GID	Spiked Blank	Dissolved Organic Carbon	2022/12/16		98	%	80 - 120
8408507	GID	Method Blank	Dissolved Organic Carbon	2022/12/16	<0.40		mg/L	
8408507	GID	RPD	Dissolved Organic Carbon	2022/12/16	0.51		%	20
8408543	SPC	Matrix Spike	Total Phosphorus	2022/12/19		109	%	80 - 120
8408543	SPC	QC Standard	Total Phosphorus	2022/12/19		110	%	80 - 120
8408543	SPC	Spiked Blank	Total Phosphorus	2022/12/19		102	%	80 - 120
8408543	SPC	Method Blank	Total Phosphorus	2022/12/19	<0.020		mg/L	
8408543	SPC	RPD	Total Phosphorus	2022/12/19	5.5		%	20
8408741	GID	Matrix Spike	Total Organic Carbon (TOC)	2022/12/17		95	%	80 - 120
8408741	GID	Spiked Blank	Total Organic Carbon (TOC)	2022/12/17		97	%	80 - 120
8408741	GID	Method Blank	Total Organic Carbon (TOC)	2022/12/17	<0.40		mg/L	
8408741	GID	RPD	Total Organic Carbon (TOC)	2022/12/17	0.39		%	20
8408770	LKH	Matrix Spike	Dissolved Chloride (Cl-)	2022/12/19		100	%	80 - 120
			Dissolved Bromide (Br-)	2022/12/19		100	%	80 - 120
			Dissolved Sulphate (SO4)	2022/12/19		101	%	80 - 120
8408770	LKH	Spiked Blank	Dissolved Chloride (Cl-)	2022/12/19		100	%	70 - 130
			Dissolved Bromide (Br-)	2022/12/19		102	%	80 - 120
			Dissolved Sulphate (SO4)	2022/12/19		101	%	80 - 120
8408770	LKH	Method Blank	Dissolved Chloride (Cl-)	2022/12/19	<1.0		mg/L	
			Dissolved Bromide (Br-)	2022/12/19	<1.0		mg/L	
			Dissolved Sulphate (SO4)	2022/12/19	<1.0		mg/L	
8408770	LKH	RPD	Dissolved Chloride (Cl-)	2022/12/19	1.0		%	20
			Dissolved Bromide (Br-)	2022/12/19	NC		%	20
			Dissolved Sulphate (SO4)	2022/12/19	0.15		%	20
8408969	RTY	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2022/12/20		109	%	80 - 120
8408969	RTY	QC Standard	Total Kjeldahl Nitrogen (TKN)	2022/12/20		94	%	80 - 120
8408969	RTY	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2022/12/20		95	%	80 - 120
8408969	RTY	Method Blank	Total Kjeldahl Nitrogen (TKN)	2022/12/20	<0.10		mg/L	
8408969	RTY	RPD	Total Kjeldahl Nitrogen (TKN)	2022/12/20	4.4		%	20
8409471	GID	Matrix Spike	Total Inorganic Carbon (C)	2022/12/19		88	%	80 - 120
8409471	GID	Spiked Blank	Total Inorganic Carbon (C)	2022/12/19		91	%	80 - 120
8409471	GID	Method Blank	Total Inorganic Carbon (C)	2022/12/19	<1		mg/L	
8409471	GID	RPD	Total Inorganic Carbon (C)	2022/12/19	NC		%	20
8409553	C_N	Matrix Spike	Nitrite (N)	2022/12/20		105	%	80 - 120
			Nitrate (N)	2022/12/20		NC	%	80 - 120
8409553	C_N	Spiked Blank	Nitrite (N)	2022/12/20		106	%	80 - 120
			Nitrate (N)	2022/12/20		101	%	80 - 120
8409553	C_N	Method Blank	Nitrite (N)	2022/12/20	<0.010		mg/L	
			Nitrate (N)	2022/12/20	<0.10		mg/L	
8409553	C_N	RPD	Nitrite (N)	2022/12/20	7.7		%	20
			Nitrate (N)	2022/12/20	2.1		%	20
8409593	ASP	Matrix Spike	Total Ammonia-N	2022/12/17		99	%	75 - 125
8409593	ASP	Spiked Blank	Total Ammonia-N	2022/12/17		99	%	80 - 120
8409593	ASP	Method Blank	Total Ammonia-N	2022/12/17	<0.050		mg/L	
8409593	ASP	RPD	Total Ammonia-N	2022/12/17	6.6		%	20
8410119	N_R	Matrix Spike [UPE695-05]	Dissolved Aluminum (Al)	2022/12/20		104	%	80 - 120
			Dissolved Arsenic (As)	2022/12/20		103	%	80 - 120
			Dissolved Barium (Ba)	2022/12/20		101	%	80 - 120
			Dissolved Bismuth (Bi)	2022/12/20		90	%	80 - 120



Bureau Veritas Job #: C2A1573
Report Date: 2022/12/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-004
Sampler Initials: A.C

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8410119	N_R	Spiked Blank	Dissolved Boron (B)	2022/12/20		105	%	80 - 120
			Dissolved Cadmium (Cd)	2022/12/20		100	%	80 - 120
			Dissolved Calcium (Ca)	2022/12/20		NC	%	80 - 120
			Dissolved Cesium (Cs)	2022/12/20		101	%	80 - 120
			Dissolved Chromium (Cr)	2022/12/20		101	%	80 - 120
			Dissolved Cobalt (Co)	2022/12/20		99	%	80 - 120
			Dissolved Copper (Cu)	2022/12/20		99	%	80 - 120
			Dissolved Iron (Fe)	2022/12/20		102	%	80 - 120
			Dissolved Lead (Pb)	2022/12/20		93	%	80 - 120
			Dissolved Lithium (Li)	2022/12/20		103	%	80 - 120
			Dissolved Magnesium (Mg)	2022/12/20		102	%	80 - 120
			Dissolved Nickel (Ni)	2022/12/20		97	%	80 - 120
			Dissolved Potassium (K)	2022/12/20		105	%	80 - 120
			Dissolved Rubidium (Rb)	2022/12/20		101	%	80 - 120
			Dissolved Selenium (Se)	2022/12/20		102	%	80 - 120
			Dissolved Silicon (Si)	2022/12/20		103	%	80 - 120
			Dissolved Sodium (Na)	2022/12/20		NC	%	80 - 120
			Dissolved Strontium (Sr)	2022/12/20		NC	%	80 - 120
			Dissolved Thorium (Th)	2022/12/20		99	%	80 - 120
			Dissolved Uranium (U)	2022/12/20		101	%	80 - 120
			Dissolved Zirconium (Zr)	2022/12/20		110	%	80 - 120
			Dissolved Aluminum (Al)	2022/12/19		99	%	80 - 120
			Dissolved Arsenic (As)	2022/12/19		99	%	80 - 120
			Dissolved Barium (Ba)	2022/12/19		99	%	80 - 120
			Dissolved Bismuth (Bi)	2022/12/19		97	%	80 - 120
			Dissolved Boron (B)	2022/12/19		104	%	80 - 120
			Dissolved Cadmium (Cd)	2022/12/19		98	%	80 - 120
			Dissolved Calcium (Ca)	2022/12/19		103	%	80 - 120
			Dissolved Cesium (Cs)	2022/12/19		102	%	80 - 120
			Dissolved Chromium (Cr)	2022/12/19		101	%	80 - 120
			Dissolved Cobalt (Co)	2022/12/19		99	%	80 - 120
			Dissolved Copper (Cu)	2022/12/19		103	%	80 - 120
			Dissolved Iron (Fe)	2022/12/19		98	%	80 - 120
			Dissolved Lead (Pb)	2022/12/19		99	%	80 - 120
			Dissolved Lithium (Li)	2022/12/19		108	%	80 - 120
			Dissolved Magnesium (Mg)	2022/12/19		97	%	80 - 120
			Dissolved Nickel (Ni)	2022/12/19		96	%	80 - 120
			Dissolved Potassium (K)	2022/12/19		102	%	80 - 120
			Dissolved Rubidium (Rb)	2022/12/19		96	%	80 - 120
			Dissolved Selenium (Se)	2022/12/19		101	%	80 - 120
			Dissolved Silicon (Si)	2022/12/19		101	%	80 - 120
			Dissolved Sodium (Na)	2022/12/19		98	%	80 - 120
			Dissolved Strontium (Sr)	2022/12/19		97	%	80 - 120
			Dissolved Thorium (Th)	2022/12/19		96	%	80 - 120
			Dissolved Uranium (U)	2022/12/19		96	%	80 - 120
			Dissolved Zirconium (Zr)	2022/12/19		102	%	80 - 120
8410119	N_R	Method Blank	Dissolved Aluminum (Al)	2022/12/19	<4.9		ug/L	
			Dissolved Arsenic (As)	2022/12/19	<1.0		ug/L	
			Dissolved Barium (Ba)	2022/12/19	<2.0		ug/L	
			Dissolved Bismuth (Bi)	2022/12/19	<1.0		ug/L	



Bureau Veritas Job #: C2AI573
Report Date: 2022/12/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-004
Sampler Initials: A.C

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8410119	N_R	RPD [UPE695-05]	Dissolved Boron (B)	2022/12/19	<10		ug/L	
			Dissolved Cadmium (Cd)	2022/12/19	<0.090		ug/L	
			Dissolved Calcium (Ca)	2022/12/19	<200		ug/L	
			Dissolved Cesium (Cs)	2022/12/19	<0.20		ug/L	
			Dissolved Chromium (Cr)	2022/12/19	<5.0		ug/L	
			Dissolved Cobalt (Co)	2022/12/19	<0.50		ug/L	
			Dissolved Copper (Cu)	2022/12/19	<0.90		ug/L	
			Dissolved Iron (Fe)	2022/12/19	<100		ug/L	
			Dissolved Lead (Pb)	2022/12/19	<0.50		ug/L	
			Dissolved Lithium (Li)	2022/12/19	<5.0		ug/L	
			Dissolved Magnesium (Mg)	2022/12/19	<50		ug/L	
			Dissolved Nickel (Ni)	2022/12/19	<1.0		ug/L	
			Dissolved Potassium (K)	2022/12/19	<200		ug/L	
			Dissolved Rubidium (Rb)	2022/12/19	<0.20		ug/L	
			Dissolved Selenium (Se)	2022/12/19	<2.0		ug/L	
			Dissolved Silicon (Si)	2022/12/19	<50		ug/L	
			Dissolved Sodium (Na)	2022/12/19	<100		ug/L	
			Dissolved Strontium (Sr)	2022/12/19	<1.0		ug/L	
			Dissolved Thorium (Th)	2022/12/19	<2.0		ug/L	
			Dissolved Uranium (U)	2022/12/19	<0.10		ug/L	
			Dissolved Zirconium (Zr)	2022/12/19	<1.0		ug/L	
			Dissolved Aluminum (Al)	2022/12/20	NC		%	20
			Dissolved Arsenic (As)	2022/12/20	NC		%	20
			Dissolved Barium (Ba)	2022/12/20	2.8		%	20
			Dissolved Bismuth (Bi)	2022/12/20	NC		%	20
			Dissolved Boron (B)	2022/12/20	1.7		%	20
			Dissolved Cadmium (Cd)	2022/12/20	NC		%	20
			Dissolved Calcium (Ca)	2022/12/20	4.2		%	20
			Dissolved Cesium (Cs)	2022/12/20	NC		%	20
			Dissolved Chromium (Cr)	2022/12/20	NC		%	20
			Dissolved Cobalt (Co)	2022/12/20	NC		%	20
			Dissolved Copper (Cu)	2022/12/20	NC		%	20
			Dissolved Iron (Fe)	2022/12/20	NC		%	20
			Dissolved Lead (Pb)	2022/12/20	NC		%	20
			Dissolved Lithium (Li)	2022/12/20	3.3		%	20
			Dissolved Magnesium (Mg)	2022/12/20	1.3		%	20
			Dissolved Nickel (Ni)	2022/12/20	NC		%	20
			Dissolved Potassium (K)	2022/12/20	0.018		%	20
			Dissolved Rubidium (Rb)	2022/12/20	2.6		%	20
			Dissolved Selenium (Se)	2022/12/20	NC		%	20
			Dissolved Silicon (Si)	2022/12/20	2.5		%	20
			Dissolved Sodium (Na)	2022/12/20	0.072		%	20
			Dissolved Strontium (Sr)	2022/12/20	0.74		%	20
			Dissolved Thorium (Th)	2022/12/20	NC		%	20
			Dissolved Uranium (U)	2022/12/20	NC		%	20
			Dissolved Zirconium (Zr)	2022/12/20	NC		%	20
8410517	ADB	Matrix Spike	Orthophosphate (P)	2022/12/19		103	%	75 - 125
8410517	ADB	Spiked Blank	Orthophosphate (P)	2022/12/19		102	%	80 - 120
8410517	ADB	Method Blank	Orthophosphate (P)	2022/12/19	<0.010		mg/L	
8410517	ADB	RPD	Orthophosphate (P)	2022/12/19	NC		%	20



Bureau Veritas Job #: C2AI573
Report Date: 2022/12/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-004
Sampler Initials: A.C

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8410519	TLG	Matrix Spike [UPE695-05]	Dissolved Iron (Fe)	2022/12/19		96	%	80 - 120
			Dissolved Sulphur (S)	2022/12/19		NC	%	80 - 120
8410519	TLG	Spiked Blank	Dissolved Iron (Fe)	2022/12/19		102	%	80 - 120
			Dissolved Sulphur (S)	2022/12/19		102	%	80 - 120
8410519	TLG	Method Blank	Dissolved Iron (Fe)	2022/12/19	<0.02		mg/L	
			Dissolved Sulphur (S)	2022/12/19	<0.5		mg/L	
8410519	TLG	RPD [UPE695-05]	Dissolved Iron (Fe)	2022/12/19	18		%	25
			Dissolved Sulphur (S)	2022/12/19	0.28		%	25
8411277	SAU	Spiked Blank	pH	2022/12/20		102	%	98 - 103
8411277	SAU	RPD	pH	2022/12/20	0.56		%	N/A
8411281	SAU	Spiked Blank	Alkalinity (Total as CaCO ₃)	2022/12/20		95	%	85 - 115
8411281	SAU	Method Blank	Alkalinity (Total as CaCO ₃)	2022/12/20	<1.0		mg/L	
8411281	SAU	RPD	Alkalinity (Total as CaCO ₃)	2022/12/20	0.0065		%	20
8411282	SAU	Matrix Spike	Fluoride (F ⁻)	2022/12/20		57 (1)	%	80 - 120
8411282	SAU	Spiked Blank	Fluoride (F ⁻)	2022/12/20		103	%	80 - 120
8411282	SAU	Method Blank	Fluoride (F ⁻)	2022/12/20	<0.10		mg/L	
8411282	SAU	RPD	Fluoride (F ⁻)	2022/12/20	0.95		%	20
8411837	TAK	Matrix Spike	Sulphide	2022/12/20		85	%	80 - 120
8411837	TAK	Spiked Blank	Sulphide	2022/12/20		99	%	80 - 120
8411837	TAK	Method Blank	Sulphide	2022/12/20	<0.020		mg/L	
8411837	TAK	RPD	Sulphide	2022/12/20	NC		%	20
8417750	KDB	Matrix Spike	Dissolved Iodide	2022/12/20		95	%	80 - 120
8417750	KDB	Spiked Blank	Dissolved Iodide	2022/12/20		101	%	80 - 120
8417750	KDB	Method Blank	Dissolved Iodide	2022/12/20	<0.10		mg/L	
8417750	KDB	RPD	Dissolved Iodide	2022/12/20	NC		%	20
8423382	ÉJ3	Matrix Spike	Reactive Silica (SiO ₂)	2022/12/23		99	%	80 - 120
8423382	ÉJ3	Spiked Blank	Reactive Silica (SiO ₂)	2022/12/23		105	%	80 - 120
8423382	ÉJ3	Method Blank	Reactive Silica (SiO ₂)	2022/12/23	<0.050		mg/L	
8423382	ÉJ3	RPD	Reactive Silica (SiO ₂)	2022/12/23	2.5		%	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

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

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

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

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

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

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



Bureau Veritas Job #: C2A1573
Report Date: 2022/12/29

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE
Your P.O. #: 202031-004
Sampler Initials: A.C

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Cristina Carriere, Senior Scientific Specialist

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Suwan (Sze Yeung) Fock, B.Sc., Scientific Specialist

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by {0}, {1} responsible for {2} {3} laboratory operations.

**SGS Canada Inc.**

P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - K0L 2H0
Phone: 705-652-2000 FAX: 705-652-6365

29-December-2022

Bureau Veritas Canada - Mississauga

Attn : Subcontract Coordinator

6740 Campobello Road
Mississauga, ON
L5N 2L8, Canada

Phone: 905-817-5798
Fax:

Date Rec. : 20 December 2022
LR Report: CA40211-DEC22
Reference: Job#: C2AI573/20-203-1

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Sample ID	Sample Date & Time	Temperature Upon Receipt °C	Ruthenium (total) mg/L
1: Analysis Start Date		---	23-Dec-22
2: Analysis Start Time		---	01:52
3: Analysis Completed Date		---	29-Dec-22
4: Analysis Completed Time		---	11:08
5: RL		---	0.0001
6: QC - Blank		---	< 0.0001
7: QC - STD % Recovery		---	104%
8: QC - DUP % RPD		---	ND
9: IG_BH01_GW036	10-Dec-22 13:30	8.0	0.00011

RL - SGS Reporting Limit
ND - Not Detected

Kimberley Didsbury
Project Specialist,
Environment, Health & Safety

**Attention: Amy Cartier**

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
CANADA K1R 1A2

Your P.O. #: 202031-004
Your Project #: 20-203-1
Site Location: IGNACE, ON
Your C.O.C. #: n/a

Report Date: 2023/01/16

Report #: R7471944

Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT**BUREAU VERITAS JOB #: C2AJ973****Received: 2022/12/15, 14:13**

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	2	N/A	2022/12/20	CAM SOP-00448	SM 23 2320 B m
Carbonate, Bicarbonate and Hydroxide	2	N/A	2022/12/20	CAM SOP-00102	APHA 4500-CO2 D
Anions	2	N/A	2022/12/20	CAM SOP-00435	SM 23 4110 B m
Dissolved Organic Carbon (DOC) (3)	2	N/A	2022/12/17	CAM SOP-00446	SM 23 5310 B m
Fluoride	2	2022/12/19	2022/12/20	CAM SOP-00449	SM 23 4500-F C m
Dissolved Metals Analysis by ICP	2	2022/12/19	2022/12/21	CAM SOP-00408	EPA 6010D m
Dissolved Metals by ICPMS	2	N/A	2022/12/21	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICP	2	2022/12/19	2022/12/20	CAM SOP-00408	EPA 6010D m
Iodide, Thiosulphate, Thiocyanate (1)	2	N/A	2022/12/23	CAL SOP-00057	Dionex #034035 R09 m
Total Extractable Elements by ICP-MS (2, 4)	2	2023/01/09	2023/01/11	STL SOP-00071	MA.200-Mét. 1.2 R5 m
Silica (Reactive) (1)	2	N/A	2022/12/23	AB SOP-00011	EPA370.1 R1978 m
Total Ammonia-N	2	N/A	2022/12/21	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (5)	2	N/A	2022/12/20	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	2	2022/12/19	2022/12/20	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	2	N/A	2022/12/21	CAM SOP-00461	SM 23 4500-P E m
Sulphide	2	N/A	2022/12/20	CAM SOP-00455	SM 23 4500-S G m
Total Inorganic Carbon (TIC)	2	N/A	2022/12/19	CAM SOP-00433	SM 23 5310 m
Total Kjeldahl Nitrogen in Water	2	2022/12/19	2022/12/20	CAM SOP-00938	OMOE E3516 m
Total Nitrogen (calculated)	2	N/A	2022/12/21	Auto Calc.	
Total Organic Carbon (TOC) (6)	2	N/A	2022/12/20	CAM SOP-00446	SM 23 5310B m
Total Phosphorus (Colourimetric)	2	2022/12/19	2022/12/21	CAM SOP-00407	SM 23 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.



Your P.O. #: 202031-004
Your Project #: 20-203-1
Site Location: IGNACE, ON
Your C.O.C. #: n/a

Attention: Amy Cartier

Geofirma Engineering Ltd
1 Raymond St
Suite 200
Ottawa, ON
CANADA K1R 1A2

Report Date: 2023/01/16
Report #: R7471944
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BUREAU VERITAS JOB #: C2AJ973

Received: 2022/12/15, 14:13

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

- (1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE, Calgary, AB, T2E 6P8
- (2) This test was performed by Bureau Veritas Montreal, 889 Montée de Liesse, Ville St-Laurent, QC, H4T 1P5
- (3) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
- (4) Non-accredited test method
- (5) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
- (6) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

Encryption Key

Katherine Szozda

Katherine Szozda
Project Manager
16 Jan 2023 12:26:09

Please direct all questions regarding this Certificate of Analysis to:

Katherine Szozda, Project Manager
Email: Katherine.Szozda@bureauveritas.com
Phone# (613)274-0573 Ext:7063633

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Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



Bureau Veritas Job #: C2AJ973
Report Date: 2023/01/16

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		UPN197			UPN197			UPN198		
Sampling Date		2022/12/13			2022/12/13			2022/12/13		
COC Number		n/a			n/a			n/a		
	UNITS	IG_BH05_GW011	RDL	QC Batch	IG_BH05_GW011 Lab-Dup	RDL	QC Batch	IG_BH05_GW012	RDL	QC Batch

Calculated Parameters

Bicarb. Alkalinity (calc. as CaCO ₃)	mg/L	150	1.0	8408710				150	1.0	8408710
Carb. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	8408710				<1.0	1.0	8408710
Hydrox. Alkalinity (calc. as CaCO ₃)	mg/L	<1.0	1.0	8408710				<1.0	1.0	8408710
Total Nitrogen (N)	mg/L	2.2	1.0	8408712				3.0	1.0	8408712

Inorganics

Total Ammonia-N	mg/L	0.17	0.050	8412399				0.12	0.050	8412399
Fluoride (F ⁻)	mg/L	0.21	0.10	8411282	0.21	0.10	8411282	0.22	0.10	8411282
Total Inorganic Carbon (C)	mg/L	23	1	8409471				23	1	8409471
Dissolved Iodide	mg/L	<10 (1)	10	8425306				<10 (1)	10	8425306
Total Kjeldahl Nitrogen (TKN)	mg/L	2.2	1.0	8412044				3.0	1.0	8412044
Dissolved Organic Carbon	mg/L	66	0.40	8408507				65	0.40	8408507
Total Organic Carbon (TOC)	mg/L	76	0.40	8412355				76	0.40	8412355
Orthophosphate (P)	mg/L	0.011	0.010	8412697	<0.010	0.010	8412697	<0.010	0.010	8412697
pH	pH	6.95		8411277	6.99		8411277	6.98		8411277
Total Phosphorus	mg/L	0.18	0.020	8412134				0.10	0.020	8412134
Reactive Silica (SiO ₂)	mg/L	7.5	0.25	8423382				19	0.25	8423382
Sulphide	mg/L	<0.020	0.020	8408944				<0.020	0.020	8408944
Alkalinity (Total as CaCO ₃)	mg/L	150	1.0	8411281	150	1.0	8411281	150	1.0	8411281
Nitrite (N)	mg/L	<0.010	0.010	8411287	<0.010	0.010	8411287	<0.010	0.010	8411287
Chloride (Cl ⁻)	mg/L	7000	50	8413262				7000	50	8413262
Nitrate (N)	mg/L	<0.10	0.10	8411287	<0.10	0.10	8411287	<0.10	0.10	8411287
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8411287	<0.10	0.10	8411287	<0.10	0.10	8411287
Bromide (Br ⁻)	mg/L	140 (2)	50	8413262				140 (2)	50	8413262
Sulphate (SO ₄)	mg/L	55 (2)	50	8413262				59 (2)	50	8413262

Metals

Total Ruthenium (Ru)	ug/L	<2.0	2.0	8447651				<2.0	2.0	8447651
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RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

(1) Detection limits raised due to matrix interference.

(2) Due to high concentrations of the target analyte (Cl), sample required dilution. Detection limits were adjusted accordingly.



Bureau Veritas Job #: C2AJ973

Report Date: 2023/01/16

Geofirma Engineering Ltd

Client Project #: 20-203-1

Site Location: IGNACE, ON

Your P.O. #: 202031-004

Sampler Initials: AC

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		UPN197	UPN198			UPN198		
Sampling Date		2022/12/13	2022/12/13			2022/12/13		
COC Number		n/a	n/a			n/a		
	UNITS	IG_BH05_GW011	IG_BH05_GW012	RDL	QC Batch	IG_BH05_GW012 Lab-Dup	RDL	QC Batch
Metals								
Dissolved Iron (Fe)	mg/L	13	13	0.02	8411243	13	0.02	8411243
Total Iron (Fe)	mg/L	190	230	0.02	8412070			
Dissolved Sulphur (S)	mg/L	17	17	0.5	8411243	17	0.5	8411243
Total Sulphur (S)	mg/L	16	16	0.5	8412070			
Dissolved Aluminum (Al)	ug/L	<25	<25	25	8411256			
Dissolved Arsenic (As)	ug/L	<5.0	<5.0	5.0	8411256			
Dissolved Barium (Ba)	ug/L	330	320	10	8411256			
Dissolved Bismuth (Bi)	ug/L	<5.0	<5.0	5.0	8411256			
Dissolved Boron (B)	ug/L	420	420	50	8411256			
Dissolved Cadmium (Cd)	ug/L	<0.45	<0.45	0.45	8411256			
Dissolved Calcium (Ca)	ug/L	3400000	3400000	2000	8411256			
Dissolved Cesium (Cs)	ug/L	<1.0	<1.0	1.0	8411256			
Dissolved Chromium (Cr)	ug/L	<25	<25	25	8411256			
Dissolved Cobalt (Co)	ug/L	<2.5	<2.5	2.5	8411256			
Dissolved Copper (Cu)	ug/L	<4.5	<4.5	4.5	8411256			
Dissolved Iron (Fe)	ug/L	14000	14000	500	8411256			
Dissolved Lead (Pb)	ug/L	<2.5	<2.5	2.5	8411256			
Dissolved Lithium (Li)	ug/L	73	73	25	8411256			
Dissolved Magnesium (Mg)	ug/L	11000	11000	250	8411256			
Dissolved Nickel (Ni)	ug/L	<5.0	<5.0	5.0	8411256			
Dissolved Potassium (K)	ug/L	16000	15000	1000	8411256			
Dissolved Rubidium (Rb)	ug/L	22	22	1.0	8411256			
Dissolved Selenium (Se)	ug/L	<10	<10	10	8411256			
Dissolved Silicon (Si)	ug/L	9900	9900	250	8411256			
Dissolved Sodium (Na)	ug/L	680000	660000	500	8411256			
Dissolved Strontium (Sr)	ug/L	40000	42000	5.0	8411256			
Dissolved Thorium (Th)	ug/L	<10	<10	10	8411256			
Dissolved Uranium (U)	ug/L	<0.50	<0.50	0.50	8411256			
Dissolved Zirconium (Zr)	ug/L	<5.0	<5.0	5.0	8411256			
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								
Lab-Dup = Laboratory Initiated Duplicate								



Bureau Veritas Job #: C2AJ973
Report Date: 2023/01/16

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

TEST SUMMARY

Bureau Veritas ID: UPN197
Sample ID: IG_BH05_GW011
Matrix: Water

Collected: 2022/12/13
Shipped:
Received: 2022/12/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8411281	N/A	2022/12/20	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	8408710	N/A	2022/12/20	Automated Statchk
Anions	IC	8413262	N/A	2022/12/20	Lusine Khachatryan
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8408507	N/A	2022/12/17	Gyulshen Idriz
Fluoride	ISE	8411282	2022/12/19	2022/12/20	Surinder Rai
Dissolved Metals Analysis by ICP	ICP	8411243	2022/12/19	2022/12/21	Suban Kanapathipillai
Dissolved Metals by ICPMS	ICP/MS	8411256	N/A	2022/12/21	Rupinder Gill
Total Metals Analysis by ICP	ICP	8412070	2022/12/19	2022/12/20	Suban Kanapathipillai
Iodide, Thiosulphate, Thiocyanate	IC/EC	8425306	N/A	2022/12/23	Kanwardeep Brar
Total Extractable Elements by ICP-MS	ICP/MSMS	8447651	2023/01/09	2023/01/11	Sinhuja Thambiayah
Silica (Reactive)	KONE	8423382	N/A	2022/12/23	Ana Katrina Cariaga
Total Ammonia-N	LACH/NH4	8412399	N/A	2022/12/21	Shivani Shivani
Nitrate & Nitrite as Nitrogen in Water	LACH	8411287	N/A	2022/12/20	Chandra Nandlal
pH	AT	8411277	2022/12/19	2022/12/20	Surinder Rai
Orthophosphate	KONE	8412697	N/A	2022/12/21	Samuel Law
Sulphide	ISE/S	8408944	N/A	2022/12/20	Taslina Aktar
Total Inorganic Carbon (TIC)	TOCV/NDIR	8409471	N/A	2022/12/19	Gyulshen Idriz
Total Kjeldahl Nitrogen in Water	SKAL	8412044	2022/12/19	2022/12/20	Jency Sara Johnson
Total Nitrogen (calculated)	CALC	8408712	N/A	2022/12/21	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	8412355	N/A	2022/12/20	Gyulshen Idriz
Total Phosphorus (Colourimetric)	SKAL/P	8412134	2022/12/19	2022/12/21	Sachi Patel

Bureau Veritas ID: UPN197 Dup
Sample ID: IG_BH05_GW011
Matrix: Water

Collected: 2022/12/13
Shipped:
Received: 2022/12/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8411281	N/A	2022/12/20	Surinder Rai
Fluoride	ISE	8411282	2022/12/19	2022/12/20	Surinder Rai
Nitrate & Nitrite as Nitrogen in Water	LACH	8411287	N/A	2022/12/20	Chandra Nandlal
pH	AT	8411277	2022/12/19	2022/12/20	Surinder Rai
Orthophosphate	KONE	8412697	N/A	2022/12/21	Samuel Law

Bureau Veritas ID: UPN198
Sample ID: IG_BH05_GW012
Matrix: Water

Collected: 2022/12/13
Shipped:
Received: 2022/12/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	8411281	N/A	2022/12/20	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	8408710	N/A	2022/12/20	Automated Statchk
Anions	IC	8413262	N/A	2022/12/20	Lusine Khachatryan
Dissolved Organic Carbon (DOC)	TOCV/NDIR	8408507	N/A	2022/12/17	Gyulshen Idriz
Fluoride	ISE	8411282	2022/12/19	2022/12/20	Surinder Rai



Bureau Veritas Job #: C2AJ973
Report Date: 2023/01/16

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

TEST SUMMARY

Bureau Veritas ID: UPN198
Sample ID: IG_BH05_GW012
Matrix: Water

Collected: 2022/12/13
Shipped:
Received: 2022/12/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals Analysis by ICP	ICP	8411243	2022/12/19	2022/12/21	Suban Kanapathippillai
Dissolved Metals by ICPMS	ICP/MS	8411256	N/A	2022/12/21	Rupinder Gill
Total Metals Analysis by ICP	ICP	8412070	2022/12/19	2022/12/20	Suban Kanapathippillai
Iodide, Thiosulphate, Thiocyanate	IC/EC	8425306	N/A	2022/12/23	Kanwardeep Brar
Total Extractable Elements by ICP-MS	ICP/MSMS	8447651	2023/01/09	2023/01/11	Sinhuja Thambiayah
Silica (Reactive)	KONE	8423382	N/A	2022/12/23	Ana Katrina Cariaga
Total Ammonia-N	LACH/NH4	8412399	N/A	2022/12/21	Shivani Shivani
Nitrate & Nitrite as Nitrogen in Water	LACH	8411287	N/A	2022/12/20	Chandra Nandlal
pH	AT	8411277	2022/12/19	2022/12/20	Surinder Rai
Orthophosphate	KONE	8412697	N/A	2022/12/21	Samuel Law
Sulphide	ISE/S	8408944	N/A	2022/12/20	Taslina Aktar
Total Inorganic Carbon (TIC)	TOCV/NDIR	8409471	N/A	2022/12/19	Gyulshen Idriz
Total Kjeldahl Nitrogen in Water	SKAL	8412044	2022/12/19	2022/12/20	Jency Sara Johnson
Total Nitrogen (calculated)	CALC	8408712	N/A	2022/12/21	Automated Statchk
Total Organic Carbon (TOC)	TOCV/NDIR	8412355	N/A	2022/12/20	Gyulshen Idriz
Total Phosphorus (Colourimetric)	SKAL/P	8412134	2022/12/19	2022/12/21	Sachi Patel

Bureau Veritas ID: UPN198 Dup
Sample ID: IG_BH05_GW012
Matrix: Water

Collected: 2022/12/13
Shipped:
Received: 2022/12/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals Analysis by ICP	ICP	8411243	2022/12/19	2022/12/21	Suban Kanapathippillai



Bureau Veritas Job #: C2AJ973
Report Date: 2023/01/16

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

GENERAL COMMENTS

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

Package 1	3.0°C
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Revised Report (2023/01/16): Sample IDs revised

Sample UPN197 [IG_BH05_GW011] : Total Phosphorus < ortho-Phosphate: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Metal analysis: Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

Sample UPN198 [IG_BH05_GW012] : Metal analysis: Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

RESULTS OF ANALYSES OF WATER

Sample UPN197 [IG_BH05_GW011] Iodide, Thiosulphate, Thiocyanate: Detection limits raised due to matrix interference.

Sample UPN198 [IG_BH05_GW012] Iodide, Thiosulphate, Thiocyanate: Detection limits raised due to matrix interference.

Results relate only to the items tested.



Bureau Veritas Job #: C2AJ973
Report Date: 2023/01/16

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8408507	GID	Matrix Spike	Dissolved Organic Carbon	2022/12/17		95	%	80 - 120
8408507	GID	Spiked Blank	Dissolved Organic Carbon	2022/12/16		98	%	80 - 120
8408507	GID	Method Blank	Dissolved Organic Carbon	2022/12/16	<0.40		mg/L	
8408507	GID	RPD	Dissolved Organic Carbon	2022/12/16	0.51		%	20
8408944	TAK	Matrix Spike	Sulphide	2022/12/20		85	%	80 - 120
8408944	TAK	Spiked Blank	Sulphide	2022/12/20		99	%	80 - 120
8408944	TAK	Method Blank	Sulphide	2022/12/20	<0.020		mg/L	
8408944	TAK	RPD	Sulphide	2022/12/20	NC		%	20
8409471	GID	Matrix Spike	Total Inorganic Carbon (C)	2022/12/19		88	%	80 - 120
8409471	GID	Spiked Blank	Total Inorganic Carbon (C)	2022/12/19		91	%	80 - 120
8409471	GID	Method Blank	Total Inorganic Carbon (C)	2022/12/19	<1		mg/L	
8409471	GID	RPD	Total Inorganic Carbon (C)	2022/12/19	NC		%	20
8411243	SUK	Matrix Spike [UPN198-05]	Dissolved Iron (Fe)	2022/12/21		NC	%	80 - 120
			Dissolved Sulphur (S)	2022/12/21		NC	%	80 - 120
8411243	SUK	Spiked Blank	Dissolved Iron (Fe)	2022/12/21		101	%	80 - 120
			Dissolved Sulphur (S)	2022/12/21		101	%	80 - 120
8411243	SUK	Method Blank	Dissolved Iron (Fe)	2022/12/21	<0.02		mg/L	
			Dissolved Sulphur (S)	2022/12/21	<0.5		mg/L	
8411243	SUK	RPD [UPN198-05]	Dissolved Iron (Fe)	2022/12/21	0.60		%	25
			Dissolved Sulphur (S)	2022/12/21	0.59		%	25
8411256	RG4	Matrix Spike	Dissolved Aluminum (Al)	2022/12/21		116	%	80 - 120
			Dissolved Arsenic (As)	2022/12/21		102	%	80 - 120
			Dissolved Barium (Ba)	2022/12/21		104	%	80 - 120
			Dissolved Bismuth (Bi)	2022/12/21		92	%	80 - 120
			Dissolved Boron (B)	2022/12/21		96	%	80 - 120
			Dissolved Cadmium (Cd)	2022/12/21		102	%	80 - 120
			Dissolved Calcium (Ca)	2022/12/21		NC	%	80 - 120
			Dissolved Cesium (Cs)	2022/12/21		100	%	80 - 120
			Dissolved Chromium (Cr)	2022/12/21		104	%	80 - 120
			Dissolved Cobalt (Co)	2022/12/21		98	%	80 - 120
			Dissolved Copper (Cu)	2022/12/21		109	%	80 - 120
			Dissolved Iron (Fe)	2022/12/21		104	%	80 - 120
			Dissolved Lead (Pb)	2022/12/21		95	%	80 - 120
			Dissolved Lithium (Li)	2022/12/21		105	%	80 - 120
			Dissolved Magnesium (Mg)	2022/12/21		NC	%	80 - 120
			Dissolved Nickel (Ni)	2022/12/21		94	%	80 - 120
			Dissolved Potassium (K)	2022/12/21		109	%	80 - 120
			Dissolved Rubidium (Rb)	2022/12/21		97	%	80 - 120
			Dissolved Selenium (Se)	2022/12/21		101	%	80 - 120
			Dissolved Silicon (Si)	2022/12/21		115	%	80 - 120
			Dissolved Sodium (Na)	2022/12/21		2790 (1)	%	80 - 120
			Dissolved Strontium (Sr)	2022/12/21		NC	%	80 - 120
			Dissolved Thorium (Th)	2022/12/21		94	%	80 - 120
			Dissolved Uranium (U)	2022/12/21		97	%	80 - 120
			Dissolved Zirconium (Zr)	2022/12/21		112	%	80 - 120
8411256	RG4	Spiked Blank	Dissolved Aluminum (Al)	2022/12/21		103	%	80 - 120
			Dissolved Arsenic (As)	2022/12/21		100	%	80 - 120
			Dissolved Barium (Ba)	2022/12/21		99	%	80 - 120
			Dissolved Bismuth (Bi)	2022/12/21		99	%	80 - 120



Bureau Veritas Job #: C2AJ973
Report Date: 2023/01/16

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Boron (B)	2022/12/21		98	%	80 - 120
			Dissolved Cadmium (Cd)	2022/12/21		99	%	80 - 120
			Dissolved Calcium (Ca)	2022/12/21		101	%	80 - 120
			Dissolved Cesium (Cs)	2022/12/21		97	%	80 - 120
			Dissolved Chromium (Cr)	2022/12/21		101	%	80 - 120
			Dissolved Cobalt (Co)	2022/12/21		100	%	80 - 120
			Dissolved Copper (Cu)	2022/12/21		101	%	80 - 120
			Dissolved Iron (Fe)	2022/12/21		101	%	80 - 120
			Dissolved Lead (Pb)	2022/12/21		102	%	80 - 120
			Dissolved Lithium (Li)	2022/12/21		105	%	80 - 120
			Dissolved Magnesium (Mg)	2022/12/21		101	%	80 - 120
			Dissolved Nickel (Ni)	2022/12/21		97	%	80 - 120
			Dissolved Potassium (K)	2022/12/21		101	%	80 - 120
			Dissolved Rubidium (Rb)	2022/12/21		97	%	80 - 120
			Dissolved Selenium (Se)	2022/12/21		103	%	80 - 120
			Dissolved Silicon (Si)	2022/12/21		102	%	80 - 120
			Dissolved Sodium (Na)	2022/12/21		100	%	80 - 120
			Dissolved Strontium (Sr)	2022/12/21		96	%	80 - 120
			Dissolved Thorium (Th)	2022/12/21		96	%	80 - 120
			Dissolved Uranium (U)	2022/12/21		101	%	80 - 120
			Dissolved Zirconium (Zr)	2022/12/21		100	%	80 - 120
8411256	RG4	Method Blank	Dissolved Aluminum (Al)	2022/12/21	<4.9		ug/L	
			Dissolved Arsenic (As)	2022/12/21	<1.0		ug/L	
			Dissolved Barium (Ba)	2022/12/21	<2.0		ug/L	
			Dissolved Bismuth (Bi)	2022/12/21	<1.0		ug/L	
			Dissolved Boron (B)	2022/12/21	<10		ug/L	
			Dissolved Cadmium (Cd)	2022/12/21	<0.090		ug/L	
			Dissolved Calcium (Ca)	2022/12/21	<200		ug/L	
			Dissolved Cesium (Cs)	2022/12/21	<0.20		ug/L	
			Dissolved Chromium (Cr)	2022/12/21	<5.0		ug/L	
			Dissolved Cobalt (Co)	2022/12/21	<0.50		ug/L	
			Dissolved Copper (Cu)	2022/12/21	<0.90		ug/L	
			Dissolved Iron (Fe)	2022/12/21	<100		ug/L	
			Dissolved Lead (Pb)	2022/12/21	<0.50		ug/L	
			Dissolved Lithium (Li)	2022/12/21	<5.0		ug/L	
			Dissolved Magnesium (Mg)	2022/12/21	<50		ug/L	
			Dissolved Nickel (Ni)	2022/12/21	<1.0		ug/L	
			Dissolved Potassium (K)	2022/12/21	<200		ug/L	
			Dissolved Rubidium (Rb)	2022/12/21	<0.20		ug/L	
			Dissolved Selenium (Se)	2022/12/21	<2.0		ug/L	
			Dissolved Silicon (Si)	2022/12/21	<50		ug/L	
			Dissolved Sodium (Na)	2022/12/21	<100		ug/L	
			Dissolved Strontium (Sr)	2022/12/21	<1.0		ug/L	
			Dissolved Thorium (Th)	2022/12/21	<2.0		ug/L	
			Dissolved Uranium (U)	2022/12/21	<0.10		ug/L	
			Dissolved Zirconium (Zr)	2022/12/21	<1.0		ug/L	
8411256	RG4	RPD	Dissolved Lead (Pb)	2022/12/21	NC		%	20
8411277	SAU	Spiked Blank	pH	2022/12/20		102	%	98 - 103
8411277	SAU	RPD [UPN197-01]	pH	2022/12/20	0.56		%	N/A
8411281	SAU	Spiked Blank	Alkalinity (Total as CaCO3)	2022/12/20		95	%	85 - 115



Bureau Veritas Job #: C2AJ973
Report Date: 2023/01/16

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8411281	SAU	Method Blank	Alkalinity (Total as CaCO ₃)	2022/12/20	<1.0		mg/L	
8411281	SAU	RPD [UPN197-01]	Alkalinity (Total as CaCO ₃)	2022/12/20	0.0065		%	20
8411282	SAU	Matrix Spike [UPN197-01]	Fluoride (F-)	2022/12/20		57 (1)	%	80 - 120
8411282	SAU	Spiked Blank	Fluoride (F-)	2022/12/20		103	%	80 - 120
8411282	SAU	Method Blank	Fluoride (F-)	2022/12/20	<0.10		mg/L	
8411282	SAU	RPD [UPN197-01]	Fluoride (F-)	2022/12/20	0.95		%	20
8411287	C_N	Matrix Spike [UPN197-01]	Nitrite (N)	2022/12/20		99	%	80 - 120
			Nitrate (N)	2022/12/20		97	%	80 - 120
8411287	C_N	Spiked Blank	Nitrite (N)	2022/12/20		106	%	80 - 120
			Nitrate (N)	2022/12/20		101	%	80 - 120
8411287	C_N	Method Blank	Nitrite (N)	2022/12/20	<0.010		mg/L	
			Nitrate (N)	2022/12/20	<0.10		mg/L	
8411287	C_N	RPD [UPN197-01]	Nitrite (N)	2022/12/20	NC		%	20
			Nitrate (N)	2022/12/20	NC		%	20
8412044	JJH	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2022/12/20		100	%	80 - 120
8412044	JJH	QC Standard	Total Kjeldahl Nitrogen (TKN)	2022/12/20		97	%	80 - 120
8412044	JJH	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2022/12/20		105	%	80 - 120
8412044	JJH	Method Blank	Total Kjeldahl Nitrogen (TKN)	2022/12/20	<0.10		mg/L	
8412044	JJH	RPD	Total Kjeldahl Nitrogen (TKN)	2022/12/20	NC (2)		%	20
8412070	SUK	Matrix Spike	Total Iron (Fe)	2022/12/20		98	%	80 - 120
			Total Sulphur (S)	2022/12/20		NC	%	80 - 120
8412070	SUK	Spiked Blank	Total Iron (Fe)	2022/12/20		101	%	80 - 120
			Total Sulphur (S)	2022/12/20		94	%	80 - 120
8412070	SUK	Method Blank	Total Iron (Fe)	2022/12/20	<0.02		mg/L	
			Total Sulphur (S)	2022/12/20	<0.5		mg/L	
8412134	SPC	Matrix Spike	Total Phosphorus	2022/12/21		101	%	80 - 120
8412134	SPC	QC Standard	Total Phosphorus	2022/12/21		99	%	80 - 120
8412134	SPC	Spiked Blank	Total Phosphorus	2022/12/21		99	%	80 - 120
8412134	SPC	Method Blank	Total Phosphorus	2022/12/21	<0.020		mg/L	
8412134	SPC	RPD	Total Phosphorus	2022/12/21	0.12		%	20
8412355	GID	Matrix Spike	Total Organic Carbon (TOC)	2022/12/20		97	%	80 - 120
8412355	GID	Spiked Blank	Total Organic Carbon (TOC)	2022/12/20		99	%	80 - 120
8412355	GID	Method Blank	Total Organic Carbon (TOC)	2022/12/20	<0.40		mg/L	
8412355	GID	RPD	Total Organic Carbon (TOC)	2022/12/20	0.87		%	20
8412399	SSV	Matrix Spike	Total Ammonia-N	2022/12/21		107	%	75 - 125
8412399	SSV	Spiked Blank	Total Ammonia-N	2022/12/21		101	%	80 - 120
8412399	SSV	Method Blank	Total Ammonia-N	2022/12/21	<0.050		mg/L	
8412399	SSV	RPD	Total Ammonia-N	2022/12/21	4.8		%	20
8412697	S1L	Matrix Spike [UPN197-01]	Orthophosphate (P)	2022/12/21		95	%	75 - 125
8412697	S1L	Spiked Blank	Orthophosphate (P)	2022/12/21		100	%	80 - 120
8412697	S1L	Method Blank	Orthophosphate (P)	2022/12/21	<0.010		mg/L	
8412697	S1L	RPD [UPN197-01]	Orthophosphate (P)	2022/12/21	14		%	20
8413262	LKH	Matrix Spike	Chloride (Cl-)	2022/12/20		107	%	80 - 120
			Bromide (Br-)	2022/12/20		102	%	80 - 120
			Sulphate (SO ₄)	2022/12/20		103	%	80 - 120
8413262	LKH	Spiked Blank	Chloride (Cl-)	2022/12/20		100	%	70 - 130
			Bromide (Br-)	2022/12/20		102	%	80 - 120



Bureau Veritas Job #: C2AJ973
Report Date: 2023/01/16

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8413262	LKH	Method Blank	Sulphate (SO ₄)	2022/12/20		102	%	80 - 120
			Chloride (Cl ⁻)	2022/12/20	<1.0		mg/L	
			Bromide (Br ⁻)	2022/12/20	<1.0		mg/L	
			Sulphate (SO ₄)	2022/12/20	<1.0		mg/L	
8413262	LKH	RPD	Chloride (Cl ⁻)	2022/12/20	1.2		%	20
			Bromide (Br ⁻)	2022/12/20	NC		%	20
8423382	éJ3	Matrix Spike	Reactive Silica (SiO ₂)	2022/12/23		99	%	80 - 120
8423382	éJ3	Spiked Blank	Reactive Silica (SiO ₂)	2022/12/23		105	%	80 - 120
8423382	éJ3	Method Blank	Reactive Silica (SiO ₂)	2022/12/23	<0.050		mg/L	
8423382	éJ3	RPD	Reactive Silica (SiO ₂)	2022/12/23	2.5		%	20
8425306	KDB	Matrix Spike	Dissolved Iodide	2022/12/23		98	%	80 - 120
8425306	KDB	Spiked Blank	Dissolved Iodide	2022/12/23		107	%	80 - 120
8425306	KDB	Method Blank	Dissolved Iodide	2022/12/23	<0.10		mg/L	
8447651	ST5	Spiked Blank	Total Ruthenium (Ru)	2023/01/11		113	%	70 - 130
8447651	ST5	Method Blank	Total Ruthenium (Ru)	2023/01/11	<2.0		ug/L	

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

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

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

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

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

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

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

(2) Due to a high concentration of NO_x, the sample required dilution. The detection limit was adjusted accordingly.



Bureau Veritas Job #: C2AJ973
Report Date: 2023/01/16

Geofirma Engineering Ltd
Client Project #: 20-203-1
Site Location: IGNACE, ON
Your P.O. #: 202031-004
Sampler Initials: AC

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Cristina Carriere

Cristina Carriere, Senior Scientific Specialist



Jonathan Fauvel

Jonathan Fauvel, B.Sc, Chimiste, Supervisor, Inorganics

Sandy Yuan

Sandy Yuan, M.Sc., QP, Scientific Specialist



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Isotope Analyses for:
Geofirma Engineering LTD

IT² FILE #
221105

2023-03-15

Approved by:

Orfan Shouakar-Stash, PhD
Director

Isotope Tracer Technologies Inc.

608 Weber St. North Unit 3&4,

Waterloo, ON, N2V 1Z5 Tel: 519-886-5555 |

Fax: 519-886-5575

Email: orfan@it2isotopes.com

Website: www.it2isotopes.com



Client: Geofirma Engineering LTD
Address: 1 RAYMOND ST. SUITE 200
 Ottawa, ON. K1R 1A2
Tel.: (613)402-1701/ (514)-730-0961
Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: 221105
Project Number: 20-203-1
COC ID# GFIM IT2 007

#	Client ID	Sample #	Sampling		E ³ H	Result	± 1σ	δ ¹⁸ O	Aver	Stdv	δ ² H	Aver	Stdv
			Date	Time									
						TU		H ₂ O	VSMOW		H ₂ O	VSMOW	
1	IG_BH05_GW010	126102	2022-12-09	11:30	X	< 0.8	0.8						
2	IG_BH05_GW011	126103	2022-12-12/13	various	X	2.3	0.8	X	-11.20	0.03	X	-79.7	0.1
3	IG_BH05_GW012	126104	2022-12-12/13	various	X	2.3	0.9	X	-11.27	0.02	X	-79.8	0.1
4	IG_BH01_GW036	126105	2022-12-09	10:45-17:00	X	< 0.8	0.8	X	-12.04	0.02	X	-78.3	0.1

E³H ANALYSES

Tritium is reported in Tritium Units.

1TU = 3.221 Picocuries/L per IAEA, 2000 Report.

1TU = 0.11919 Becquerels/L per IAEA, 2000 Report.

¹⁸O & ²H (CRDS)

Instrument Used: Cavity Ring Down Spectroscopy (CRDS)

CRDS (Model L2130-i) (Picarro, California, USA).

Standard Used:

IT2-12C / IT2-13B / IT2-14B Calibrated with IAEA Standards (V-SMOW, SLAP, and GISP)

Typical Standard deviation:

(¹⁸O ± 0.1‰) (²H ± 1‰)

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

Isotope Tracer Technologies Inc.

608 Weber St. North Unit 3&4, Waterloo, ON, N2V 1K4

Tel: 519-886-5555 | Fax: 519-886-5575

Email: orfan@it2isotopes.com

Website: www.it2isotopes.com



Client: Geofirma Engineering LTD
Address: 1 RAYMOND ST. SUITE 200
 Ottawa, ON. K1R 1A2
Tel.: (613)402-1701/ (514)-730-0961
Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: 221105
Project Number: 20-203-1
COC ID# GFIM IT2 007

#	Client ID	Sample #	Sampling		$^{87}\text{Sr}/^{86}\text{Sr}$	Result	StdErr (abs)	StdDev (abs)	$\delta^{37}\text{Cl}$	Result	Stdv
			Date	Time						SMOC	
1	IG_BH05_GW010	126102	2022-12-09	11:30							
2	IG_BH05_GW011	126103	2022-12-12/13	various	X	0.71563	4.836E-06	6.212E-05	X	-0.85	0.08
3	IG_BH05_GW012	126104	2022-12-12/13	various	X	0.71523	4.349E-06	5.449E-05	X	-0.66	0.09
4	IG_BH01_GW036	126105	2022-12-09	10:45-17:00	X	0.71529	6.855E-06	9.299E-05	X	-0.65	0.12

$^{87}\text{Sr}/^{86}\text{Sr}$ ANALYSES

Instrument Used:

Thermal Ionization Mass Spectrometry (TIMS), TI-Box, spectromat, Germany

Standard Used:

NIST-987

Typical Standard deviation:

± 0.0001

^{37}Cl ANALYSES

Instrument Used:

Isotope Ratio Mass Spectrometry (IRMS) - MAT 253, Thermo Scientific, Germany
 Coupled with an Agilent 6890 Gas Chromatograph (GC)

Standard Used:

SMOC

Typical Standard deviation:

$\pm 0.15\%$

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

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608 Weber St. North Unit 3&4, Waterloo, ON, N2V 1K4

Tel: 519-886-5555 | Fax: 519-886-5575

Email: orfan@it2isotopes.com

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Client: Geofirma Engineering LTD
Address: 1 RAYMOND ST. SUITE 200
 Ottawa, ON. K1R 1A2
Tel.: (613)402-1701/ (514)-730-0961
Attn.: Chris Morgan/Amy Cartier
E-mail: cmorgan@geofirma.com
E-mail: acartier@geofirma.com

File Number: 221105
Project Number: 20-203-1
COC ID# GFIM IT2 007

#	Client ID	Sample #	Sampling		$\delta^{13}\text{C}$	Result	Repeat	^{14}C	Fraction of Modern		Radiocarbon age	
			Date	Time					Pmc	\pm	BP	\pm
1	IG_BH05_GW010	126102	2022-12-09	11:30	X	-10.9	-10.5	X	40.45	0.17	7271	34
2	IG_BH05_GW011	126103	2022-12-12/13	various	X	-23.5		X	91.81	0.23	686	20
3	IG_BH05_GW012	126104	2022-12-12/13	various	X	-23.6		X	90.50	0.23	802	20
4	IG_BH01_GW036	126105	2022-12-09	10:45-17:00	X	-14.0		X	48.39	0.25	5831	42

^{13}C DIC Analyses

Instrument Used:

Finnigan MAT, Delta^{Plus} XL IRMS, Germany.

Standard Used:

IT²-27

IT²-34

NBS-18

NBS-19

Typical Standard deviation:

± 0.2 ‰

^{14}C DIC Analyses

Results are presented in units of percent modern carbon (Pmc) and the uncalibrated radiocarbon age before present (BP).

The results relate only the sample material submitted and the portion analyzed. All results have been corrected for isotopic fractionation with an $\delta^{13}\text{C}$ value measured on the prepared carbon by the accelerator. The pMC reported requires no further correction for fractionation.

Approved by:

Orfan S-Stash

Orfan Shouakar-Stash, PhD

Director

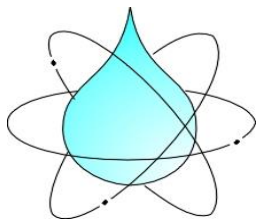
Isotope Tracer Technologies Inc.

608 Weber St. North Unit 3&4, Waterloo, ON, N2V 1K4

Tel: 519-886-5555 | Fax: 519-886-5575

Email: orfan@it2isotopes.com

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Hydrogeochemistry Laboratory
Analytical Report - Clark group
University of Ottawa
25 Templeton Street
Ottawa, ON K1N 6N5


Analytical report for:

Geofirma Engineering Ltd.
1 Raymond Street #200
Ottawa, ON K1R 1A2

Sample description

Site	Ignace
Type	Water
Container	Nalgene
Volume	1 L

Analysis

Analyte	^{36}Cl in dissolved Cl
Method	AMS
Facility	Hydrogeochemistry Laboratory, University of Ottawa
Report Approved by	 Ian Clark, P.Geo.

Timeline

Samples received	Analyses completed	Report date
October 04, 2022 (5), 2022 Q3 December 20, 2022 (3), 2022 Q4	^{36}Cl	April 27, 2023

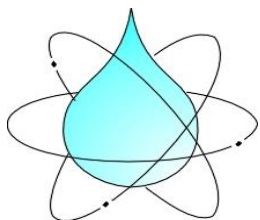
Notes

Samples were collected in the field by Geofirma staff. Bottles were received sealed and in good condition. Samples were extracted as Cl^- from solution on an anion exchange column, eluted and precipitated as AgCl target material. AMS analysis was undertaken on a 6 MV tandem accelerator mass spectrometer at PRIME Lab, Purdue.

Hydrogeochemistry Laboratory
Analytical Report - Clark group

Report prepared for:
Geofirma Engineering Ltd.

Sample	Lab ID	Comment	Cl (mg/L)	$^{36}\text{Cl}/\text{Cl}$ final (10^{-15})	±	^{36}Cl atoms/L (10^6)	±
IG_BH01_GW036	PRIME	prepared at uOttawa	19000	16.9	1.2	5445	392
IG_BH05_GW011	PRIME	prepared at uOttawa	7000	15.6	1.2	1849	147
IG_BH05_GW012	PRIME	prepared at uOttawa	7000	15.31	1.2	1818	141



Hydrogeochemistry Laboratory
Analytical Report - Clark group
University of Ottawa
25 Templeton Street
Ottawa, ON K1N 6N5


Analytical report for:

Geofirma Engineering Ltd.
1 Raymond Street #200
Ottawa, ON K1R 1A2

Sample description

Site	Ignace
Type	Water
Container	Nalgene
Volume	1L

Analysis

Analyte	^{129}I
Method	^{129}I extraction to AgI and AMS analysis
Facility	Hydrogeochemistry Laboratory, University of Ottawa
Report Approved by	 Ian Clark, P.Geo.

Timeline

Samples received	Analyses completed	Report date
December 2022	^{129}I	July 18, 2023

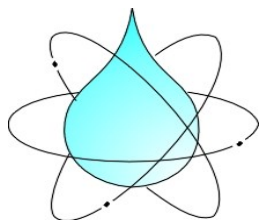
Sample	Date Sampled	Sample Weight (g)	¹²⁷ I Concentration Measured (ppb)	Mass of Iodide Carrier Added (mg)	¹²⁹ I/ ¹²⁷ I Ratio Measured ($\times 10^{-14}$) *		¹²⁹ I Concentration ($\times 10^6$ atoms/g)		Original Ratio ($\times 10^{-09}$) **	
					Ratio	Standard Deviation	Concentration	Standard Deviation	OR	Standard Deviation
IG_BH01_GW036	09/12/2022	201.00	1254	1.74	6.85E+01	3.15E+00	3.22E-02	1.48E-03	3.26E-02	1.50E-03
IG_BH05_GW011	14/12/2022	200.17	732	1.66	6.70E+01	2.68E+00	2.87E-02	1.15E-03	4.98E-02	1.99E-03
IG_BH05_GW012	14/12/2022	201.53	744	1.66	7.03E+01	2.46E+00	3.00E-02	1.05E-03	5.11E-02	1.79E-03

Note: * ¹²⁹I/¹²⁷I Ratio Measured includes both sample and carrier added.

Note 2: ** ¹²⁹I/¹²⁷I Ratio calculated before added the carrier.

AMS Measurements

Samples were run on a 6MV Tandetron electrostatic AMS at the Helmholtz-Zentrum Dresden-Rossendorf facility.
Raw machine ratios were background corrected by a blank machine count rate of 0.06 cps.




Hydrogeochemistry Laboratory
Analytical Report - Clark group
University of Ottawa
25 Templeton Street
Ottawa, ON K1N 6N5

Analytical report for:

Geofirma Engineering Ltd.
1 Raymond Street #200
Ottawa, ON K1R 1A2

Sample description

Site	Ignace
Type	Noble gas
Container	Cu tubes
Volume	
Report Approved by	 Ian Clark, P.Geo.

Analysis

Analyte	Noble gases
Method	Mass spectrometry
Facility	Noble gas laboratory, University of Utah

Timeline

Samples received	Analyses completed	Report date
2022 Q3 and Q4	He, Ne, Ar, Kr, Xe	Rev 0: 2023-06-19 Rev 1: 2024-01-08

Notes

Gas extraction from water follows the procedure outlined in Aeschbach-Hertig & Solomon 2013.
Please see sheet tab titled "Notes" for further explanation of the noble gas analysis.

Hydrogeochemistry Laboratory
Analytical Report - Clark group

Report prepared for:
Geofirma Engineering Ltd.

Quarter	Sample ID	Mass g	He3		He4		x/Ra	HeTotal	
			cc/g	±	cc/g	±		cc/g	±
2022 Q3	IG_BH03_GW017	10.7	5.39E-11	5.39E-13	3.05E-04	3.05E-06	0.128	3.05E-04	3.05E-06
2022 Q3	IG_BH03_GW018	10.2	4.87E-12	4.87E-14	2.83E-04	2.83E-06	0.012	2.83E-04	2.83E-06
2022 Q3	IG_BH01_GW035	11.1	2.80E-11	2.80E-13	3.00E-04	3.00E-06	0.068	3.00E-04	3.00E-06
2022 Q3	IG_BH05_GW005	13.0	4.01E-11	4.01E-13	2.54E-04	2.54E-06	0.114	2.54E-04	2.54E-06
2022 Q3	IG_BH05_GW006	11.5	4.26E-11	4.26E-13	2.88E-04	2.88E-06	0.107	2.88E-04	2.88E-06
2022 Q4	IG_BH01_GW028	10.1	1.67E-11	1.67E-13	3.33E-04	3.33E-06	0.036	3.33E-04	3.33E-06
2022 Q4	IG_BH01_GW036	9.8	2.39E-11	2.39E-13	3.29E-04	3.29E-06	0.053	3.29E-04	3.29E-06
2022 Q4	IG_BH05_GW011	9.9	2.26E-12	2.26E-14	1.36E-04	1.36E-06	0.012	1.36E-04	1.36E-06
2022 Q4	IG_BH05_GW012	11.1	4.87E-11	4.87E-13	2.99E-04	2.99E-06	0.118	2.99E-04	2.99E-06

Quarter	Sample ID	Mass g	Ne20		Ne22		NeTotal		20Ne/22Ne
			cc/g	±	cc/g	±	cc/g	±	
2022 Q3	IG_BH03_GW017	10.7	6.56E-08	1.97E-09	7.14E-09	2.14E-10	7.27E-08	2.18E-09	9.19
2022 Q3	IG_BH03_GW018	10.2	7.84E-08	2.35E-09	7.79E-09	2.34E-10	8.62E-08	2.59E-09	10.07
2022 Q3	IG_BH01_GW035	11.1	6.57E-07	1.97E-08	6.59E-08	1.98E-09	7.22E-07	2.17E-08	9.96
2022 Q3	IG_BH05_GW005	13.0	3.69E-07	1.11E-08	3.93E-08	1.18E-09	4.08E-07	1.22E-08	9.39
2022 Q3	IG_BH05_GW006	11.5	4.62E-07	1.39E-08	5.02E-08	1.51E-09	5.13E-07	1.54E-08	9.22
2022 Q4	IG_BH01_GW028	10.1	3.53E-08	1.06E-09	3.55E-09	1.06E-10	3.89E-08	1.17E-09	9.96
2022 Q4	IG_BH01_GW036	9.8	5.50E-08	1.65E-09	5.85E-09	1.75E-10	6.09E-08	1.83E-09	9.41
2022 Q4	IG_BH05_GW011	9.9	7.86E-08	2.36E-09	8.01E-09	2.40E-10	8.66E-08	2.60E-09	9.80
2022 Q4	IG_BH05_GW012	11.1	1.48E-07	4.43E-09	1.53E-08	4.60E-10	1.63E-07	4.89E-09	9.63

Quarter	Sample ID	Mass g	Ar36		Ar40		ArTotal		36Ar/40Ar
			cc/g	±	cc/g	±	cc/g	±	
2022 Q3	IG_BH03_GW017	10.7	1.43E-07	4.29E-09	2.22E-03	6.66E-05	2.22E-03	6.66E-05	6.45E-05
2022 Q3	IG_BH03_GW018	10.2	1.54E-07	4.62E-09	7.39E-04	2.22E-05	7.39E-04	2.22E-05	2.09E-04
2022 Q3	IG_BH01_GW035	11.1	1.38E-06	4.15E-08	7.73E-04	2.32E-05	7.75E-04	2.32E-05	1.79E-03
2022 Q3	IG_BH05_GW005	13.0	1.11E-06	3.32E-08	1.35E-03	4.06E-05	1.36E-03	4.07E-05	8.18E-04
2022 Q3	IG_BH05_GW006	11.5	1.06E-06	3.18E-08	1.36E-03	4.08E-05	1.36E-03	4.08E-05	7.79E-04
2022 Q4	IG_BH01_GW028	10.1	5.13E-07	1.54E-08	6.43E-04	1.93E-05	6.43E-04	1.93E-05	7.99E-04
2022 Q4	IG_BH01_GW036	9.8	4.90E-07	1.47E-08	1.22E-03	3.67E-05	1.22E-03	3.67E-05	4.01E-04
2022 Q4	IG_BH05_GW011	9.9	5.49E-07	1.65E-08	3.86E-04	1.16E-05	3.87E-04	1.16E-05	1.42E-03
2022 Q4	IG_BH05_GW012	11.1	5.81E-07	1.74E-08	1.25E-03	3.75E-05	1.25E-03	3.75E-05	4.65E-04

Hydrogeochemistry Laboratory
Analytical Report - Clark group

Report prepared for:
 Geofirma Engineering Ltd.

Quarter	Sample ID	Mass g	KrTotal		XeTotal	
			<i>cc/g</i>	<i>±</i>	<i>cc/g</i>	<i>±</i>
2022 Q3	IG_BH03_GW017	10.7	1.94E-08	9.71E-10	3.46E-09	1.73E-10
2022 Q3	IG_BH03_GW018	10.2	1.25E-08	6.24E-10	2.59E-09	1.30E-10
2022 Q3	IG_BH01_GW035	11.1	6.41E-08	3.20E-09	8.21E-09	4.10E-10
2022 Q3	IG_BH05_GW005	13.0	4.56E-08	2.28E-09	7.87E-09	3.94E-10
2022 Q3	IG_BH05_GW006	11.5	5.11E-08	2.56E-09	7.88E-09	3.94E-10
2022 Q4	IG_BH01_GW028	10.1	4.65E-08	2.32E-09	8.35E-09	4.18E-10
2022 Q4	IG_BH01_GW036	9.8	3.19E-08	1.59E-09	5.27E-09	2.63E-10
2022 Q4	IG_BH05_GW011	9.9	3.66E-08	1.83E-09	6.02E-09	3.01E-10
2022 Q4	IG_BH05_GW012	11.1	5.51E-08	2.76E-09	8.35E-09	4.18E-10

cc/g - cc of noble gas at STP per gram of sample solution

± - analytical uncertainty, as cc/g

xRa - $3\text{He}/4\text{He}$ ratio in sample normalized to the ratio in Air ($1.38\text{E}-6$)

Noble Gas Analysis

Gas extraction from water follows the procedure outlined in *Aeschbach-Hertig & Solomon 2013*. This involves gas extraction from copper tube water samples under vacuum by water vapour sweep into a stainless steel gas flask. The extracted gases are let into a sample preparation line and cryogenically separated. For light noble gases (He and Ne), standards and samples are introduced into an ultra-high vacuum preparation system where bulk (N_2 , O_2) and trace gases (CO_2 , Ar) are removed using liquid N_2 charcoal traps and two SAES getters, followed by analysis on a Thermo Scientific Helix SFT Noble Gas Mass Spectrometer. Internal standards using precise aliquots from a tank of clean dry atmospheric air are run each morning and during analysis to measure instrument drift and sensitivity. Internal standards of air equilibrated water (AEW) are also run as internal checks on the water extraction procedure and analyses. Following purification, He is separated from Ne using a He cooled cryo trap that cycles down to 5K, before releasing He at 28K and Ne at 70K. He and Ne are introduced separately into the Helix SFT operating under static vacuum. Each analysis undergoes a mass peak center, followed by separate integrations on each mass peak. These integrations generate a linear regression used to calculate peak intensity at time zero (when the sample was released into the mass spectrometer). For Ar, Kr and Xe, gases, residual water vapour was removed cryogenically prior to gettering of reactive gases and cryogenic separation of Kr and Xe from Ar. Abundance analysis was done by quadrupole mass spectrometry at the University of Utah Noble Gas Lab.

References:

Aeschbach-Hertig W., Solomon D.K. (2013) Noble Gas Thermometry in Groundwater Hydrology. In: Burnard P. (eds) The Noble Gases as

Appendix F

Data Quality Confirmation Workbooks

2022 Q1 (March)
Data Quality Workbook (DQC)

20-203-1: Laboratory Data Quality Confirmation Report

Borehole ID:	BH01, BH03, BH05	Comments:
Date:	18 Mar - 26 Mar 2022	
Completed by:	AMSC, MdK	
Sampling Interval(s):	IG BH01 INT T 004; IG BH03 INT T 002; IG BH05 INT T 007	

Equipment	Date/Time	Decontamination Required (Y/N)	Location	PPE	Decontamination Procedure					Comments
					Loose Contamination Removed	Detergent Wash (record type of detergent used)	Dionized Water Rinse	Air Dried (Minimize Dust)	Rinsate Sample Collected (Y/N)	
Electronic Water Level Tape	2022-03-18 9:15	Y	BH03	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 5230	2022-03-19 11:15	Y	BH03	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-03-20 8:00	Y	BH01	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 5230	2022-03-20 8:00	Y	BH01	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-03-20 11:20	Y	BH03	Y	Y	Alconox	Y	Y	N	
Bladder Pump	2022-03-20 11:20	Y	BH03	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 5230	2022-03-21 8:25	Y	BH05	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-03-21 8:10	Y	BH05	Y	Y	Alconox	Y	Y	N	
Bladder Pump	2022-03-21 11:30	Y	BH05	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 5230	2022-03-22 10:15	Y	BH03	Y	Y	Alconox	Y	Y	N	
7 x Westbay sample bottles	2022-03-22 10:15	Y	BH03	Y	Y	Alconox	Y	Y	Y	Collected rinsate sample: IG_BH03_GW014
Electronic Water Level Tape	2022-03-24 8:50	Y	BH01	Y	Y	Alconox	Y	Y	N	
Bladder Pump	2022-03-24 8:50	Y	BH01	Y	Y	Alconox	Y	Y	N	
7 x Westbay sample bottles	2022-03-25 8:30	Y	BH05	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-03-25 8:30	Y	BH05	Y	Y	Alconox	Y	Y	N	
7 x Westbay sample bottles	2022-03-26 12:00	Y	BH01	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-03-26 12:00	Y	BH01	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 5230	2022-03-26 12:00	Y	BH01	Y	Y	Alconox	Y	Y	N	

Completed by:	AMSC, MdK	Verified by:	SNS
Date:	18 Mar - 26 Mar 2022	Date:	02-Apr-22

20-203-1: Laboratory Data Quality Confirmation Report

Date	Time	Personnel	Equipment Type	Serial Number	Calibration Check			Calibration Performed			Comments
					Check Method & Standard(s) Used	Equipment Reading(s)	Calibration Required (Y/N)	Calibration Method & Standard(s) Used	Equipment Reading(s)	Calibration Completed (Y/N)	
19-Mar-22	12:40	AMSC	Westbay MOSDAX	EMS5230	Water pressure check vs manual water level	Manual WL (m Head): 7.31m; Westbay (m Head): 8.44m	N	--	--	--	
20-Mar-22	11:45	MdK	Fluorometer	801434	--	--	--	2 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.004ppb, 9.984ppb, 99.39ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 10F0679), 100ppb (LOT# 1F0684) Exp. Jan 2023
20-Mar-22	11:45	MdK	HoribaU52	UG3N4PTO	--	--	--	Lab-provided auto calibration solution 4.0 pH, 4.49mS/cm, 0.0NTU	4.00pH, 4.50mS/cm, 0.0NTU	Y	
21-Mar-22	6:45	MdK	Fluorometer	801434	--	--	--	2 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.003ppb, 10.02ppb, 99.95ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 10F0679), 100ppb (LOT# 1F0684) Exp. Jan 2023
21-Mar-22	6:45	MdK	HoribaU52	UG3N4PTO	Lab provided solutions; 4.00, 7.00, 10.00	4.02, 7.01, 10.00	N	Lab-provided auto calibration solution 4.0 pH, 4.49mS/cm, 0.0NTU	4.00pH, 4.49mS/cm, 0.0NTU	Y	
22-Mar-22	7:00	MdK	Fluorometer	801434	--	--	--	2 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.003ppb, 10.03ppb, 99.45ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 10F0679), 100ppb (LOT# 1F0684) Exp. Jan 2023
22-Mar-22	7:15	MdK	HoribaU52	UG3N4PTO	Lab provided solutions; 4.00, 7.00, 10.00	4.00, 6.99, 10.01	--	Lab-provided auto calibration solution 4.0 pH, 4.49mS/cm, 0.0NTU	4.00pH, 4.50mS/cm, 0.0NTU	Y	
22-Mar-22	7:30	AMSC	DR900	181720001030	Absorbance Std Test Kit 520nm: Blank: 0.00 Std 1: 0.558 ± 0.05 Std 2: 1.141 ± 0.10 Std 3: 1.741 ± 0.15	0.000, 0.594, 1.187, 1.788	N	--	--	--	Cal checked using DR900 absorbance check kit (SN.2763900).
					Absorbance Std Test Kit 610nm: Blank: 0.00 Std 1: 0.566 ± 0.05 Std 2: 1.133 ± 0.10 Std 3: 1.730 ± 0.15	0.000, 0.605, 1.194, 1.799	N	--	--	--	
23-Mar-22	7:00	MdK	Fluorometer	801434	--	--	--	2 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.001ppb, 9.954ppb, 99.10ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 10F0679), 100ppb (LOT# 1F0684) Exp. Jan 2023
23-Mar-22	7:15	MdK	HoribaU52	UG3N4PTO	Lab provided solutions; 4.00, 7.00, 10.00	3.99, 6.98, 9.97	N	Lab-provided auto calibration solution 4.0 pH, 4.49mS/cm, 0.0NTU	4.00pH, 4.51mS/cm, 0.1NTU	Y	
24-Mar-22	7:00	MdK	Fluorometer	801434	--	--	--	2 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000ppb, 9.989ppb, 101.9ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 10F0679), 100ppb (LOT# 1F0684) Exp. Jan 2023
24-Mar-22	7:15	AMSC	HoribaU52	UG3N4PTO	--	--	--	Lab-provided auto calibration solution 4.0 pH, 4.49mS/cm, 0.0NTU	3.99pH, 4.49mS/cm, 0.0NTU	Y	Attempted pH cal check with buffer solutions but would not stabilize. Issue is likely with solutions and not the probe, the solutions have debris in them. Will replace for next quarter event.
25-Mar-22	8:50	AMSC	Fluorometer	801434	--	--	--	2 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000ppb, 10.02ppb, 98.54ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 10F0679), 100ppb (LOT# 1F0684) Exp. Jan 2023
25-Mar-22	8:55	AMSC	HoribaU52	UG3N4PTO	--	--	--	Lab-provided auto calibration solution 4.0 pH, 4.49mS/cm, 0.0NTU	3.99pH, 4.54mS/cm, 0.0NTU	Y	
25-Mar-22	8:55	AMSC	DR900	181720001030	Absorbance Std Test Kit 520nm: Blank: 0.00 Std 1: 0.558 ± 0.05 Std 2: 1.141 ± 0.10 Std 3: 1.741 ± 0.15	0.000, 0.577, 1.179, 1.769	N	--	--	--	Cal checked using DR900 absorbance check kit (SN.2763900).
					Absorbance Std Test Kit 610nm: Blank: 0.00 Std 1: 0.566 ± 0.05 Std 2: 1.133 ± 0.10 Std 3: 1.730 ± 0.15	0.000, 0.598, 1.193, 1.789	N	--	--	--	
26-Mar-22	10:30	AMSC	Fluorometer	801434	--	--	--	2 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	-0.010ppb, 9.975ppb, 102.1ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 10F0679), 100ppb (LOT# 1F0684) Exp. Jan 2023
26-Mar-22	10:30	AMSC	HoribaU52	UG3N4PTO	--	--	--	Lab-provided auto calibration solution 4.0 pH, 4.49mS/cm, 0.0NTU	3.99pH, 4.51mS/cm, 0.0NTU	Y	
26-Mar-22	14:30	AMSC	DR900	181720001030	Absorbance Std Test Kit 520nm: Blank: 0.00 Std 1: 0.558 ± 0.05 Std 2: 1.141 ± 0.10 Std 3: 1.741 ± 0.15	0.000, 0.594, 1.196, 1.797	N	--	--	--	Cal checked using DR900 absorbance check kit (SN.2763900).
					Absorbance Std Test Kit 610nm: Blank: 0.00 Std 1: 0.566 ± 0.05 Std 2: 1.133 ± 0.10 Std 3: 1.730 ± 0.15	0.000, 0.605, 1.185, 1.794	N	--	--	--	
27-Mar-22	8:00	AMSC	Fluorometer	801434	--	--	--	2 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	-0.005ppb, 9.989ppb, 101.9ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 10F0679), 100ppb (LOT# 1F0684) Exp. Jan 2023

Completed by:	AMSC, MdK	Verified by:	SNS
Date:	18 Mar - 26 Mar 2022	Date:	02-Apr-22

20-203-1: Laboratory Data Quality Confirmation Report

[illegible]

Notes:

[illegible]

Completed by:	AMSC	Verified by:	CAM
Date:	05-May-22	Date:	06-May-22

20-203-1: Laboratory Data Quality Confirmation Report

Well ID	IG_BH03			Pre Profile		Post Profile		Weather: 2 °C	
Datum:	Ground Surface	Probe Type:	MOSDAX	P _{atm}	98.16	kPa	P _{atm}	97.86	kPa
Elev. G.S.:	441.403	Serial No.:	EMS5230	Temp.	3.85	°C	Temp.	5.51	°C
Height of Westbay above G.S.:	1.299	Probe Range:	2000psi	Time	12:35	19-Mar-22	Time	16:08	19-Mar-22
Elev. Top of Westbay Casing:	442.702	Westbay Casing Type:	MP38	MP38 Water Level	66.58	mBTOC	MP38 Water Level	65.88	mBTOC
Reference Elevation:	441.403	Sampler Valve Position:	Closed					Specific Weight	9.807
Borehole angle:	70°							Gravitational Acceleration	9.8065
								P _{atm}	98.01

Notes:	
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Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (mBGS)	Fluid Pressure Readings						Inside Casing (P1) (kPa)	Pressure Head Outside Port (m) H=(P2- Patm)/w	Piezo Level Outside Port (m) Dz = Dp-H	Z: Elev of pressure measurement port (mASL)	Freshwater Head (mASL)	Comments	
				Inside Casing (P1) (psi)	Inside Casing (P1) (kPa)	Outside Casing (P2) (psi)	Outside Casing (P2) (kPa)	Time (H:M:S)	Probe Temp. (°C)							Inside Casing (P1) (psi)
1	966.8		888.57	n/a	8469.59	n/a	8638.46	13:24:00	12.95	n/a	8470.09	870.85	17.72	-447.17	423.69	Interval being pumped by NWMO for sampling. Re-landed to verify interval pressure (8265.19kPa)
2	943.9		868.28	n/a	8264.62	n/a	8265.79	13:35:00	13.01	n/a	8264.67	832.85	35.43	-426.88	405.98	
3	924.0		850.53	n/a	8085.72	n/a	8230.11	13:40:00	12.93	n/a	8085.77	829.21	21.32	-409.13	420.09	
4	882.8		813.57	n/a	7711.07	n/a	7932.42	13:45:00	12.66	n/a	7711.02	798.86	14.71	-372.17	426.69	
5	859.9		792.89	n/a	7501.32	n/a	7702.15	13:51:00	12.38	n/a	7501.38	775.38	17.51	-351.49	423.89	
6	794.3		733.26	n/a	6896.06	n/a	7129.15	13:59:00	11.92	n/a	6896.10	716.95	16.31	-291.86	425.09	
7	752.8		695.28	n/a	6510.94	n/a	6728.33	14:04:00	11.57	n/a	6511.06	676.08	19.20	-253.88	422.20	Verified by MdK
8	676.0		624.50	n/a	5793.25	n/a	6044.18	14:17:00	10.65	n/a	5793.76	606.32	18.18	-183.10	423.22	
9	637.8		589.28	n/a	5436.92	n/a	5692.03	14:23:00	10.38	n/a	5436.46	570.41	18.87	-147.88	422.53	
10	613.4		566.78	n/a	5208.53	n/a	5451.57	14:26:00	10.18	n/a	5208.67	545.89	20.89	-125.38	420.51	
11	567.7		524.65	n/a	4781.26	n/a	5044.58	14:32:00	9.83	n/a	4781.41	504.39	20.26	-83.25	421.14	
12	544.1		502.91	n/a	4561.90	n/a	4848.13	14:35:00	9.59	n/a	4562.04	484.36	18.55	-61.51	422.85	
13	506.1		467.93	n/a	4207.22	n/a	4510.68	14:40:00	9.28	n/a	4207.30	449.95	17.98	-26.53	423.42	
14	465.9		430.90	n/a	3831.90	n/a	4180.13	14:44:00	8.88	n/a	3832.06	416.25	14.65	10.50	426.75	
15	421.1		389.63	n/a	3415.19	n/a	3777.32	14:49:00	8.48	n/a	3415.36	375.17	14.46	51.77	426.94	
16	370.3		342.83	n/a	2941.75	n/a	3318.85	14:54:00	8.04	n/a	2941.55	328.42	14.41	98.57	427.00	
17	321.0		297.42	n/a	2482.88	n/a	2872.87	15:41:00	6.65	n/a	2482.09	282.95	14.47	143.98	426.93	Unable to get proper reading, issue with shoe, brought probe to surface to inspect and replace then continued profile
18	251.0		232.90	n/a	1831.67	n/a	2246.24	13:47:00	6.72	n/a	1831.58	219.05	13.85	208.50	427.55	
19	228.1		211.75	n/a	1617.92	n/a	2044.48	15:50:00	6.60	n/a	1618.02	198.48	13.27	229.65	428.13	
20	165.7		154.03	n/a	1036.98	n/a	1484.85	15:55:00	6.16	n/a	1036.79	141.41	12.62	287.37	428.79	
21	73.0		68.16	n/a	180.90	n/a	681.85	16:01:00	5.66	n/a	181.23	59.53	8.63	373.24	432.78	

Completed by:	AMSC	Verified by:	CAM
Date:	05-May-22	Date:	0-May-22

20-203-1: Laboratory Data Quality Confirmation Report

Well ID IG_BH05 Datum: Ground Surface Elev. G.S.: 432.29 m Height of Westbay above G.S.: 1.31 m AGS Elev. Top of Westbay Casing: 433.60 m Reference Elevation: 432.29 mASL Borehole angle: 70°	Probe Type: MOSDAX		Pre Profile		Post Profile		Weather: -2 °C sunny & windy	
	Serial No.: EMSS230		P _{atm} 99.14 kPa		P _{atm} 98.75 kPa			
	Probe Range: 2000psi		Temp. 10.83 °C		Temp. 5.64 °C			
	Westbay Casing Type: MP38		Time 8:30 21-Mar-22		Time 11:40 21-Mar-22			
	Sampler Valve Position: Closed		MP38 Water Level 29.38 mBTC		MP38 Water Level 30.06 mBTC			
							Gravitational Acceleratic 9.807 kN/m3 P _{atm} 9.8065 m/s2 98.95	

Notes:

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings						Pressure Head		Piezo Level Outside Port (m) Dz = Dp-H	Z: Elev of pressure measurement port (mASL)	Freshwater Head (mASL)	Comments	
				Inside Casing (P1) (psi)	Inside Casing (P1) (kPa)	Outside Casing (P2) (psi)	Outside Casing (P2) (kPa)	Time (H:M:S)	Probe Temp. (°C)	Inside Casing (P1) (psi)	Inside Casing (P1) (kPa)					Outside Port (m) H=(P2- Patm)/w
1	991.2		923.15	n/a	9000.99	n/a	9068.26	9:15:00	12.88	n/a	9000.17	914.58	8.57	-490.86	423.72	Re-checked values to confirm. Likely influenced by INT007 being purged Interval being purged Verified by MdK
2	974.3		907.47	n/a	8845.16	n/a	8899.54	9:20:00	13.22	n/a	8845.11	897.38	10.09	-475.18	422.20	
3	928.6		865.06	n/a	8422.66	n/a	8516.10	9:25:00	13.12	n/a	8422.76	858.28	6.78	-432.77	425.51	
4	865.5		806.50	n/a	7839.89	n/a	7936.99	9:33:00	12.54	n/a	7839.62	799.23	7.27	-374.21	425.02	
5	857.2		798.79	n/a	7762.73	n/a	7789.62	9:37:00	12.42	n/a	7762.84	784.20	14.59	-366.50	417.70	
6	800.8		746.43	n/a	7241.90	n/a	7232.98	9:46:00	11.79	n/a	7241.64	727.44	18.99	-314.14	413.30	
7	788.0		734.54	n/a	7122.43	n/a	7122.18	9:53:00	11.63	n/a	7122.49	716.15	18.39	-302.25	413.90	
8	736.2		686.45	n/a	6643.18	n/a	6683.67	9:59:00	11.36	n/a	6642.93	671.43	15.02	-254.16	417.27	
9	679.8		634.09	n/a	6122.41	n/a	6160.37	10:05:00	10.89	n/a	6122.56	618.07	16.02	-201.80	416.27	
10	635.0		592.48	n/a	5709.65	n/a	5776.51	10:10:00	10.46	n/a	5709.41	578.93	13.55	-160.19	418.74	
11	627.3		585.33	n/a	5638.43	n/a	5675.67	10:14:00	10.21	n/a	5638.56	568.65	16.68	-153.04	415.61	
12	587.7		548.51	n/a	5272.91	n/a	5334.83	10:18:00	9.90	n/a	5272.95	533.89	14.62	-116.22	417.67	
13	542.0		505.99	n/a	4851.25	n/a	4926.12	10:23:00	9.55	n/a	4851.01	492.22	13.77	-73.70	418.52	
14	487.2		454.95	n/a	4344.38	n/a	4405.82	10:28:00	9.07	n/a	4344.39	439.16	15.79	-22.66	416.50	
15	427.8		399.56	n/a	3795.51	n/a	3823.35	10:33:00	8.56	n/a	3795.75	379.77	19.79	32.73	412.50	
16	372.9		348.37	n/a	3288.49	n/a	3326.60	10:48:00	7.50	n/a	3288.49	329.12	19.25	83.92	413.04	
17	326.6		305.20	n/a	2860.46	n/a	2917.50	10:54:00	7.27	n/a	2860.63	287.40	17.80	127.09	414.49	
18	312.9		292.42	n/a	2733.59	n/a	2786.19	10:57:00	7.19	n/a	2733.77	274.01	18.41	139.87	413.88	
19	264.2		246.98	n/a	2283.39	n/a	2341.04	11:01:00	6.84	n/a	2283.48	228.62	18.36	185.31	413.93	
20	226.1		211.41	n/a	1931.51	n/a	1991.10	11:05:00	6.52	n/a	1931.45	192.94	18.47	220.88	413.82	
21	180.5		168.82	n/a	1509.41	n/a	1568.49	11:14:00	6.04	n/a	1509.51	149.85	18.97	263.47	413.32	
22	156.0		145.94	n/a	1283.22	n/a	1366.28	11:17:00	5.88	n/a	1283.32	129.23	16.71	286.35	415.58	
23	100.1		93.69	n/a	765.22	n/a	856.72	11:27:00	5.44	n/a	765.32	77.27	16.42	338.60	415.87	
24	90.9		85.09	n/a	680.37	n/a	786.62	11:30:00	5.40	n/a	680.48	70.12	14.97	347.20	417.32	
25	70.5		66.00	n/a	492.00	n/a	604.75	11:33:00	5.37	n/a	491.89	51.58	14.42	366.29	417.87	

Completed by:	AMSC	Verified by:	CAM
Date:	05-May-22	Date:	06-May-22

20-203-1: Laboratory Data Quality Confirmation Report

Well ID:	IG_BH01	Multiparameter Probe:	Horiba U52 (SN. UG3N4PTO)	Other Notes/Comments
Date(s):	24 Mar - 27 Mar 2022	Fluorometer:	AquaFluor (SN.801434)	
Operator(s):	AMSC, MdK	Colorimeter:	DR900 (SN. 181720001030)	

Port ID	Cumulative Purge/Sampled Volume (L)	Measurement Date and Time	Multiparameter Probe								Fluorometer		Hydrometer	Colorimetric				Alkalinity		Sample Collected (Y/N)	Comments (sampling run #, sample ID, water colour or odour, etc.)
			Calibrated	pH	Temp (°C)	EC (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	TDS (g/L)	Calibrated	Fluorescein (ppb)		Calibrated	Dissolved Oxygen (mg/L)	Dissolved Ferrous Iron Fe ²⁺ (mg/L)	Total Dissolved Sulphide S ²⁻ (mg/L)	Phenol. (mg/L)	Total as CaCO ₃ (mg/L)		
IG_BH01_IN T_T_004	12	2022-03-24 10:18	Y	6.48	3.58	16.1	235	1.65	22.7	10.0	Y	13.52	1.017	--	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85 mBTOC
IG_BH01_IN T_T_004	30	2022-03-24 12:05	Y	8.51	6.87	19.0	101	0.00	9.3	11.8	Y	11.37	1.018	--	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85 mBTOC
IG_BH01_IN T_T_004	38	2022-03-24 12:45	Y	8.72	6.50	19.4	73	0.00	5.7	12.0	Y	12.54	--	--	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85 mBTOC
IG_BH01_IN T_T_004	52	2022-03-24 14:20	Y	8.80	7.36	19.2	73	0.00	4.4	11.9	Y	11.33	1.015	--	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85 mBTOC
IG_BH01_IN T_T_004	62	2022-03-24 15:45	Y	8.76	7.40	19.1	103	0.00	6.3	11.8	Y	12.36	1.015	--	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85 mBTOC
IG_BH01_IN T_T_004	--	2022-03-26 14:45	Y	5.87	5.50	21.3	231	0.00	59.7	13.3	Y	5.665	1.017	Y	0.162	1.18	0.03	0	11	Y	Parameters and field analyses collected from Run#1 during sampling.
IG_BH01_IN T_T_004	--	2022-03-26 15:00	Y	6.25	5.44	21.7	148	0.00	44.5	13.5	--	--	--	--	--	--	--	--	--	Y	Parameters collected from sample water in measuring cup after 15 mins.
IG_BH01_IN T_T_004	--	2022-03-26 15:15	Y	6.95	6.36	21.4	43	0.00	27.6	13.3	--	--	--	--	--	--	--	--	--	Y	Parameters collected from sample water in measuring cup after 30 mins.
IG_BH01_IN T_T_004	--	2022-03-26 15:35	Y	7.15	6.81	21.6	15	0.00	14.9	13.3	--	--	--	--	--	--	--	--	--	Y	Parameters collected from sample water in measuring cup after 50 mins.
IG_BH01_IN T_T_004	--	2022-03-27 14:15	--	--	--	--	--	--	--	--	Y	8.554	--	--	--	--	--	--	--	Y	Collected during sampling from Run #6

Completed by:	AMSC	Verified by:	SNS
Date:	27-Mar-22	Date:	02-Apr-22

20-203-1: Laboratory Data Quality Confirmation Report

Well ID:	IG_BH01	Start Time	13:15
MP38 Water Level Before Sampling:	31.20 (Mar 26) / 31.11 (Mar 27)	m BTOC	Starting Ambient Pressure 98.38 (Mar 26) / 98.82 (Mar 27) kPa
MP38 Water Level After Sampling:	34.52 (Mar 26) / 34.77 (Mar 27)	m BTOC	End Sampling Time 14:30
Probe Serial #/Range	EMS5230/2000	kPa	Ending Ambient Pressure 98.66 (Mar 26) / 99.42 (Mar 27) kPa
Date:	26-27 - Mar -2022		

Other Notes/Comments:	IG_BH01_GW032 - Primary Sample
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Sampling Run Start Time	Port #	Run #	Function Tests/Preparation						Landed Port	Sampling Sequence								Sampling Run End Time	Comments (volume recovered, parameters measured, samples collected, etc)	
			Shoe-Out	Close Valve	Vaccum Check	Open Valve	Evacuate Bottles (<35 kPa)	Close Valve		Landed Westbay MP38 Pressure (pre-sample, kPa)	Shoe-Out	Zone Pressure (pre-sample, kPa)	Open-Valve	Stablization Time (sec)	Zone Pressure (post-sample kPa)	Close Valve	Shoe-In			Landed Westbay MP38 Pressure (post-sample, kPa)
13:55	IG_BH01_INT_T_004	1	x	x	x	x	x	x	x	7637.74	N/A	N/A	x	150	N/A	x	N/A	7625.40	14:40	Sample collected from inside MP38 casing, at 782mBHA. Run #1 used to collect field parameters and analytical measurements, Ru, SiO2, ammonia and nutreints.
15:15	IG_BH01_INT_T_004	2	x	x	x	x	x	x	x	7611.02	N/A	N/A	x	80	N/A	x	N/A	7609.26	15:48	Sample collected from inside MP38 casing, at 782mBHA. Run #2 used to collect noble gas samples.
16:23	IG_BH01_INT_T_004	3	x	x	x	x	x	x	x	7617.04	N/A	N/A	x	150	N/A	x	N/A	7605.22	17:00	Sample collected from inside MP38 casing, at 782mBHA. Run #3 used to collect archive and 18O/2H/3H samples
10:56	IG_BH01_INT_T_004	4	x	x	x	x	x	x	x	7640.51	N/A	N/A	x	160	N/A	x	N/A	7628.49	11:30	Sample collected from inside MP38 casing, at 782mBHA. Run #4 used to collect 14C, 13C, DOC and gen chem samples
12:20	IG_BH01_INT_T_004	5	x	x	x	x	x	x	x	7624.90	N/A	N/A	x	165	N/A	x	N/A	7612.98	12:55	Sample collected from inside MP38 casing, at 782mBHA. Run #5 used to collect archive 129I/36Cl, sulphide and metals samples
13:41	IG_BH01_INT_T_004	6	x	x	x	x	x	x	x	7613.74	N/A	N/A	x	150	N/A	x	N/A	7602.62	14:15	Sample collected from inside MP38 casing, at 782mBHA. Run #6 used to collect 87Sr/86Sr, 37Cl samples and fluorescein measurement

Note: Record field parameter measurements on 20-203-01: Field Parameter Measurement/Testing - Field Data Sheet

Completed by:	MdK/AMSC	Verified by:	SNS
Date:	27-Mar-22	Date:	02-Apr-22

20-203-1: Laboratory Data Quality Confirmation Report

Well ID:	IG_BH03	Multiparameter Probe:	Horiba U52 (SN. UG3N4PTO)	Other Notes/Comments
Date(s):	20 Mar - 23 Mar 2022	Fluorometer:	AquaFluor (SN.801434)	
Operator(s):	AMSC, MdK	Colorimeter:	DR900 (SN. 181720001030)	

Port ID	Cumulative Purge/Sampled Volume (L)	Measurement Date and Time	Multiparameter Probe								Fluorometer		Hydrometer	Colorimetric				Alkalinity		Sample Collected (Y/N)	Comments (sampling run #, sample ID, water colour or odour, etc.)
			Calibrated	pH	Temp (°C)	EC (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	TDS (g/L)	Calibrated	Fluorescein (ppb)		Calibrated	Dissolved Oxygen (mg/L)	Dissolved Ferrous Iron Fe ²⁺ (mg/L)	Total Dissolved Sulphide S ²⁻ (mg/L)	Phenol. (mg/L)	Total as CaCO ₃ (mg/L)		
IG_BH03_IN T_T_002	7	2022-03-20 12:50	Y	7.72	6.83	5.95	110	2.97	20.7	3.75	Y	27.02	1.001	--	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85mBTOC
IG_BH03_IN T_T_002	12	2022-03-20 13:50	Y	8.63	6.73	7.00	67	2.04	19.1	4.41	Y	19.19	1.001	--	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85mBTOC
IG_BH03_IN T_T_002	17	2022-03-20 14:45	Y	9.28	5.3	7.89	11	1.81	27.5	4.97	Y	18.95	--	--	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85mBTOC
IG_BH03_IN T_T_002	20	2022-03-20 15:50	Y	9.17	5.46	7.71	45	2.17	23.8	4.86	Y	18.49	1.002	--	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85mBTOC
IG_BH03_IN T_T_002	--	2022-03-22 14:00	Y	6.57	3.60	0.039	-13	0.00	368	0.025	Y	5.502	1.035	Y	>1.0	1.29	0.48	--	74	Y	Parameters and field analyses collected from Run#1 during sampling. Multiparameter probe not very reliable as the seal of the flow through cell failed. Sample water transferred to measuring cup.
IG_BH03_IN T_T_002	--	2022-03-22 14:30	Y	6.97	5.71	41.2	-83	2.83	45.8	25.1	--	--	--	--	--	--	--	--	--	Y	Parameters collected from sample water in measuring cup after 30 mins. Note that the use of the cup rather than the flow-through cell may affect redox sensitive parameters (DO, ORP, TDS)
IG_BH03_IN T_T_002	--	2022-03-23 13:30	--	--	--	--	--	--	--	--	Y	5.94	--	--	--	--	--	--	--	Y	Collected from Run #5 during sampling.

Completed by:	AMSC	Verified by:	SNS
Date:	23-Mar-22	Date:	02-Apr-22

20-203-1: Laboratory Data Quality Confirmation Report

Well ID:	IG_BH03	Start Time	11:25	Mar 22 2022
MP38 Water Level Before Sampling:	72.43 (Mar 22) / 72.66 (Mar 23)	m BTOC	Starting Ambient Pressure	97.56 (Mar 22) / 97.07 (Mar 23) kPa
MP38 Water Level After Sampling:	74.64 (Mar 22) / 75.61 (Mar 23)	m BTOC	End Sampling Time	16:35 Mar 23 2022
Probe Serial #/Range	EMS5230/2000	kPa	Ending Ambient Pressure	98.42 (Mar 22)/ 98.46 (Mar 23) kPa
Date:	22-23 Mar 2022			

Other Notes/Comments:	IG_BH03_GW013 - Primary Sample
	IG_BH03_GW014 - Rinsate Sample
	IG_BH03_GW015 - Field Blank Sample

Sampling Run Start Time	Port #	Run #	Function Tests/Preparation						Landed Port	Sampling Sequence								Sampling Run End Time	Comments (volume recovered, parameters measured, samples collected, etc)	
			Shoe-Out	Close Valve	Vaccum Check	Open Valve	Evacuate Bottles (<35 kPa)	Close Valve		Landed Westbay MP38 Pressure (pre-sample, kPa)	Shoe-Out	Zone Pressure (pre-sample, kPa)	Open-Valve	Stablization Time (sec)	Zone Pressure (post-sample kPa)	Close Valve	Shoe-In			Landed Westbay MP38 Pressure (post-sample, kPa)
12:33	IG_BH03_INT_T_002	1	x	x	x	x	x	x	x	8274.22	N/A	N/A	x	105	N/A	x	N/A	8266.47	13:33	Sample collected from inside MP38 casing, at 942mBHA. Run #1 used to collect field parameters and field analytical measurements
14:49	IG_BH03_INT_T_002	2	x	x	x	x	x	x	x	8261.68	N/A	N/A	x	140	N/A	x	N/A	8259.29	15:44	Sample collected from inside MP38 casing, at 942mBHA. Run #2 used to collect noble gas samples and general chemistry sample.
17:57	IG_BH03_INT_T_002	3	x	x	x	x	x	x	x	8270.00	N/A	N/A	x	110	N/A	x	N/A	8262.16	18:48	Sample collected from inside MP38 casing, at 942mBHA. Run #3 used to collect remainder of BVL sample suite (Ammonia, Nutrients, DOC, Sulphide, SiO2, Ru and metals)
11:02	IG_BH03_INT_T_002	4	x	x	x	x	x	x	x	8280.95	N/A	N/A	x	120	N/A	x	N/A	8273.00	11:48	Sample collected from inside MP38 casing, at 942mBHA. Run #4 used to collect 18O/2H/3H sample.
12:38	IG_BH03_INT_T_002	5	x	x	x	x	x	x	x	8273.40	N/A	N/A	x	110	N/A	x	N/A	8265.55	13:25	Sample collected from inside MP38 casing, at 942mBHA. Run #5 used to collect 14C, 13C, archive samples and fluorescein measurement.
14:18	IG_BH03_INT_T_002	6	x	x	x	x	x	x	x	8266.77	N/A	N/A	x	105	N/A	x	N/A	8258.70	15:10	Sample collected from inside MP38 casing, at 942mBHA. Run #6 used to collect 129I/36Cl sample.
15:52	IG_BH03_INT_T_002	7	x	x	x	x	x	x	x	8259.96	N/A	N/A	x	110	N/A	x	N/A	8252.05	16:35	Sample collected from inside MP38 casing, at 942mBHA. Run #7 used to colect 87Sr/86Sr and 37Cl samples.

Note: Record field parameter measurements on 20-203-01: Field Parameter Measurement/Testing - Field Data Sheet

Completed by:	MdK/AMSC	Verified by:	SNS
Date:	23-Mar-22	Date:	02-Apr-22

20-203-1: Laboratory Data Quality Confirmation Report

Well ID:	IG_BH05	Multiparameter Probe:	Horiba U52 (SN. UG3N4PTO)	Other Notes/Comments
Date(s):	21 Mar - 25 Mar 2022	Fluorometer:	AquaFluor (SN.801434)	
Operator(s):	AMSC, MdK	Colorimeter:	DR900 (SN. 181720001030)	

Port ID	Cumulative Purge/Sampled Volume (L)	Measurement Date and Time	Multiparameter Probe								Fluorometer		Hydrometer	Colorimetric				Alkalinity		Sample Collected (Y/N)	Comments (sampling run #, sample ID, water colour or odour, etc.)
			Calibrated	pH	Temp (°C)	EC (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	TDS (g/L)	Calibrated	Fluorescein (ppb)	Specific Gravity	Calibrated	Dissolved Oxygen (mg/L)	Dissolved Ferrous Iron Fe ²⁺ (mg/L)	Total Dissolved Sulphide S ²⁻ (mg/L)	Phenol. (mg/L)	Total as CaCO ₃ (mg/L)		
IG_BH05_IN T_T_007	12	2022-03-21 12:38	Y	7.60	6.16	1.53	198	12.31	8.6	0.982	Y	92.91	1.005	N/A	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85mBTOC
IG_BH05_IN T_T_007	20	2022-03-21 13:20	Y	8.26	5.84	0.241	182	0.49	7.3	0.157	Y	98.88	1.003	N/A	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85mBTOC
IG_BH05_IN T_T_007	30	2022-03-21 14:10	Y	8.68	6.41	0.219	158	0.72	7.4	0.142	Y	97.98	1.006	N/A	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85mBTOC
IG_BH05_IN T_T_007	50	2022-03-21 15:40	Y	8.74	6.63	0.276	176	1.42	6.9	0.180	Y	93.08	1.006	N/A	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85mBTOC
IG_BH05_IN T_T_007	55	2022-03-21 16:55	Y	8.20	7.12	0.292	182	1.40	6.9	0.190	Y	89.84	--	N/A	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85mBTOC
IG_BH05_IN T_T_007	--	2022-03-21 17:30	Y	8.09	7.13	0.291	185	1.68	6.8	0.189	Y	94.54	1.005	N/A	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85mBTOC
IG_BH05_IN T_T_007	--	2022-03-25 10:00	Y	6.11	5.72	5.55	-21	0.00	11.2	3.49	Y	37.79	1.005	Y	>1.0	2.85	0.05	0	206	Y	Parameters and field analyses collected from Run#1 during sampling.
IG_BH05_IN T_T_007	--	2022-03-25 10:35	Y	6.73	5.99	5.54	-67	0.00	7.8	3.49	N/A	--	--	N/A	--	--	--	--	--	N	Parameters collected after keeping Horiba in sample for 35 minutes

Completed by:	AMSC, MdK	Verified by:	SNS
Date:	Mar 21-25, 2022	Date:	02-Apr-22

20-203-1: Laboratory Data Quality Confirmation Report

Well ID:	IG_BH05	Start Time	8:45
MP38 Water Level Before Sampling:	30.28 (Mar 25) / 31.49 (Mar 26)	m BTOC	Starting Ambient Pressure 96.63 (Mar 25) / 97.93 (Mar 26) kPa
MP38 Water Level After Sampling:	34.76 (Mar 25) / 32.68 (Mar 26)	m BTOC	End Sampling Time 11:30
Probe Serial #/Range	EMS5230/2000	kPa	Ending Ambient Pressure 97.08 (Mar 25) / 98.77 (Mar 26) kPa
Date:	25-26 Mar 2022		

Other Notes/Comments:	IG_BH05_GW001 - Primary Sample
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Sampling Run Start Time	Port #	Run #	Function Tests/Preparation						Landed Port	Sampling Sequence								Sampling Run End Time	Comments (volume recovered, parameters measured, samples collected, etc)	
			Shoe-Out	Close Valve	Vacuum Check	Open Valve	Evacuate Bottles (<35 kPa)	Close Valve		Landed Westbay MP38 Pressure (pre-sample, kPa)	Shoe-Out	Zone Pressure (pre-sample, kPa)	Open-Valve	Stablization Time (sec)	Zone Pressure (post-sample kPa)	Close Valve	Shoe-In			Landed Westbay MP38 Pressure (post-sample, kPa)
9:15	IG_BH05_INT_T_007	1	x	x	x	x	x	x	x	7134.77	N/A	N/A	x	110	N/A	x	N/A	7126.39	9:50	Sample collected from inside MP38 casing, at 788mBHA. Run #1 used to collect field parameters and field analytical measurements
10:30	IG_BH05_INT_T_007	2	x	x	x	x	x	x	x	7128.39	N/A	N/A	x	100	N/A	x	N/A	7119.70	11:10	Sample collected from inside MP38 casing, at 788mBHA. Run #2 used to collect 87/86Sr and 37Cl
11:54	IG_BH05_INT_T_007	3	x	x	x	x	x	x	x	7118.22	N/A	N/A	x	110	N/A		N/A	7109.72	12:30	Sample collected from inside MP38 casing, at 788mBHA. Run #3 used to collect 14C, 13C and metals
13:15	IG_BH05_INT_T_007	4	x	x	x	x	x	x	x	7108.93	N/A	N/A	x	120	N/A	x	N/A	7100.49	13:50	Sample collected from inside MP38 casing, at 788mBHA. Run #4 used to collect 18O/2H/3H
14:37	IG_BH05_INT_T_007	5	x	x	x	x	x	x	x	7093.60	N/A	N/A	x	120	N/A	x	N/A	7092.94	15:13	Sample collected from inside MP38 casing, at 788mBHA. Run #5 used to collect noble gas and SiO2
15:46	IG_BH05_INT_T_007	6	x	x	x	x	x	x	x	7103.61	N/A	N/A	x	100	N/A	x	N/A	7095.60	16:20	Sample collected from inside MP38 casing, at 788mBHA. Run #6 used to collect 129I/36Cl
10:23	IG_BH05_INT_T_007	7	x	x	x	x	x	x	x	7131.80	N/A	N/A	x	150	N/A	x	N/A	7120.75	11:00	Sample collected from inside MP38 casing, at 788mBHA. Run #7 used to collect gen chem, sulphide, DOC and archive.

Note: Record field parameter measurements on 20-203-01: Field Parameter Measurement/Testing - Field Data Sheet

Completed by:	AMSC, MdK	Verified by:	SNS
Date:	26-Mar-22	Date:	02-Apr-22

20-203-1: Laboratory Data Quality Confirmation Report

COC Number/ID	Sample ID(s)	Shipping Information						Receiving Information				Comments
		Shipped Date	Shipped Time	Temp. Shipped (deg C)	COC Signed by Geofirma (Y/N)	Shipping Address	Shipping Method	Received Date	Received Time	Temp Received (deg C)	COC Signed By Receiving Lab (Y/N)	
GFIM_BVL_0005	IG_BH03_GW013, IG_BH03_GW014	23-Mar-22	7:00	<10	Y	946 Cobalt Crescent, Thunder Bay, ON P7B 5W3	Courier	24-Mar-22	13:44	3,2,2	Y	
GFIM_BVL_0006	IG_BH01_GW032, IG_BH05_GW001	28-Mar-22	7:30	<10	Y	946 Cobalt Crescent, Thunder Bay, ON P7B 5W3	Courier	29-Mar-22	16:26	1,2,1	Y	
GFIM_IT2_0004	IG_BH03_GW013, IG_BH03_GW015, IG_BH01_GW032, IG_BH05_GW001	28-Mar-22	7:30	<10	Y	608 Weber St. North, Unit 3, Waterloo ON N2V 1K4	Courier	31-Mar-22	--	--	Y	
GFIM_NWMO_0004	IG_BH03_GW013, IG_BH01_GW032, IG_BH05_GW001	28-Mar-22	7:30	<10	Y	304 Main St., Ignace ON P0T 1T0	Hand delivered	28-Mar-22	7:30	<10	Y	
GFIM_UofO_0004	IG_BH03_GW013, IG_BH01_GW032, IG_BH05_GW001	06-Apr-22	15:00	<10	Y	25 Templeton St., Ottawa ON	Hand delivered	06-Apr-22	15:30	--	Y	

Completed by:	AMSC	Verified by:	CAM
Date:	06-Apr-22	Date:	06-May-22

20-203-1: Laboratory Data Quality Confirmation Report

Laboratory Report Date	19-Apr-22
Laboratory Name	Bureau Veritas Laboratory
Laboratory Report ID (If applicable)	C279306, C283100
Analyses Completed	Major and Trace Elements and Metals; Total dissolved sulphur; Total dissolved iron; Reactive silica; Sulphide; Anions; pH; Alkalinity; Fluoride; TIC; TOC; DOC; TKN; Total Phosphorus; Total Ammonia; Total Nitrogen; Carbonate, Bicarbonate and Hydroxide

Associated COC #(s)	GFIM_BVL_0005, GFIM_BVL_0006
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Samples Included in Laboratory Report
IG_BH03_GW013, IG_BH03_GW014, IG_BH01_GW032, IG_BH05_GW001

Quality Check and Verification	Verified By (Initials)	Comments
Results received from laboratory	AMSC	
All samples were tested or accounted for. Justification provided for any untested samples (e.g. spare sample)	AMSC	
Laboratory data report provided with results	AMSC	
Laboratory testing methods/techniques included in data report	AMSC	
Laboratory QA procedures and equipment calibration included in data report	AMSC	
Laboratory results are within reasonable/expected range	AMSC	DOC and TOC for sample IG_BH05_GW001 and IG_BH03_GW013 seem a bit high, Geofirma reached out to BV re-run the analyses, and it the original values reported were confirmed.

Other Comments/Notes:
RDL for metals on samples IG_BH01_GW032 and IG_BH03_GW013 are higher than what is normally reported. Geofirma has reached out to the lab to verify the reasoning behind this or if it was mis-reported. Lab confirmed the raised RDLs were due to elevated concentrations of Ca, Na and Sr.

Note: A copy of this form is to be complete for each laboratory data report that is received by Geofirma

Completed by: AMSC	Verified by: CAM
Date: 04-May-22	Date: 06-May-22

20-203-1: Laboratory Data Quality Confirmation Report

Laboratory Report Date	2022-07-04, 2022-09-20
Laboratory Name	University of Ottawa (Radiohalides Laboratory)
Laboratory Report ID (If applicable)	20220704
Analyses Completed	129-I, 36-Cl

Associated COC #(s)	GFIM_UofO_0004
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Samples Included in Laboratory Report
IG_BH03_GW013, IG_BH01_GW032, IG_BH05_GW001

Quality Check and Verification	Verified By (Initials)	Comments
Results received from laboratory	AMSC	
All samples were tested or accounted for. Justification provided for any untested samples (e.g. spare sample)	AMSC	
Laboratory data report provided with results	AMSC	
Laboratory testing methods/techniques included in data report	AMSC	
Laboratory QA procedures and equipment calibration included in data report	AMSC	
Laboratory results are within reasonable/expected range	AMSC	

Other Comments/Notes:
Received original lab report for 129-I on July 4 2022, requested the lab re-issue the report to adjust the reporting units to atoms/g to keep it consistent with previous reports. Geofirma received revised lab report on October 28, 2022.
Received lab report for 36-Cl on September 20, 2022.

Note: A copy of this form is to be complete for each laboratory data report that is received by Geofirma

Completed by: AMSC	Verified by: CAM
Date: 2022-07-08 / 2022-10-31	Date: 21-Jul-22

20-203-1: Laboratory Data Quality Confirmation Report

Laboratory Report Date	2022-10-26 / 2023-03-30
Laboratory Name	University of Ottawa - Noble Gases Laboratory
Laboratory Report ID (If applicable)	n/a
Analyses Completed	Noble gases (He, Ne, Ar, Kr, Xe)

Associated COC #(s)	GFIM_UofO_0004
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Samples Included in Laboratory Report
IG_BH03_GW013, IG_BH01_GW032, IG_BH05_GW001

Quality Check and Verification	Verified By (Initials)	Comments
Results received from laboratory	AMSC	
All samples were tested or accounted for. Justification provided for any untested samples (e.g. spare sample)	AMSC	
Laboratory data report provided with results	AMSC	
Laboratory testing methods/techniques included in data report	AMSC	
Laboratory QA procedures and equipment calibration included in data report	AMSC	
Laboratory results are within reasonable/expected range	AMSC	

Other Comments/Notes:
<p>Note: Previous reports included 21Ne results, going forward only 20 and 22 Ne will be reported.</p> <p>Received revised noble gas report, including the missing Ar ratios. [30-Mar-2023]</p>

Note: A copy of this form is to be complete for each laboratory data report that is received by Geofirma

Completed by: AMSC	Verified by: SNS
Date: 2022-11-03 / 2023-04-04	Date: 04-Nov-22

20-203-1: Laboratory Data Quality Confirmation Report

Laboratory Report Date	08-Aug-22
Laboratory Name	Isotope Tracer Technologies Inc. (IT2)
Laboratory Report ID (If applicable)	220158
Analyses Completed	18-O, 2-H, 3-H, 87-Sr/86-Sr, 37-Cl, 13-C, 14-C

Associated COC #(s)	GFIM_IT2_0004
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Samples Included in Laboratory Report
IG_BH03_GW013, IG_BH03_GW015, IG_BH01_GW032, IG_BH05_GW001

Quality Check and Verification	Verified By (Initials)	Comments
Results received from laboratory	AMSC	
All samples were tested or accounted for. Justification provided for any untested samples (e.g. spare sample)	AMSC	
Laboratory data report provided with results	AMSC	
Laboratory testing methods/techniques included in data report	AMSC	
Laboratory QA procedures and equipment calibration included in data report	AMSC	
Laboratory results are within reasonable/expected range	AMSC	

Other Comments/Notes:

Note: A copy of this form is to be complete for each laboratory data report that is received by Geofirma

Completed by: AMSC	Verified by: SNS
Date: 30-Sep-22	Date: 04-Nov-22

2022 Q2 (June)
Data Quality Workbook (DQC)

20-203-1: Decontamination Record Form

Ignace Fluid Pressure Profiling and Sampling

Borehole ID:	BH01, BH03, BH05, BH06	Comments:
Date:	May 27 - June 06 2022	
Completed by:	AMSC, TKG	
Sampling Interval:	IG_BH01_T_INT_004, IG_BH03_T_INT_002, IG_BH05_T_INT_007	

Equipment	Date/Time	Decontamination Required (Y/N)	Location	PPE	Decontamination Procedure					Comments
					Loose Contamination Removed	Detergent Wash (record type of detergent used)	Dionized Water Rinse	Air Dried (Minimize Dust)	Rinsate Sample Collected (Y/N)	
Electronic Water Level Tape	2022-05-27 10:20	Y	IG_BH05	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-05-27 10:20	Y	IG_BH05	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-05-27 13:45	Y	IG_BH06	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-05-27 13:45	Y	IG_BH06	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-05-28 8:45	Y	IG_BH05	Y	Y	Alconox	Y	Y	N	
Solinst double valve pump	2022-05-28 9:00	Y	IG_BH05	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-05-29 9:45	Y	IG_BH05	Y	Y	Alconox	Y	Y	N	
Westbay sample bottles x 6	2022-05-29 9:50	Y	IG_BH05	Y	Y	Alconox	Y	Y	Y	Rinsate sample collected: IG_BH05_GW003
Electronic Water Level Tape	2022-05-30 14:30	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-05-30 14:40	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-05-31 9:15	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-05-31 9:15	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
Solinst double valve pump	2022-05-31 12:30	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-06-01 8:45	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-06-01 8:50	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
Solinst double valve pump	2022-06-01 9:35	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-06-02 9:00	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-06-02 9:00	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
Westbay sample bottles x 6	2022-06-02 9:00	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-06-04 11:30	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-06-04 11:30	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
Westbay sample bottles x 6	2022-06-04 11:30	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-06-06 15:30	Y	IG_BH01	Y	Y	None	Y	Y	N	DI rinsed after sampling before returning to NWMO
Westbay sample bottles x 6	2022-06-06 13:30	Y	IG_BH01	Y	Y	None	Y	Y	N	DI rinsed after sampling before returning to NWMO

Completed by:	AMSC	Verified by:	MdK
Date:	06-Jun-22	Date:	12-Jul-22

Date	Time	Personnel	Equipment Type	Serial Number	Calibration Check			Calibration Performed			Comments
					Check Method & Standard(s) Used	Equipment Reading(s)	Calibration Required (Y/N)	Calibration Method & Standard(s) Used	Equipment Reading(s)	Calibration Completed (Y/N)	
27-May-22	10:30	AMSC	MOSDAX Probe	EMS4960	Manual W/LP vs. Probe P	Manual P (anticipated) = 276.72 KPa; P (measured) = 288.32 Kpa	N	--	--	--	
28-May-22	9:15	AMSC	Fluorometer	807537	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000ppb, 9.900ppb, 99.61ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1GF0679), 100ppb (LOT# 1F0680) Exp. Jan 2023
28-May-22	9:20	AMSC	HoribaU52	40H7XHMF	Lab provided solutions; 4.00, 7.00, 10.00	4.00, 7.01, 10.01	--	Lab-provided auto calibration solution 4.0 Ph, 4.49mS/cm, 0.0NTU	4.00pH, 4.49mS/cm, 0.0NTU	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470, Exp. Oct 2022), pH 10.0 (LOT# 0GJ821, Exp. Oct 2022), pH 7.0 (LOT# 1GF003, Exp. Jun 2023), pH 4.0 (LOT# 1GE539, Exp. May 2023)
29-May-22	7:15	AMSC	Fluorometer	807537	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000ppb, 9.967ppb, 99.82ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1GF0679), 100ppb (LOT# 1F0680) Exp. Jan 2023
29-May-22	7:15	TKG	HoribaU52	40H7XHMF	Lab provided solutions; 4.00, 7.00, 10.00	4.00, 7.00, 10.00	--	Lab-provided auto calibration solution 4.0 Ph, 4.49mS/cm, 0.0NTU	4.00pH, 4.51mS/cm, 0.0NTU	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470, Exp. Oct 2022), pH 10.0 (LOT# 0GJ821, Exp. Oct 2022), pH 7.0 (LOT# 1GF003, Exp. Jun 2023), pH 4.0 (LOT# 1GE539, Exp. May 2023)
29-May-22	7:30	AMSC	DR900	200660001027	Absorbance Std Test Kit	520nm: Blank: 0.00 Std 1: 0.558 ± 0.05 Std 2: 1.141 ± 0.10 Std 3: 1.741 ± 0.15	520nm: Blank: 0.00 Std 1: 0.588 Std 2: 1.174 Std 3: 1.782	N	--	--	Cal checked using DR900 absorbance check kit (SN.2763900).
						610nm: Blank: 0.00 Std 1: 0.566 ± 0.05 Std 2: 1.133 ± 0.10 Std 3: 1.730 ± 0.15	610nm: Blank: 0.00 Std 1: 0.588 Std 2: 1.162 Std 3: 1.779	N	--	--	
30-May-22	7:15	AMSC	Fluorometer	807537	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000ppb, 9.901ppb, 99.63ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1GF0679), 100ppb (LOT# 1F0680) Exp. Jan 2023
30-May-22	7:20	AMSC	HoribaU52	40H7XHMF	Lab provided solutions; 4.00, 7.00, 10.00	4.00, 7.00, 10.00	--	Lab-provided auto calibration solution 4.0 Ph, 4.49mS/cm, 0.0NTU	3.99pH, 4.49mS/cm, 0.0NTU	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470, Exp. Oct 2022), pH 10.0 (LOT# 0GJ821, Exp. Oct 2022), pH 7.0 (LOT# 1GF003, Exp. Jun 2023), pH 4.0 (LOT# 1GE539, Exp. May 2023)
31-May-22	12:15	AMSC	Fluorometer	807537	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000ppb, 10.03ppb, 99.57ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1GF0679), 100ppb (LOT# 1F0680) Exp. Jan 2023
31-May-22	12:05	AMSC	HoribaU52	40H7XHMF	Lab provided solutions; 4.00, 7.00, 10.00	4.00, 7.00, 10.01	--	Lab-provided auto calibration solution 4.0 Ph, 4.49mS/cm, 0.0NTU	3.99pH, 4.49mS/cm, 0.0NTU	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470, Exp. Oct 2022), pH 10.0 (LOT# 0GJ821, Exp. Oct 2022), pH 7.0 (LOT# 1GF003, Exp. Jun 2023), pH 4.0 (LOT# 1GE539, Exp. May 2023)
01-Jun-22	9:15	AMSC	Fluorometer	807537	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000ppb, 9.963ppb, 99.41ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1GF0679), 100ppb (LOT# 1F0680) Exp. Jan 2023
01-Jun-22	9:25	AMSC	HoribaU52	40H7XHMF	Lab provided solutions; 4.00, 7.00, 10.00	4.00, 7.00, 10.00	--	Lab-provided auto calibration solution 4.0 Ph, 4.49mS/cm, 0.0NTU	3.99pH, 4.52mS/cm, 0.0NTU	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470, Exp. Oct 2022), pH 10.0 (LOT# 0GJ821, Exp. Oct 2022), pH 7.0 (LOT# 1GF003, Exp. Jun 2023), pH 4.0 (LOT# 1GE539, Exp. May 2023)
02-Jun-22	7:20	AMSC	Fluorometer	807537	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000ppb, 9.909ppb, 99.81ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1GF0679), 100ppb (LOT# 1F0680) Exp. Jan 2023
02-Jun-22	7:30	AMSC	HoribaU52	40H7XHMF	Lab provided solutions; 4.00, 7.00, 10.00	4.00, 7.00, 10.00	--	Lab-provided auto calibration solution 4.0 Ph, 4.49mS/cm, 0.0NTU	4.00pH, 4.49mS/cm, 0.0NTU	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470, Exp. Oct 2022), pH 10.0 (LOT# 0GJ821, Exp. Oct 2022), pH 7.0 (LOT# 1GF003, Exp. Jun 2023), pH 4.0 (LOT# 1GE539, Exp. May 2023)
02-Jun-22	7:45	AMSC	DR900	200660001027	Absorbance Std Test Kit	520nm: Blank: 0.00 Std 1: 0.558 ± 0.05 Std 2: 1.141 ± 0.10 Std 3: 1.741 ± 0.15	520nm: Blank: 0.00 Std 1: 0.583 Std 2: 1.163 Std 3: 1.797	N	--	--	Cal checked using DR900 absorbance check kit (SN.2763900).
						610nm: Blank: 0.00 Std 1: 0.566 ± 0.05 Std 2: 1.133 ± 0.10 Std 3: 1.730 ± 0.15	610nm: Blank: 0.00 Std 1: 0.577 Std 2: 1.152 Std 3: 1.766	N	--	--	
04-Jun-22	7:15	AMSC	Fluorometer	807537	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000ppb, 10.01ppb, 99.66ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1GF0679), 100ppb (LOT# 1F0680) Exp. Jan 2023
04-Jun-22	7:30	AMSC	HoribaU52	40H7XHMF	Lab provided solutions; 4.00, 7.00, 10.00	4.00, 7.00, 10.02	--	Lab-provided auto calibration solution 4.0 Ph, 4.49mS/cm, 0.0NTU	4.00pH, 4.50mS/cm, 0.0NTU	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470, Exp. Oct 2022), pH 10.0 (LOT# 0GJ821, Exp. Oct 2022), pH 7.0 (LOT# 1GF003, Exp. Jun 2023), pH 4.0 (LOT# 1GE539, Exp. May 2023)
04-Jun-22	7:25	AMSC	DR900	200660001027	Absorbance Std Test Kit	520nm: Blank: 0.00 Std 1: 0.558 ± 0.05 Std 2: 1.141 ± 0.10 Std 3: 1.741 ± 0.15	520nm: Blank: 0.00 Std 1: 0.585 Std 2: 1.163 Std 3: 1.779	N	--	--	Cal checked using DR900 absorbance check kit (SN.2763900).
						610nm: Blank: 0.00 Std 1: 0.566 ± 0.05 Std 2: 1.133 ± 0.10 Std 3: 1.730 ± 0.15	610nm: Blank: 0.00 Std 1: 0.589 Std 2: 1.165 Std 3: 1.774	N	--	--	
06-Jun-22	9:00	AMSC	Fluorometer	807537	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000ppb, 9.914ppb, 99.54ppb	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1GF0679), 100ppb (LOT# 1F0680) Exp. Jan 2023
06-Jun-22	9:20	AMSC	HoribaU52	40H7XHMF	Lab provided solutions; 4.00, 7.00, 10.00	3.99, 7.00, 10.00	--	Lab-provided auto calibration solution 4.0 Ph, 4.49mS/cm, 0.0NTU	3.99pH, 4.51mS/cm, 0.0NTU	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470, Exp. Oct 2022), pH 10.0 (LOT# 0GJ821, Exp. Oct 2022), pH 7.0 (LOT# 1GF003, Exp. Jun 2023), pH 4.0 (LOT# 1GE539, Exp. May 2023)

Completed by:	AMSC	Verified by:	MdK
Date:	06-Jun-22	Date:	12-Jul-22

Ignace Fluid Pressure Profiling and Sampling

Well ID	IG_BH01			Pre Profile		Post Profile		Weather: 25.0 °C		
Datum:	Ground Level	Probe Type:	MOSDAX	P_{atm}	94.30	kPa	P_{atm}	95.10	kPa	
Elev. G.S.:	430.562	m	Serial No.:	EMS4960	Temp.	23.16	°C	Temp.	5.59	°C
Height of Westbay above G.S.:	0.32	m	AGS	Probe Range:	2000psi	Date/Time	2022-05-30 14:55	Date/Time	2022-05-30 17:03	
Elev. Top of Westbay Casing:	430.88	m	Westbay Casing Type:	MP38	MP38 Water Level	51.07	mBTOC	MP38 Water Level	51.255	mBTOC
Reference Elevation:	430.562	mASL	Sampler Valve Position:	Closed						
Borehole angle:	-90									

Notes:

[illegible]

Completed by: AMSC	Verified by: MdK
Date: 30-May-22	Date: 12-Jul-22 / 30-Oct-22

Ignace Fluid Pressure Profiling and Sampling

Well ID	JG_BH03			Pre Profile		Post Profile		Weather:	
Datum:	Ground Level	Probe Type:	MOSDAX	P _{atm}	93.12 kPa	P _{atm}	93.95 kPa		17 °C
Elev. G.S.:	441.403 m	Serial No.:	EMS4960	Temp.	17.49 °C	Temp.	5.82 °C		Rainy
Height of Westbay above G.S.:	1.299 m AGS	Probe Range:	2000psi	Date/Time	2022-05-31 9:38	Date/Time	2022-05-31 11:45		
Elev. Top of Westbay Casing:	442.702 m	Westbay Casing Type:	MP38	MP38 Water Level	60.62 mBTOC	MP38 Water Level	60.96 mBTOC	Specific Weight	9.807 kN/m³
Reference Elevation:	441.403 mASL	Sampler Valve Position:	Closed					Gravitational Accelerati	9.8065 m/s²
Borehole angle:	-70°							P _{atm}	93.54

Notes:	
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[illegible]

Completed by: AMSC	Verified by: MdK
Date: 31-May-22	Date: 12-Jul-22 / 30-Oct-22

Well ID IG_BH05	Probe Type: MOSDAX	Pre Profile	Post Profile	Weather: 15 °C
Datum: Ground Level	Serial No.: EMS4960	P _{atm} 95.52 kPa	P _{atm} 95.55 kPa	Sunny
Elev. G.S.: 432.29 m	Probe Range: 2000psi	Temp. 20.99 °C	Temp. 5.62 °C	
Height of Westbay above G.S.: 1.31 m AGS	Westbay Casing Type: MP38	Date/Time 2022-05-27 10:25	Date/Time 2022-05-27 13:05	
Elev. Top of Westbay Casing: 433.60 m	Sampler Valve Position: Closed	MP38 Water Level 51.675 mBTC	MP38 Water Level 50.32 mBTC	Specific Weight 9.807 kN/m3
Reference Elevation: 432.29 mASL				Gravitational Accelerati 9.8065 m/s2
Borehole angle: -70				P _{atm} 95.54

Notes:

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m BGS)	Fluid Pressure Readings							Pressure Head Outside Port (m) H=(P2-Patm)/w	Piezo Level Outside Port (m) Dz = Dp-H	Z: Elev of pressure measurement port (mASL)	Freshwater Head (mASL)	Comments	
				Start Profile Time	Inside Casing (P1- Landed Pressure) (kPa)	Shoe Out	Outside Casing (P2) (kPa)	Time (H:M:S)	Probe Temp. (°C)	Shoe In						Inside Casing (P1) (kPa)
1	991.20		923.15	11:20:00	8840.15	x	9052.29	11:21:00	13.29	x	8839.94	913.30	9.85	-490.86	422.44	
2	974.30		907.47	11:25:00	8683.88	x	8894.21	11:26:00	13.40	x	8684.36	897.18	10.29	-475.18	422.00	Winch not spooling properly. Attempted to try to reposition but too much weight on wireline/ guide would not move. Will try again at top.
3	928.60		865.06	11:45:00	8260.50	x	8473.44	11:46:00	13.19	x	8260.55	854.28	10.78	-432.77	421.51	re-checked values by shoeing out a again (8472.64kPa)
4	865.50		806.50	11:51:00	7674.38	x	7888.10	11:52:00	12.66	x	7674.39	794.59	11.91	-374.21	420.38	
5	857.20		798.79	11:54:00	7597.52	x	7780.25	11:54:00	12.48	x	7597.63	783.59	15.20	-366.50	417.09	
6	800.80		746.43	11:59:00	7074.66	x	7159.26	12:00:00	12.04	x	7075.01	720.27	26.16	-314.14	406.13	
7	788.00		734.54	12:01:00	6955.39	x	6955.54	12:02:00	11.84	x	6955.73	699.50	35.04	-302.25	397.25	Re-landed to confirm value (6955.69kPa). Verified by TKG. Interval being purged by NWMO.
8	736.20		686.45	12:06:00	6475.24	x	6633.04	12:07:00	11.39	x	6475.21	666.62	19.83	-254.16	412.46	
9	679.80		634.09	12:11:00	5953.29	x	6110.47	12:12:00	10.89	x	5953.38	613.33	20.76	-201.80	411.53	
10	635.00		592.48	12:15:00	5538.51	x	5754.25	12:16:00	10.44	x	5538.08	577.01	15.47	-160.19	416.82	
11	627.30		585.33	12:17:00	5466.46	x	5671.89	12:18:00	10.28	x	5466.75	568.61	16.72	-153.04	415.57	
12	587.70		548.51	12:20:00	5099.76	x	5311.34	12:21:00	9.94	x	5099.63	531.85	16.66	-116.22	415.63	
13	542.00		505.99	12:23:00	4675.22	x	4875.51	12:24:00	9.52	x	4675.55	487.40	18.59	-73.70	413.70	
14	487.20		454.95	12:27:00	4166.25	x	4374.61	12:28:00	9.03	x	4166.51	436.33	18.62	-22.66	413.67	
15	427.80		399.56	12:31:00	3614.15	x	3821.55	12:32:00	8.48	x	3614.41	379.93	19.63	32.73	412.66	
16	372.90		348.37	12:36:00	3105.47	x	3333.08	12:38:00	7.81	x	3105.66	330.13	18.24	83.92	414.05	
17	326.60		305.20	12:40:00	2676.11	x	2925.16	12:41:00	7.45	x	2676.26	288.53	16.67	127.09	415.62	
18	312.90			12:43:00	2548.81	x	2786.69	12:44:00	7.25	x	2548.90	274.41	-274.41	432.29	706.70	
19	264.20		246.98	12:46:00	2097.23	x	2340.66	12:47:00	6.87	x	2096.88	228.93	18.05	185.31	414.24	
20	226.10		211.41	12:48:00	1743.77	x	1998.28	12:49:00	6.54	x	1743.81	194.02	17.39	220.88	414.90	
21	180.5		168.82	12:52:00	1320.32	x	1571.26	12:53:00	6.16	x	1320.77	150.48	18.34	263.47	413.95	
22	156.0		145.94	12:54:00	1093.56	x	1369.42	12:55:00	5.96	x	1093.12	129.90	16.04	286.35	416.25	
23	100.1		93.69	12:58:00	574.23	x	857.00	12:59:00	5.70	x	574.63	77.65	16.04	338.60	416.25	
24	90.9		85.09	12:59:00	489.29	x	789.55	13:00:00	5.61	x	489.25	70.77	14.32	347.20	417.97	verified by TKG
25	70.5		66.00	13:02:00	300.24	x	618.08	13:02:00	5.54	x	300.68	53.28	12.72	366.29	419.57	

Completed by: AMSC	Verified by: MdK
Date: 27-May-22	Date: 12-Jul-22 / 30-Oct-22

Well ID IG_BH06	Probe Type: MOSDAX	Pre Profile	Post Profile	Weather: 20 °C
Datum: Ground Level	Serial No.: EMS4960	P _{atm} 95.55 kPa	P _{atm} 95.65 kPa	Sunny
Elev. G.S.: 417.74 m	Probe Range: 2000psi	Temp. 20.45 °C	Temp. 5.30 °C	
Height of Westbay above G.S.: 0.91 m AGS	Westbay Casing Type: MP38	Date/Time 2022-05-27 14:05	Date/Time 2022-05-27 16:37	
Elev. Top of Westbay Casing: 418.65 m	Sampler Valve Position: Closed	MP38 Water Level 41.80 mBTOC	MP38 Water Level 42.05 mBTOC	Specific Weight 9.807 kN/m3
Reference Elevation: 417.74 mASL				Gravitational Acceleration 9.8065 m/s2
Borehole angle: -70				P _{atm} 95.60

Notes:

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m BGS)	Fluid Pressure Readings							Pressure Head Outside Port (m) H=(P2-Patm)/w	Piezo Level Outside Port (m) Dz = Dp-H	Z: Elev of pressure measurement port (mASL)	Freshwater Head (mASL)	Comments
				Start Profile Time	Inside Casing (P1-Landed Pressure) (kPa)	Shoe Out	Outside Casing (P2) (kPa)	Time (H:M:S)	Probe Temp. (°C)	Shoe In	Inside Casing (P1) (kPa)				
1	990.20		919.41	14:59:00	8844.87	x	9167.46	15:00:00	13.42	x	8844.04	925.04	-5.63	-501.67	423.37
2	948.40		880.65	15:03:00	8458.64	x	8784.19	15:04:00	13.36	x	8458.58	885.96	-5.31	-462.91	423.05
3	907.20		842.46	15:12:00	8079.71	x	8399.23	15:13:00	12.90	x	8079.88	846.70	-4.24	-424.72	421.98
4	852.30		791.60	15:18:00	7574.54	x	7866.67	15:19:00	12.48	x	7574.11	792.40	-0.80	-373.86	418.54
5	828.00		769.09	15:21:00	7349.47	x	7628.98	15:23:00	12.20	x	7349.56	768.16	0.93	-351.35	416.81
6	796.90		740.28	15:27:00	7064.56	x	7339.97	15:28:00	11.86	x	7064.43	738.69	1.59	-322.54	416.15
7	739.00		686.61	15:35:00	6531.12	x	6795.54	15:37:00	11.33	x	6531.86	683.18	3.43	-268.87	414.31
8	719.10		668.15	15:39:00	6347.44	x	6597.50	15:40:00	11.14	x	6348.18	662.99	5.16	-250.41	412.58
9	702.20		652.47	15:45:00	6193.55	x	6436.79	15:46:00	10.78	x	6193.20	646.60	5.87	-234.73	411.87
10	687.00		638.37	15:47:00	6053.59	x	6302.11	15:48:00	10.69	x	6053.32	632.87	5.50	-220.63	412.24
11	629.10		584.64	15:51:00	5519.76	x	5777.45	15:53:00	10.32	x	5519.77	579.37	5.27	-166.90	412.47
12	568.10		528.00	15:58:00	4957.21	x	5207.44	15:59:00	9.72	x	4957.44	521.24	6.76	-110.26	410.98
13	514.80		478.50	16:01:00	4466.07	x	4728.46	16:03:00	9.30	x	4466.05	472.40	6.10	-60.76	411.64
14	488.90		454.44	16:04:00	4227.83	x	4490.71	16:05:00	9.03	x	5227.63	448.16	6.28	-36.70	411.46
15	464.50		431.77	16:07:00	4002.53	x	4270.76	16:08:00	8.77	x	4002.79	425.73	6.04	-14.03	411.70
16	411.20		382.27	16:11:00	3513.10	x	3784.37	16:12:00	8.35	x	3512.91	376.14	6.13	35.47	411.61
17	368.50		342.64	16:14:00	3120.82	x	3400.61	16:15:00	7.94	x	3121.03	337.01	5.63	75.10	412.11
18	278.70			16:19:00	2294.82	x	2581.34	16:20:00	7.19	x	2294.55	253.47	-253.47	417.74	671.21
19	214.80		199.93	16:24:00	1706.01	x	2003.89	16:25:00	6.57	x	1705.65	194.58	5.35	217.81	412.39
20	160.00		148.98	16:28:00	1200.89	x	1510.10	16:29:00	5.96	x	1200.45	144.23	4.75	268.76	412.99
21	147.8		137.63	16:30:00	1087.89	x	1411.14	16:31:00	5.76	x	1087.88	134.14	3.49	280.11	414.25
22	82.4		76.73	16:33:00	483.96	x	827.77	16:34:00	5.44	x	483.92	74.66	2.07	341.01	415.67

Completed by: AMSC	Verified by: MdK
Date: 27-May-22	Date: 12-Jul-22 / 30-Oct-22

Well ID:	IG_BH01	Multiparameter Probe:	Horiba U52 (SN. 40H7XHMF)	Other Notes/Comments	IG_BH01_GW033 - Primary Sample
Date(s):	01 Jun - 06 Jun 2022	Fluorometer:	AquaFluor (SN.807537)		IG_BH01_GW034 - Duplicate Sample
Operator(s):	AMSC, TKG	Colorimeter:	DR900 (SN. 200660001027)		

Port ID	Cumulative Purge/Sampled Volume (L)	Measurement Date and Time	Multiparameter Probe								Fluorometer		Hydrometer	Colorimetric				Alkalinity		Sample Collected (Y/N)	Comments (sampling run #, sample ID, water colour or odour, etc.)
			Calibrated	pH	Temp (°C)	EC (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	TDS (g/L)	Calibrated	Fluorescein (ppb)		Calibrated	Dissolved Oxygen (mg/L)	Dissolved Ferrous Iron Fe ²⁺ (mg/L)	Total Dissolved Sulphide S ²⁻ (mg/L)	Phenol. (mg/L)	Total as CaCO ₃ (mg/L)		
IG_BH01_IN_T_T_004	16	2022-06-01 11:00	Y	8.2	11.13	24.5	150	0.14	27.2	15.2	Y	5.792	--	--	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85mBTOC with MOSDAX probe landed on port and valve open.
IG_BH01_IN_T_T_004	22	2022-06-01 12:30	Y	8.33	13.00	23.9	155	0.00	50.3	14.8	Y	5.278	1.020	--	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85mBTOC with MOSDAX probe landed on port and valve open.
IG_BH01_IN_T_T_004	26	2022-06-01 14:00	Y	8.29	15.59	22.3	152	0.00	0.0	13.8	Y	5.054	--	--	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85mBTOC with MOSDAX probe landed on port and valve open.
IG_BH01_IN_T_T_004	35	2022-06-01 15:30	Y	8.28	17.79	22.6	178	0.06	0.0	14.0	Y	4.315	1.018	--	--	--	--	--	--	N	Parameters collected during purging using bladder pump placed at 85mBTOC with MOSDAX probe landed on port and valve open.
IG_BH01_IN_T_T_004	--	2022-06-04 13:25	Y	8.22	12.32	19.9	209	0.00	56.1	12.4	Y	4.092	1.013	Y	0.631	0.27	0.05	0	8	Y	Collected during sampling from run #1. Parameters collected by running sample through horiba flow through cell
IG_BH01_IN_T_T_004	--	2022-06-04 13:50	Y	8.36	16.07	19.4	47	0.00	39.9	12.0	--	--	--	--	--	--	--	--	--	Y	Collected during sampling from run #1. Parameters collected after 25min of sample sitting in horiba flow through cell
IG_BH01_IN_T_T_004	--	2022-06-06 10:05	--	--	--	--	--	--	--	--	Y	3.604	--	--	--	--	--	--	--	Y	Collected during sampling from run #10.
IG_BH01_IN_T_T_004	--	2022-06-06 11:35	Y	8.30	15.12	20.3	171	0.00	4.3	12.6	--	--	--	--	--	--	--	--	--	Y	Collected during sampling from run #11. Parameters collected by running sample through horiba flow through cell
IG_BH01_IN_T_T_004	--	2022-06-06 12:00	Y	8.47	15.57	15.9	60	0.00	0.0	9.89	--	--	--	--	--	--	--	--	--	Y	Collected during sampling from run #11. Parameters collected after 25min of sample sitting in horiba flow through cell

Completed by:	AMSC	Verified by:	MdK
Date:	06-Jun-22	Date:	12-Jul-22

Well ID:	IG_BH01		Start Time	12:05 (4-Jun) / 9:02 (5-Jun) /8:49 (6-June)	
MP38 Water Level Before Sampling:	73.90 (4-Jun)/ 74.295 (5-Jun) / 74.90 (6-Jun)		m BTOC	Starting Ambient Pressure	94.94 (4-Jun) / 95.34 (5-Jun)/95.46 (6-Jun) kPa
MP38 Water Level After Sampling:	74.34 (4-Jun) / 75.02 (5-Jun) /71.70 (6-Jun)		m BTOC	End Sampling Time	16:27 (4-Jun) / 18:20 (5-Jun) / 13:02 (6-Jun)
Probe Serial #/Range	EMS4960/2000		kPa	Ending Ambient Pressure	95.20 (4-Jun) / 95.29 (5-Jun) / 95.15 (6-Jun) kPa
Date:	4-Jun-22 / 5-Jun-22 / 6-Jun-22				

Other Notes/Comments:	IG_BH01_GW033 - Primary Sample
	IG_BH01_GW034 - Duplicate Sample

Sampling Run Start Time	Port #	Run #	Function Tests/Preparation						Landed Port	Sampling Sequence								Sampling Run End Time	Comments (volume recovered, parameters measured, samples collected, etc)	
			Shoe-Out	Close Valve	Vaccum Check	Open Valve	Evacuate Bottles (<35 kPa)	Close Valve		Landed Westbay MP38 Pressure (pre-sample, kPa)	Shoe-Out	Zone Pressure (pre-sample, kPa)	Open-Valve	Stablization Time (sec)	Zone Pressure (post-sample kPa)	Close Valve	Shoe-In			Landed Westbay MP38 Pressure (post-sample, kPa)
12:07	IG_BH01_INT_T_004	1	x	x	x	x	x	x	x	7087.81	x	7460.08	x	900	7435.67	x	x	7087.03	13:23	Collected by landing probe on the sampling port. Run #1 used to collect multimeter parameters, infield analytical measurements, ammonia and nutrient samples
13:37	IG_BH01_INT_T_004	2	x	x	x	x	x	x	x	7085.39	x	7456.67	x	900	7432.20	x	x	7085.65	14:52	Collected by landing probe on the sampling port. Run #2 used to collect 13-C and 14-C samples.
15:02	IG_BH01_INT_T_004	3	x	x	x	x	x	x	x	7084.64	x	7455.07	x	900	7430.87	x	x	7084.37	16:17	Collected by landing probe on the sampling port. Run #3 used to collect archive, SiO2 and Ru samples
9:02	IG_BH01_INT_T_004	4	x	x	x	x	x	x	x	7083.64	x	7460.45	x	900	7432.48	x	x	7082.81	10:17	Collected by landing probe on the sampling port. Run #4 used to collect gen chem and DOC samples
10:31	IG_BH01_INT_T_004	5	x	x	x	x	x	x	x	7070.23	x	7457.18	x	600	7447.91	x	x	7069.59	11:47	Collected by landing probe on the sampling port. Run #5 used to collect noble gas and metals samples
11:57	IG_BH01_INT_T_004	6	x	x	x	x	x	x	x	7068.69	x	7457.77	x	600	7447.71	x	x	7068.45	14:00	Collected by landing probe on the sampling port. Run #6 used to collect noble gas and sulfide samples
14:05	IG_BH01_INT_T_004	7	x	x	x	x	x	x	x	7081.64	x	7458.36	x	900	7433.05	x	x	7080.11	15:20	Collected by landing probe on the sampling port. Run #7 used to collect 18-O/2-H/3-H sample
15:33	IG_BH01_INT_T_004	8	x	x	x	x	x	x	x	7079.18	x	7455.61	x	900	7431.07	x	x	7079.25	16:49	Collected by landing probe on the sampling port. Run #8 used to collect 18-O/2-H/3-H sample
17:01	IG_BH01_INT_T_004	9	x	x	x	x	x	x	x	7078.54	x	7454.32	x	900	7431.02	x	x	7078.02	18:12	Collected by landing probe on the sampling port. Run #9 used to collect 37-Cl samples
8:49	IG_BH01_INT_T_004	10	x	x	x	x	x	x	x	7077.90	x	7459.82	x	900	7433.06	x	x	7077.65	10:04	Collected by landing probe on the sampling port. Run #10 used to collect 129-I/36-Cl sample
10:15	IG_BH01_INT_T_004	11	x	x	x	x	x	x	x	7077.24	x	7456.09	x	900	7431.30	x	x	7076.22	11:34	Collected by landing probe on the sampling port. Run #11 used to collect 129-I/36-Cl sample
11:43	IG_BH01_INT_T_004	12	x	x	x	x	x	x	x	7075.53	x	7454.96	x	900	7429.17	x	x	7074.99	12:55	Collected by landing probe on the sampling port. Run #12 used to collect 87-Sr/86-Sr samples

Note: Record field parameter measurements on 20-203-01: Field Parameter Measurement/Testing - Field Data Sheet

Completed by:	TKG/AMSC	Verified by:	MdK
Date:	06-Jun-22	Date:	12-Jul-22

Well ID:	IG_BH03	Multiparameter Prob:	Horiba U52 (SN. 40H7XHMF)	Other Notes/Comments IG_BH03_GW016 - Primary Sample
Date(s):	31 May - 04 Jun 2022	Fluorometer:	AquaFluor (SN.807537)	
Operator(s):	AMSC, TKG	Colorimeter:	DR900 (SN. 200660001027)	

Port ID	Cumulative Purge/Sampled Volume (L)	Measurement Date and Time	Multiparameter Probe								Fluorometer		Hydrometer	Colorimetric				Alkalinity		Sampl e Collec ted (Y/N)	Comments (sampling run #, sample ID, water colour or odour, etc.)
			Calibrated	pH	Temp (°C)	EC (mS/cm)	ORP (mV)	DO (mg/L)	Turbidit y (NTU)	TDS (g/L)	Calibrated	Fluorescein (ppb)		Calibrated	Dissolved Oxygen (mg/L)	Dissolved Ferrous Iron Fe ²⁺ (mg/L)	Total Dissolved Sulphide S ²⁻ (mg/L)	Phenol. (mg/L)	Total as CaCO ₃ (mg/L)		
IG_BH03_INT_ T_002	10	2022-05-31 14:00	Y	7.81	11.85	35.8	30	0.92	34.2	21.8	Y	19.07	--	--	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTOC with Mosdax probe landed on port and valve opened.
IG_BH03_INT_ T_002	16	2022-05-31 15:00	Y	8.12	11.02	37.80	30	0.92	21.8	23.1	Y	20.39	--	--	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTOC with Mosdax probe landed on port and valve opened.
IG_BH03_INT_ T_002	18	2022-05-31 16:00	Y	8.19	11.11	38.3	28	0.85	21.6	23.4	Y	20.89	--	--	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTOC with Mosdax probe landed on port and valve opened.
IG_BH03_INT_ T_002	20	2022-05-31 16:45	Y	8.17	11.41	37.9	33	0.89	38.4	23.10	Y	21.93	--	--	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTOC with Mosdax probe landed on port and valve opened.
IG_BH03_INT_ T_002	--	2022-06-02 11:50	Y	7.13	14.26	8.69	-189	0.00	2.1	5.47	Y	18.47	1.015	Y	0.298	3.23	0.03	0	35	Y	Collected during sampling run #1 by landing on sampling port. Sample diluted 11x for ferrous iron measurement. After discusssion to change method, these data are to be disregarded.
IG_BH03_INT_ T_002	--	2022-06-02 15:10	Y	7.47	10.04	39.4	-177	0.00	346	24.0	Y	4.575	1.030	--	--	--	--	--	--	Y	Collected during sampling fro run #3, measured by running sample through horiba flow- through cell.
IG_BH03_INT_ T_002	--	2022-06-02 15:40	Y	8.05	11.23	40.2	-349	0.00	186	24.5	Y	--	--	Y	0.417	1.43	0.57	0	106	Y	Collected during sampling fro run #3, measured after sample remained in horiba flow through cell for 30mins. Precipate formed in test tube when sulfide reagents were added, this may have effected the reading. Sample wa diluted and the reading was 0.2mg/L.
IG_BH03_INT_ T_002	--	2022-06-04 10:35	--	--	--	--	--	--	--	--	Y	3.701	--	--	--						Collected during sampling from run #9.

Completed by:	AMSC	Verified by:	MdK
Date:	04-Jun-22	Date:	12-Jul-22

Well ID:	IG_BH03	Start Time	10:08 (2-Jun) / 9:15 (3-Jun) / 9:12 (4-Jun)	Other Notes/Comments: IG_BH03_GW016 - Primary Sample
MP38 Water Level Before Sampling:	69.15 (2-Jun) / 69.96 (3-Jun) /71.75 (4-Jun)	m BTOC	94.33 (2-Jun) / 95.02 (3-Jun) /95.32 (4-Jun)	
MP38 Water Level After Sampling:	73.31 (2-Jun) / 74.35 (3-Jun) / 72.89 (4-Jun)	m BTOC	16:55 (2-Jun) / 15:50 (3-Jun) / 10:45 (4-Jun)	
Probe Serial #/Range	EMS4960/2000psi	Ending Ambient Pressure	94.71 (2-Jun) / 95.51 (3-Jun) / 95.48 (4-Jun)	
Date:	2-Jun-22 / 3-Jun-22 /4-Jun-22			

Sampling Run Start Time	Port #	Run #	Function Tests/Preparation						Landed Port	Sampling Sequence								Sampling Run End Time	Comments (volume recovered, parameters measured, samples collected, etc)	
			Shoe-Out	Close Valve	Vaccum Check	Open Valve	Evacuate Bottles (<35 kPa)	Close Valve		Landed Westbay MP38 Pressure (pre-sample, kPa)	Shoe-Out	Zone Pressure (pre-sample, kPa)	Open-Valve	Stablization Time (sec)	Zone Pressure (post-sample kPa)	Close Valve	Shoe-In			Landed Westbay MP38 Pressure (post-sample, kPa)
10:08	IG_BH03_INT_T_002	1	x	x	x	x	x	x	x	8266.60	x	8268.01	x	253	8258.08	x	x	8256.8	11:40	Collected by landing probe on the sampling port.Run #1 used to collect multimeter parameters and infield analytical measurements. Pumping port appears to be open. Noted that the NaFI levels were above what was expected. Notified NWMO and Geofirma PM
11:55	IG_BH03_INT_T_002	2	x	x	x	x	x	x	x	8256.78	x	8257.77	x	206	8248.29	x	x	8247.32	13:15	Collected by landing probe on the sampling port.Run #2 used to collect 129-I/36-Cl
13:40	IG_BH03_INT_T_002	3	x	x	x	x	x	x	x	8307.77	na	na	x	220	8297.88	x	na	na	15:10	Following discussions, change in method was used to collect these sample. Previous samples were discarded . Run #3 was collected from within the MP38 casing, ~2m above pumping port. Run #3 was used to collect multimeter parameters and infield analytical measurements.
15:25	IG_BH03_INT_T_002	4	x	x	x	x	x	x	x	8297.61	na	na	x	209	8287.55	x	na	na	16:40	Collected from within the MP38 casing, ~2m above pumping port. Run #4 was used to collect 87/86-Sr, 37Cl and Ru.
9:15	IG_BH03_INT_T_002	5	x	x	x	x	x	x	x	8309.99	na	na	x	185	8299.65	x	na	na	10:35	Collected from within the MP38 casing, ~2m above pumping port. Run #5 was used to collect 129-I/36-Cl and SiO2
10:50	IG_BH03_INT_T_002	6	x	x	x	x	x	x	x	8289.74	na	na	x	80	8287.35	x	na	na	12:36	Collected from within the MP38 casing, ~2m above pumping port. Run #6 was used to collect noble gases and archive.
12:45	IG_BH03_INT_T_002	7	x	x	x	x	x	x	x	8299.05	na	na	x	200	8289.24	x	na	na	14:05	Collected from within the MP38 casing, ~2m above pumping port. Run #7 was used to collect 18-O/2-H/3-H.
14:20	IG_BH03_INT_T_002	8	x	x	x	x	x	x	x	8289.83	na	na	x	210	8279.83	x	na	na	15:38	Collected from within the MP38 casing, ~2m above pumping port. Run #8 was used to collect 14-C, 13-C, ammonia and nutrients.
9:12	IG_BH03_INT_T_002	9	x	x	x	x	x	x	x	8297.05	na	na	x	214	8287.06	x	na	na	10:33	Collected from within the MP38 casing, ~2m above pumping port. Run #9 was used to collect DOC, sulfide, metals and gen chem

Note: Record field parameter measurements on 20-203-01: Field Parameter Measurement/Testing - Field Data Sheet

Completed by:	TKG/ AMSC	Verified by:	MdK
Date:	04-Jun-22	Date:	12-Jul-22

Well ID:	IG_BH05	Multiparameter Probe:	Horiba U52 (SN. 40H7XHMF)	Other Notes/Comments	IG_BH05_GW002 - Primary Sample
Date(s):	28 May - 30 May 2022	Fluorometer:	AquaFluor (SN.807537)		IG_BH05_GW003 - Rinsate Sample
Operator(s):	AMSC, TKG	Colorimeter:	DR900 (SN. 200660001027)		IG_BH05_GW004 - Blank Sample

Port ID	Cumulative Purge/Sampled Volume (L)	Measurement Date and Time	Multiparameter Probe								Fluorometer		Hydrometer	Colorimetric				Alkalinity		Sample Collected (Y/N)	Comments (sampling run #, sample ID, water colour or odour, etc.)
			Calibrated	pH	Temp (°C)	EC (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	TDS (g/L)	Calibrated	Fluorescein (ppb)	Specific Gravity	Calibrated	Dissolved Oxygen (mg/L)	Dissolved Ferrous Iron Fe ²⁺ (mg/L)	Total Dissolved Sulphide S ²⁻ (mg/L)	Phenol. (mg/L)	Total as CaCO ₃ (mg/L)		
IG_BH05_IN T_T_007	8	2022-05-28 10:30	Y	7.28	16.10	9.78	74	1.58	19.1	6.16	Y	36.24	1.005	--	--	--	--	--	--	N	Collecetd during purging through Solisnt double valve pump placed at ~85mBTOC
IG_BH05_IN T_T_007	15	2022-05-28 12:00	Y	7.21	18.97	7.74	49	1.70	41.2	4.87	Y	37.40	1.004	--	--	--	--	--	--	N	Collecetd during purging through Solisnt double valve pump placed at ~85mBTOC
IG_BH05_IN T_T_007	20	2022-05-28 13:30	Y	7.14	17.93	7.00	61	1.17	48.1	4.41	Y	41.99	1.004	--	--	--	--	--	--	N	Collecetd during purging through Solisnt double valve pump placed at ~85mBTOC
IG_BH05_IN T_T_007	35	2022-05-28 15:30	Y	7.24	14.81	4.89	82	3.12	23.0	3.130	Y	43.63	1.006	--	--	--	--	--	--	N	Collecetd during purging through Solisnt double valve pump placed at ~85mBTOC
IG_BH05_IN T_T_007	--	2022-05-29 11:05	Y	6.98	10.97	13.9	105	0.00	121	8.64	Y	5.43	1.012	--	--	--	--	--	--	Y	Collected from run #1 during sampling from within the MP38 casing (~790 mBHA). Parameters collected in horiba flow through cell
IG_BH05_IN T_T_007	--	2022-05-29 11:15	--	--	--	--	--	--	--	--	--	--	--	Y	0.374	7.50	2.10	0	235	Y	Collected from run #1 during sampling from within the MP38 casing (~790 mBHA). Sample had to be diluted 10x to get readings for ferrous iron and sulfide.
IG_BH05_IN T_T_007	--	2022-05-29 11:30	Y	7.12	14.08	10.9	-75	0.00	54.9	6.78	--	--	--	--	--	--	--	--	--	--	Collected from run #1 during sampling from within the MP38 casing (~790 mBHA). Parameters collected from water in the horiba flow through cell after sitting for 25mins.
IG_BH05_IN T_T_007	--	2022-05-30 13:35	Y	6.42	19.13	7.25	-74	0.00	94.1	4.56	Y	6.544	--	--	--	--	--	--	--	--	Collected from run #7 during sampling from within the MP38 casing (~790 mBHA). Parameters collected in horiba flow through cell

Completed by:	AMSC	Verified by:	MdK
Date:	30-May-22	Date:	12-Jul-22

Well ID:	IG_BH05	Start Time	9:55 (29-May)/ 9:30 (30-May)
MP38 Water Level Before Sampling:	46.85 (29-May)/ 43.60 (30-May)	m BTOC	Starting Ambient Pressure 94.59 (29-May)/ 94.61 (30-May) kPa
MP38 Water Level After Sampling:	48.955 (29-May)/ 46.275 (30_May)	m BTOC	End Sampling Time 16:45 (29-May)/ 13:44 (30-May)
Probe Serial #/Range	EMS4960/2000psi	Ending Ambient Pressure	94.47 (29-May)/ 94.34 (30-May) kPa
Date:	29-May-22 / 30-May-22		

Other Notes/Comments:	IG_BH05_GW002 - Primary Sample
	IG_BH05_GW003 - Rinsate Sample
	IG_BH05_GW004 - Blank Sample

Sampling Run Start Time	Port #	Run #	Function Tests/Preparation						Landed Port	Sampling Sequence								Sampling Run End Time	Comments (volume recovered, parameters measured, samples collected, etc)
			Shoe-Out	Close Valve	Vaccum Check	Open Valve	Evacuate Bottles (<35 kPa)	Close Valve		Landed Westbay MP38 Pressure (pre-sample, kPa)	Shoe-Out	Zone Pressure (pre-sample, kPa)	Open-Valve	Stablization Time (sec)	Zone Pressure (post-sample kPa)	Close Valve	Shoe-In	Landed Westbay MP38 Pressure (post-sample, kPa)	
9:55	IG_BH05_INT_T_007	1	x	x	x	x	x	x	x	7040.86	na	na	x	130	7033.00	x	na	na	11:00 Port open, did not land probe. Valve opened approx. 2m above pumping port. Run #1 used to collect multimeter parameters and infield analytical measurements.
11:32	IG_BH05_INT_T_007	2	x	x	x	x	x	x	x	7025.42	na	na	x	65	7022.23	x	na	na	12:34 Valve opened approx. 2m above pumping port. Run #2 used to collect gen chem, Ru, reactive silica, nutrients and ammonia
14:26	IG_BH05_INT_T_007	3	x	x	x	x	x	x	x	7025.93	na	na	x	168	7015.22	x	na	na	15:30 Standby due to thunderstorm. Valve opened approx. 2m above pumping port. Run #3 used to collect metals, sulfide, DOC, archive, 87/86 Sr
15:41	IG_BH05_INT_T_007	4	x	x	x	x	x	x	x	7014.84	na	na	x	170	7003.42	x	na	na	16:45 Valve opened approx. 2m above pumping port. Run #4 used to collect 129I / 36Cl, 37Cl
9:30	IG_BH05_INT_T_007	5	x	x	x	x	x	x	x	7046.24	na	na	x	45	7043.33	x	na	na	11:12 Valve opened approx. 2m above pumping port. Run #5 used to collect noble gas samples and fluorescein measurements
11:22	IG_BH05_INT_T_007	6	x	x	x	x	x	x	x	7050.36	na	na	x	175	7040.68	x	na	na	12:25 Valve opened approx. 2m above pumping port. Run #6 used to collect 18O/2H/3H.
12:34	IG_BH05_INT_T_007	7	x	x	x	x	x	x	x	7041.78	na	na	x	170	2030.44	x	na	na	13:36 Valve opened approx. 2m above pumping port. Run #7 used to collect 14C and horiba measurements

Note: Record field parameter measurements on 20-203-01: Field Parameter Measurement/Testing - Field Data Sheet

Completed by:	TKG/AMSC	Verified by:	MdK
Date:	30-May-22	Date:	12-Jul-22

COC Number/ID	Sample ID(s)	Shipping Information						Receiving Information				Comments
		Shipped Date	Shipped Time	Temp. Shipped (deg C)	COC Signed by Geofirma (Y/N)	Shipping Address	Shipping Method	Received Date	Received Time	Temp Received (deg C)	COC Signed By Receiving Lab (Y/N)	
GFIM_BVL_0007	IG_BH05_GW002, IG_BH05_GW003	31-May-22	7:30	<10 (on ice)	Y	946 Cobalt Cres Thunder Bay ON P7B 5W3	Courier	01-Jun-22	16:01	5,5,6	Y	
GFIM_BVL_0008	IG_BH03_GW016, IG_BH01_GW033, IG_BH01_GW034	07-Jun-22	9:00	<10 (on ice)	Y	946 Cobalt Cres Thunder Bay ON P7B 5W3	Courier	07-Jun-22	14:02	8,7,7	Y	
GFIM_IT2_0005	IG_BH05_GW002, IG_BH05_GW004, IG_BH03_GW016, IG_BH01_GW033, IG_BH01_GW034	07-Jun-22	9:00	<10 (on ice)	Y	608 Weber St. N Unit3, Waterloo, ON N2V 1K4	Courier	09-Jun-22	11:20	n/a	Y	
GFIM_NWMO_0005	IG_BH05_GW002, IG_BH03_GW016, IG_BH01_GW033, IG_BH01_GW034	06-Jun-22	17:00	<10 (on ice to fridge)	Y	304 Main St., Ignace ON P0T 1T0	Hand delivered	06-Jun-22	17:00	n/a	Y	
GFIM_Uofo_0005	IG_BH05_GW002, IG_BH03_GW016, IG_BH01_GW033, IG_BH01_GW034	13-Jun-22	13:30	<10 (on ice)	Y	25 Templeton St., Ottawa ON K1N 6N5	Hand delivered	13-Jun-22	13:30	n/a	Y	Comment from lab "leaks when squeezed". After follow-up with the lab: no evidence of leaking during transit, it only leaked when the bottle was squeezed. There was no volume loss in the sample observed and as the samples were being analyzed for 129-I and 36-Cl, contact with air would not contaminate the sample. No impact on the sample.

Completed by:	AMSC	Verified by:	MdK
Date:	13-Jun-22	Date:	12-Jul-22

Laboratory Report Date	2022/06/29, 2022/07/12
Laboratory Name	Bureau Veritas
Laboratory Report ID (If applicable)	C2F6327, C2F0223
Analyses Completed	Major and Trace Elements and Metals; Total dissolved sulphur; Total dissolved iron; Reactive silica; Sulphide; Anions; pH; Alkalinity; Fluoride; TIC; TOC; DOC; TKN; Total Phosphorus; Total Ammonia; Total Nitrogen; Carbonate, Bicarbonate and Hydroxide

Associated COC #(s)	GFIM_BVL_0007, GFIM_BVL_0008
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Samples Included in Laboratory Report
[IG_BH05_GW002] [IG_BH05_GW003] [IG_BH03_GW016] [IG_BH01_GW033] [IG_BH01_GW034]

Quality Check and Verification	Verified By (Initials)	Comments
Results received from laboratory	AMSC	
All samples were tested or accounted for. Justification provided for any untested samples (e.g. spare sample)	AMSC	
Laboratory data report provided with results	AMSC	
Laboratory testing methods/techniques included in data report	AMSC	
Laboratory QA procedures and equipment calibration included in data report	AMSC	
Laboratory results are within reasonable/expected range	AMSC	See note below

Other Comments/Notes:
Chloride concentration of sample IG_BH05_GW002 was slightly below what was expected (3700 mg/L), Geofirma requested that the lab re-analyze the sample to confirm the results. The revised report (C2F0223V2) reported a higher concentration (5200 mg/L), more in-line with what was expected and still within the labs RPD acceptance criteria for duplicates.

Note: A copy of this form is to be complete for each laboratory data report that is received by Geofirma

Completed by:	AMSC	Verified by:	MdK
Date:	18-Jul-22	Date:	20-Jul-22

Laboratory Report Date	2022-08-08
Laboratory Name	Isotope Tracer Technologies Inc. (IT2)
Laboratory Report ID (If applicable)	220237
Analyses Completed	18-O, 2-H, 3-H, 87-Sr/86-Sr, 37-Cl, 13-C, 14-C

Associated COC #(s)	GFIM_IT2_0005
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Samples Included in Laboratory Report
[IG_BH05_GW002][IG_BH05_GW004][IG_BH03_GW016][IG_BH01_GW033][IG_BH01_GW034]

Quality Check and Verification	Verified By (Initials)	Comments
Results received from laboratory	AMSC	
All samples were tested or accounted for. Justification provided for any untested samples (e.g. spare sample)	AMSC	
Laboratory data report provided with results	AMSC	
Laboratory testing methods/techniques included in data report	AMSC	
Laboratory QA procedures and equipment calibration included in data report	AMSC	
Laboratory results are within reasonable/expected range	AMSC	See comment below

Other Comments/Notes:
Results slightly higher than expected for sample IG_BH05_GW004 (blank), asked lab to re-run analysis to confirm. Re-analysis showed lower value (as expected), repeat result was still within the variation of the original.

Note: A copy of this form is to be complete for each laboratory data report that is received by Geofirma

Completed by: AMSC	Verified by: SNS
Date: 09-Nov-22	Date: 10-Jan-23

Laboratory Report Date	20-Sep-22, 28-Oct-22
Laboratory Name	University of Ottawa (Radiohalides Laboratory)
Laboratory Report ID (If applicable)	n/a
Analyses Completed	129-I, 36-Cl

Associated COC #(s)	GFIM_UofO_0005
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Samples Included in Laboratory Report
[IG_BH05_GW002][IG_BH03_GW016][IG_BH01_GW033][IG_BH01_GW034]

Quality Check and Verification	Verified By (Initials)	Comments
Results received from laboratory	AMSC	
All samples were tested or accounted for. Justification provided for any untested samples (e.g. spare sample)	AMSC	
Laboratory data report provided with results	AMSC	
Laboratory testing methods/techniques included in data report	AMSC	
Laboratory QA procedures and equipment calibration included in data report	AMSC	
Laboratory results are within reasonable/expected range	AMSC	

Other Comments/Notes:

Note: A copy of this form is to be complete for each laboratory data report that is received by Geofirma

Completed by:	AMSC	Verified by:	SNS
Date:	09-Nov-22	Date:	10-Jan-23

Laboratory Report Date	26-Oct-22
Laboratory Name	University of Ottawa - Noble Gases Laboratory
Laboratory Report ID (If applicable)	n/a
Analyses Completed	Noble gases (He, Ne, Ar, Kr, Xe)

Associated COC #(s)	GFIM_UofO_0005
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Samples Included in Laboratory Report
[IG_BH05_GW002][IG_BH03_GW016][IG_BH01_GW033][IG_BH01_GW034]

Quality Check and Verification	Verified By (Initials)	Comments
Results received from laboratory	AMSC	
All samples were tested or accounted for. Justification provided for any untested samples (e.g. spare sample)	AMSC	
Laboratory data report provided with results	AMSC	
Laboratory testing methods/techniques included in data report	AMSC	
Laboratory QA procedures and equipment calibration included in data report	AMSC	
Laboratory results are within reasonable/expected range	AMSC	

Other Comments/Notes:
<p>Note: Previous reports included 21Ne results, going forward (including this quarter) only total Ne will be reported.</p>

Note: A copy of this form is to be complete for each laboratory data report that is received by Geofirma

Completed by:	AMSC	Verified by:	SNS
Date:	09-Nov-22	Date:	10-Jan-23

**2022 Q3 (September)
Data Quality Workbook (DQC)**

Borehole ID:	BH01, BH03, BH05, BH06	Comments:
Date:	16-Sept-22 to 29-Sept-22	
Completed by:	MdK, MEOR	
Sampling Interval:		

Equipment	Date/Time	Decontamination Required (Y/N)	Location (BH)	PPE	Decontamination Procedure					Comments
					Loose Contamination Removed	Detergent Wash (record type of detergent used)	Dionized Water Rinse	Air Dried (Minimize Dust)	Rinsate Sample Collected (Y/N)	
Electronic Water Level Tape	2022-09-16 9:00	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-09-16 9:00	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-09-16 15:45	Y	IG_BH06	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-09-16 15:45	Y	IG_BH06	Y	Y	Alconox	Y	Y	N	
Westbay sample bottle	2022-09-16 15:45	Y	IG_BH06	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-09-17 9:30	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-09-17 9:30	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
Bladder Pump	2022-09-17 9:30	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
Westbay sample bottle	2022-09-17 17:00	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-09-18 9:00	Y	IG_BH05	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-09-18 9:00	Y	IG_BH05	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-09-18 13:00	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-09-18 13:10	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-09-19 8:00	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 5288	2022-09-19 8:30	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
Westbay sample bottles (x6)	2022-09-19 8:30	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
Copper tubing (2x)	2022-09-19 9:30	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
Copper tubing (6x)	2022-09-20 9:00	Y	IG_BH03	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-09-22 8:15	Y	IG_BH05	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 5288	2022-09-22 8:15	Y	IG_BH05	Y	Y	Alconox	Y	Y	N	
Bladder Pump	2022-09-22 8:15	Y	IG_BH05	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-09-23 8:15	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
Bladder Pump	2022-09-23 8:15	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 5288	2022-09-24 7:15	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
Westbay sample bottles (x7)	2022-09-24 7:15	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
Copper tubing (4x)	2022-09-24 8:15	Y	IG_BH01	Y	Y	Alconox	Y	Y	N	
Electronic Water Level Tape	2022-09-25 7:15	Y	IG_BH05	Y	Y	Alconox	Y	Y	N	
MOSDAX sampler probe EMS 5288	2022-09-25 7:30	Y	IG_BH05	Y	Y	Alconox	Y	Y	N	
Westbay sample bottles (x7)	2022-09-25 7:30	Y	IG_BH05	Y	Y	Alconox	Y	Y	Y	Collected rinsate sample: IG_BH05_GW007
Copper tubing (8x)	2022-09-25 7:30	Y	IG_BH05	Y	Y	Alconox	Y	Y	N	

Completed by:	MDK	Verified by:	AMSC
Date:	04-Oct-22	Date:	24-Oct-22

Date	Time	Personnel	Equipment Type	Serial Number	Calibration Check			Calibration Performed			Comments
					Check Method & Standard(s) Used	Equipment Reading(s)	Calibration Required (Y/N)	Calibration Method & Standard(s) Used	Equipment Reading(s)	Calibration Completed (Y/N)	
16-Sep-22	9:45	MdK	MOSDAX Probe	EMS4960	Manual WL/P vs. Probe P	Manual P (anticipated) = 331.26 KPa; Probe P (measured) =344.68 Kpa	N	--	--	--	
16-Sep-22	17:00	MdK	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.002 10.06 100.0	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1F0730), 100ppb (LOT# 1F0732) Exp. Jan 2024
17-Sep-22	17:00	MdK	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.007 10.04 99.92	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1F0730), 100ppb (LOT# 1F0732) Exp. Jan 2024
17-Sep-22	10:45	MEOR	HoribaU52	PDWJB880	Lab provided solutions; 4.00, 7.00, 10.00	4.00 7.00 10.00	--	Lab-provided auto calibration solution 4.0 pH, 4.49mS/cm, 0.0NTU	3.99 4.49 0.1	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470), pH 10.0 (LOT# 1GI516), pH 7.0 (LOT# 1GF003), pH 4.0 (LOT# 1GE539)
19-Sep-22	9:50	MdK	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000 10.04 99.84	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1F0730), 100ppb (LOT# 1F0732) Exp. Jan 2024
19-Sep-22	10:00	MdK	HoribaU52	PDWJB880	Lab provided solutions; 4.00, 7.00, 10.00	4.00 7.01 10.01	--	Lab-provided auto calibration solution 4.0 pH, 4.49mS/cm, 0.0NTU	3.98 4.49 0.0	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470), pH 10.0 (LOT# 1GI516), pH 7.0 (LOT# 1GF003), pH 4.0 (LOT# 1GE539)
19-Sep-22	9:50	MdK	DR900	200660001027	Absorbance Std Test Kit	520nm: Blank: 0.00 Std 1: 0.558 ± 0.05 Std 2: 1.141 ± 0.10 Std 3: 1.741 ± 0.15	N	--	--	--	Cal checked using DR900 absorbance check kit (SN:2763900).
						610nm: Blank: 0.00 Std 1: 0.566 ± 0.05 Std 2: 1.133 ± 0.10 Std 3: 1.730 ± 0.15	N	--	--	--	
20-Sep-22	8:30	MdK	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000 9.680 100.3	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1F0730), 100ppb (LOT# 1F0732) Exp. Jan 2024
20-Sep-22	8:30	MdK	HoribaU52	PDWJB880	Lab provided solutions; 4.00, 7.00, 10.00	3.96 7.02 10.01	--	Lab-provided auto calibration solution 4.0 pH, 4.49mS/cm, 0.0NTU	3.99 4.49 0.2	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470), pH 10.0 (LOT# 1GI516), pH 7.0 (LOT# 1GF003), pH 4.0 (LOT# 1GE539)
20-Sep-22	8:30	MdK	DR900	200660001027	Absorbance Std Test Kit	520nm: Blank: 0.00 Std 1: 0.558 ± 0.05 Std 2: 1.141 ± 0.10 Std 3: 1.741 ± 0.15	N	--	--	--	Cal checked using DR900 absorbance check kit (SN:2763900).
						610nm: Blank: 0.00 Std 1: 0.567 ± 0.05 Std 2: 1.162 Std 3: 1.769	N	--	--	--	
21-Sep-22	9:15	MdK	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000 9.932 100.1	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1F0730), 100ppb (LOT# 1F0732) Exp. Jan 2024
22-Sep-22	9:00	MdK	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000 9.680 100.3	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1F0730), 100ppb (LOT# 1F0732) Exp. Jan 2024
22-Sep-22	9:00	MdK	HoribaU52	PDWJB880	Lab provided solutions; 4.00, 7.00, 10.00	4.03 7.00 10.04	--	Lab-provided auto calibration solution 4.0 pH, 4.49mS/cm, 0.0NTU	4.00 4.50 0.8	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470), pH 10.0 (LOT# 1GI516), pH 7.0 (LOT# 1GF003), pH 4.0 (LOT# 1GE539)
23-Sep-22	8:30	MdK	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.005 10.25 100.5	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1F0730), 100ppb (LOT# 1F0732) Exp. Jan 2024
23-Sep-22	9:00	MdK	HoribaU52	PDWJB880	Lab provided solutions; 4.00, 7.00, 10.00	3.97 7.07 10.00	--	Lab-provided auto calibration solution 4.0 pH, 4.49mS/cm, 0.0NTU	3.99 4.53 0.2	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470), pH 10.0 (LOT# 1GI516), pH 7.0 (LOT# 1GF003), pH 4.0 (LOT# 1GE539)
24-Sep-22	8:00	MdK	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000 10.21 99.82	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1F0730), 100ppb (LOT# 1F0732) Exp. Jan 2024
24-Sep-22	8:20	MdK	HoribaU52	PDWJB880	Lab provided solutions; 4.00, 7.00, 10.00	3.95 7.05 10.00	--	Lab-provided auto calibration solution 4.0 pH, 4.49mS/cm, 0.0NTU	4.00 4.50 0.1	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470), pH 10.0 (LOT# 1GI516), pH 7.0 (LOT# 1GF003), pH 4.0 (LOT# 1GE539)
24-Sep-22	8:00	MdK	DR900	200660001027	Absorbance Std Test Kit	520nm: Blank: 0.00 Std 1: 0.558 ± 0.05 Std 2: 1.141 ± 0.10 Std 3: 1.741 ± 0.15	N	--	--	--	Cal checked using DR900 absorbance check kit (SN:2763900).
						610nm: Blank: 0.00 Std 1: 0.566 ± 0.05 Std 2: 1.133 ± 0.10 Std 3: 1.730 ± 0.15	N	--	--	--	
25-Sep-22	7:45	MdK	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000 10.20 101.2	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 1F0730), 100ppb (LOT# 1F0732) Exp. Jan 2024
25-Sep-22	8:00	MdK	HoribaU52	PDWJB880	Lab provided solutions; 4.00, 7.00, 10.00	3.96 6.98 9.99	--	Lab-provided auto calibration solution 4.0 pH, 4.49mS/cm, 0.0NTU	4.00 4.51 0.0	Y	Calibrated using lab provided solutions: AutoCal (LOT# 1GJ470), pH 10.0 (LOT# 1GI516), pH 7.0 (LOT# 1GF003), pH 4.0 (LOT# 1GE539)

25-Sep-22	7:45	Mdk	DR900	200660001027	Absorbance Std Test Kit	520nm: Blank: 0.00 Std 1: 0.558 ± 0.05 Std 2: 1.141 ± 0.10 Std 3: 1.741 ± 0.15	520nm: Blank: 0.000 Std 1: 0.590 Std 2: 1.165 Std 3: 1.776	N	--	--	--	Cal checked using DR900 absorbance check kit (SN.2763900).
						610nm: Blank: 0.00 Std 1: 0.566 ± 0.05 Std 2: 1.133 ± 0.10 Std 3: 1.730 ± 0.15	610nm: Blank: 0.000 Std 1: 0.584 Std 2: 1.160 Std 3: 1.767	N	--	--	--	
26-Sep-22	8:30	Mdk	Fluorometer	807511	--	--	--	--	3 pt calibration with standard solution, 0ppb, 10ppb, 100ppb	0.000 9.709 99.85	Y	Calibrated using turner design fluorescein standards: 10ppb (LOT# 10F0730), 100ppb (LOT# 1F0732) Exp. Jan 2024

Completed by:	MDK	Verified by:	AMSC
Date:	27-Sep-22	Date:	24-Oct-22

Ignace Fluid Pressure Profiling and Sampling

Well ID JG_BH01				Pre Profile				Post Profile				Weather: 15 °C			
Datum: Ground Level				Probe Type: MOSDAX				P _{atm} 95.06 kPa				P _{atm} 95.99 kPa			
Elev. G.S.: 430.562 m				Serial No.: EMS4960				Temp. 19.68 °C				Temp. 5.65 °C			
Height of Westbay above G.S.: 0.32 m AGS				Probe Range: 2000psi				Date/Time 2022-09-18 13:20				Date/Time 2022-09-18 17:15			
Elev. Top of Westbay Casing: 430.88 m				Westbay Casing Type: MP38				MP38 Water Level 28.35 mBTC				MP38 Water Level 29.79 mBTC			
Reference Elevation: 430.562 mASL				amplifier Valve Position: Closed											
Borehole angle: 90												Specific Weight 9.807 kN/m ³			
												Gravitational Accelerati 9.8065 m/s ²			
												P _{atm} 95.53			

Notes:	Sample interval: IG_BH01_INT_T_002
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[illegible]

Completed by:	MDK, MEOR	Verified by:	AMSC / MdK
Date:	18-Sep-22	Date:	24-Oct-22 / 31-Oct-23

Ignace Fluid Pressure Profiling and Sampling

Well ID: IG_BH03			Pre Profile			Post Profile			Weather: 10 °C		
Datum: Ground Level			Probe Type: MOSDAX			P _{amb} : 96.36 kPa			Overcast		
Elev. G.S.: 441.403 m			Serial No.: EMS4960			Temp.: 14.93 °C					
Height of Westbay above G.S.: 1.299 m AGS			Probe Range: 2000psi			Date/Time: 2022-09-16 9:32					
Elev. Top of Westbay Casing: 442.702 m			Westbay Casing Type: MP38			Date/Time: 2022-09-16 14:37					
Reference Elevation: 441.403 mASL			MP38 Water Level: 75.35 mBTOC			MP38 Water Level: 75.09 mBTOC			Specific Weight: 9.807 kN/m ³		
Borehole angle: -70			amplifier Valve Position: Closed						Gravitational Accelerati: 9.8065 m/s ²		
									P _{amb} : 95.92		

Notes: Sample interval: IG_BH03_INT_T_002

				Fluid Pressure Readings												
	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m BGS)	Start Profile Time	Inside Casing (P1-Landed Pressure) (kPa)	Shoe Out	Outside Casing (P2) (kPa)	Time (H:M:S)	Probe Temp. (°C)	Shoe In	Inside Casing (P1) (kPa)	Pressure Head Outside Port (m) H=(P2-Patm)/w	Piezo Level Outside Port (m) Dz = Dp-H	Z: Elev of pressure measurement port (mASL)	Freshwater Head (mASL)	Comments
Port No.																
1	966.8	964.78	888.57	10:38:00	8400.98	Y	8638.88	10:39:00	12.96	Y	8400.15	871.11	17.46	-447.17	423.94	
2	943.9	941.98	868.28	10:49:30	8194.49	Y	8340.75	10:50:30	13.02	Y	8194.36	840.71	27.57	-426.88	413.83	Pumping port closed on 2022/06/12 in preparation for sampling
3	924.0	922.16	850.53	10:56:30	8015.58	Y	8237.07	10:57:30	12.87	Y	8015.13	830.14	20.39	-409.13	421.01	
4	882.8	880.73	813.57	11:07:00	7640.56	Y	7918.39	11:08:00	12.50	Y	7640.35	797.64	15.93	-372.17	425.47	Verified by MEOR
5	859.9	857.92	792.89	11:13:00	7430.40	Y	7700.32	11:14:00	12.32	Y	7430.19	775.41	17.48	-351.49	423.92	
6	794.3	792.74	733.26	11:21:00	6826.81	Y	7115.59	11:22:00	11.82	Y	6826.48	715.78	17.48	-291.86	423.92	
7	752.8	751.20	695.28	11:28:00	6442.28	Y	6725.92	11:29:00	11.33	Y	6442.16	676.05	19.23	-253.88	422.17	
8	676.0	674.71	624.50	11:39:00	5725.24	Y	6039.04	11:40:00	10.69	Y	5725.19	606.01	18.49	-183.10	422.91	
9	637.8	636.72	589.28	11:43:00	5368.96	Y	5689.11	11:44:00	10.33	Y	5368.84	570.33	18.95	-147.88	422.45	
10	613.4	612.13	566.78	11:48:00	5141.00	Y	5455.78	11:49:00	10.06	Y	5140.87	546.53	20.25	-125.38	421.16	
11	567.7	566.71	524.65	11:56:00	4713.97	Y	5045.45	11:57:00	9.54	Y	4713.63	504.69	19.96	-83.25	421.45	
12	544.1	543.12	502.91	12:03:00	4493.86	Y	4844.47	12:04:00	9.28	Y	4493.94	484.20	18.71	-61.51	422.69	
13	506.1	505.52	467.93	12:09:00	4138.77	Y	4508.31	12:10:00	9.04	Y	4138.92	449.92	18.01	-26.53	423.40	
14	465.9	465.80	430.90	12:14:00	3763.79	Y	4169.08	12:15:00	8.65	Y	3763.98	415.33	15.57	10.50	425.83	Verified by MEOR
15	421.1	420.68	389.63	12:28:00	3346.27	Y	3621.43	12:29:00	8.16	Y	3346.70	359.49	30.14	51.77	411.26	Rechecked [3634.12kPa], re-landed and rechecked again [3635.11kPa] and Verified by MEOR. P2 is ~100kPa lower than previously recorded
16	370.3	369.95	342.83	12:53:00	2872.66	Y	3304.45	12:54:00	7.84	Y	2872.36	327.17	15.66	98.57	425.74	
17	321.0	320.81	297.42	13:19:00	2412.87	Y	2878.23	13:20:00	7.33	Y	2412.92	283.71	13.71	143.98	427.69	
18	251.0	250.93	232.90	13:26:00	1760.12	Y	2244.58	13:27:00	6.79	Y	1759.72	219.09	13.81	208.50	427.60	
19	228.1	228.11	211.75	13:30:00	1545.53	Y	2042.90	13:31:00	6.56	Y	1545.55	198.53	13.22	229.65	428.18	
20	165.7	165.95	154.03	13:42:00	960.99	Y	1494.05	13:43:00	5.91	Y	961.49	142.56	11.47	287.37	429.94	
21	73.0	73.3	68.16	14:02:00	96.98	Y	690.47	09:43:00	11.24	Y	96.17	60.63	7.53	373.24	433.87	Parameters associated with final check at 14:02 were unexpected, therefore the more accurate values at 9:43 were taken. This may be due to the low water level, as it was below the sampling port location.

Completed by:	MDK, MEOR	Verified by:	AMSC / MdK
Date:	16-Sep-22	Date:	24-Oct-22 / 31-Oct-23

Well ID IG_BH05	Probe Type: MOSDAX	Pre Profile	Post Profile	Weather: 15 °C
Datum: Ground Level	Serial No.: EMS4960	P _{atm} 94.71 kPa	P _{atm} 96.08 kPa	Overcast
Elev. G.S.: 432.29 m	Probe Range: 2000psi	Temp. 17.32 °C	Temp. 8.85 °C	
Height of Westbay above G.S.: 1.31 m AGS	Westbay Casing Type: MP38	Date/Time 2022-09-18 9:15	Date/Time 2022-09-18 12:40	
Elev. Top of Westbay Casing: 433.60 m	amplifier Valve Position: Closed	MP38 Water Level 56.44 mBTOC	MP38 Water Level 56.58 mBTOC	Specific Weight 9.807 kN/m3
Reference Elevation: 432.29 mASL				Gravitational Accelerati 9.8065 m/s2
Borehole angle: -70				P _{atm} 95.40

Notes: Sample interval: IG_BH05_INT_T_007

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m BGS)	Fluid Pressure Readings							Pressure Head Outside Port (m) H=(P2-Patm)/w	Piezo Level Outside Port (m) Dz = Dp-H	Z: Elev of pressure measurement port (mASL)	Freshwater Head (mASL)	Comments	
				Start Profile Time	Inside Casing (P1-Landed Pressure) (kPa)	Shoe Out	Outside Casing (P2) (kPa)	Time (H:M:S)	Probe Temp. (°C)	Shoe In						Inside Casing (P1) (kPa)
1	991.20	987.94	923.15	10:09:00	8813.94	Y	9047.75	10:10:00	13.14	Y	8813.91	912.85	10.30	-490.86	421.99	Pumping port closed on 2022/08/15 in preparation for sampling
2	974.30	971.05	907.47	10:20:00	8656.67	Y	8880.17	10:21:00	13.33	Y	8657.09	895.77	11.70	-475.18	420.59	
3	928.60	925.86	865.06	10:25:00	8232.70	Y	8499.94	10:26:00	13.14	Y	8232.20	856.99	8.07	-432.77	424.22	
4	865.50	863.01	806.50	10:31:00	7644.86	Y	7924.10	10:32:00	12.61	Y	7644.92	798.28	8.22	-374.21	424.07	
5	857.20	855.13	798.79	10:33:00	7568.07	Y	7775.05	10:34:00	12.42	Y	7567.51	783.08	15.71	-366.50	416.58	
6	800.80	798.67	746.43	10:46:00	7043.97	Y	7147.49	10:47:00	11.73	Y	7044.07	719.09	27.34	-314.14	404.95	
7	788.00	786.00	734.54	10:59:00	6924.54	Y	7005.95	11:00:00	11.49	Y	6924.52	704.66	29.88	-302.25	402.41	
8	736.20	734.75	686.45	11:04:00	6443.39	Y	6598.62	11:05:00	11.26	Y	6442.94	663.12	23.33	-254.16	408.96	Rechecked
9	679.80	678.61	634.09	11:09:00	5919.70	Y	6077.73	11:10:00	10.76	Y	5919.91	610.01	24.08	-201.80	408.21	
10	635.00	633.88	592.48	11:15:00	5503.95	Y	5765.38	11:15:00	10.33	Y	5503.88	578.16	14.32	-160.19	417.97	Verified by MEOR
11	627.30	626.21	585.33	11:17:00	5432.35	Y	5670.55	11:18:00	10.15	Y	5432.50	568.49	16.84	-153.04	415.45	
12	587.70	586.93	548.51	11:22:00	5064.48	Y	5326.12	11:23:00	9.76	Y	5064.14	533.37	15.14	-116.22	417.15	
13	542.00	541.57	505.99	11:26:00	4639.49	Y	4919.31	11:28:00	9.37	Y	4639.52	491.88	14.11	-73.70	418.18	
14	487.20	486.95	454.95	11:32:00	4128.84	Y	4396.19	11:33:00	8.84	Y	4128.73	438.54	16.41	-22.66	415.88	
15	427.80	427.59	399.56	11:38:00	3575.27	Y	3821.49	11:39:00	8.32	Y	3575.08	379.94	19.62	32.73	412.67	
16	372.90	373.00	348.37	11:47:00	3064.55	Y	3324.08	11:48:00	7.55	Y	3064.60	329.22	19.15	83.92	413.14	
17	326.60	327.11	305.20	11:53:00	2633.25	Y	2912.24	11:55:00	7.12	Y	2633.37	287.23	17.97	127.09	414.32	
18	312.90	313.20	292.42	11:57:00	2505.87	Y	2781.05	12:00:00	6.94	Y	2505.92	273.85	18.57	139.87	413.72	
19	264.20	264.94	246.98	12:05:00	2051.53	Y	2334.42	12:06:00	6.58	Y	2051.58	228.31	18.67	185.31	413.62	
20	226.10	226.91	211.41	12:09:00	1696.58	Y	1985.39	12:09:00	6.35	Y	1696.61	192.72	18.69	220.88	413.60	
21	180.5	181.52	168.82	12:13:00	1271.26	Y	1563.48	12:14:00	6.05	Y	1271.26	149.70	19.12	263.47	413.17	
22	156.0	157.08	145.94	12:17:00	1043.99	Y	1357.71	12:18:00	5.80	Y	1043.55	128.72	17.22	286.35	415.07	
23	100.1	101.25	93.69	12:21:00	521.48	Y	841.29	12:22:00	5.55	Y	521.44	76.06	17.63	338.60	414.66	
24	90.9	91.94	85.09	12:24:00	435.63	Y	770.35	12:25:00	5.46	Y	435.61	68.82	16.27	347.20	416.02	
25	70.5	71.68	66.00	12:29:00	245.67	Y	591.02	12:30:00	5.42	Y	245.67	50.54	15.46	366.29	416.83	

Completed by: MDK, MEOR	Verified by: AMSC / MdK
Date: 18-Sep-22	Date: 24-Oct-22 / 31-Oct-23

Well ID IG_BH06	Pre Profile		Post Profile		Weather: 10 °C	
Datum: Ground Level	P _{atm} 96.73 kPa	P _{atm} 96.38 kPa	Overcast			
Elev. G.S.: 417.74 m	Temp. 13.77 °C	Temp. 5.15 °C				
Height of Westbay above G.S.: 0.91 m AGS	Date/Time 2022-09-16 15:50	Date/Time 2022-09-16 19:10				
Elev. Top of Westbay Casing: 418.65 m	MP38 Water Level 67.13 mBTOC	MP38 Water Level 67.31 mBTOC				
Reference Elevation: 417.74 mASL			Specific Weight 9.807 kN/m3			
Borehole angle: -70			Gravitational Accelerati 9.8065 m/s2			
			P _{atm} 96.56			

Notes:	Sample interval: IG_BH06_INT_T_008
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Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m BGS)	Fluid Pressure Readings							Pressure Head Outside Port (m) H=(P2-Patm)/w	Piezo Level Outside Port (m) Dz = Dp-H	Z: Elev of pressure measurement port (mASL)	Freshwater Head (mASL)	Comments	
				Start Profile Time	Inside Casing (P1- Landed Pressure) (kPa)	Shoe Out	Outside Casing (P2) (kPa)	Time (H:M:S)	Probe Temp. (°C)	Shoe In						Inside Casing (P1) (kPa)
1	990.20	986.56	919.41	16:58:00	8613.40		9174.47	16:59:00	13.22	Y	8613.57	925.66	-6.25	-501.67	423.99	Verified by MEOR Pumping port open. Currently being purged by NWMO.
2	948.40	945.35	880.65	17:09:00	8228.03	Y	8790.04	17:10:00	13.18	Y	8228.09	886.46	-5.81	-462.91	423.55	
3	907.20	903.87	842.46	17:14:00	7847.41	Y	8406.81	17:15:00	12.91	Y	7847.38	847.38	-4.92	-424.72	422.66	
4	852.30	849.15	791.60	17:21:00	7343.17	Y	7853.76	17:22:00	12.41	Y	7343.31	790.99	0.61	-373.86	417.13	
5	828.00	824.92	769.09	17:25:00	7119.40	Y	7621.21	17:26:00	12.15	Y	7119.27	767.27	1.82	-351.35	415.92	
6	796.90	794.15	740.28	17:32:00	6833.87	Y	7342.18	17:33:00	11.77	Y	6833.64	738.82	1.46	-322.54	416.28	
7	739.00	736.36	686.61	17:37:00	6301.11	Y	6762.87	17:38:00	11.35	Y	6300.77	679.75	6.86	-268.87	410.88	
8	719.10	717.01	668.15	17:41:00	6117.77	Y	6117.97	17:42:00	11.05	Y	6117.71	613.99	54.16	-250.41	363.58	
9	702.20	699.94	652.47	17:45:00	5962.98	Y	6443.19	17:46:00	10.87	Y	5962.80	647.15	5.32	-234.73	412.42	
10	687.00	684.65	638.37	17:47:00	5822.52	Y	6308.17	17:48:00	10.69	Y	5822.72	633.39	4.98	-220.63	412.76	
11	629.10	626.89	584.64	17:55:00	5289.62	Y	5777.91	17:56:00	10.21	Y	5289.57	579.32	5.32	-166.90	412.42	
12	568.10	566.28	528.00	18:01:00	4727.58	Y	5207.98	18:02:00	9.70	Y	4727.82	521.20	6.80	-110.26	410.94	
13	514.80	513.00	478.50	18:09:00	4236.20	Y	4720.37	18:10:00	9.14	Y	4236.41	471.48	7.02	-60.76	410.72	
14	488.90	487.17	454.44	18:12:00	3997.56	Y	4492.44	18:13:00	8.89	Y	3997.72	448.24	6.20	-36.70	411.54	
15	464.50	462.85	431.77	18:18:00	3773.18	Y	4273.13	18:19:00	8.54	Y	3773.25	425.88	5.89	-14.03	411.85	
16	411.20	409.93	382.27	18:23:00	3283.15	Y	3788.55	18:24:00	8.20	Y	3283.29	376.47	5.80	35.47	411.94	
17	368.50	367.43	342.64	18:30:00	2891.53	Y	3403.25	18:31:00	7.67	Y	2891.60	337.18	5.46	75.10	412.28	
18	278.70	277.97	259.30	18:36:00	2065.58	Y	2584.21	18:37:00	6.92	Y	2065.66	253.66	5.64	158.44	412.10	
19	214.80	214.05	199.93	18:41:00	1476.57	Y	2007.45	18:42:00	6.41	Y	1476.59	194.85	5.08	217.81	412.66	
20	160.00	159.71	148.98	18:46:00	972.29	Y	1511.43	18:47:00	5.84	Y	971.82	144.27	4.71	268.76	413.03	
21	147.8	147.58	137.63	18:51:00	859.12	Y	1394.23	18:52:00	5.51	Y	859.11	132.32	5.31	280.11	412.43	
22	82.4	81.9	76.73	18:58:00	255.50	Y	822.01	18:59:00	5.12	Y	255.43	73.97	2.76	341.01	414.98	

Completed by:	MDK, MEOR	Verified by:	AMSC / MdK
Date:	16-Sep-22	Date:	24-Oct-22 / 31-Oct-23

Well ID:	IG_BH01	Multiparameter Probe:	Horiba U52 (SN. PDWJB880)	Other Notes/Comments	IG BH01 GW035 - Primary Sample
Date(s):	23-Sep-22 to 24-Sep-22	Fluorometer:	AquaFluor (SN.807511)		
Operator(s):	MdK, MEOR	Colorimeter:	DR900 (SN. 200660001027)		

Port ID	Cumulative Purge/Sampled Volume (L)	Measurement Date and Time	Multiparameter Probe								Fluorometer		Hydrometer	Colorimetric				Alkalinity		Sample Collected (Y/N)	Comments (sampling run #, sample ID, water colour or odour, etc.)
			Calibrated	pH	Temp (°C)	EC (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	TDS (g/L)	Calibrated	Fluorescei n (ppb)	Specific Gravity	Calibrated	Dissolved Oxygen (mg/L)	Dissolved Ferrous Iron Fe ²⁺ (mg/L)	Total Dissolved Sulphide S ²⁻ (mg/L)	Phenol. (mg/L)	Total as CaCO ₃ (mg/L)		
IG_BH01_IN T_T_002	10	2022-09-23 9:45	Y	7.91	7.59	18.0	123	0.26	93.5	11.2	Y	18.18	1.015	--	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTC with Mosdax probe landed on port and valve opened.
IG_BH01_IN T_T_002	20	2022-09-23 10:45	Y	8.29	8.45	18.0	-73	0.00	54.8	11.2	Y	18.46	1.015	--	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTC with Mosdax probe landed on port and valve opened.
IG_BH01_IN T_T_002	25	2022-09-23 11:45	Y	8.39	9.60	18.0	-112	0.00	30.8	11.1	Y	18.42	1.012	--	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTC with Mosdax probe landed on port and valve opened.
IG_BH01_IN T_T_002	30	2022-09-23 12:45	Y	8.40	10.92	17.6	-129	0.00	19.2	10.9	Y	18.70	1.015	--	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTC with Mosdax probe landed on port and valve opened.
IG_BH01_IN T_T_002	38	2022-09-23 13:45	Y	8.58	11.33	17.3	-150	0.00	14.8	10.7	Y	18.65	1.015	--	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTC with Mosdax probe landed on port and valve opened.
IG_BH01_IN T_T_002	--	2022-09-24 9:15	--	--	--	--	--	--	--	--	Y	51.17	--	--	--	--	--	--	--	Y	Collected during sampling from run #1
IG_BH01_IN T_T_002	--	2022-09-24 13:20	Y	9.70	10.83	13.7	-120	0.00	36.0	8.50	Y	49.10	1.012	Y	0.631	2.19	0.09	0	18	Y	Collected during sampling from run #3. Horiba parameters collected by running sample through horiba flow through cell
IG_BH01_IN T_T_002	--	2022-09-24 13:30	Y	9.14	11.96	13.9	-137	0.00	35.0	8.61	Y	--	--	--	--	--	--	--	--	Y	Collected during sampling from run #3. Parameters collected after 10min of sample sitting in horiba flow through cell
IG_BH01_IN T_T_002	--	2022-09-24 13:45	Y	8.80	12.18	14.0	-136	0.00	29.9	8.71	Y	--	--	--	--	--	--	--	--	Y	Collected during sampling from run #3. Parameters collected after 25min of sample sitting in horiba flow through cell
IG_BH01_IN T_T_002	--	2022-09-24 16:25	--	--	--	--	--	--	--	--	Y	50.05	--	--	--	--	--	--	--	Y	Collected during sampling from run #5

Completed by:	MDK, MEOR	Verified by:	AMSC
Date:	24-Sep-22	Date:	24-Oct-22

Well ID:	IG_BH01	Start Time	7:40		
MP38 Water Level Before Sampling:	29.39	m BTOC	Starting Ambient Pressure	96.64	kPa
MP38 Water Level After Sampling:	32.97	m BTOC	End Sampling Time	17:56	
Probe Serial #/Range	EMS5288	kPa	Ending Ambient Pressure	94.75	kPa
Date:	24-Sep-22				

Other Notes/Comments:

IG BH01 GW035 - Primary Sample

Sampling Run Start Date/Time	Port #	Run #	Function Tests/Preparation						Landed Port	Sampling Sequence								Sampling Run End Time	Comments (volume recovered, parameters measured, samples collected, etc)	
			Shoe-Out	Close Valve	Vacuum Check	Open Valve	Evacuate Bottles (<35 kPa)	Close Valve		Landed Westbay MP38 Pressure (pre-sample, kPa)	Shoe-Out	Zone Pressure (pre-sample, kPa)	Open-Valve	Stabilization Time (sec)	Zone Pressure (post-sample kPa)	Close Valve	Shoe-In			Landed Westbay MP38 Pressure (post-sample, kPa)
2022-09-24 8:19	IG_BH01_INT_T_002	1	x	x	x	x	x	x	x	8726.79	x	8722.29	x	212	8712.06	x	x	8716.96	9:13	Collected by landing probe on the sampling port. Run #1 used to collect field filtered parameters (metals, sulphide,DOC, δ ¹³ C-DIC), Ammonia, Nutrients, and FI).
2022-09-24 9:58	IG_BH01_INT_T_002	2	x	x	x	x	x	x	x	8705.15	x	8701.87	x	87	8698.59	x	x	8701.86	11:22	Collected by landing probe on the sampling port. Run #2 used to collect noble gas and Archive sample.
2022-09-24 12:08	IG_BH01_INT_T_002	3	x	x	x	x	x	x	x	8711.28	x	8707.19	x	262	8696.54	x	x	8702.66	13:12	Collected by landing probe on the sampling port. Run #3 used to collect in-field analysis and non-field filtered parameters (Relative Silica and Anions).
2022-09-24 13:52	IG_BH01_INT_T_002	4	x	x	x	x	x	x	x	8698.60	x	8695.33	x	113	8690.42	x	x	8694.91	14:50	Collected by landing probe on the sampling port. Run #4 used to collect noble gas and ¹⁴ C-DIC
2022-09-24 15:32	IG_BH01_INT_T_002	5	x	x	x	x	x	x	x	8705.15	x	8701.87	x	243	8690.82	x	x	8696.95	16:18	Collected by landing probe on the sampling port. Run #5 used to collect δ ¹⁸ O, δ ² H, ³ H and ³ SR/ ³ SR
2022-09-24 17:08	IG_BH01_INT_T_002	6	x	x	x	x	x	x	x	8702.70	x	8699.43	x	240	8688.78	x	x	8694.50	17:56	Collected by landing probe on the sampling port. Run #6 used to collect ³⁶ Ar, ³⁶ Ar and δ ³⁷ Cl

Note: Record field parameter measurements on 20-203-01: Field Parameter Measurement/Testing - Field Data Sheet

Completed by:	MDK, MEOR	Verified by:	AMSC
Date:	24-Sep-22	Date:	24-Oct-22

Well ID:	IG_BH03	Multiparameter Prc	Horiba U52 (SN. PDWJB880)	Other Notes/Comments	IG BH03 GW017 - Primary Sample
Date(s):	Sept 17, 2022 to Sept 21, 2022	Fluorometer:	AquaFluor (SN.807511)		IG BH03 GW018 - Duplicate Sample
Operator(s):	MdK, MEOR	Colorimeter:	DR900 (SN. 200660001027)		

Port ID	Cumulative Purge/Sampled Volume (L)	Measurement Date and Time	Multiparameter Probe								Fluorometer		Hydrometer	Colorimetric				Alkalinity		Sampl e Collec ted (Y/N)	Comments (sampling run #, sample ID, water colour or odour, etc.)
			Calibrated	pH	Temp (°C)	EC (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	TDS (g/L)	Calibrated	Fluorescein (ppb)	Specific Gravity	Calibrated	Dissolved Oxygen (mg/L)	Dissolved Ferrous Iron Fe ²⁺ (mg/L)	Total Dissolved Sulphide S ²⁻ (mg/L)	Phenol. (mg/L)	Total as CaCO ₃ (mg/L)		
IG_BH03_INT _T_002	2	2022-09-17 13:00	Y	8.86	15.14	26.8	199	--	8.2	16.6	Y	19.09	--	--	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTOC with Mosdax probe landed on port and valve opened.
IG_BH03_INT _T_002	6	2022-09-17 14:00	Y	8.43	14.31	45.9	75	0.65	25.0	28.0	Y	13.54	--	--	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTOC with Mosdax probe landed on port and valve opened.
IG_BH03_INT _T_002	10	2022-09-17 15:00	Y	8.70	15.23	44.0	40	0.32	14.9	26.8	Y	13.52	--	--	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTOC with Mosdax probe landed on port and valve opened.
IG_BH03_INT _T_002	18	2022-09-17 16:30	Y	8.83	12.22	43.6	39	0.49	50.9	26.6	Y	13.52	--	--	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTOC with Mosdax probe landed on port and valve opened.
IG_BH03_INT _T_002	--	2022-09-19 14:25	--	--	--	--	--	--	--	--	Y	2.804	--	--	--	--	--	--	--	Y	Collected during sampling from run #2
IG_BH03_INT _T_002	--	2022-09-20 14:15	Y	7.28	17.54	47.4	-46	0.00	27.6	28.9	Y	2.676	1.037	Y	0.602	2.065	0.307	0	18	Y	Collected during sampling from run #6. Horiba parameters collected by running sample through horiba flow through cell; A lot of flocculant was observed in sulfide analysis.
IG_BH03_INT _T_002	--	2022-09-20 14:25	Y	7.13	19.95	46.3	-112	0.00	14.8	28.3	--	--	--	--	--	--	--	--	--	Y	Collected during sampling from run #6. Parameters collected after 10min of sample sitting in horiba flow through cell
IG_BH03_INT _T_002	--	2022-09-20 14:40	Y	7.00	20.38	46.7	-145	0.00	15.8	28.5	--	--	--	--	--	--	--	--	--	Y	Collected during sampling from run #6. Parameters collected after 25min of sample sitting in horiba flow through cell
IG_BH03_INT _T_002	--	2022-09-21 13:30	--	--	--	--	--	--	--	--	Y	2.898	--	--	--	--	--	--	--	Y	Collected during sampling from run #11

Completed by:	MDK, MEOR	Verified by:	AMSC
Date:	21-Sep-22	Date:	24-Oct-22

Well ID:	IG_BH03	Start Time	9:00 ; 7:55; 8:00	Other Notes/Comments: IG BH03 GW017 - Primary Sample IG BH03 GW018 - Duplicate Sample		
MP38 Water Level Before Sampling:	83.10; 83.48; 84.10	m BTOC	Starting Ambient Pressure		94.75; 95.87; 95.66	kPa
MP38 Water Level After Sampling:	83.52; 84.25; 84.01	m BTOC	End Sampling Time		16:00 ; 20:15: 15:05	
Probe Serial #/Range	EMS4960/ EMS 5288		Ending Ambient Pressure		95.93; 95.06; 96.55	kPa
Date:	19-Sep-22 ; 20-Sep-22; 21-Sep-22					

Sampling Run Start Date/Time	Port #	Run #	Function Tests/Preparation							Landed Port	Sampling Sequence								Sampling Run End Time	Comments (volume recovered, parameters measured, samples collected, etc)
			Shoe-Out	Close Valve	Vacuum Check	Open Valve	Evacuate Bottles (≤ 35 kPa)	Close Valve	Landed Westbay MP38 Pressure (pre- sample, kPa)		Shoe-Out	Zone Pressure (pre-sample, kPa)	Open-Valve	Stablization Time (sec)	Zone Pressure (post- sample kPa)	Close Valve	Shoe-In	Landed Westbay MP38 Pressure (post-sample, kPa)		
2022-09-19 9:56	IG_BH03_INT _T_002	1	x	x	x	x	x	x	x	8137.91	x	8323.83	x	N/A	N/A	x	x	N/A	Pressures did not stabilize, no water was collected during run. Changed sampler probe (to EMS5288) to troubleshoot issue.	
2022-09-19 12:29	IG_BH03_INT _T_002	2	x	x	x	x	x	x	x	8124.72	x	8325.61	x	120	8294.98	x	x	8124.31	14:20	Collected by landing probe on the sampling port. Run #2 used to collect noble gas and Ruthenium samples
2022-09-19 14:58	IG_BH03_INT _T_002	3	x	x	x	x	x	x	x	8134.96	x	8311.75	x	288	8182.70	x	x	8134.11	15:51	Collected by landing probe on the sampling port. Run #3 used to collect $^{87}\text{Sr}/^{86}\text{Sr}$ sample and Ammonia
2022-09-20 8:39	IG_BH03_INT _T_002	4	x	x	x	x	x	x	x	8134.13	x	8314.19	x	426	8190.86	x	x	8133.29	9:38	Collected by landing probe on the sampling port. Run #4 used to collect filtered samples (metals, DOC, sulfide, $\delta^{13}\text{C-DIC}$, archive)
2022-09-20 10:51	IG_BH03_INT _T_002	5	x	x	x	x	x	x	x	8121.05	x	8250.47	x	75	8216.17	x	x	8120.23	11:58	Collected by landing probe on the sampling port. Run #5 used to collect noble gas
2022-09-20 12:50	IG_BH03_INT _T_002	6	x	x	x	x	x	x	x	8132.50	x	8253.76	x	471	8130.39	x		8131.66	13:52	Collected by landing probe on the sampling port. Run #6 used to collect field parameters, reactive silica, and nutrients
2022-09-20 14:54	IG_BH03_INT _T_002	7	x	x	x	x	x	x	x	8119.02	x	8205.98	x	95	8171.68	x	x	8119.01	15:56	Collected by landing probe on the sampling port. Run #7 used to collect noble gas
2022-09-20 19:01	IG_BH03_INT _T_002	8	x	x	x	x	x	x	x	8130.46	x	8242.33	x	437	8118.6	x	x	8129.62	19:53	Collected by landing probe on the sampling port. Run #8 used to collect 500mL general bottle for BVL
2022-09-21 8:42	IG_BH03_INT _T_002	9	x	x	x	x	x	x	x	8131.29	x	8279.02	x	394	8152.9	x	x	8130.44	9:40	Collected by landing probe on the sampling port. Run #9 used to collect $^{14}\text{C-DIC}$ bottles
2022-09-21 10:35	IG_BH03_INT _T_002	10	x	x	x	x	x	x	x	8130.48	x	8215.5	x	566	8096.55	x	x	8130.03	11:34	Collected by landing probe on the sampling port. Run #10 used to collect bottles for $\delta^{18}\text{O}$, $\delta^{15}\text{N}$, H_4
2022-09-21 12:27	IG_BH03_INT _T_002	11	x	x	x	x	x	x	x	8130.47	x	8169.67	x	400	8044.71	x	x	8130.03	13:28	Collected by landing probe on the sampling port. Run #11 used to collect bottles for $\delta^{45}\text{Cl}$ and FI measurement.
2022-09-21 14:15	IG_BH03_INT _T_002	12	x	x	x	x	x	x	x	8130.49	x	8132.11	x	393	8008.8	x	x	8129.63	15:05	Collected by landing probe on the sampling port. Run #12 used to collect bottles for ^{19}F , ^{40}Ar

Note: Record field parameter measurements on 20-203-01: Field Parameter Measurement/Testino - Field Data Sheet

Completed by:	MDK. MEOR	Verified by:	AMSC
Date:	21-Sep-22	Date:	24-Oct-22

Well ID:	IG_BH05	Multiparameter Probe:	Horiba U52 (SN. PDWJB880)	Other Notes/Comments IG BH05 GW005 - Primary Sample IG BH05 GW006 - Duplicate Sample IG BH05 GW007 - Rinsate Sample IG_BH05_GW008 - Blank Sample
Date(s):	22-Sept-22 ; 25-Sept-22; 26-Sep-22	Fluorometer:	AquaFluor (SN.807511)	
Operator(s):	MdK, MEOR	Colorimeter:	DR900 (SN. 200660001027)	

Port ID	Cumulative Purge/Sampled Volume (L)	Measurement Date and Time	Multiparameter Probe								Fluorometer		Hydrometer	Colorimetric				Alkalinity		Sample Collected (Y/N)	Comments (sampling run #, sample ID, water colour or odour, etc.)
			Calibrated	pH	Temp (°C)	EC (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	TDS (g/L)	Calibrated	Fluorescei n (ppb)	Specific Gravity	Calibrated	Dissolved Oxygen (mg/L)	Dissolved Ferrous Iron Fe ²⁺ (mg/L)	Total Dissolved Sulphide S ²⁻ (mg/L)	Phenol. (mg/L)	Total as CaCO ₃ (mg/L)		
IG_BH05_IN T_T_007	2	2022-09-22 10:05	Y	7.81	10.05	16.6	-97	0.40	120	10.3	Y	13.47	1.020	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTOC with Mosdax probe landed on port and valve opened.	
IG_BH05_IN T_T_007	10	2022-09-22 11:00	Y	8.22	7.88	16.0	-112	0.00	64.9	9.93	Y	13.94	1.017	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTOC with Mosdax probe landed on port and valve opened.	
IG_BH05_IN T_T_007	15	2022-09-22 12:00	Y	7.86	11.35	15.0	-117	0.02	40.2	9.32	Y	13.28	1.015	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTOC with Mosdax probe landed on port and valve opened.	
IG_BH05_IN T_T_007	18	2022-09-22 13:00	Y	7.76	10.66	15.10	-123	0.16	54.2	9.36	Y	13.35	1.010	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTOC with Mosdax probe landed on port and valve opened.	
IG_BH05_IN T_T_007	30	2022-09-22 14:00	Y	7.75	8.66	15.1	-101	0.69	57.8	9.36	Y	13.13	1.015	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTOC with Mosdax probe landed on port and valve opened.	
IG_BH05_IN T_T_007	35	2022-09-22 14:50	Y	7.75	9.53	14.8	-102	0.98	55.6	9.23	Y	13.40	1.015	--	--	--	--	--	N	Collected during purging using solinst bladder pump lowered to ~85 mBTOC with Mosdax probe landed on port and valve opened.	
IG_BH05_IN T_T_007	--	2022-09-25 9:50	--	--	--	--	--	--	--	--	Y	2.679	--	--	--	--	--	--	Y	Collected during sampling from run #1	
IG_BH05_IN T_T_007	--	2022-09-25 15:00	Y	9.64	10.28	17.6	-112	0.04	22.5	10.9	Y	2.212	1.011	Y	0.427	2.73	0.90	0	180	Y	Collected during sampling from run #4. Horiba parameters collected by running sample through horiba flow through cell; Sulfide and Ferrous Iron initially exceeded detection limit, therefore were diluted
IG_BH05_IN T_T_007	--	2022-09-25 15:10	Y	8.60	11.80	17.2	-148	0.00	32.5	10.7	--	--	--	--	--	--	--	--	Y	Collected during sampling from run #4. Parameters collected after 10min of sample sitting in horiba flow through cell	
IG_BH05_IN T_T_007	--	2022-09-25 15:25	Y	8.17	11.90	17.3	-159	0.00	24.3	10.7	--	--	--	--	--	--	--	--	Y	Collected during sampling from run #4. Parameters collected after 25min of sample sitting in horiba flow through cell	
IG_BH05_IN T_T_007	--	2022-09-26 14:45	--	--	--	--	--	--	--	--	Y	4.146	--	--	--	--	--	--	Y	Collected during sampling from run #9	
IG_BH05_IN T_T_007	--	2022-09-26 16:10	--	--	--	--	--	--	--	--	Y	4.822	--	--	--	--	--	--	Y	Collected during sampling from run #10	

Completed by:	MDK, MEOR	Verified by:	AMSC
Date:	26-Sep-22	Date:	24-Oct-22

Well ID:

IG_BH05

Start Time

8:00; 7:45; 9:20

MP38 Water Level Before Sampling:

76.70; 76.99; 77.30

m BTOC

Starting Ambient Pressure

95.24; 97.14; 98.14

kPa

MP38 Water Level After Sampling:

77.07; 77.47; 77.59

m BTOC

End Sampling Time

16:35; 16:10; 11:00

Probe Serial #/Range

EMS 5288

Ending Ambient Pressure

95.96; 96.99; 97.83

kPa

Date:

25-Sep-22; 26-Sep-22; 27-Sep-22

Other Notes/Comments:

IG_BH05_GW005 - Primary Sample

IG_BH05_GW006 - Duplicate Sample

IG_BH05_GW007 - Rinsate Sample

IG_BH05_GW008 - Blank Sample

Sampling Run Start Date/Time	Port #	Run #	Function Tests/Preparation						Landed Port	Sampling Sequence								Sampling Run End Time	Comments (volume recovered, parameters measured, samples collected, etc)	
			Shoe-Out	Close Valve	Vacuum Check	Open Valve	Evacuate Bottles (<35 kPa)	Close Valve		Landed Westbay MP38 Pressure (pre-sample, kPa)	Shoe-Out	Zone Pressure (pre-sample, kPa)	Open-Valve	Stablization Time (sec)	Zone Pressure (post-sample kPa)	Close Valve	Shoe-In			Landed Westbay MP38 Pressure (post-sample, kPa)
2022-09-25 8:47	IG_BH05_INT_T_007	1	x	x	x	x	x	x	x	6741.70	x	7016.27	x	441	7003.18	x	x	6741.22	9:43	Collected by landing probe on the sampling port. Run #1 used to collect noble gas and nutrients
2022-09-25 10:25	IG_BH05_INT_T_007	2	x	x	x	x	x	x	x	6752.71	x	7014.65	x	862	6997.46	x	x	6751.38	11:25	Collected by landing probe on the sampling port. Run #2 used to collect metals, DOC, Sulphide, Reactive Silica and Ammonia
2022-09-25 12:10	IG_BH05_INT_T_007	3	x	x	x	x	x	x	x	6740.07	x	7013.43	x	482	6997.07	x	x	6739.59	13:03	Collected by landing probe on the sampling port. Run #3 used to collect noble gases and ruthenium
2022-09-25 13:43	IG_BH05_INT_T_007	4	x	x	x	x	x	x	x	6750.67	x	7013.03	x	928	6996.24	x	x	6749.75	14:44	Collected by landing probe on the sampling port. Run #4 used to collect in-field analysis and general chemistry bottles.
2022-09-25 15:36	IG_BH05_INT_T_007	5	x	x	x	x	x	x	x	6741.70	x	7012.21	x	661	6997.47	x	x	6740.80	16:31	Collected by landing probe on the sampling port. Run #5 used to collect noble gases and Archive
2022-09-26 8:22	IG_BH05_INT_T_007	6	x	x	x	x	x	x	x	6751.53	x	7017.55	x	966	7001.94	x	x	6750.57	9:15	Collected by landing probe on the sampling port. Run #6 used to collect $\delta^{13}\text{C}$ -DIC and ^{14}C -DIC
2022-09-26 10:08	IG_BH05_INT_T_007	7	x	x	x	x	x	x	x	6750.69	x	7015.06	x	993	6999.9	x	x	6749.34	11:08	Collected by landing probe on the sampling port. Run #7 used to collect $\delta^{18}\text{O}$, $\delta^2\text{H}$, ^3H
2022-09-26 11:52	IG_BH05_INT_T_007	8	x	x	x	x	x	x	x	6750.26	x	7013.03	x	921	6997.05	x	x	6748.94	12:43	Collected by landing probe on the sampling port. Run #8 used to collect $\delta^{18}\text{O}$, $\delta^2\text{H}$, ^3H
2022-09-26 13:37	IG_BH05_INT_T_007	9	x	x	x	x	x	x	x	6749.86	x	7011.81	x	885	6994.2	x	x	6748.13	14:30	Collected by landing probe on the sampling port. Run #9 used to collect $\delta^{37}\text{Cl}$ and FI
2022-09-26 15:18	IG_BH05_INT_T_007	10	x	x	x	x	x	x	x	6749.04	x	7010.99	x	921	6995.01	x	x	6747.31	16:10	Collected by landing probe on the sampling port. Run #10 used to collect $^{87}\text{Sr}/^{86}\text{Sr}$ and FI
2022-09-26 9:57	IG_BH05_INT_T_007	11	x	x	x	x	x	x	x	6750.28	x	7016.71	x	930	7001.94	x	x	6748.53	10:55	Collected by landing probe on the sampling port. Run #11 used to collect ^{199}I , ^{129}I

Note: Record field parameter measurements on 20-203-01: Field Parameter Measurement/Testing - Field Data Sheet

Completed by:

MDK, MEOR

Verified by:

AMSC

Date:

26-Sep-22

Date:

24-Oct-22

COC Number/ID	Sample ID(s)	Shipping Information						Receiving Information				Comments
		Shipped Date	Shipped Time	Temp. Shipped (deg C)	COC Signed by Geofirma (Y/N)	Shipping Address	Shipping Method	Received Date	Received Time	Temp Received (deg C)	COC Signed By Receiving Lab (Y/N)	
GFIM_BVL_0009	IG_BH03_GW017 IG_BH03_GW018	21-Sep-22	12:30	8	Y	Bureau Veritas Labs 946 Cobalt Crescent Thunder Bay, ON	Purolator	22-Sep-22	11:12	4,2,3	Y	
GFIM_BVL_0010	IG_BH01_GW035 IG_BH05_GW005 IG_BH05_GW006 IG_BH05_GW007	26-Sep-22	10:30	4	Y	Bureau Veritas Labs 946 Cobalt Crescent Thunder Bay, ON	Purolator	28-Sep-22	16:24	1,2,1	Y	
GFIM_NWMO_0006	IG_BH03_GW017 IG_BH03_GW018 IG_BH01_GW035 IG_BH05_GW005 IG_BH05_GW006	27-Sep-22	13:00	5	Y	Ignace	Hand delivered	27-Sep-22	13:15	6	Y	Archive Samples
GFIM_IT2_0006	IG_BH03_GW017 IG_BH03_GW018 IG_BH01_GW035 IG_BH05_GW005 IG_BH05_GW006 IG_BH05_GW008	28-Sep-22	13:05	4	Y	608 Weber St. N Unit3, Waterloo, ON N2V 1K4	Purolator	29-Sep-22	n/a	n/a	Y	
GFIM_Uofo_0006	IG_BH03_GW017 IG_BH03_GW018 IG_BH01_GW035 IG_BH05_GW005 IG_BH05_GW006	04-Oct-22	11:30	<10 (on ice)	Y	25 Templeton St., Ottawa ON K1N 6N5	Hand delivered	04-Oct-22	11:30	n/a	Y	

Completed by:	MDK	Verified by:	AMSC
Date:	05-Oct-22	Date:	24-Oct-22

Laboratory Report Date	25-Nov-22
Laboratory Name	Bureau Veritas
Laboratory Report ID (if applicable)	C2R5589, C2S0594
Analyses Completed	Major and Trace Elements and Metals; Total dissolved sulphur; Total dissolved iron; Reactive silica; Sulphide; Anions; pH; Alkalinity; Fluoride; TIC; TOC; DOC; TKN; Total Phosphorus; Total Ammonia; Total Nitrogen; Carbonate, Bicarbonate and Hydroxide

Associated COC #(s)	GFIM_BVL_0009, GFIM_BVL_0010
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Samples Included in Laboratory Report
IG_BH03_GW017 IG_BH03_GW018 IG_BH01_GW035 IG_BH05_GW005 IG_BH05_GW006 IG_BH05_GW007

Quality Check and Verification	Verified By (Initials)	Comments
Results received from laboratory	AMSC	
All samples were tested or accounted for. Justification provided for any untested samples (e.g. spare sample)	AMSC	
Laboratory data report provided with results	AMSC	
Laboratory testing methods/techniques included in data report	AMSC	
Laboratory QA procedures and equipment calibration included in data report	AMSC	
Laboratory results are within reasonable/expected range	AMSC	See notes below

Other Comments/Notes:
-Report #C2R5589: Some discrepancies between samples IG_BH03_GW017 and IG_BH03_GW018 for TKN analysis (and associated total Nitrogen calc). Geofirma reached out to lab to confirm reported results and to re-run TKN analysis, if possible. Awaiting response. [AMSC 14-Nov-22] -Lab re-ran samples for TKN (and associated Nitrogen calc) and the repeated results were lower and more inline with the original result reported for IG_BH03_GW017. The lab is investigating the discrepancy. [AMSC 29-Nov-22] -Geofirma asked lab to correct the sample IDs : changing the hyphens (-) to underscores (_). Awaiting corrected lab reports. [AMSC 14-Nov-22] -Corrected lab report received. [AMSC 29-Nov-22]

Note: A copy of this form is to be complete for each laboratory data report that is received by Geofirma

Completed by:	AMSC	Verified by:	SNS
Date:	14-Nov-22	Date:	18-Nov-22

Laboratory Report Date	24-Mar-23		
Laboratory Name	Isotope Tracer Technologies (IT2)		
Laboratory Report ID (if applicable)	220901		
Analyses Completed	18-O, 2-H, 3-H, 87-Sr/86-Sr, 37-Cl, 13-C, 14-C		

Associated COC #(s)	GFIM IT2_0006		
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Samples Included in Laboratory Report			
IG_BH03_GW017 IG_BH03_GW018 IG_BH01_GW035 IG_BH05_GW005 IG_BH05_GW006 IG_BH05_GW008			

Quality Check and Verification		Verified By (Initials)	Comments
Results received from laboratory		AMSC	
All samples were tested or accounted for. Justification provided for any untested samples (e.g. spare sample)		AMSC	
Laboratory data report provided with results		AMSC	
Laboratory testing methods/techniques included in data report		AMSC	
Laboratory QA procedures and equipment calibration included in data report		AMSC	
Laboratory results are within reasonable/expected range		AMSC	

Other Comments/Notes:			
Partial results received from lab as a draft. Awaiting 14-C results and official lab report. [10-Jan-2023]			
Final report received. [24-Mar-2023]			

Note: A copy of this form is to be complete for each laboratory data report that is received by Geofirma

Completed by:	AMSC	Verified by:	CAM
Date:	29-Mar-23	Date:	18-Jul-23

Laboratory Report Date	01-Mar-2023; 27-Apr-2023; 19-Jun-2023
Laboratory Name	University of Ottawa - Hydrogeochemistry Laboratory
Laboratory Report ID (if applicable)	N/A
Analyses Completed	129-I, 36-Cl, Noble Gases

Associated COC #(s)	GFIM_UoO_0006
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Samples Included in Laboratory Report
IG_BH03_GW017 IG_BH03_GW018 IG_BH01_GW035 IG_BH05_GW005 IG_BH05_GW006

Quality Check and Verification	Verified By (Initials)	Comments
Results received from laboratory	AMSC	
All samples were tested or accounted for. Justification provided for any untested samples (e.g. spare sample)	AMSC	
Laboratory data report provided with results	AMSC	
Laboratory testing methods/techniques included in data report	AMSC	
Laboratory QA procedures and equipment calibration included in data report	AMSC	
Laboratory results are within reasonable/expected range	AMSC	

Other Comments/Notes:
Results provided by the University of Ottawa in three separate reports for 36Cl, 129I, and noble gases.

Note: A copy of this form is to be complete for each laboratory data report that is received by Geofirma

Completed by:	AMSC	Verified by:	CAM
Date:	10-May-23	Date:	18-Jul-23

**2022 Q4 (December)
Data Quality Workbook (DQC)**

Borehole ID:	BH01, BH03, BH05, BH06	Comments:
Date:	Nov 30 - Dec 14, 2022	
Completed by:	AMSC, KBT	
Sampling Interval:	[IG_BH01_T_INT_007] [IG_BH01_T_INT_002] [IG_BH03_T_INT_021] [IG_BH05_T_INT_005] [IG_BH06_T_INT_008]	

Equipment	Date/Time	Decontamination Required (Y/N)	Location (BH)	PPE	Decontamination Procedure					Comments
					Loose Contamination Removed	Detergent Wash (record type of detergent used)	Dionized Water Rinse	Air Dried (Minimize Dust)	Rinsate Sample Collected (Y/N)	
Electronic Water Level Tape	2022-11-30 8:15	Y	BH03	Y	Y	Y	Y	Y	N	
MOSDAX sampler probe EMS 5230	2022-11-30 8:45	Y	BH03	Y	Y	Y	Y	Y	N	
Electronic Water Level Tape	2022-12-01 7:30	Y	BH01	Y	Y	Y	Y	Y	N	
MOSDAX sampler probe EMS 5230	2022-12-01 8:15	Y	BH01	Y	Y	Y	Y	Y	N	
Westbay sample bottles (x8)	2022-12-01 14:30	Y	BH01	Y	Y	Y	Y	Y	N	
Electronic Water Level Tape	2022-12-04 8:05	Y	BH06	Y	Y	Y	Y	Y	N	
MOSDAX sampler probe EMS 5230	2022-12-04 8:05	Y	BH06	Y	Y	Y	Y	Y	N	
Westbay sample bottles (x8)	2022-12-04 12:00	Y	BH06	Y	Y	Y	Y	Y	Y	IG BH05 GW009 (Rinsate)
Electronic Water Level Tape	2022-12-06 9:00	Y	BH03	Y	Y	Y	Y	Y	N	
MOSDAX sampler probe EMS 5230	2022-12-06 8:45	Y	BH03	Y	Y	Y	Y	Y	N	
Westbay sample bottles (x4)	2022-12-06 9:00	Y	BH03	Y	Y	Y	Y	Y	N	
MOSDAX sampler probe EMS 5288	2022-12-06 12:40	Y	BH03	Y	Y	Y	Y	Y	N	
Electronic Water Level Tape	2022-12-07 14:00	Y	BH01	Y	Y	Y	Y	Y	N	
Bladder Pump	2022-12-07 14:00	Y	BH01	Y	Y	Y	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-12-08 13:00	Y	BH01	Y	Y	Y	Y	Y	N	
Westbay sample bottles (x5)	2022-12-08 13:00	Y	BH01	Y	Y	Y	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-12-10 15:00	Y	BH05	Y	Y	Y	Y	Y	N	
Electronic Water Level Tape	2022-12-10 15:00	Y	BH05	Y	Y	Y	Y	Y	N	
Bladder Pump	2022-12-11 14:00	Y	BH05	Y	Y	Y	Y	Y	N	
Westbay sample bottles (x6)	2022-12-12 11:00	Y	BH05	Y	Y	Y	Y	Y	N	
MOSDAX sampler probe EMS 4960	2022-12-14 15:30	Y	BH03	Y	Y	Y	Y	Y	N	
Electronic Water Level Tape	2022-12-14 15:30	Y	BH03	Y	Y	Y	Y	Y	N	

Completed by:	AMSC	Verified by:	MdK
Date:	14-Dec-22	Date:	13-Jan-23

Date	Time	Personnel	Equipment Type	Serial Number	Calibration Check		Calibration Required (Y/N)	Calibration Performed		Comments
					Check Method & Standard(s) Used	Equipment Reading(s)		Calibration Method & Standard(s) Used	Equipment Reading(s)	
30-Nov-22	9:35	AMSC	MOSDAX Probe	EMSS230	Manual W/LP vs. Probe P	Manual P (anticipated) = 654.08 KPa; Probe P (measured) = 659.58 Kpa	N	--	--	--
30-Nov-22	6:15	KBT	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 10ppb, 100ppb, 1000ppb	0.000 9.971 99.94	Calibrated using turner design fluorescein standards: 10ppb (LOTR 1F0730), 100ppb (LOTR 1F0732) Exp. Jan 2024
30-Nov-22	6:00	AMSC	HoribaU52	21214	Lab provided solutions: 4.00, 7.00, 10.00	3.98 7.00 10.00	N	Lab-provided auto calibration solution 4.0 pH, 4.4mS/cm, 0.0NTU	4.00 4.40 mS/cm 0.0 NTU	Calibrated using lab provided solutions: AutoCal (LOTR 2GE988), pH 10.0 (LOTR 1GS16), pH 7.0 (LOTR 2GES79), pH 4.0 (LOTR 1GES39)
30-Nov-22	6:15	AMSC	DR900	20066001027	Absorbance Spectrophotometer 520nm: Blank: 0.00 Std 1: 0.597 ± 0.05 Std 2: 1.257 ± 0.10 Std 3: 1.890 ± 0.15 610nm: Blank: 0.00 Std 1: 0.556 ± 0.05 Std 2: 1.173 ± 0.10 Std 3: 1.764 ± 0.15	520nm: Blank: 0.000 Std 1: 0.603 Std 2: 1.271 Std 3: 1.913 610nm: Blank: 0.000 Std 1: 0.565 Std 2: 1.196 Std 3: 1.752	N	--	--	Cal checked using DR900 absorbance check kit (LOTR A2294)
01-Dec-22	6:00	AMSC	Fluorometer	807511	--	--	--	--	0.000 10.07 99.60	Calibrated using turner design fluorescein standards: 10ppb (LOTR 1F0730), 100ppb (LOTR 1F0732) Exp. Jan 2024
02-Dec-22	6:00	KBT	HoribaU52	21214	Lab provided solutions: 4.00, 7.00, 10.00	3.98 7.02 10.00	N	Lab-provided auto calibration solution 4.0 pH, 4.4mS/cm, 0.0NTU	3.99 4.40 mS/cm 0.0 NTU	Calibrated using lab provided solutions: AutoCal (LOTR 2GE988), pH 10.0 (LOTR 1GS16), pH 7.0 (LOTR 2GES79), pH 4.0 (LOTR 1GES39)
03-Dec-22	6:00	KBT	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 10ppb, 100ppb, 1000ppb	0.000 9.968 99.96	Calibrated using turner design fluorescein standards: 10ppb (LOTR 1F0730), 100ppb (LOTR 1F0732) Exp. Jan 2024
03-Dec-22	7:00	KBT	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 10ppb, 100ppb, 1000ppb	0.001 9.984 99.99	Calibrated using turner design fluorescein standards: 10ppb (LOTR 1F0730), 100ppb (LOTR 1F0732) Exp. Jan 2024
03-Dec-22	7:15	KBT	HoribaU52	21214	Lab provided solutions: 4.00, 7.00, 10.00	3.99 7.00 10.01	N	Lab-provided auto calibration solution 4.0 pH, 4.4mS/cm, 0.0NTU	3.99 4.40 mS/cm 0.0 NTU	Calibrated using lab provided solutions: AutoCal (LOTR 2GE988), pH 10.0 (LOTR 1GS16), pH 7.0 (LOTR 2GES79), pH 4.0 (LOTR 1GES39)
03-Dec-22	7:00	KBT	DR900	20066001027	Absorbance Spectrophotometer 520nm: Blank: 0.00 Std 1: 0.597 ± 0.05 Std 2: 1.257 ± 0.10 Std 3: 1.890 ± 0.15 610nm: Blank: 0.00 Std 1: 0.556 ± 0.05 Std 2: 1.173 ± 0.10 Std 3: 1.764 ± 0.15	520nm: Blank: 0.000 Std 1: 0.598 Std 2: 1.269 Std 3: 1.908 610nm: Blank: 0.000 Std 1: 0.565 Std 2: 1.165 Std 3: 1.801	N	--	--	Cal checked using DR900 absorbance check kit (LOTR A2294)
04-Dec-22	6:15	AMSC	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 10ppb, 100ppb, 1000ppb	0.000 9.971 99.96	Calibrated using turner design fluorescein standards: 10ppb (LOTR 1F0730), 100ppb (LOTR 1F0732) Exp. Jan 2024
04-Dec-22	6:25	KBT	HoribaU52	21214	Lab provided solutions: 4.00, 7.00, 10.00	3.99 7.00 10.01	N	Lab-provided auto calibration solution 4.0 pH, 4.4mS/cm, 0.0NTU	3.99 4.42 mS/cm 0.0 NTU	Calibrated using lab provided solutions: AutoCal (LOTR 2GE988), pH 10.0 (LOTR 1GS16), pH 7.0 (LOTR 2GES79), pH 4.0 (LOTR 1GES39)
04-Dec-22	6:25	AMSC	DR900	20066001027	Absorbance Spectrophotometer 520nm: Blank: 0.00 Std 1: 0.597 ± 0.05 Std 2: 1.257 ± 0.10 Std 3: 1.890 ± 0.15 610nm: Blank: 0.00 Std 1: 0.566 ± 0.05 Std 2: 1.173 ± 0.10 Std 3: 1.764 ± 0.15	520nm: Blank: 0.000 Std 1: 0.611 Std 2: 1.277 Std 3: 1.916 610nm: Blank: 0.000 Std 1: 0.576 Std 2: 1.168 Std 3: 1.791	N	--	--	Cal checked using DR900 absorbance check kit (LOTR A2294)
05-Dec-22	6:45	KBT	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 10ppb, 100ppb, 1000ppb	0.000 9.969 100.1	Calibrated using turner design fluorescein standards: 10ppb (LOTR 1F0730), 100ppb (LOTR 1F0732) Exp. Jan 2024
05-Dec-22	7:00	AMSC	HoribaU52	21214	Lab provided solutions: 4.00, 7.00, 10.00	3.99 7.01 10.00	N	Lab-provided auto calibration solution 4.0 pH, 4.4mS/cm, 0.0NTU	3.99 4.40 mS/cm 0.0 NTU	Calibrated using lab provided solutions: AutoCal (LOTR 2GE988), pH 10.0 (LOTR 1GS16), pH 7.0 (LOTR 2GES79), pH 4.0 (LOTR 1GES39)
05-Dec-22	6:50	KBT	DR900	20066001027	Absorbance Spectrophotometer 520nm: Blank: 0.00 Std 1: 0.597 ± 0.05 Std 2: 1.257 ± 0.10 Std 3: 1.890 ± 0.15 610nm: Blank: 0.00 Std 1: 0.566 ± 0.05 Std 2: 1.173 ± 0.10 Std 3: 1.764 ± 0.15	520nm: Blank: 0.000 Std 1: 0.620 Std 2: 1.275 Std 3: 1.910 610nm: Blank: 0.000 Std 1: 0.576 Std 2: 1.197 Std 3: 1.796	N	--	--	Cal checked using DR900 absorbance check kit (LOTR A2294)
06-Dec-22	6:45	KBT	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 10ppb, 100ppb, 1000ppb	0.001 9.986 99.93	Calibrated using turner design fluorescein standards: 10ppb (LOTR 1F0730), 100ppb (LOTR 1F0732) Exp. Jan 2024
06-Dec-22	7:00	AMSC	HoribaU52	21214	Lab provided solutions: 4.00, 7.00, 10.00	4.00 7.00 10.00	N	Lab-provided auto calibration solution 4.0 pH, 4.4mS/cm, 0.0NTU	4.00 4.48 mS/cm 0.1 NTU	Calibrated using lab provided solutions: AutoCal (LOTR 2GE988), pH 10.0 (LOTR 1GS16), pH 7.0 (LOTR 2GES79), pH 4.0 (LOTR 1GES39)
06-Dec-22	7:00	KBT	DR900	20066001027	Absorbance Spectrophotometer 520nm: Blank: 0.00 Std 1: 0.597 ± 0.05 Std 2: 1.257 ± 0.10 Std 3: 1.890 ± 0.15 610nm: Blank: 0.00 Std 1: 0.556 ± 0.05 Std 2: 1.173 ± 0.10 Std 3: 1.764 ± 0.15	520nm: Blank: 0.000 Std 1: 0.609 Std 2: 1.273 Std 3: 1.905 610nm: Blank: 0.000 Std 1: 0.549 Std 2: 1.166 Std 3: 1.782	N	--	--	Cal checked using DR900 absorbance check kit (LOTR A2294)
07-Dec-22	6:40	KBT	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 10ppb, 100ppb, 1000ppb	0.000 9.960 99.98	Calibrated using turner design fluorescein standards: 10ppb (LOTR 1F0730), 100ppb (LOTR 1F0732) Exp. Jan 2024
07-Dec-22	6:45	AMSC	HoribaU52	21214	Lab provided solutions: 4.00, 7.00, 10.00	3.99 7.00 10.00	N	Lab-provided auto calibration solution 4.0 pH, 4.4mS/cm, 0.0NTU	3.99 4.40 mS/cm 0.1 NTU	Calibrated using lab provided solutions: AutoCal (LOTR 2GE988), pH 10.0 (LOTR 1GS16), pH 7.0 (LOTR 2GES79), pH 4.0 (LOTR 1GES39)
07-Dec-22	6:50	KBT	DR900	20066001027	Absorbance Spectrophotometer 520nm: Blank: 0.00 Std 1: 0.597 ± 0.05 Std 2: 1.257 ± 0.10 Std 3: 1.890 ± 0.15 610nm: Blank: 0.00 Std 1: 0.565 ± 0.05 Std 2: 1.173 ± 0.10 Std 3: 1.764 ± 0.15	520nm: Blank: 0.001 Std 1: 0.612 Std 2: 1.272 Std 3: 1.911 610nm: Blank: 0.000 Std 1: 0.562 Std 2: 1.199 Std 3: 1.808	N	--	--	Cal checked using DR900 absorbance check kit (LOTR A2294)
08-Dec-22	6:25	AMSC	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 10ppb, 100ppb, 1000ppb	0.000 9.929 100.1	Calibrated using turner design fluorescein standards: 10ppb (LOTR 1F0730), 100ppb (LOTR 1F0732) Exp. Jan 2024

08-Dec-22	6:30	KBT	HorbalJ52	21214	Lab provided solutions: 4.00, 7.00, 10.00	4.00 7.00 10.00	N	Lab-provided auto calibration solution 4.0 pH, 4.4mS/cm, 0.0NTU	4.00 4.42 mS/cm 0.1 NTU		Calibrated using lab provided solutions: AutoCal (LOT# 2GE988), pH 10.0 (LOT# 1GE16), pH 7.0 (LOT# 2GE579), pH 4.0 (LOT#1GE539)
08-Dec-22	6:35	AMSC	DR900	200660001027	520nm: Blank: 0.00 Std 1: 0.997 ± 0.05 Std 2: 1.257 ± 0.10 Std 3: 1.890 ± 0.15 610nm: Blank: 0.00 Std 1: 0.956 ± 0.05 Std 2: 1.173 ± 0.10 Std 3: 1.764 ± 0.15	520nm: Blank: 0.000 Std 1: 0.816 Std 2: 1.273 Std 3: 1.930 610nm: Blank: 0.000 Std 1: 0.980 Std 2: 1.201 Std 3: 1.812	N	--	--	--	Cal checked using DR900 absorbance check kit (LOT# A2294)
09-Dec-22	6:15	AMSC	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 10ppb, 10ppb, 100ppb	0.000 10.25 99.65		Calibrated using turner design fluorescein standards: 10ppb (LOT# 1GF0730), 100ppb (LOT# 1F0732) Exp. Jan 2024
09-Dec-22	6:20	KBT	HorbalJ52	21214	Lab provided solutions: 4.00, 7.00, 10.00	3.98 7.00 10.00	N	Lab-provided auto calibration solution 4.0 pH, 4.4mS/cm, 0.1 NTU	3.98 4.48 mS/cm 0.1 NTU		Calibrated using lab provided solutions: AutoCal (LOT# 2GE988), pH 10.0 (LOT# 1GE16), pH 7.0 (LOT# 2GE579), pH 4.0 (LOT#1GE539)
10-Dec-22	6:45	KBT	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 10ppb, 10ppb, 100ppb	0.000 10.05 99.91		Calibrated using turner design fluorescein standards: 10ppb (LOT# 1GF0730), 100ppb (LOT# 1F0732) Exp. Jan 2024
10-Dec-22	6:30	KBT	HorbalJ52	21214	Lab provided solutions: 4.00, 7.00, 10.00	4.00 7.00 10.00	N	Lab-provided auto calibration solution 4.0 pH, 4.4mS/cm, 0.1 NTU	4.00 4.48 mS/cm 0.1 NTU		Calibrated using lab provided solutions: AutoCal (LOT# 2GE988), pH 10.0 (LOT# 1GE16), pH 7.0 (LOT# 2GE579), pH 4.0 (LOT#1GE539)
10-Dec-22	6:35	KBT	DR900	200660001027	520nm: Blank: 0.00 Std 1: 0.997 ± 0.05 Std 2: 1.257 ± 0.10 Std 3: 1.890 ± 0.15 610nm: Blank: 0.00 Std 1: 0.956 ± 0.05 Std 2: 1.173 ± 0.10 Std 3: 1.764 ± 0.15	520nm: Blank: 0.000 Std 1: 0.814 Std 2: 1.281 Std 3: 1.923 610nm: Blank: 0.000 Std 1: 0.966 Std 2: 1.200 Std 3: 1.800	N	--	--	--	Cal checked using DR900 absorbance check kit (LOT# A2294)
11-Dec-22	7:00	KBT	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 10ppb, 10ppb, 100ppb	0.000 9.953 100.1		Calibrated using turner design fluorescein standards: 10ppb (LOT# 1GF0730), 100ppb (LOT# 1F0732) Exp. Jan 2024
11-Dec-22	7:00	AMSC	HorbalJ52	21214	Lab provided solutions: 4.00, 7.00, 10.00	4.00 7.02 10.00	N	Lab-provided auto calibration solution 4.0 pH, 4.4mS/cm, 0.0NTU	4.00 4.47 mS/cm 0.0 NTU		Calibrated using lab provided solutions: AutoCal (LOT# 2GE988), pH 10.0 (LOT# 1GE16), pH 7.0 (LOT# 2GE579), pH 4.0 (LOT#1GE539)
12-Dec-22	6:40	KBT	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 10ppb, 10ppb, 100ppb	0.004 9.964 99.93		Calibrated using turner design fluorescein standards: 10ppb (LOT# 1GF0730), 100ppb (LOT# 1F0732) Exp. Jan 2024
12-Dec-22	6:45	KBT	HorbalJ52	21214	Lab provided solutions: 4.00, 7.00, 10.00	3.99 7.02 10.00	N	Lab-provided auto calibration solution 4.0 pH, 4.4mS/cm, 0.0 NTU	3.99 4.48 mS/cm 0.0 NTU		Calibrated using lab provided solutions: AutoCal (LOT# 2GE988), pH 10.0 (LOT# 1GE16), pH 7.0 (LOT# 2GE579), pH 4.0 (LOT#1GE539)
13-Dec-22	6:35	AMSC	Fluorometer	807511	--	--	--	3 pt calibration with standard solution, 10ppb, 10ppb, 100ppb	0.000 9.916 100.0		Calibrated using turner design fluorescein standards: 10ppb (LOT# 1GF0730), 100ppb (LOT# 1F0732) Exp. Jan 2024
13-Dec-22	6:30	KBT	HorbalJ52	21214	Lab provided solutions: 4.00, 7.00, 10.00	3.97 7.00 10.00	N	Lab-provided auto calibration solution 4.0 pH, 4.4mS/cm, 0.0 NTU	3.97 4.48 mS/cm 0.0 NTU		Calibrated using lab provided solutions: AutoCal (LOT# 2GE988), pH 10.0 (LOT# 1GE16), pH 7.0 (LOT# 2GE579), pH 4.0 (LOT#1GE539)
13-Dec-22	6:35	AMSC	DR900	200660001027	520nm: Blank: 0.00 Std 1: 0.997 ± 0.05 Std 2: 1.257 ± 0.10 Std 3: 1.890 ± 0.15 610nm: Blank: 0.00 Std 1: 0.956 ± 0.05 Std 2: 1.173 ± 0.10 Std 3: 1.764 ± 0.15	520nm: Blank: 0.000 Std 1: 0.801 Std 2: 1.267 Std 3: 1.922 610nm: Blank: 0.000 Std 1: 0.972 Std 2: 1.203 Std 3: 1.795	N	--	--	--	Cal checked using DR900 absorbance check kit (LOT# A2294)
Completed by: AMSC					Verified by: MdK						
Date: 14-Dec-22					Date: 13-Jan-23						

Ignace Fluid Pressure Profiling and Sampling

Well ID IG_BH01			Pre Profile			Post Profile			Weather: -12 °C		
Datum: Ground Level			P _{stem} 97.49 kPa			P _{stem} 96.96 kPa			Partly Sunny		
Elev. G.S.: 430.562 m			Temp. 6.81 °C			Temp. 5.59 °C					
Height of Westbay above G.S.: 0.32 m AGS			Serial No.: EM55230								
Elev. Top of Westbay Casing: 430.88 m			Probe Range: 2000psi			Date/Time 2022-12-01 10:05			Date/Time 2022-12-01 16:05		
Elev. Top of Westbay Casing: 430.88 m			Westbay Casing Type: MP38			MP38 Water Level 38.13 mBTOC			MP38 Water Level 39.30 mBTOC		
Reference Elevation: 430.562 mASL			Sampler Valve Position: Closed						Specific Weight 9.807 kN/m ³		
Borehole angle: 90									Gravitational Acceleration 9.8065 m/s ²		
									P _{atm} 97.23		

Notes: Sample interval: IG_BH01_INT_T_002
Pressure profile took longer than expected due to spooling issues with winch.

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m BGS)	Fluid Pressure Readings										Pressure Head Outside Port (m) H=(P2- P atm)/w	Piezo Level Outside Port (m) Dz = Dp-H	Z: Elev of pressure measurement port (mASL)	Freshwater Head (mASL)	Comments
				Start Profile Time	Inside Casing (P1- Landed Pressure) (kPa)	Shoe Out	#Rotation	Outside Casing (P2) (kPa)	Time (H:M:S)	Probe Temp. (°C)	Shoe In	#Rotation	Inside Casing (P1) (kPa)					
1	977.3	973.16	976.91	11:10:00	9601.66	X	14	9625.42	11:11:00	13.79	X	14	9601.15	971.57	5.34	-546.35	425.22	
2	888.8	885.43	888.49	11:29:00	8702.08	X	14	8693.24	11:30:00	13.35	X	14	8701.88	876.52	11.97	-457.92	418.59	Confirmed measurement by re-measuring (P2 = 8692.92 Kpa). Normal pressure spike and stabilization observed on both measurements. Verified by AMSC. Currently being purged by NWMO.
3	804.4	801.61	804.14	11:47:00	7844.44	X	14	7846.35	11:49:00	12.44	X	14	7843.80	790.16	13.98	-373.58	416.58	Confirmed measurement by re-measuring (P2 = 7846.4 Kpa). Normal pressure spike and stabilization observed on both measurements.
4	769.3	766.18	769.06	12:03:00	7486.93	X	14	7473.55	12:04:00	12.01	X	14	7486.99	752.15	16.91	-338.50	413.65	Confirmed measurement by re-measuring (P2 = 7473.60 Kpa). Normal pressure spike and stabilization observed on both measurements.
5	703.1	700.39	702.90	12:19:00	6815.17	x	14	6818.15	12:20:00	11.34	x	14	6814.92	685.32	17.58	-272.33	412.99	Confirmed measurement by re-measuring (P2 = 6819.07 Kpa). Normal pressure spike and stabilization observed on both measurements.
6	649.8	647.11	649.62	12:36:00	6274.24	x	14	6282.10	12:38:00	10.74	x	14	6274.00	630.66	18.96	-219.06	411.60	Confirmed measurement by re-measuring (P2 = 6282.23 Kpa). Normal pressure spike and stabilization observed on both measurements.
7	628.4	626.07	628.23	12:50:00	6056.85	x	14	6068.36	12:52:00	10.46	x	14	6056.92	608.86	19.37	-197.67	411.19	Confirmed measurement by re-measuring (P2 = 6068.42 Kpa). Normal pressure spike and stabilization observed on both measurements.
8	574.4	571.86	574.26	13:07:00	5509.97	x	14	5536.01	13:09:00	9.99	x	14	5510.11	554.58	19.68	-143.70	410.89	Confirmed measurement by re-measuring (P2 = 5536.07 Kpa). Normal pressure spike and stabilization observed on both measurements.
9	540.2	538.07	540.07	13:22:00	5163.24	x	13	5200.32	13:24:00	9.59	x	13	5163.31	520.35	19.72	-109.51	410.84	
10	517.4	515.33	517.28	13:31:00	4932.26	x	14	4981.26	13:33:00	9.35	x	14	4932.09	498.02	19.27	-86.72	411.30	
11	493.0	491.26	492.89	13:42:00	4685.56	x	14	4744.48	13:43:00	9.11	x	14	4685.26	473.87	19.02	-62.33	411.54	
12	432.1	430.79	432.01	13:57:00	4066.41	x	14	4143.11	1:58:00	8.39	x	14	4069.49	412.55	19.46	-1.45	411.10	
13	409.3	407.79	409.22	14:09:00	3839.14	x	14	3924.29	14:10:00	8.15	x	14	3839.22	390.24	18.98	21.34	411.58	
14	325.6	324.19	325.54	14:27:00	2992.27	x	14	3096.29	14:28:00	7.44	x	14	2992.44	305.81	19.73	105.02	410.83	
15	307.3	306.12	307.25	14:37:00	2808.82	x	14	2921.68	14:39:00	7.07	x	14	2808.16	288.00	19.24	123.31	411.32	
16	231.2	230.09	231.17	14:53:00	2039.96	x	15	2180.37	14:54:00	6.31	x	15	2040.35	212.41	18.75	199.40	411.81	
17	199.2	198.28	199.17	15:04:00	1717.58	x	15	1886.35	15:05:00	6.03	x	15	1717.68	182.43	16.74	231.39	413.83	
18	149.0	148.37	148.98	15:15:00	1212.80	x	14	1379.22	15:37:00	5.46	x	14	1213.14	130.72	18.26	281.58	412.31	Trouble landing (no mag collar). AMSC verified.
19	128.5	127.80	128.48	15:44:00	1006.70	X	15	1173.12	15:45:00	5.43	X	14	1006.70	109.71	18.78	302.08	411.79	
20	69.1	68.33	69.09	15:54:00	407.77	X	14	633.61	15:55:00	5.32	X	14	407.66	54.69	14.40	361.47	416.17	

Completed by:	KBT, AMSC	Verified by:	MdK
Date:	01-Dec-22	Date:	13-Jan-23 / 30-Oct-23

Well ID JG_BH03				Pre Profile		Post Profile		Weather: -1 °C	
Datum: Ground Level		Probe Type: MOSDAX		P _{atm} 95.36 kPa		P _{atm} 96.22 kPa			
Elev. G.S.: 441.403 m		Serial No.: EMS4960		Temp 8.31 °C		Temp 5.58 °C		snowy	
Height of Westbay above G.S.: 1.299 m AGS		Probe Range:		Date/Time 2022-12-14 15:48		Date/Time 2022-12-14 19:34			
Elev. Top of Westbay Casing: 442.702 m		Westbay Casing Type: MP38		MP38 Water Level 11.23 mBTOC		MP38 Water Level 12.06 mBTOC		Specific Weight 9.807 kN/m3	
Reference Elevation: 441.403 mASL		amplifier Valve Position: Closed						Gravitational Accelerati 9.8065 m/s2	
Borehole angle: -70								P _{atm} 95.79	

Notes:	<p>Re-occurring issues with winch and probes while pressure profiling IG_BH03, during multiple attempts. Pressure profile is likely biased.</p> <p>Communication issues were encountered during profiling and increased with depth. To a point where there was not enough communication to collect the pressure measurements from the two deepest intervals. Geofirma made multiple attempts to complete the profile with a combination of equipment including switching out probes, winches and MAGI units but the same issues occurred.</p> <p>Attempt #1 on Nov 30 2022 using EMSS230 - no success</p> <p>Attempt #2 on Dec 06 2022 using EMSS230 & EMSS288 - no success</p> <p>Attempt #3 on Dec 14 2022 (recorded here) using EMS4960</p>
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Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m BGS)	Fluid Pressure Readings										Pressure Head Outside Port (m) H=(P2-Patm)/w	Piezo Level Outside Port (m) Dz = Dp-H	Z: Elev of pressure measurement port (mASL)	Freshwater Head (mASL)	Comments
				Start Profile Time	Inside Casing (P1- Landed Pressure) (kPa)	Shoe Out	# rotations	Outside Casing (P2) (kPa)	Time (H:M:S)	Probe Temp. (°C)	Shoe In	# rotations	Inside Casing (P1) (kPa)					
1	966.8	967.13	888.57	18:07:00	8993.07	x	2	--	--	--	--	--	#VALUE!	#VALUE!	-447.17	#VALUE!	unable to shoe out, only 2-3 rotations. Seems to be some sort of comms issue	
2	943.9	941.07	868.28	17:53:00	8760.23	x	3	--	--	--	--	--	#VALUE!	#VALUE!	-426.88	#VALUE!	unable to shoe out, only 2-3 rotations. Seems to be some sort of comms issue	
3	924.0	921.84	850.53	17:48:00	8582.35	x	14	8267.85	17:49:00	12.51	x	14	8582.28	833.29	17.24	-409.13	424.16	
4	882.8	880.56	813.57	17:43:00	8208.31	x	14	7931.70	17:44:00	12.18	x	14	8208.39	799.01	14.56	-372.17	426.84	
5	859.9	857.86	792.89	17:39:00	7998.87	x	14	7708.44	17:40:00	11.86	x	14	7998.85	776.25	16.64	-351.49	424.76	
6	794.3	792.59	733.26	17:32:00	7394.61	x	14	7131.49	17:33:00	11.32	x	14	7394.04	717.42	15.84	-291.86	425.56	
7	752.8	752.50	695.28	17:26:00	7010.06	x	14	6801.65	17:27:00	10.89	x	14	7009.67	683.78	11.50	-253.88	429.91	P2 flagged as anomolous. Re-checked (P2 = 6801.75 kPa). Normal pressure spike and stabilization observed on both measurements.
8	676.0	675.73	624.50	17:18:00	6292.77	x	14	6156.22	17:19:00	10.23	x	14	6293.41	617.97	6.53	-183.10	434.87	P2 flagged as anomolous. Re-checked (P2 = 6156.44 kPa). Normal pressure spike and stabilization observed on both measurements.
9	637.8	638.37	589.28	17:10:00	5936.63	x	14	5903.19	17:11:00	9.94	x	14	5936.94	592.17	-2.89	-147.88	444.29	Re-checked (P2 = 5903.46 kPa). Normal pressure spike and stabilization observed on both measurements.
10	613.4	612.42	566.78	17:05:00	5708.63	x	15	5554.28	17:06:00	9.66	x	15	5708.80	556.59	10.19	-125.38	431.21	P2 flagged as anomolous Re-checked (P2 = 5554.95 kPa). Normal pressure spike and stabilization observed on both measurements.
11	567.7	567.39	524.65	16:57:00	5281.73	x	15	5132.75	16:58:00	9.27	x	15	5281.95	513.61	11.04	-83.25	430.36	P2 flagged as anomolous Re-checked (P2 = 5134.33 kPa). Normal pressure spike and stabilization observed on both measurements.
12	544.1	543.72	502.91	16:52:00	5062.80	x	15	5035.69	16:53:00	9.02	x	15	5062.64	503.71	-0.80	-61.51	442.20	P2 flagged as anomolous Re-checked (P2 = 5035.99 kPa). Normal pressure spike and stabilization observed on both measurements.
13	506.1	506.38	467.93	16:45:00	4708.11	x	15	4690.03	16:46:00	8.70	x	15	4707.53	468.47	-0.54	-26.53	441.94	P2 flagged as anomolous Re-checked (P2 = 4690.31 kPa). Normal pressure spike and stabilization observed on both measurements.
14	465.9	465.77	430.90	16:37:00	4332.79	x	15	4314.68	16:38:00	8.34	x	15	4332.71	430.19	0.71	10.50	440.69	P2 flagged as anomolous Re-checked (P2 = 4315.04 kPa). Normal pressure spike and stabilization observed on both measurements.
15	421.1	421.74	389.63	16:30:00	3915.92	x	16	3798.19	16:31:00	7.83	x	16	3915.77	377.53	12.10	51.77	429.30	P2 flagged as anomolous
16	370.3	370.54	342.83	16:23:00	3441.29	x	16	3375.21	16:24:00	7.32	x	16	3441.14	334.40	8.43	98.57	432.97	Re-checked (P2 = 3375.49 Kpa) Normal pressure spike and stabilization observed on both measurements.
17	321.0	321.52	297.42	16:17:00	2982.01	x	15	2892.06	16:18:00	6.86	x	15	2981.92	285.13	12.29	143.98	429.11	verified by AMSC
18	251.0	252.36	232.90	16:11:00	2328.78	x	16	2253.42	16:12:00	6.38	x	16	2328.76	220.01	12.89	208.50	428.51	
19	228.1	229.37	211.75	16:04:00	2115.38	x	16	2050.79	16:05:00	6.14	x	16	2115.36	199.35	12.40	229.65	429.00	
20	165.7	166.56	154.03	19:18:00	1529.02	x	15	1535.10	19:19:00	5.93	x	15	1529.46	146.76	7.27	287.37	434.14	recently closed, previously being purged by NWMO
21	73.0	73.67	68.16	19:26:00	675.32	x	15	678.36	19:27:00	5.45	x	15	676.17	59.40	8.76	373.24	432.65	currently being purged by NWMO

Completed by:	KBT, AMSC	Verified by:	MdK
Date:	14-Dec-22	Date:	13-Jan-23 / 30-Oct-23

Well ID IG_BH05	Probe Type: MOSDAX	Pre Profile	Post Profile	Weather: -4 °C
Datum: Ground Level	Serial No.: EMS4960	P _{atm} 97.63 kPa	P _{atm} 97.30 kPa	Cloudy
Elev. G.S.: 432.29 m	Probe Range: 2000psi	Temp. 7.96 °C	Temp. 5.78 °C	
Height of Westbay above G.S.: 1.31 m AGS	Westbay Casing Type: MP38	Date/Time 2022-12-10 15:10	Date/Time 2022-12-11 13:30	
Elev. Top of Westbay Casing: 433.60 m	sampler Valve Position: Closed	MP38 Water Level 35.20 mBTOC	MP38 Water Level 36.42 mBTOC	Specific Weight 9.807 kN/m3
Reference Elevation: 432.29 mASL				Gravitational Acceleration 9.8065 m/s2
Borehole angle: -70				P _{atm} 97.47

Notes: Sample interval: IG_BH05_INT_T_005

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m) BGS	Fluid Pressure Readings								Pressure Head Outside Port (m) H=(P2-Patm)/w	Piezo Level Outside Port (m) Dz = Dp-H	Z: Elev of pressure measurement port (mASL)	Freshwater Head (mASL)	Comments
				Start Profile Time	Inside Casing (P1-Landed Pressure) (kPa)	Shoe Out	Outside Casing (P2) (kPa)	Time (H:M:S)	Probe Temp. (°C)	Shoe In	Inside Casing (P1) (kPa)					
1	991.20	989.34	923.15	10:44:00	9001.94	x 14	9052.88	10:45:00	13.51	x 14	9002.17	913.17	9.98	-490.86	422.31	
2	974.30	972.00	907.47	11:00:00	8843.63	x 12	8874.17	11:01:00	13.41	x 12	8844.00	894.94	12.53	-475.18	419.76	
3	928.60	927.34	865.06	11:07:00	8418.74	x 10	8495.66	11:08:00	13.08	x 10	8418.59	856.35	8.71	-432.77	423.58	
4	865.50	864.43	806.50	11:16:00	7830.50	x 13	7918.67	11:17:00	12.38	x 13	7830.67	797.51	8.99	-374.21	423.30	
5	857.20	856.22	798.79	11:20:00	7753.67	x 11	7749.31	11:23:00	12.24	x 11	7753.57	780.24	18.55	-366.50	413.74	Currently being purged, re-checked (P2 = 7749.79 kPa). Verified by AMSC
6	800.80	800.10	746.43	11:28:00	7230.03	x 9	7187.71	11:29:00	11.90	x 9	7230.06	722.98	23.45	-314.14	408.84	Communication issues, unable to shoe-out (10-Dec-22). Remeasured on 11-Dec-22
7	788.00	787.17	734.54	17:24:00	7112.31	x 9	7070.51	17:30:00	11.48	x 9	711.83	711.03	23.51	-302.25	408.78	re-landed and re-checked (P2 = 7070.41 Kpa)
8	736.20	736.53	686.45	17:08:00	6632.15	x 13	6624.80	17:10:00	10.80	x 13	6631.92	665.58	20.87	-254.16	411.42	
9	679.80	679.44	634.09	16:59:00	6109.64	x 14	6106.61	17:00:00	10.33	x 14	6109.95	612.74	21.35	-201.80	410.94	re-checked to confirm (P2 = 6106.91 Kpa)
10	635.00	634.76	592.48	16:50:00	5694.95	x 14	5761.70	16:51:00	9.86	x 14	5693.83	577.57	14.91	-160.19	417.38	
11	627.30	627.20	585.33	16:45:00	5624.29	x 14	5675.17	16:46:00	9.64	x 14	5094.06	568.75	16.58	-153.04	415.71	
12	587.70	587.63	548.51	16:40:00	5256.41	x 14	5324.53	16:41:00	9.27	x 14	5256.64	532.99	15.52	-116.22	416.77	
13	542.00	542.17	505.99	16:34:00	4832.50	x 14	4909.32	16:35:00	8.78	x 14	4832.32	490.66	15.33	-73.70	416.96	
14	487.20	487.40	454.95	16:28:00	4323.63	x 14	4390.72	16:29:00	8.24	x 14	4323.42	437.77	17.18	-22.66	415.11	
15	427.80	428.26	399.56	16:21:00	3770.60	x 15	3824.86	16:22:00	7.66	x 15	3770.64	380.07	19.49	32.73	412.80	
16	372.90	373.54	348.37	16:15:00	3260.64	x 14	3328.81	16:16:00	7.16	x 14	3260.53	329.49	18.88	83.92	413.41	
17	326.60	327.35	305.20	16:10:00	2829.92	x 14	2918.53	16:11:00	6.79	x 14	2829.84	287.66	17.54	127.09	414.75	
18	312.90	313.85	292.42	16:06:00	2702.63	x 14	2791.27	16:07:00	6.56	x 14	2702.55	274.68	17.74	139.87	414.55	
19	264.20	265.25	246.98	16:00:00	2249.27	x 15	2339.36	16:01:00	6.17	x 15	2249.23	228.60	18.38	185.31	413.91	verified by AMSC
20	226.10	227.28	211.41	15:55:00	1894.87	x 15	1994.18	15:56:00	5.86	x 15	1894.84	193.40	18.01	220.88	414.28	
21	180.5	181.62	168.82	15:48:00	1469.61	x 15	1574.70	15:49:00	5.60	x 15	1469.61	150.63	18.19	263.47	414.10	
22	156.0	157.14	145.94	15:43:00	1241.98	x 15	1360.61	15:43:00	5.43	x 15	1242.41	128.80	17.14	286.35	415.15	
23	100.1	101.11	93.69	15:35:00	720.54	x 15	857.59	15:36:00	5.36	x 15	720.53	77.51	16.18	338.60	416.11	
24	90.9	91.91	85.09	15:30:00	634.87	x 14	779.76	15:31:00	5.48	x 14	634.85	69.57	15.52	347.20	416.77	
25	70.5	71.56	66.00	15:23:00	444.70	x 15	602.85	15:26:00	5.85	x 15	444.84	51.53	14.47	366.29	417.82	

Completed by: KBT, AMSC	Verified by: MdK
Date: 11-Dec-22	Date: 13-Jan-23 / 30-Oct-23

20-203-1: Decontamination Record Form

Ignace Fluid Pressure Profiling and Sampling

Well ID IG_BH06	Probe Type: MOSDAX	Pre Profile	Post Profile	Weather: -16 °C
Datum: Ground Level	Serial No.: EMS5230	P _{atm} 96.32 kPa	P _{atm} 95.67 kPa	snowy
Elev. G.S.: 417.74 m	Probe Range: 2000psi	Temp. 7.89 °C	Temp. 4.75 °C	
Height of Westbay above G.S.: 0.91 m AGS	Westbay Casing Type: MP38	Date/Time 2022-12-04 8:30	Date/Time 2022-12-04 15:37	
Elev. Top of Westbay Casing: 418.65 m	Sampler Valve Position: Closed	MP38 Water Level 59.81 mBTOC	MP38 Water Level 59.34 mBTOC	Specific Weight 9.807
Reference Elevation: 417.74 mASL				Gravitational Acceleration 9.8065 kN/m3
Borehole angle: -70				P _{atm} 96.00 m/s2

Notes: Sample interval: IG_BH06_INT_T_008

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m BGS)	Fluid Pressure Readings										Pressure Head Outside Port (m) H=(P2-Patm)/w	Piezo Level Outside Port (m) Dz = Dp-H	Z: Elev of pressure measurement port (mASL)	Freshwater Head (mASL)	Comments
				Start Profile Time	Inside Casing (P1- Landed Pressure) (kPa)	Shoe Out	Rotations	Outside Casing (P2) (kPa)	Time (H:M:S)	Probe Temp. (°C)	Shoe In	Rotations	Inside Casing (P1) (kPa)					
1	990.20	988.10	919.41	09:53:00	8683.34	x	14	9179.38	09:54:00	13.24	x	14	8683.29	926.21	-6.80	-501.67	424.54	
2	948.40	946.33	880.65	10:04:00	8297.70	x	14	8791.32	10:06:00	13.22	x	14	8297.44	886.64	-5.99	-462.91	423.73	
3	907.20	905.34	842.46	10:21:00	7918.77	x	14	8409.51	10:22:00	12.78	x	14	7918.82	847.71	-5.25	-424.72	422.99	
4	852.30	850.76	791.60	10:37:00	7413.77	x	13	7883.77	10:38:00	12.23	x	13	7413.83	794.10	-2.50	-373.86	420.24	
5	828.00	826.61	769.09	10:47:00	7189.97	x	13	7635.66	10:48:00	12.04	x	13	7189.59	768.80	0.29	-351.35	417.45	
6	796.90	795.40	740.28	11:05:00	6902.93	x	13	7341.78	11:06:00	11.64	x	13	6902.93	738.84	1.44	-322.54	416.30	
7	739.00	737.69	686.61	11:17:00	6370.14	x	13	6754.55	11:19:00	11.17	x	13	6370.33	678.96	7.65	-268.87	410.09	
8	719.10	718.00	668.15	11:26:00	6187.17	x	13	6186.87	11:29:00	10.91	x	13	6186.93	621.07	47.08	-250.41	370.66	verified by AMSC, Port open for purging, rechecked value by shoe in-out
9	702.20	701.27	652.47	11:40:00	6031.59	x	13	6435.52	11:42:00	10.73	x	13	6031.65	646.43	6.04	-234.73	411.70	
10	687.00	686.04	638.37	11:49:00	5891.56	x	13	6305.82	11:50:00	10.53	x	13	5891.62	633.20	5.17	-220.63	412.57	
11	629.10	628.19	584.64	12:00:00	5358.79	x	14	5774.73	12:02:00	10.10	x	14	5358.56	579.05	5.59	-166.90	412.15	
12	568.10	567.35	528.00	12:11:00	4796.59	x	14	5207.36	12:12:00	9.55	x	14	4796.37	521.20	6.80	-110.26	410.94	
13	514.80	514.31	478.50	12:27:00	4304.83	x	14	4718.32	12:28:00	8.99	x	14	4304.53	471.33	7.17	-60.76	410.57	
14	488.90	488.52	454.44	12:35:00	4066.11	x	13	4488.08	12:36:00	8.75	x	13	4066.19	447.85	6.59	-36.70	411.15	
15	464.50	464.32	431.77	12:55:00	3841.70	x	14	4269.77	12:56:00	8.39	x	14	3841.70	425.59	6.18	-14.03	411.56	
16	411.20	411.28	382.27	13:08:00	3351.75	x	15	3785.13	13:09:00	7.95	x	15	3351.93	376.17	6.10	35.47	411.64	
17	368.50	368.61	342.64	13:23:00	2959.92	x	14	3398.76	13:24:00	7.51	x	14	2960.01	336.78	5.86	75.10	411.88	
18	278.70	279.14	259.30	13:47:00	2134.36	x	14	2581.51	13:48:00	6.58	x	14	2134.46	253.44	5.86	158.44	411.88	
19	214.80	215.41	199.93	14:08:00	1546.09	x	14	2003.26	14:09:00	5.94	x	14	1546.09	194.48	5.45	217.81	412.29	
20	160.00	160.79	148.98	14:23:00	1041.18	x	15	1509.35	14:35:00	5.41	x	15	1041.12	144.12	4.86	268.76	412.88	
21	147.8	148.53	137.63	14:41:00	928.70	x	15	1395.59	14:45:00	5.29	x	15	929.17	132.52	5.11	280.11	412.63	
22	82.4	83.0	76.73	14:58:00	325.79	x	15	802.21	15:01:00	4.90	x	15	326.18	72.01	4.72	341.01	413.02	

Completed by: KBT	Verified by: MdK
Date: 04-Dec-22	Date: 13-Jan-23 / 30-Oct-23

Well ID:	IG_BH01	Multiparameter Probe:	Horiba U52 (SN. 21214)	Other Notes/Comments IG_BH01_GW028 - Requested Re-sample from IG_BH01_T_INT_007 for noble gas analyses IG_BH01_GW036 - Primary Sample
Date(s):	Dec 02 2022 & Dec 09 - 10 2022	Fluorometer:	AquaFluor (SN.807511)	
Operator(s):	AMSC, KBT	Colorimeter:	DR900 (SN. 200660001027)	

Port ID	Cumulative Purge/Sampled Volume (L)	Measurement Date and Time	Multiparameter Probe								Fluorometer		Hydrometer	Colorimetric				Alkalinity		Sample Collected (Y/N)	Comments (sampling run #, sample ID, water colour or odour, etc.)
			Calibrated	pH	Temp (°C)	EC (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	TDS (g/L)	Calibrated	Fluorescein (ppb)		Calibrated	Dissolved Oxygen (mg/L)	Dissolved Ferrous Iron Fe ²⁺ (mg/L)	Total Dissolved Sulphide S ²⁻ (mg/L)	Phenol. (mg/L)	Total as CaCO ₃ (mg/L)		
IG_BH01_T_INT_007	1	2022-12-02 14:45	Y	8.08	3.88	17.0	-35	0	14.7	--	Y	4.095	1.015	--	--	--	--	--	--	N	Parameters collected from purge water, collected by Westbay sample bottles prior to the re-sampling of IG_BH01_T_INT_007 for noble gas analyses. As requested by NWMO. Purge water collected from interval using WB bottles - WB probe attached to the sampling port.
IG_BH01_T_INT_002	10	2022-12-07 16:30	Y	8.02	7.27	38.1	97	0.03	194	23.2	Y	3.469	1.027	--	--	--	--	--	--	N	Collected during purging through bladder pump at ~85 mBTC within MP38 casing (pumping port open).
IG_BH01_T_INT_002	15	2022-12-07 17:15	Y	8.16	4.91	37.9	49	2.81	157	23.1	Y	3.456	1.026	--	--	--	--	--	--	N	Collected during purging through bladder pump at ~85 mBTC within MP38 casing (pumping port open).
IG_BH01_T_INT_002	26	2022-12-08 10:10	Y	8.52	8.32	36.1	13	0.00	107	22.0	Y	3.472	1.027	--	--	--	--	--	--	N	Collected during purging through bladder pump at ~85 mBTC within MP38 casing (pumping port open).
IG_BH01_T_INT_002	43	2022-12-08 12:25	Y	8.56	9.36	35.7	-34	0.23	102	21.8	Y	3.241	1.027	--	--	--	--	--	--	N	Collected during purging through bladder pump at ~85 mBTC within MP38 casing (pumping port open). Horiba moved into new bucket, likely why DO exceeds 0.
IG_BH01_T_INT_002	51	2022-12-08 13:30	Y	8.57	8.64	35.8	-39	0.00	176.0	21.8	Y	3.379	1.027	--	--	--	--	--	--	N	Collected during purging through bladder pump at ~85 mBTC within MP38 casing (pumping port open).
IG_BH01_T_INT_002	n/a	2022-12-09 10:45	--	--	--	--	--	--	--	--	Y	1.537	1.027	--	--	--	--	--	--	Y	Collected from run #1 while sampling. Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port left open). Sample was filtered before any measurements were taken.
IG_BH01_T_INT_002	n/a	2022-12-10 11:25	Y	8.81	7.84	35.0	133	0.00	201.0	21.3	Y	1.922	1.025	Y	>1.0	0.02	0.41	0	15	Y	Collected from run #6 during sampling. Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port left open).
IG_BH01_T_INT_002	n/a	2022-12-10 11:35	Y	8.48	8.19	35.2	106	0.00	196	21.5	--	--	--	--	--	--	--	--	--	Y	Collected from run #6 during sampling. Horiba measurements taken after sample sat in flow through cell for 10 mins. Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port left open).

Completed by:	AMSC	Verified by:	MdK
Date:	10-Dec-22	Date:	13-Jan-23

Well ID:	IG_BH01	Start Time	8:50 (09-Dec-22)	IG_BH01_GW028 - Requested Re-sample from IG_BH01_T_INT_007 for noble gas analyses	
MP38 Water Level Before Sampling:	38.27 (09-Dec-22)	m BTOC	Starting Ambient Pressure		97.01 kPa
MP38 Water Level After Sampling:	39.66 (10-Dec-22)	m BTOC	End Sampling Time		13:30 (10-Dec-22)
Probe Serial #/Range	EMS5230, EMS4960	kPa	Ending Ambient Pressure		-- kPa
Date:	02-Dec-22 to 10-Dec-22				

Sampling Run Start Date/Time	Port #	Run #	Function Tests/Preparation							Landed Port	Sampling Sequence								Sampling Run End Time	Comments (volume recovered, parameters measured, samples collected, etc)
			Shoe-Out	Close Valve	Vacuum Check	Open Valve	Evacuate Bottles (~35 kPa)	Close Valve	Landed Westbay MP38 Pressure (pre-sample, kPa)		Shoe-Out	Zone Pressure (pre-sample, kPa)	Open-Valve	Stablization Time (sec)	Zone Pressure (post-sample kPa)	Close Valve	Shoe-In	Landed Westbay MP38 Pressure (post-sample, kPa)		
2022-12-02 13:05	IG_BH01_INT_T_007	1	X	X	X	X	33	X	X	6073.73	X	6067.60	X	406	6054.58	X	X	6071.29	13:37	Start of day: WL = 37.83mBTOC, Patm = 95.53 Kpa, T= 10.35 deg C. Run 1 was used for purging prior to noble gas sampling as requested by NWMO on Nov. 10 2022. Sample collected from interval - WB probe attached to the sampling port (pumping port closed).
2022-12-02 15:30	IG_BH01_INT_T_007	2	X	X	X	X	31	x	x	6074.72	x	6064.56	x	553	6053.03	x	x	6071.53	16:14	Run 2 was used for purging prior to noble gas sampling as requested by NWMO on Nov. 10 2022. Sample collected from interval - WB probe attached to the sampling port (pumping port closed). End of day: WL = 33.44mBTOC, Patm = 95.32 KPa,T= 6.22 deg C.
2022-12-03 10:47	IG_BH01_INT_T_007	3	x	x	x	x	28	x	x	6081.20	x	6067.40	x	304	6063.05	x	x	6069.01	10:56	Run 3 was used to collect (2 of 4 Cu tubes) noble gas samples and field parameters. As requested by NWMO. Sample collected from interval - WB probe attached to the sampling port (pumping port closed).
2022-12-03 14:20	IG_BH01_INT_T_007	4	X	X	X	X	34	X	X	6073.34	X	6066.96	X	246	6062.31	X	X	6071.96	14:28	Run 4 was used to collect (2 of 4 Cu tubes) noble gas samples and field parameters. As requested by NWMO. Sample collected from interval - WB probe attached to the sampling port (pumping port closed)
2022-12-09 8:50	IG_BH01_INT_T_002	1	X	X	X	X	33	x	na	9392.66	na	na	x	127	na	x	na	9382.41	10:45	mag collar 885.92m, Target 2m above port 951.92m, depth on counter 951.87m. Samples was collected from within the MP38 casing ~2m above the pumping port (pumping port left open). Run#1 used to collect NaFI and SG measurments and 14C, 13C and archive samples
2022-12-09 10:59	IG_BH01_INT_T_002	2	X	X	X	X	32	x	na	9394.76	na	na	x	147	na	x	na	9384.65	12:28	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port left open). Depth on counter 951.91m. Run #2 was used to collect 3H/2H/18O sample.
2022-12-09 12:47	IG_BH01_INT_T_002	3	X	X	X	X	33	x	na	9393.35	na	na	x	81	na	x	na	9387.90	14:32	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port left open). Depth on counter 951.98m. Run #3 used to collect half of the noble gas (2 of 4) and 37Cl.
2022-12-09 14:47	IG_BH01_INT_T_002	4	X	X	X	X	33	x	na	9394.82	na	na	x	90	na	x	na	9389.59	16:55	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port left open). Depth on counter 951.96m. Run #4 was used to collect remaining half (2 of 4) noble gas sample and 87Sr/86Sr.
2022-12-09 17:14	IG_BH01_INT_T_002	5	X	X	X	X	32	x	na	9423.94	na	na	x	221	na	x	na	9413.97	19:01	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port left open).Depth on counter 951.92m. Run #5 used to collect 36Cl/129I.
2022-12-10 9:00	IG_BH01_INT_T_002	6	X	X	X	X	33	x	na	9399.94	na	na	x	114	na	x	na	9389.97	11:20	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port left open).Mag Collar 885.72m, Target 2m above port 951.72m. Depth on counter 951.78m. Run #6 used to collect field parameters /measurements and Si and ammonia samples.
2022-12-10 11:37	IG_BH01_INT_T_002	7	X	X	X	X	32	x	--	9398.21	na	na	x	135	na	x	na	9388.32	13:35	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port left open).Depth on counter 951.75m. Run #7 used to collect gen chem, nutrients, Ru, metals, DOC and sulfide samples.

Note: Record field parameter measurements on 20-203-01: Field Parameter Measurement/Testing - Field Data Sheet

Completed by:	AMSC, KBT	Verified by:	MdK
Date:	10-Dec-22	Date:	13-Jan-23

Well ID:	IG_BH03	Multiparameter Pro	Horiba U52 (SN. 21214)	Other Notes/Comments IG_BH03_GW019 - Primary Sample
Date(s):	07-Dec-22	Fluorometer:	AquaFluor (SN.807511)	
Operator(s):	AMSC, KBT	Colorimeter:	DR900 (SN. 200660001027)	

Port ID	Cumulative Purge/Sampled Volume (L)	Measurement Date and Time	Multiparameter Probe								Fluorometer		Hydrometer	Colorimetric				Alkalinity		Sample Collected (Y/N)	Comments (sampling run #, sample ID, water colour or odour, etc.)
			Calibrated	pH	Temp (°C)	EC (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	TDS (g/L)	Calibrated	Fluorescein (ppb)	Specific Gravity	Calibrated	Dissolved Oxygen (mg/L)	Dissolved Ferrous Iron Fe ²⁺ (mg/L)	Total Dissolved Sulphide S ²⁻ (mg/L)	Phenol. (mg/L)	Total as CaCO ₃ (mg/L)		
IG_BH03_INT_T_021	na	2022-12-07 9:45	Y	8.10	3.19	2.86	215	3.15	497	1.83	Y	10.34	1.006	Y	--	1.79	0.53	0	44	N	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port left open). Collected sample from INT021 just for in-field parameters as requested by NWMO.

Completed by:	AMSC	Verified by:	MdK
Date:	07-Dec-22	Date:	13-Jan-23

Well ID:	IG_BH03	Start Time	9:25	
MP38 Water Level Before Sampling:	12.05	m BTOC	Starting Ambient Pressure	97.37 kPa
MP38 Water Level After Sampling:	11.14	m BTOC	End Sampling Time	10:15
Probe Serial #/Range	EMS 4960/ 2000psi	Ending Ambient Pressure	97.39	kPa
Date:	07-Dec-22			

Other Notes/Comments: IG_BH03_GW019 - Primary Sample

Sampling Run Start Date/Time	Port #	Run #	Function Tests/Preparation							Landed Port	Sampling Sequence								Sampling Run End Time	Comments (volume recovered, parameters measured, samples collected, etc)
			Shoe-Out	Close Valve	Vacuum Check	Open Valve	Evacuate Bottles (<small><35 kPa</small>)	Close Valve	Landed Westbay MP38 Pressure (pre- sample, kPa)		Shoe-Out	Zone Pressure (pre-sample, kPa)	Open-Valve	Stablization Time (sec)	Zone Pressure (post- sample kPa)	Close Valve	Shoe-In	Landed Westbay MP38 Pressure (post-sample, kPa)		
2022-12-07 9:31	IG_BH03_INT _T_021	1	x	x	x	x	32	x	na	677.25	na	na	x	300	na	x	na	673.33	9:38	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port left open). Sample collected to take in-field measurements. Weather was -30 deg C, all measurements were taken inside work truck with heat on.

Note: Record field parameter measurements on 20-203-01: Field Parameter Measurement/Testina - Field Data Sheet

Completed by:	AMSC, KBT	Verified by:	MdK
Date:	07-Dec-22	Date:	13-Jan-23

Well ID:	IG_BH05	Multiparameter Probe:	Horiba U52 (SN. 21214)	Other Notes/Comments IG_BH05_GW009 - Rinsate Sample IG_BH05_GW010 - Blank Sample IG_BH05_GW011 - Primary Sample IG_BH05_GW012 - Duplicate Sample
Date(s):	Dec 11 - 14 2022	Fluorometer:	AquaFluor (SN.807511)	
Operator(s):	AMSC, KBT	Colorimeter:	DR900 (SN. 200660001027)	

Port ID	Cumulative Purge/Sampled Volume (L)	Measurement Date and Time	Multiparameter Probe								Fluorometer		Hydrometer	Colorimetric				Alkalinity		Sample Collected (Y/N)	Comments (sampling run #, sample ID, water colour or odour, etc.)
			Calibrated	pH	Temp (°C)	EC (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	TDS (g/L)	Calibrated	Fluorescein (ppb)		Calibrated	Dissolved Oxygen (mg/L)	Dissolved Ferrous Iron Fe ²⁺ (mg/L)	Total Dissolved Sulphide S ²⁻ (mg/L)	Phenol. (mg/L)	Total as CaCO ₃ (mg/L)		
IG_BH05_IN T_T_005	10	2022-12-11 15:00	Y	7.69	8.05	13.7	-176	0.25	216	8.49	Y	8.273	1.008	--	--	--	--	--	--	N	Collected during purging through bladder pump at ~85 mBTOC within MP38 casing (pumping port open).Purge water is dark brown and slightly turbid
IG_BH05_IN T_T_005	18	2022-12-11 16:10	Y	7.65	8.15	13.6	-188	0.00	136	8.45	Y	9.092	1.008	--	--	--	--	--	--	N	Collected during purging through bladder pump at ~85 mBTOC within MP38 casing (pumping port open).Purge water is dark brown and slightly turbid
IG_BH05_IN T_T_005	26	2022-12-11 17:00	Y	7.62	8.03	14.5	-188	0.00	122	9.01	Y	9.217	1.008	--	--	--	--	--	--	N	Collected during purging through bladder pump at ~85 mBTOC within MP38 casing (pumping port open).Purge water is dark brown and slightly turbid
IG_BH05_IN T_T_005	30	2022-12-12 9:10	Y	7.64	7.49	14.50	-175	0.54	82.6	8.99	Y	9.557	1.010	--	--	--	--	--	--	N	Collected during purging through bladder pump at ~85 mBTOC within MP38 casing (pumping port open).Purge water is dark brown and slightly turbid
IG_BH05_IN T_T_005	38	2022-12-12 10:20	Y	7.69	7.61	14.2	-205	0.00	57.7	8.82	Y	9.853	1.009	--	--	--	--	--	--	N	Collected during purging through bladder pump at ~85 mBTOC within MP38 casing (pumping port open). Purge water is brown coloured
IG_BH05_IN T_T_005	44	2022-12-12 11:45	Y	7.65	6.9	14.2	-195	0.00	43.1	8.82	Y	9.858	1.010	--	--	--	--	--	--	N	Collected during purging through bladder pump at ~85 mBTOC within MP38 casing (pumping port open). Purge water is brown coloured
IG_BH05_IN T_T_005	n/a	2022-12-12 14:50	--	--	--	--	--	--	--	--	Y	10.27	--	--	--	--	--	--	--	Y	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port left open). Measurement taken from during sampling from run #1, sample was filtered prior to measurement
IG_BH05_IN T_T_005	n/a	2022-12-13 10:45	Y	9.60	10.87	13.2	-184	8.16	0.0	8.16	Y	4.914	1.013	Y	0.234	8.50	1.15	0	158	Y	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port left open). Infield measurements taken during sampling from run #4. Sample water was black and very turbid. Sample needed to be filtered to measure alkalinity. Fluorescein from the filtered sample was 11.08ppb . Sample was diluted (x50) for ferrous iron and (X5) for sulfide measurements.
IG_BH05_IN T_T_005	n/a	2022-12-13 11:00	Y	7.58	16.78	13.3	-138	6.52	646	8.27	Y	--	--	--	--	--	--	--	--	N	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port left open). Horiba measurements taken after sample sat in flow-through cell for 15mins. DO measurement is likely unreliable, higher than expected from a sample at depth (may be due to high turbidity dirtying the DO sensor). The high temperature reading is likely a refelection of the water being at surface (near a heater) while allowing meaurements to stabilize in flow through cell.

Completed by:	AMSC	Verified by:	MdK
Date:	14-Dec-22	Date:	13-Jan-23

Well ID:

IG_BH05

Start Time

13:00 (12-Dec-22)

MP38 Water Level Before Sampling:

53.62 (12-Dec-22)

m BTOC

Starting Ambient Pressure

97.15 (12-Dec-22)

kPa

MP38 Water Level After Sampling:

46.49 (14-Dec-22)

m BTOC

End Sampling Time

14:35 (14-Dec-22)

Probe Serial #/Range

EMS4960 / 2000psi

Ending Ambient Pressure

96.42 (14-Dec-22)

kPa

Date:

Dec 12 - 14, 2022

Other Notes/Comments:

IG_BH05_QW009 - Rinsate Sample

IG_BH05_QW010 - Blank Sample

IG_BH05_QW011 - Primary Sample

IG_BH05_QW012 - Duplicate Sample

Sampling Run Start Date/Time	Port #	Run #	Function Tests/Preparation						Landed Port	Sampling Sequence								Sampling Run End Time	Comments (volume recovered, parameters measured, samples collected, etc)	
			Shoe-Out	Close Valve	Vacuum Check	Open Valve	Evacuate Bottles (-35 kPa)	Close Valve		Landed Westbay MP38 Pressure (pre-sample, kPa)	Shoe-Out	Zone Pressure (pre-sample, kPa)	Open-Valve	Stabilization Time (sec)	Zone Pressure (post-sample kPa)	Close Valve	Shoe-In			Landed Westbay MP38 Pressure (post-sample, kPa)
2022-12-12 12:50	IG_BH05_INT_T_005	1	x	x	x	x	33	x	na	7607.63	na	na	x	185	na	x	na	7597.62	14:50	Mag collar at 856.08m. Installed Mag collar 857.8m. Target 2m above Pumping Port: 855.08m, Actual depth reading: 855.09m. Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port open). Run #1 used to collect FI measurements and 14-C and 13-C samples. Sample water is black and turbid
2022-12-12 15:02	IG_BH05_INT_T_005	2	x	x	x	x	33	x	na	7617.85	na	na	x	154	na	x	na	7607.26	16:50	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port open). depth reading 855.08m. Run #2 used to collect 37-CI and Ru samples. Sample water is black and turbid
2022-12-12 16:59	IG_BH05_INT_T_005	3	x	x	x	x	34	x	na	7624.61	na	na	x	139	na	x	na	7614.18	18:45	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port open). Depth reading 855.07m. Run #3 used to collect 87-Sr/86-Sr and ammonia samples. Sample water is black and turbid.
2022-12-13 8:50	IG_BH05_INT_T_005	4	x	x	x	x	33	x	na	7659.62	na	na	x	160	na	x	na	7648.92	10:32	Mag collar at 855.90m. Installed Mag collar 857.8m. Target 2m above Pumping Port:854.90m. Actual depth reading: 854.92m. Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port open). Run #4 used to collect in field measurements and parameters and Si samples. Sample water is black and turbid.
2022-12-13 10:45	IG_BH05_INT_T_005	5	x	x	x	x	34	x	na	7657.35	na	na	x	163	na	x	na	7646.37	12:32	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port open). Depth reading: 854.89m. Run #5 used to collect 3H/2H/18O and metals samples. Sample water is black and turbid.
2022-12-13 12:42	IG_BH05_INT_T_005	6	x	x	x	x	33	x	na	7658.79	na	na	x	147	na	x	na	7648.08	14:30	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port open). Depth reading: 854.92m. Run #6 used to collect 3H/2H/18O and DOC samples. Sample water is black and turbid.
2022-12-13 14:44	IG_BH05_INT_T_005	7	x	x	x	x	16	x	na	7659.48	na	na	x	146	na	x	na	7649.30	16:22	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port open). Depth reading: 854.93m. Run #7 used to collect gen chem and nutrient samples. Sample water is black and turbid.
2022-12-13 16:38	IG_BH05_INT_T_005	8	x	x	x	x	13	x	na	7660.86	na	na	x	138	na	x	na	7650.47	18:15	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port open). Depth reading: 854.89m. Run #8 used to collect archive and sulphide samples. Sample water is black and turbid.
2022-12-14 9:10	IG_BH05_INT_T_005	9	x	x	x	x	13	x	na	7664.36	na	na	x	85	na	x	na	7659.30	10:44	Mag collar at 855.93m. Installed Mag collar 857.8m. Target 2m above Pumping Port: 854.93m, Actual depth reading: 854.94m. Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port open). Run #9 used to collect noble gas (3/8) and 36-Cl/129-I. Sample water is black and turbid.
2022-12-14 10:55	IG_BH05_INT_T_005	10	x	x	x	x	16	x	na	7660.33	na	na	x	76	na	x	na	7655.48	12:25	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port open). Depth reading: 854.92m. Run #10 used to collect noble gas (6/8) and 36-Cl/129-I. Sample water is black and turbid.
2022-12-14 0:40	IG_BH05_INT_T_005	11	x	x	x	x	11	x	na	7660.17	na	na	x	63	na	x	na	7655.65	14:11	Sample was collected from within the MP38 casing ~2m above the pumping port (pumping port open). Depth reading: 854.94m. Run #11 used to collect noble gas (8/8) and 36-Cl/129-I. Sample water is black and turbid.

Note: Record field parameter measurements on 20-203-01: Field Parameter Measurement/Testing - Field Data Sheet

Completed by:

KBT, AMSC

Verified by:

MdK

Date:

14-Dec-22

Date:

13-Jan-23

Well ID:	IG_BH06	Multiparameter Probe:	Horiba U52 (SN. 21214)	Other Notes/Comments	IG_BH06_GW001 - Primary Sample
Date(s):	Dec 04 - 05, 2022	Fluorometer:	AquaFluor (SN.807511)		
Operator(s):	AMSC, KBT	Colorimeter:	DR900 (SN. 200660001027)	05-Dec-22: Advised by NWMO to stop sampling as the fluorescein levels were above 100ppb.	

Port ID	Cumulative Purge/Sampled Volume (L)	Measurement Date and Time	Multiparameter Probe								Fluorometer		Hydrometer	Colorimetric				Alkalinity		Sample Collected Sample Collected (Y/N)	Comments (sampling run #, sample ID, water colour or odour, etc.)
			Calibrated	pH	Temp (°C)	EC (mS/cm)	ORP (mV)	DO (mg/L)	Turbidity (NTU)	TDS (g/L)	Calibrated	Fluorescein (ppb)	Specific Gravity	Calibrated	Dissolved Oxygen (mg/L)	Dissolved Ferrous Iron Fe ²⁺ (mg/L)	Total Dissolved Sulphide S ²⁻ (mg/L)	Phenol. (mg/L)	Total as CaCO ₃ (mg/L)		
IG_BH06_IN T_T_008	N/A	2022-12-04 17:45	-	--	--	--	--	--	--	--	Y	108.83	--	--	--	--	--	--	--	Y	
IG_BH06_IN T_T_008	N/A	2022-12-05 12:00	Y	9.51	8.7	0.713	42	0.00	32.0	--	Y	110.90	1.007	--	--	--	--	--	--	Y	Parameters collected from run #2, horiba measurements collected from running sample through flow-through cell.
IG_BH06_IN T_T_008	N/A	2022-12-05 14:00	Y	8.34	9.03	0.873	96	0.71	25.7	0.559	--	--	--	Y	0.960	0.00	0.04	0	59	Y	Parameters collected from run #3, horiba measurements collected from sample in the sample cup after 10 mins.

Completed by:	AMSC	Verified by:	MdK
Date:	05-Dec-22	Date:	13-Jan-23

Well ID:	IG_BH06	Start Time	15:00	Other Notes/Comments: IG_BH06_GW001 - Primary Sample		
MP38 Water Level Before Sampling:	59.81	m BTOC	Starting Ambient Pressure		--	kPa
MP38 Water Level After Sampling:	59.34	m BTOC	End Sampling Time		17:57	
Probe Serial #/Range	EMS5230 / 2000psi	Ending Ambient Pressure	95.67		kPa	
Date:	Dec 04 - 05, 2022		4.75 degrees C			

Sampling Run Start Date/Time	Port #	Run #	Function Tests/Preparation						Landed Port	Sampling Sequence								Sampling Run End Time	Comments (volume recovered, parameters measured, samples collected, etc)	
			Shoe-Out	Close Valve	Vacuum Check	Open Valve	Evacuate Bottles (<35 kPa)	Close Valve		Landed Westbay MP38 Pressure (pre- sample, kPa)	Shoe-Out	Zone Pressure (pre-sample, kPa)	Open Valve	Stablization Time (sec)	Zone Pressure (post-sample kPa)	Close Valve	Shoe-In			Landed Westbay MP38 Pressure (post- sample, kPa)
2022-12-04 15:30	IG_BH06_INT_T_008	1	x	x	x	x	31	x	na (724.70m)	6270.08	na	na	x	327	na	x	na	6261.38	16:16	Sample was collected from within the MP38 casing ~2m above the INT008 pumping port (pumping port open) Run #1 was used for NaFI measurements and to collect Gen Chem, SiO2, Ammonia, Nutrients and Ru samples.
2022-12-05 9:00	IG_BH06_INT_T_008	2	x	x	x	x	33	x	na (724.76m)	6258.36	na	na	x	290	na	x	na	6249.87	10:56	Sample was collected from within the MP38 casing ~2m above the INT008 pumping port (pumping port open). Run #2 was used to collect NaFI
2022-12-05 12:19	IG_BH06_INT_T_008	3	x	x	x	x	34	x	na (724.71m)	6251.89	na	na	x	246	na	x	na	6243.31	13:10	Sample was collected from within the MP38 casing ~2m above the INT008 pumping port (pumping port open). Run #3 was used to collect in-field
2022-12-05 14:14	IG_BH06_INT_T_008	4	x	x	x	x	33	x	na (724.70m)	6245.40	na	na	x	233	na	x	na	6237.13	2:58	Sample was collected from within the MP38 casing ~2m above the INT008 pumping port (pumping port open). Run #4 was used to collect 36-Cl/129-I. Notified by NWMO to stop sampling.

Note: Record field parameter measurements on 20-203-01: Field Parameter Measurement/Testing - Field Data Sheet

Completed by:	KBT, AMSC	Verified by:	MdK
Date:	05-Dec-22	Date:	13-Jan-23

COC Number/ID	Sample ID(s)	Shipping Information						Receiving Information				Comments
		Shipped Date	Shipped Time	Temp. Shipped (deg C)	COC Signed by Geofirma (Y/N)	Shipping Address	Shipping Method	Received Date	Received Time	Temp Received (deg C)	COC Signed By Receiving Lab (Y/N)	
GFIM_BVL_0011	IG_BH05_GW009	06-Dec-22	7:00	4	Y	Bureau Veritas Labs 946 Cobalt Crescent Thunder Bay, ON	Courier (Purolator)	07-Dec-22	14:10	-2	Y	Geofirma followed up with lab to confirm the temperature of samples received (-2) and confirmed that this had no impact on the samples.
GFIM_BVL_0012	IG_BH01_GW036	12-Dec-22	7:00	<10 (on ice)	Y	Bureau Veritas Labs 946 Cobalt Crescent Thunder Bay, ON	Courier (Purolator)	13-Dec-22	14:19	1	Y	
GFIM_BVL_0013	IG_BH05_GW011 IG_BH05_GW012	14-Dec-22	7:00	<10 (on ice)	Y	Bureau Veritas Labs 946 Cobalt Crescent Thunder Bay, ON	Courier (Purolator)	15-Dec-22	14:13	3	Y	
GFIM_NWMO_0007	IG_BH06_GW001 IG_BH03_GW019 IG_BH01_GW036 IG_BH05_GW011 IG_BH05_GW012	14-Dec-22	7:00	<10 (on ice)	Y	NWMO Office - Ignace 304 Main St Ignace ON P0T 1T0	Hand delivered	14-Dec-22	7:20	<10 (from cooler with ice)	Y	Archive Samples
GFIM_IT2_0007	IG_BH01_GW036 IG_BH05_GW010 IG_BH05_GW011 IG_BH05_GW012	14-Dec-22	7:00	<10 (on ice)	Y	Isotope Tracer Technologies 608 Weber St. N Unit3, Waterloo, ON N2V 1K4	Courier (Purolator)	16-Dec-22	--	n/a	Y	
GFIM_UofO_0007	IG_BH01_GW028 (noble gas re-sample) IG_BH01_GW036 IG_BH05_GW011 IG_BH05_GW012	20-Dec-22	9:00	<10 (ice packs)	Y	University of Ottawa 25 Templeton St., Ottawa ON K1N 6N5	Hand delivered	20-Dec-22	10:15	n/a	Y	

Completed by:	AMSC	Verified by:	MdK
Date:	20-Dec-22	Date:	13-Jan-23

Laboratory Report Date	[2022/12/21] [2022/12/29] [2023/01/16]
Laboratory Name	Bureau Veritas
Laboratory Report ID (if applicable)	[C2AA404] [C2AI573] [C2AJ973]
Analyses Completed	Major and Trace Elements and Metals; Total dissolved sulphur; Total dissolved iron; Reactive silica; Sulphide; Anions; pH; Alkalinity; Fluoride; TIC; TOC; DOC; TKN; Total Phosphorus; Total Ammonia; Total Nitrogen; Carbonate, Bicarbonate and Hydroxide

Associated COC #(s)	[GFIM_BVL_0011] [GFIM_BVL_0012] [GFIM_BVL_0013]
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Samples Included in Laboratory Report
[IG_BH05_GW009] [IG_BH01_GW036] [IG_BH05_GW011] [IG_BH05_GW012]

Quality Check and Verification	Verified By (Initials)	Comments
Results received from laboratory	AMSC	
All samples were tested or accounted for. Justification provided for any untested samples (e.g. spare sample)	AMSC	
Laboratory data report provided with results	AMSC	
Laboratory testing methods/techniques included in data report	AMSC	
Laboratory QA procedures and equipment calibration included in data report	AMSC	
Laboratory results are within reasonable/expected range	AMSC	

Other Comments/Notes:

Note: A copy of this form is to be complete for each laboratory data report that is received by Geofirma

Completed by:	AMSC	Verified by:	MdK
Date:	18-Jan-23	Date:	23-Jan-23

Laboratory Report Date	2023-03-15
Laboratory Name	Isotope Tracer Technologies Inc. (IT2)
Laboratory Report ID (if applicable)	221105
Analyses Completed	18-O, 2-H, 3-H, 87-Sr/86-Sr, 37-Cl, 13-C, 14-C

Associated COC #(s)	GFIM_IT2_0007
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Samples Included in Laboratory Report
[IG_BH01_GW036] [IG_BH05_GW010] [IG_BH05_GW011] [IG_BH05_GW012]

Quality Check and Verification	Verified By (Initials)	Comments
Results received from laboratory	AMSC	
All samples were tested or accounted for. Justification provided for any untested samples (e.g. spare sample)	AMSC	
Laboratory data report provided with results	AMSC	
Laboratory testing methods/techniques included in data report	AMSC	
Laboratory QA procedures and equipment calibration included in data report	AMSC	
Laboratory results are within reasonable/expected range	AMSC	

Other Comments/Notes:

Note: A copy of this form is to be complete for each laboratory data report that is received by Geofirma

Completed by: AMSC	Verified by: MEOR
Date: 20-Mar-23	Date: 31-Jul-23

Laboratory Report Date	2023-04-27 / 2023-06-19 / 2023-07-18
Laboratory Name	University of Ottawa (Radiohalides Laboratory)
Laboratory Report ID (if applicable)	n/a
Analyses Completed	129-I, 36-Cl, noble gases

Associated COC #(s)	GFIM_UoFO_0007
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Samples Included in Laboratory Report
[IG_BH01_GW036] [IG_BH05_GW011] [IG_BH05_GW012]

Quality Check and Verification	Verified By (Initials)	Comments
Results received from laboratory	AMSC	
All samples were tested or accounted for. Justification provided for any untested samples (e.g. spare sample)	AMSC	
Laboratory data report provided with results	AMSC	
Laboratory testing methods/techniques included in data report	AMSC	
Laboratory QA procedures and equipment calibration included in data report	AMSC	
Laboratory results are within reasonable/expected range	AMSC	

Other Comments/Notes:
Awaiting noble gas and 129-I results [2023-05-04] Noble gas results received, still missing 129-I results [2023-06-19] 129-I results received [2023-07-19]

Note: A copy of this form is to be complete for each laboratory data report that is received by Geofirma

Completed by: AMSC	Verified by: MEOR
Date: 2023-05-04 / 2023-07-20	Date: 31-Jul-23