PHASE 2 INITIAL BOREHOLE DRILLING AND TESTING, SOUTH BRUCE

WP07 Data Report: Opportunistic Groundwater Sampling and Testing for SB_BH02

APM-REP-01332-0337 **January 2024**

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Phase 2 Initial Borehole Drilling and Testing, South Bruce

WP07 Data Report: Opportunistic Groundwater Sampling and Testing for SB_BH02

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TABLE OF CONTENTS

1 INTRODUCTION 1
1.1 Background 1
1.2 Geologic Setting 1
1.3 Technical Objectives 3

2 DESCRIPTION OF ACTIVITIES 4
2.1 Types of Samples Collected 4
2.2 Field Methods 4
2.2.1 Tracing of Drill Water 4
2.2.2 OGW Interval Selection 5
2.2.3 Interval Isolation (During Drilling OGW Sampling Events) 6
2.2.4 Interval Isolation (Post-Drilling OGW Sampling Events) 6
2.2.5 Evaluation of Sample Feasibility 6
2.2.6 Purging 6
2.2.7 Field Parameter Measurements and In-Field Analytical Testing 7
2.2.8 Sample Collection 8
2.2.9 QA/QC Sampling 10
2.2.10 Sample Shipping 11
2.3 Laboratory Analyses and Methods 12
2.3.1 Analyses at Bureau Veritas Laboratories (BVL) 12
2.3.2 Analyses at University of Ottawa (uOttawa) 12
2.3.3 Analyses at SGS Laboratories 12
2.3.4 Microbiology Analyses at the University of Waterloo 12
2.4 Data Quality Assurance and Quality Control (QA/QC) 12

3 RESULTS 14
3.1 Sample Collection Summary 14
3.2 OGW Interval Selection and Purging 14
3.3 Estimation of Drill Water Contamination on Final Groundwater Samples 15
3.4 Water Chemistry Results 16
3.4.1 Water Source (WS) Results 16
3.4.2 Drill Water (DW) Results 19
3.4.3 Groundwater (GW) Results 22
3.4.4 QA/QC Sample Results 27

4 CONCLUSIONS 30

5 REFERENCES 32

LIST OF TABLES

Table 1 Methods for Field Parameter Measurements and In-Field Analytical Testing 7
Table 2 Sample Container Specifications, Holding times, and Analytical Lab, by Analyte Group 8
Table 3 Water Sampling Summary, SB_BH02 14
Table 4 OGW Interval Selection and Purging Summary 15
Table 5 Select Water Chemistry Results – Water Source (WS) Samples 17
Table 6 Select Water Chemistry Results – Pre-Purge Drill Water (DW) Samples 21
Table 7 Select Water Chemistry Results – Primary/Final Groundwater (GW) Samples 23
Table 8 Calculated RPD, by Analyte Group, for Primary/Duplicate Sample Sets 27
Table 9 Tritium Free Blank Results Summary 28
Table 10 Rinsate Blank Sample Results (Detections Bolded) 29

LIST OF FIGURES

Figure 1 Location of SB_BH02 Drill Site 2
Figure 2 Piper Plot for Select WP07 Water Source (WS), Drill Water (DW) and Groundwater (GW) Samples. A value of 0.5 x detection limit was used for analytes with concentrations below the method detection limits. Bicarbonate/carbonate concentrations calculated by advanced speciation method based on total alkalinity and pH. 18
Figure 3 Oxygen ($\delta^{18}O$)– Deuterium ($\delta^{2}H$) Cross-Plot for Select WP02 and WP07 Water Samples. GMWL = global meteoric water line, LEL = local evaporation line for Lake Huron (Longstaffe et al. n.d). Both primary and duplicate results for GW samples are shown. 19
Figure 4 SB_BH02 Groundwater Sample Locations, calculated EC (conductivity), TDS (total dissolved solids), Cl (chloride), and isotopic ratios (^{18}O, ^{2}H, and ^{14}C). 24

APPENDICES

Appendix A List of Drill Water and Groundwater Samples Collected at SB_BH02
Appendix B SB_BH02 Water Chemistry Results Tables
Appendix C Groundwater Results - Drill Water Contamination Correction
Appendix D Relative Percent Difference (RPD) Calculations

1 INTRODUCTION

Geofirma Engineering Ltd. (Geofirma) completed a drilling and testing program at borehole SB_BH02, northwest of Teeswater, Ontario (Figure 1). This report provides a detailed summary of one component of the Geofirma geoscientific investigation as part of the NWMO Phase 2 Initial Borehole Drilling and Testing Program at the South Bruce site. Specifically, this report describes the activities associated with Geofirma's Work Package 7 (WP07) Opportunistic Groundwater (OGW) Sampling at SB_BH02.

1.1 Background

Geofirma Engineering Ltd. (Geofirma) was retained by the Nuclear Waste Management Organization (NWMO) to complete a drilling and testing program for two deep bedrock boreholes (SB_BH01 and SB_BH02) as part of the NWMO's Phase 2 Geoscientific Preliminary Field Investigations. The full scope of the drilling and testing program for SB_BH02 is described in the Initial Borehole Characterization Plan.

Borehole SB_BH02 was the second borehole drilled at the South Bruce site as part of the Phase 2 Initial Borehole Drilling and Testing program. SB_BH02 is located approximately 5.5 km northwest of the community of Teeswater, Ontario, and was drilled to a total depth of 900.57 m below ground surface (m BGS). SB_BH02 is located approximately 2.5 km west of SB_BH01, as shown in Figure 1.

1.2 Geologic Setting

The sequence of rocks encountered in the SB_BH02 borehole consist of Paleozoic-aged strata that were deposited within the Michigan Basin northwest of the Algonquin Arch in Southwestern Ontario. The Michigan Basin is a circular-shaped cratonic basin that is composed primarily of shallow marine carbonates, evaporites, and shales that were deposited while eastern North America was in tropical latitudes during the Paleozoic Era (Armstrong and Carter 2006, 2010). West of the Algonquin Arch, strata from the Michigan Basin gradually dip westward into the Michigan Basin. Borehole SB_BH02 was drilled through the entire Paleozoic sequence to approximately 14 m into the Precambrian basement, which is composed of high-grade metamorphic rocks of the Grenville Province.



LEGEND

- SB_BH02 Drill Site
- Municipality of South Bruce
- Municipality of Brockton
- Township of Huron-Kinloss
- Provincially Significant Wetland
- Wetland
- Waterbody
- Watercourse
- Major Road
- Local / Street
- OGSRL Well Locations

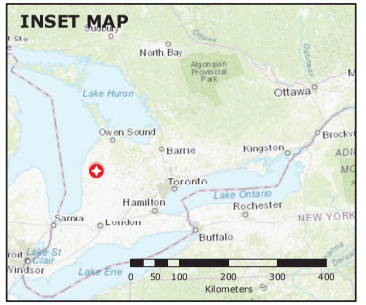


Figure 1
Location of SB_BH02 Drill Site

Scale 1:60,000

0 500 1,000 2,000 3,000 4,000
Meters

N

Projection: NAD 1983 UTM Zone 17N

Source: NWMO, Ontario GeoBase

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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NWMO South Bruce
Drilling and Testing

DESIGN: ADG
CAD/GIS: ADG
CHECK: SNS
REV: 1

DATE: 2023-10-30

GEOFIRMA ENGINEERING

E:\Data\Project\Bruce\Maps\20-211-1_SouthBruce\20-211-1_Figure1_SB_BH02_TestPlans_R1.mxd

1.3 Technical Objectives

The technical objectives of the WP07 OGW sampling and testing activities included:

- Identification of permeable intervals for collecting opportunistic groundwater samples during and/or after drilling;
- Collection and preservation of sufficient groundwater sample volumes for geochemical analysis; and;
- Laboratory analysis of collected groundwater samples.

The scientific objectives of this work package included:

- Determining chemical and isotopic character of groundwater at depth;
- Identifying the presence or absence of recent, older post-glacial and glacial recharge, interglacial recharge, and very old pre-glacial groundwater at all depths within the sedimentary sequence; and,
- Determining the transferability of groundwater chemical parameters in the context of regional understanding (i.e. based on regional data and data from OPG's DGR at the Bruce Nuclear Site).

This report has been prepared to describe the water sampling activities that were completed at SB_BH02 and present the results from the field and lab testing program. The results represent key findings including field and laboratory determination of physicochemical properties and isotopic signatures of the drill water, water source, and groundwater samples. Interpretation of the sample results with respect to water age, provenance, and regional context is to be completed as part of a separate report completed under a separate work package (WP10 data integration). Complete sample lists and results from the testing program are included in the report appendices.

2 DESCRIPTION OF ACTIVITIES

Field activities associated with the WP07 OGW sampling at SB_BH02 were completed between August 18, 2021, to September 18, 2022. All field activities, including preparation of the drill fluid tracer, purging, and sampling were completed by Geofirma.

Sampling of the drill water and the water source was completed as part of the drilling (WP02) scope of work. Field activities for sample collection that were completed as part of WP02 are described in the WP02 Data Report (Geofirma 2022a), however, laboratory results for the WP02 water samples are reported with results from WP07 (OGW sampling) in this data report.

The following sections provide a summary of the field and laboratory activities that were completed by Geofirma as part of WP07 for SB_BH02. All field measurements and equipment calibrations that were completed as part of water sampling activities were recorded in a spreadsheet-format data quality confirmation (DQC) workbook or entered directly into the NWMO acQuire “Opportunistic Groundwater and Drillwater Sampling” data entry object (DE-07).

2.1 Types of Samples Collected

Three primary water sample types were collected as part of drilling and testing activities at borehole SB_BH02: water source (WS), drill water (DW), and groundwater (GW) samples.

Water source (WS) samples were collected from the supply that was used to provide water for the drilling program. Collection of WS samples was completed as part of drilling (WP02) activities. WS samples were collected to obtain a record of water chemistry for the water source throughout drilling at SB_BH02.

Drill water (DW) samples were collected from the drill fluid return throughout the SB_BH02 drilling program as part of drilling (WP02) and OGW (WP07) activities. DW samples were collected to obtain a record of water chemistry during drilling and to evaluate the impact of drill water contamination on results for GW samples.

Groundwater (GW) samples were primarily collected from groundwater purged from the borehole as part of WP07 activities. In addition to the primary groundwater samples, purge water and QA/QC samples (duplicate, rinsate blanks, and tritium free blanks) were also assigned GW sample codes.

2.2 Field Methods

2.2.1 Tracing of Drill Water

The water used for drilling at SB_BH02 was sourced from Kincardine municipal supply, where the water is pumped from Lake Huron. This fresh water source provides a chemical signature that is distinct from groundwater at the site.

Fluorescein was used as the artificial tracer during drilling. Drill water was mixed in large half round (skid) tanks onsite using a concentrated fluorescein stock solution and the fresh water source. The concentration of the fluorescein tracer in the drill water was maintained at approximately 100±10 ppb.

Geofirma measured the fluorescein concentration in the drill water supply during each core run to ensure that the tracer concentration remained within the targeted range throughout the drilling program. Fluorescein concentrations were measured using a portable handheld fluorometer (Turner Designs Aquafluor) and were recorded in the drilling (WP02) DQC workbook.

2.2.2 OGW Interval Selection

Intervals for OGW sampling during drilling were identified based on a combination of core and drilling indicators, including:

- Evidence of potential permeability from core logging (open fractures, porosity features, alteration along fractures, etc.)
- Drilling fluid circulation measurements, including:
    - Drill fluid loss to the formation
    - Influx of formation water to the borehole
- Drill pump pressure changes
- Drilling performance indicators (e.g., increased or inconsistent rate of penetration)

Details of the methodology and field procedures to monitor drill fluid conditions and drilling parameters are described in the WP02 Data Report (Geofirma 2022a). Core logging procedures are described in WP03 Data Report (Geofirma 2022b) and associated Geological and Geotechnical Core Logging Procedures Manual.

When a potential OGW sample interval was identified, drilling was stopped and the NWMO WP07 Technical Lead was contacted by the Geofirma WP07 Technical Lead to confirm that OGW sampling activities were to be completed.

2.2.2.1 *Interval Selection Post-drilling*

Two additional intervals were selected for OGW sampling post-drilling. These intervals were selected to target permeable features identified in the Salina Group and Guelph Formation based on core observations (WP03), geophysical logs (WP05), and hydraulic testing results (WP06). The locations of the post-drilling OGW sampling intervals were confirmed by the NWMO and Geofirma WP07 technical leads prior to sampling.

2.2.2.2 *Collection of Pre-Purge Drill Water Samples*

Upon approval from the NWMO WP07 Technical Lead, Geofirma collected a sample of the drill water at each interval prior to the start of purging. The pre-purge drill water samples were collected directly from the drill water return, drill pipe, or tubing string, following sampling requirements outlined in Section 2.2.8. A microbiology sample was also collected with the pre-purge drill water sample. Field parameter measurements and in-field analytical testing were completed at the time of sampling and were recorded directly in acQuire using the “Opportunistic Groundwater and Drillwater Sampling” data entry object (DE-07) and the associated data sheets in the WP07 DQC workbook. Field parameter measurements and field analytical measurements of drill water followed procedures described in Section 2.2.7.

2.2.3 Interval Isolation (During Drilling OGW Sampling Events)

Interval isolation using an inflatable wireline packer system was completed after collection of the pre-purge drill water sample. By isolating the test interval, formation permeability for the test interval could be assessed and the required purge volume was reduced.

The OGW intervals sampled during drilling were isolated from the rest of the borehole using the STX-60 packer system, manufactured by Inflatable Packers International LLC. The STX system was lowered by wireline within the PQ drill pipe and latched inside the PQ core barrel. With the packer system latched in the core barrel, the drill pipe was raised or lowered to adjust the position of the packer to provide a seal at the top of the targeted test interval. With the packer inflated, the test interval was sealed from the borehole annulus and could be purged through the PQ drill pipe.

2.2.4 Interval Isolation (Post-Drilling OGW Sampling Events)

The OGW intervals sampled post-drilling were isolated using a modified version of the hydraulic testing tool (HTT) that was used to complete hydraulic testing (WP06) activities at SB_BH02. The hydraulic testing tool consisted of two hydraulically inflated Baski™ packers that were lowered on a string of 60.3 mm (2-3/8 inch) diameter tubing. The HTT was assembled to isolate an 8.26 m interval between the two Baski™ packers. Intervals isolated by the HTT were purged through the 60.3 mm tubing.

2.2.5 Evaluation of Sample Feasibility

After being isolated, each potential OGW interval was evaluated to determine whether sufficient drilling fluid could be purged from the interval within the project time constraints (72 hours) to provide a groundwater sample that was representative of in-situ formation conditions.

The feasibility of the OGW intervals were assessed using a short duration pumping test or slug test. The short duration pumping tests were completed with a submersible pump (e.g., Grundfos Rediflo 2) for a sufficient period to overcome wellbore storage effects and obtain steady state drawdown conditions. If the interval could not maintain a steady pumping rate, then the pump was shut off and recovery to pre-purging static water level was monitored. Water levels and purge volumes/flow rates measured during the pumping test and/or slug test were recorded in the WP07 DQC workbook.

Using the test data, interval transmissivity/hydraulic conductivity and available purge rates were estimated. The available purge rates were used to determine if the minimum required purge rate could be met. The minimum required purge rate was calculated by dividing the system volume (3 interval volumes + 3 drill rod volumes + fluid losses to formation) by 72 hours. The NWMO WP07 Technical Lead was informed by Geofirma if the test interval was expected to be capable of maintaining the minimum required purge rate. The NWMO WP07 Lead provided final confirmation to proceed with purging of each test interval.

2.2.6 Purging

Once sample collection from the isolated interval was assessed to be feasible, purging of OGW sample intervals was completed using a submersible pump or swabbing equipment. Four intervals (OGW1 through OGW4) were purged by submersible pump. Due to the small diameter of the tubing used for OGW events post-drilling (OGW5 & OGW6), purging for these samples was completed by swabbing.

Field parameter measurements (Section 2.2.8) were collected regularly throughout purging to evaluate whether sufficient drill water had been produced to obtain a representative groundwater sample. Records of field parameter measurements were maintained in the WP07 DQC workbook.

Purge water archive samples were collected at a frequency of approximately one sample every system volume purged. Field parameter measurements for purge water samples were completed at the time of sampling and were recorded directly into acQuire using the "Opportunistic Groundwater and Drillwater Sampling" data entry object (DE-07). Field measurements of dissolved oxygen, ferrous iron, alkalinity, and sulphide were also recorded in the DQC workbook for each purge water sample.

Each purge water sample was assigned an identification number in acQuire following naming conventions described in Section 2.2.8.1.

2.2.7 Field Parameter Measurements and In-Field Analytical Testing

Several atmospheric sensitive parameters required field measurements to be completed in the field. The testing methodologies that were used for these field measurements and analyses are summarized in Table 1.

Table 1 Methods for Field Parameter Measurements and In-Field Analytical Testing

Parameter	Field-Measurement Method
Fluorescein	Handheld Fluorimeter (Turner Designs AquaFluor)
Turbidity	In sealed flow-through cell (i.e., Horiba Flow Chamber) with inserted water quality multi-probe (Horiba-U52/U50)
Dissolved Oxygen (DO) (for concentrations > 1 mg/L)	
Electrical Conductivity	
Temperature	
Oxidation-Reduction Potential (ORP)	
pH	
Fluid Density	Hydrometer measurement in graduated cylinder. One of two hydrometers will be used, depending on the density of the drill fluid and sample water (SG > 1.0 or SG < 1.0)
Total Sulphide [S^{2-}_{Total}]	HACH Method 8131: Dissolved total sulphide by methylene blue method and colorimeter (Hach DR900 Multiparameter Colorimeter).
Ferrous Iron [Fe^{2+}]	HACH Method 8146: 1-10 Phenanthroline Method using portable colorimeter (Hach DR900 Multiparameter Colorimeter).
Dissolved Oxygen (DO) (for concentrations < 1 mg/L)	HACH Method 8316: Indigo Carmine method using portable colorimeter (Hach DR900) for concentrations < 1mg/L and Horiba-U52/50 for concentrations > 1 mg/L
Alkalinity	HACH Method 8203: Alkalinity Test Kit, digital titration method using sulphuric acid (H_2SO_4), phenolphthalein indicator, and bromcresol green-methyl red indicator; hydroxide, carbonate and bicarbonate alkalinities can be determined

Results from the field parameter measurements and in-field analytical testing were recorded in the WP07 DQC workbook and in acQuire, where applicable. All calibrations and calibration checks of equipment used for in-field analytical testing were recorded in the Equipment Calibration form in the WP07 DQC.

Care was taken to minimize atmospheric exposure of samples for field parameter measurements and in-field testing during the sampling process. Field measurements were either completed immediately after sample collection, or the water was held in airtight sample containers for a short duration until the water was released for testing.

2.2.8 Sample Collection

Fluorescein concentrations were the primary indicator used to assess purging progress. Purging of the OGW intervals continued until the produced water reached of target of less than 5% of the pre-purging drill water fluorescein concentration, or as otherwise directed by the NWMO WP07 Lead. Stabilization of other field parameters (e.g., dissolved oxygen, temperature, pH) was also documented to support the decision to initiate sample collection.

Prior to collection of OGW samples, all sampling equipment was decontaminated with the decontamination procedure documented in the Equipment Decontamination form in the DQC workbook. A rinsate sample for quality assurance/quality control (QA/QC) purposes was collected after decontamination activities during each OGW sampling event. Additional information about that QA/QC sampling program is provided in Section 2.2.9.

Water for the OGW samples were collected directly from the pump/swabbing discharge line using laboratory-supplied bottles. A summary of the sample bottle types, preservation methods, and holding times is provided in Table 2. Specialized sampling procedures were used for collection of noble gas samples (using a Westbay MOSDAX sampler probe) and microbiology samples.

Complete sample suites were collected for each primary groundwater sample and the associated pre-purge drill water (DW) sample. Collection of the samples was recorded on the “Sample Bottle Collection” sheet in the DQC Workbook.

Table 2 Sample Container Specifications, Holding times, and Analytical Lab, by Analyte Group

Analytes	Bottle Type	Volume	Sampling and Preservation	Lab Holding Time (Maximum)	Geofirma Holding Time[1] (Optimal)	Analytical Lab or Storage
Major Elements and Metals (Na, K, Ca, Mg, Sr, Li, Si, Al, B)	Red-capped bottle (O. Reg.)	120 mL	Field filtered, 2mL 18% NHO_3	30 days	15 days	Bureau Veritas Labs
Dissolved Sulphur, Dissolved Iron (all species)						
Ruthenium (Ru)	Red-capped bottle (O. Reg.)	120 mL	2mL 18% NHO_3	30 days	15 days	
Rare Earth Elements (Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Nd, Pr, Sc, Sm, Tb, Tm, Yb, Y)	Red-capped bottle (O. Reg.)	120 mL	Field Filtered, 2mL 18% NHO_3	30 days	15 days	

Analytes	Bottle Type	Volume	Sampling and Preservation	Lab Holding Time (Maximum)	Geofirma Holding Time[1] (Optimal)	Analytical Lab or Storage
Reactive Silica (SiO_2)	General (HDPE)	250 mL	Field Filtered	28 days	14 days	
Sulphide (S^{2-}) (by zinc acetate ppt)	Pink-capped bottle	120 mL	Field Filtered No Headspace 0.5 mL 5N NaOH 0.5 mL 2N ZnAc	7 days	3 days	
Anions (Br, Cl, SO_4, PO_4, I, NO_2, NO_3)	General (HDPE)	500 mL	None	14 days	7 days	
Fluoride (F)						
HCO_3						
Total Nitrogen	Nutrient	120 mL	0.5 mL 50% sulfuric acid	10 days	5 days	
Total Phosphorus						
Total Organic Carbon (TOC)						
Dissolved Organic Carbon (DOC)	General (HDPE)	120 mL	None	5 days	3 days	
Total Ammonia (NH_4+NH_3)	Vial	40 mL	0.17mL 50% sulfuric acid	28 days	14 days	
Gross Alpha and Gross Beta	Radiological	1000 mL	None (preserved upon arrival by laboratory)	5 days (prior to laboratory preservation)	3 days	
^{238}U, ^{234}U, ^{235}U	Radiological	1000 mL	None (preserved upon arrival by laboratory)	5 days (prior to laboratory preservation)	3 days	
^{222}Rn	Radiological	250 mL	Refer to BV Guidance	3 days	1 day	
Colloid Concentration	HDPE	500 mL x 3	None	7 days	3 days	SGS
$\delta^{18}O$, $\delta^{2}H$	HDPE	100 mL	Minimize Headspace	No Limit	No Limit	University of Ottawa
^{3}H (Enriched)	HDPE	500 mL	Minimize Headspace	No Limit	No Limit	
$^{87}Sr/^{86}Sr$	HDPE	500 mL	Minimize Headspace	No Limit	No Limit	
$\delta^{13}C$-DIC	Glass Vial with Septa	40 mL x 3	Field Filtered, Minimize Headspace	4 weeks	4 weeks	
^{14}C-DIC	Prebaked Glass	500 mL	Field Filtered, Minimize Headspace 1 drop $HgCl_2$	4 weeks	4 weeks	
^{129}I, ^{36}Cl	HDPE	1000 mL	None	No Limit	No Limit	
$\delta^{37}Cl$	HDPE	500 mL	None	No Limit	No Limit	

Analytes	Bottle Type	Volume	Sampling and Preservation	Lab Holding Time (Maximum)	Geofirma Holding Time[1] (Optimal)	Analytical Lab or Storage
Noble Gases	Crimped Copper Tubing	Annealed 3/8 inch, 1 m long	Fill in-line with Westbay sampling container, evacuate prior to sampling	No Limit	No Limit	
^{40}K	Calculate from Total K Concentrations					
Microbiology (DNA, PFLA, Cell Count)	Sampling Requirements in WP07 Test Plan			30 days	20 days	University of Waterloo
Archive	Red-capped bottle (O. Reg.)	120 mL	Field filtered, 2mL 18% NHO_3	30 days	15 days	NWMO South Bruce Core Storage Facility
NaFl and Archive	HDPE	2x 500 mL	Field Filtered, Minimize Headspace	No Limit	No Limit	

1. All water samples at SB_BH02 were shipped to laboratories within the Geofirma holding time.

2.2.8.1 *Sample Naming Convention*

AcQuire was used to log groundwater (GW), drill water (DW) and water source (WS) samples collected as part of WP02 and WP07 activities. Samples were logged in acQuire using the Opportunistic Groundwater and Drillwater Sampling data entry object (DE-07). AcQuire automatically generated sample numbers in the form of SB_BH0x_AA00x, where:

- SB_BH02 is the borehole ID
- AA is the type of sample (e.g. DW, WS, GW)
- And 00x is a sequential number automatically generated.

For purge water archive, rinsate and field blank samples, the type of sample assigned was GW and the QA/QC type was marked as either “Purge””, “Rinsate” or “Blank”, with the “Archive” box checked where applicable.

2.2.9 QA/QC Sampling

QA/QC samples were collected as part of the OGW sampling program. QA/QC samples (duplicates, rinsate and blanks) were collected for each OGW interval. Three types of QA/QC samples were collected:

- Duplicates samples for all laboratory analyses;
- Rinsate blanks to assess the equipment decontamination procedure; and
- Tritium-free blanks to assess atmospheric contamination during sample collection and transport.

2.2.9.1 Duplicate Sample Sets and Relative Percent Difference

Duplicate samples were collected using the same sampling methods as the associated primary OGW groundwater sample. Duplicate samples bottles were filled at the same time as the OGW sample by alternating between the duplicate and OGW sample bottles (e.g., fill OGW and duplicate sulphide bottles, then start filling the next bottle type).

Duplicate sets 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:

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

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 2021). However, since the uncertainty associated with a value increases dramatically as the result approaches the method detection limit (MDL), the Ministry of Environment, Conservation and Parks (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 2021).

2.2.9.2 Rinsate Blanks

Rinsate blanks were collected by running deionized water through the sampling equipment after completion of decontamination activities. Each rinsate sample was analysed for major elements, metals, and trace elements at Bureau Veritas at the same time as the corresponding OGW sample. No field parameter measurements or in-field analytical testing were conducted on the rinsate blanks.

2.2.9.3 Tritium Free Blanks

Certain analytical parameters (e.g., tritium) have the potential to be compromised through atmospheric exposure or from bottles and equipment during transport and sampling. Tritium-free blanks were used to assess atmospheric contamination of groundwater samples. Tritium-free water was provided in bottles by the University of Ottawa. These bottles would be 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. Each tritium-free blank was analyzed for tritium and ^{14}C-DIC at the same time as a corresponding OGW sample. No field parameter measurements or in-field analytical testing was conducted on tritium-free blanks.

2.2.10 Sample Shipping

All samples collected for analysis were delivered to the appropriate analytical laboratories within the lab holding time listed in Table 2. All samples were shipped using chain of custody (COC) forms to ensure

traceability from field sample collection through to the analysis results. A COC tracking sheet in the DQC Workbook was used to track the progress of COCs during shipping and receiving. All COCs were verified and signed by both the shipper and the receiver.

Groundwater samples shipped to labs for analysis were carefully packaged in bubble wrap and placed on ice packs in coolers. Except for microbiology samples (DNA PLFA), dry ice was not used for refrigerating samples during collection, storage, and transport. Archive samples were delivered to NWMO under Chain of Custody and are stored in a refrigerator at NWMO's South Bruce core storage facility.

2.3 Laboratory Analyses and Methods

2.3.1 Analyses at Bureau Veritas Laboratories (BVL)

Bureau Veritas (formerly Maxxam Analytics Inc) completed laboratory analyses of the non-isotopic parameters, which included major elements and metals, trace elements, anions, and nutrients. BVL also completed analyses for select radiological parameters. Bureau Veritas is accredited through CAEAL, Standards Council of Canada and MECP licenses for the listed analytes.

2.3.2 Analyses at University of Ottawa (uOttawa)

The University of Ottawa's Hydrogeochemistry laboratory completed most of the stable and radioactive isotope analyses. While uOttawa was the primary analytical laboratory, some isotope analyses were subcontracted to complete specific analyses. The analyses of ^{37}Cl and $^{87}Sr/^{86}Sr$ was completed by IT^2 laboratory, ^{36}Cl analysis was completed by Eidgenössische Technische Hochschule (ETH) Zurich and Lawrence Livermore National Laboratory, and noble gas analyses by the University of Utah.

2.3.3 Analyses at SGS Laboratories

SGS laboratories completed the colloid analyses at the SGS laboratory in Lakefield, Ontario. The colloid analyses included total colloids by filtration, and colloid particle size distribution by Malvern analysis. Results from the colloid analyses have been provided to NWMO with the associated data delivery but are not discussed in this report.

2.3.4 Microbiology Analyses at the University of Waterloo

All microbiological analyses that were undertaken by the University of Waterloo were completed under a separate contract with the NWMO. Laboratory analysis and reporting associated with the microbiology samples are not included in this report.

2.4 Data Quality Assurance and Quality Control (QA/QC)

Opportunistic groundwater sampling (WP07) activities were completed following the WP07 Test Plan and Project Quality Plan. All field data associated with WP07 activities were recorded directly into NWMO's acQuire database or into a purpose-built Data Quality Confirmation (DQC) workbook.

Equipment calibration checks and calibrations were completed at the start of each shift, for any equipment associated with quality control. All fridges and freezers holding samples were checked to

ensure that the internal temperature was within an acceptable range, as outline in the Project Quality Plan. Records of equipment calibration checks and calibrations were recorded in the WP07 DQC workbook. Records of fridge and freezer temperatures were recorded in the WP03 (Core Logging, Photography, and Sampling) DQC workbook.

QA/QC samples were collected as part of the OGW sampling program. The QA/QC sampling methods are described in Section 2.2.9 with results from the QA/QC sampling program presented in Section 3.4.4.

3 RESULTS

3.1 Sample Collection Summary

Table 3 provides a summary of the water samples that were collected during the drilling and testing program at SB_BH02. Of the 102 samples, 14 WS samples and 26 of the DW samples were collected as part of drilling (WP02) activities. All other samples were collected as part of OGW sampling activities (WP07).

Table 3 Water Sampling Summary, SB_BH02

Sample Type	Sample Sub-Type	Number of Samples
Water Source (WS)	WS – Full Suite (WP02)	14
	Water Source (WS) Subtotal	**14**
Drill Water (DW)	DW – While Drilling (WP02)	26
	DW – Pre-Purge for OGW	6
	Drill Water (GW) Subtotal	**32**
Groundwater (GW)	GW – Field Blank	6
	GW – Rinsate Blank	6
	GW – Purge Water Archive	32
	GW – Primary Groundwater Sample	6
	GW – Duplicate Groundwater Sample	6
	Groundwater (GW) Subtotal	**56**
	All Water Samples	**102**

3.2 OGW Interval Selection and Purging

Table 4 provides a summary of interval selection and purging results for OGW sampling events at SB_BH02. A total of six test intervals were selected and sampled, including four intervals in the shallow bedrock above the Salina Group (OGW1, OGW2, OGW3, and OGW4), one interval at the contact between the Salina A2 and Salina A1 Unis (OGW5), and one interval spanning the bottom of the Salina A0 Unit, the Guelph Formation, and the top of the Goat Island Formation (OGW6). The OGW4 interval targeted the Bass Island Formation, but also included approximately 0.8 m of the underlying Salina G Unit.

Four of the OGW intervals (OGW1 to OGW4) were purged using a submersible Grundfos pump, and two intervals (OGW5 & OGW6) were purged by swabbing. Swabbing was used for OGW5 & OGW6 because these sampling events were completed post-drilling using the hydraulic testing equipment that had a tubing diameter that was insufficient for purging with a submersible pump.

Intervals OGW1 through OGW4 were purged until meeting the targeted sampling criteria of a final fluorescein concentration below 5% of the pre-purging drill water concentration and field parameters had stabilized. Purging by swabbing for the OGW5 and OGW6 intervals was less effective, with final fluorescein concentrations in purged water for those intervals at approximately 15% and 6% of the drill water concentration that was maintained during drilling of SB_BH02 (100 ppb). Total purge volumes that were required for the OGW events were between 6,700 and 24,000 L. Average purge rates were between 1.2 to 6.7 liters/min, depending on the purging method and yield of the formation (e.g.,

continuous pumping or recovery between pumping/swabbing). Purging for OGW5 and OGW6 was only completed by swabbing during day shifts, so the average purge rate for those two OGW events was low (1.2-2.2 liters/min).

Table 4 OGW Interval Selection and Purging Summary

OGW #	WP10 Formation/Unit Sampled[1]	Interval Depth (m)	Purging and Sampling Dates	Total Volume Purged (L)[2]	Fluorescein Concentration (ppb)		P_{GW}[3]	Purging Method
					Pre-Purge DW Sample	GW Sample		
OGW1	Lucas Fm.	78.82-84.54	Nov.14-15, 2021	6,700	98.9	1.1	0.99	Submersible Pump
OGW2	Amherstburg Fm.	90.02-99.54	Nov. 16-18, 2021	7,800	83.6	1.5	0.98	Submersible Pump
OGW3	Bois Blanc Fm.	145.50-153.54	Nov. 20-22, 2021	24,000	96.6	4.0	0.96	Submersible Pump
OGW4	Bass Islands Fm. & Salina G Unit	180.02-186.54	Nov. 24-25, 2021	11,500	87.5	2.2	0.97	Submersible Pump
OGW5	Salina A2 Anhydrite & Salina A1 Carbonate Units	331.71-339.97	Sep. 10-18, 2022	13,400	35.7	14.8	0.85[3]	Swabbing
OGW6	Salina A0 Unit, Guelph Fm, & Goat Island Fm.	386.00-394.26	Sep. 03-10, 2022	22,200	13.1	5.7	0.94[3]	Swabbing

1. Formations shown are based on finalized tops from borehole data integration (WP10)
2. Total Volume Purged is rounded to the nearest 100 L
3. P_{GW} is the proportion of groundwater in the OGW sample, calculation of P_{GW} is described in section 3.3. P_{GW} for OGW5 and OGW6 was calculated assuming an initial drill water fluorescein concentration of 100 ppb.

3.3 Estimation of Drill Water Contamination on Final Groundwater Samples

Impacts of drill water contamination on the groundwater sample results were evaluated based on the relative concentration of fluorescein in the pre-purge drill water and final/primary groundwater samples.

Equation 2 was used to calculate the proportion of groundwater (P_{GW}) in the final/primary samples from for OGW1, OGW2, OGW3, and OGW4, assuming the initial (pre-drilling) fluorescein concentration in groundwater was zero. With the P_{GW} in the final sample known, results for select analytes from the final/primary groundwater samples were corrected with Equation 3.

The approach described above was not suitable for the OGW5 and OGW6 sample sets because the borehole had been left open for approximately six months after drilling prior to sample collection, during which time cross connection and mixing of drill water and formation water in the borehole had occurred. The borehole was left open to complete geophysical logging (WP05) and hydraulic testing (WP06). As a result, the pre-purge DW samples for OGW5 and OGW6 had initial fluorescein concentrations that were much lower than the fluorescein concentration that was maintained during drilling, therefore, the pre-purging drill water samples that were collected for these two OGW events were not representative of the drill water that entered the formations during drilling. Instead, an average fluorescein

concentration of 100 ppb, equal to the targeted concentration for the drill water during drilling, was used to estimate the P_{GW} for OGW5 and OGW6.

Equation 2: $$P_{GW} = (1 - \frac{Sample\ Flourescein\ Concentration}{Drill\ Water\ Flourescein\ Concentration})$$

Equation 3: $$C_{GW} = \frac{C_S - C_{DW}(1-P_{GW})}{P_{GW}}$$

Where:
C_{GW} = groundwater concentration
C_S = sample concentration
C_{DW} = drill water concentration
P_{GW} = proportion of groundwater (in sample)

For OGW1 to OGW4, the calculated P_{GW} values were used to correct for drill water contamination for each analyte where the final/primary ground water sample and associated pre-purging drill water sample had reported values above the method detection limits. Since the pre-purge DW samples for OGW5 and OGW6 were not representative of the drilling fluid, the groundwater samples results were not corrected for these two OGW events.

Results presented in the text of this report have not been corrected for drill water contamination, unless otherwise stated. The drill water corrected results are provided separately in Appendix C.

3.4 Water Chemistry Results

Section 3.4.1 to Section 3.4.4 provide a summary of major findings from the water sampling program at SB_BH02. A sample summary table is provided in Appendix A that lists all samples that were collected as part of WP02 and WP07 activities, with sample depths (where applicable) and sample descriptions. Complete result tables, including field parameter measurements, in-field analyses, and laboratory results are included in Appendix B.

Copies of chain of custody forms and final laboratory reports, including descriptions of laboratory methodologies, have been provided to the NWMO as part of a formal data delivery that accompanied this report.

3.4.1 Water Source (WS) Results

Table 5 provides a summary of key parameters for water source (WS) samples that were collected at SB_BH02. Except for sample SB_BH02_WS003, all water source samples had consistent concentrations of major anions and cations, field parameter measurements (pH, conductivity, etc.), and isotopic signatures. The high consistency between WS samples was expected since the water used throughout the drilling program was from a single source: the Kincardine municipal supply, which extracts water from an intake in Lake Huron. Complete results tables for all water source samples are provided in Appendix B.1.

Field parameter measurements for the WS samples are consistent with a fresh, surface-water source, evidenced by all WS samples having dissolved oxygen above 5 mg/L, oxidizing (positive) oxidation-reduction potential (ORP), and a specific gravity close to 1.0. No fluorescein was detected in any of the

water source samples which were collected prior to addition of fluorescein for preparation of the drill water.

Major ion proportions for water samples from SB_BH02 are plotted on a piper plot in Figure 2. The major anion chemistry of the water source samples consists of bicarbonate with lesser amounts sulfate and chloride. The most abundant cation for the water source samples was calcium, with lesser proportions of magnesium, sodium, and potassium.

Major anion/cation chemistry and isotopic signatures suggest that sample SB_BH02_WS003 was an outlier. Concentrations of major ions, including chloride, calcium, and sodium in the SB_BH02_WS003 sample were 2-10 times the mean concentration recorded for other water source samples collected at SB_BH02 (Table 5). Tritium in the SB_BH02_WS003 sample was also high (123.4 TU) compared to other water source samples collected at SB_BH02 and regional values from recent surface water and groundwater sampling programs (Canadian Nuclear Safety Commission 2013, Dove et al. 2021, Priebe & Hamilton 2022).

Table 5 Select Water Chemistry Results – Water Source (WS) Samples

Analyte	Unit	Min.	Max.	Mean	Standard Deviation (σ)	SB_BH02_WS003
Select Field Parameters and In-Field Analyses						
Fluorescein	ppb	<0.4	<0.4	<0.4	<0.4	<0.4
pH	--	6.1	7.7	7.0	0.5	7.5
Electrical Conductivity (EC)	mS/cm	0.20	0.29	0.25	0.03	0.65
Oxidation Reduction Potential	mV	128	782	531	180	296
Dissolved Oxygen	mg/L	5.6	13.1[1]	9	2.3	6.5
Total Dissolved Solids (EC Calculated)	g/L	0.13	0.19	0.17	0.02	0.42
Total Alkalinity (as $CaCO_3$)	mg/L	65	100	76	11	69
Specific Gravity	--	0.996	1.000	0.999	0.001	1.002
Select Non-Isotopic Analytes						
Chloride (Cl)	mg/L	2.5	14	10.9	2.7	130
Sulphate (SO_4)	mg/L	6.2	37	29.6	7.7	34
Calcium (Ca)	mg/L	24	36	29.9	2.8	71
Sodium (Na)	mg/L	4.4	6.6	5.3	0.7	37
Select Isotopic Analytes						
^{3}H (Tritium)	TU	33.9	64.5	44.1	9.1	123.4
^{14}C	pmC[2]	97.57	100.15	98.88	0.70	97.95
$\delta^{18}O$	‰ VSMOW	-7.5	-6.8	-7.2	0.2	-7.1
$\delta^{2}H$ (Deuterium)	‰ VSMOW	-57.0	-52.3	-53.9	1.4	-52.7
^{129}I	atoms/kg	4.1E+07	6.8E+07	5.6E+07	8.0E+06	6.2E+07

1. Reported dissolved oxygen for serval WS samples exceed the theoretical saturation limit. These exceedances may be caused by aeration of the water when it was offloaded from the tanker vehicles prior to collection of field measurements.
2. pmC = percent modern carbon

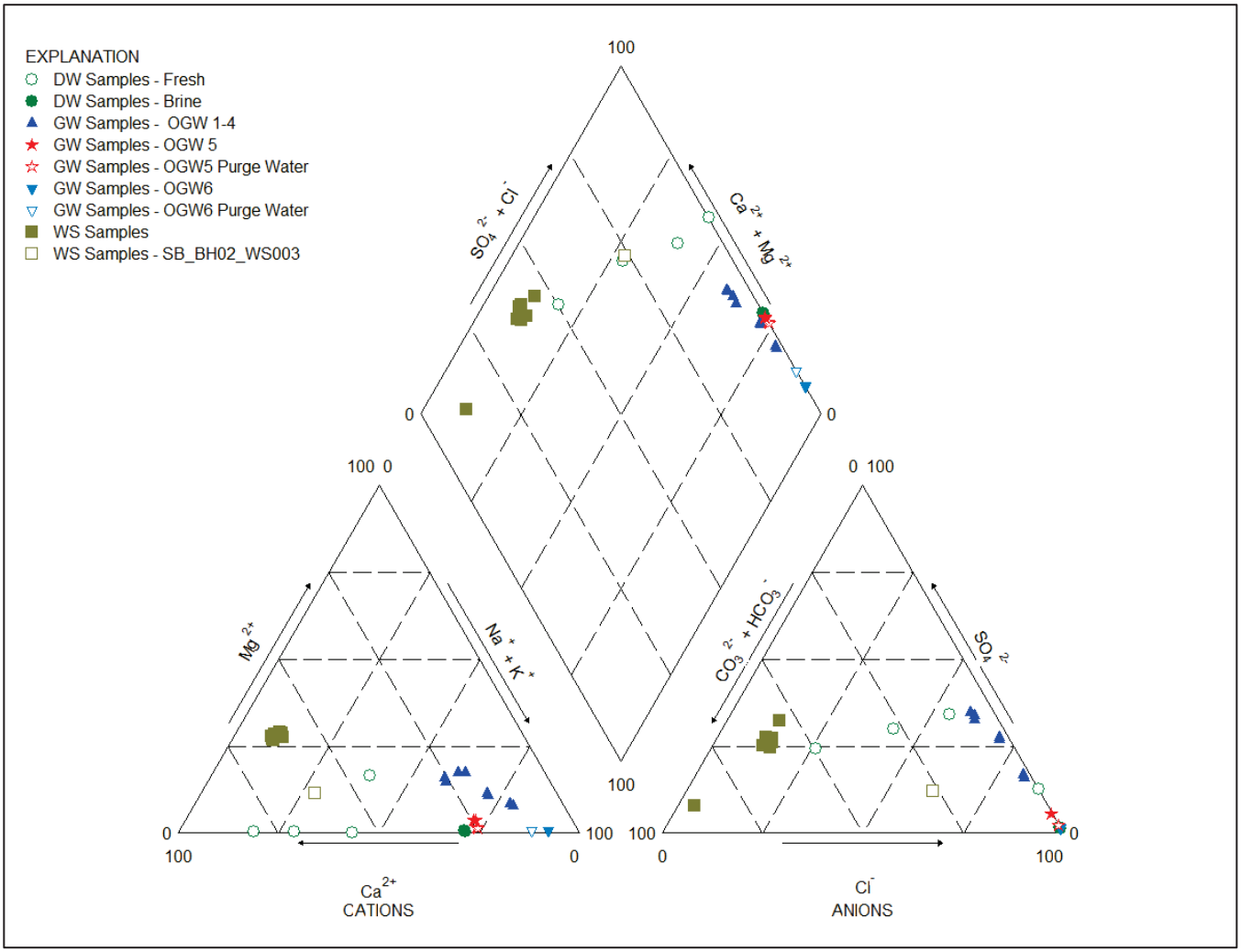


Figure 2 **Piper Plot for Select WP07 Water Source (WS), Drill Water (DW) and Groundwater (GW) Samples. A value of 0.5 x detection limit was used for analytes with concentrations below the method detection limits. Bicarbonate/carbonate concentrations calculated by advanced speciation method based on total alkalinity and pH.**

Isotopic data for the WS samples, excluding SB_BH02_WS003, show similar high concentrations of ^{14}C (97.57-100.15 pmC, mean = 98.88 pmC, σ = 0.7 pmC) and tritium (33.9-64.5 TU, mean =44.1 TU, σ = 9.1 TU) that are consistent with modern surface waters in Southwestern Ontario. Elevated tritium in the samples was expected with the intake for the Kincardine municipal water supply located only 15 km from the Bruce Power nuclear generating station. Recent regional studies of surface water and shallow groundwater in Ontario have shown elevated concentrations of tritium near active nuclear power generating stations, including the Bruce Power (Canadian Nuclear Safety Commission 2013, Dove et al. 2021, Priebe & Hamilton 2022). For context, tritium in all WS samples, notably SB_BH02_WS003, were elevated relative to typical groundwater concentrations, but are still low and well below the Canadian Drinking Water Quality Guideline of 7000 Bq/L (~59,300 TU). ^{129}I concentrations in the water source samples were between $4.1x10^7$ to $6.8x10^7$ atoms/kg (mean = $5.6x10^7$ atoms/kg, σ = $8.0x10^6$ atoms/kg).

On an oxygen ($\delta^{18}O$)-deuterium ($\delta^{2}H$) cross plot (Figure 3), all water source samples plot in a tight grouping with the drill water (DW) samples near the Lake Huron Local Evaporation Line (LEL). $\Delta^{18}O$ and $\delta^{2}H$ values for the water source samples were between -7.5 ‰ to -6.8 ‰ (σ = 0.02 ‰) and -57.0 ‰ to -52.3 ‰ (σ = 1.4‰) VSMOW, respectively.

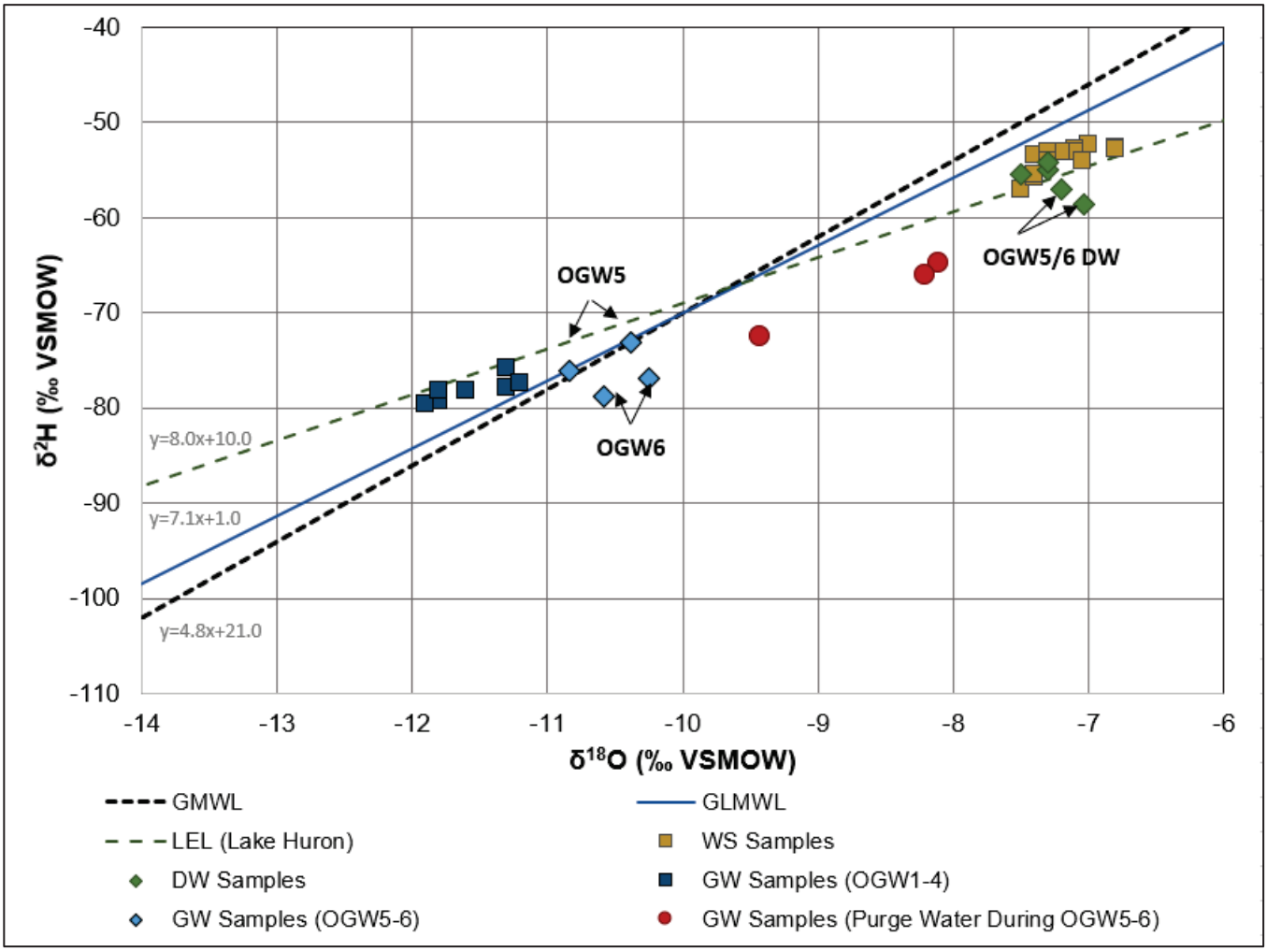


Figure 3 **Oxygen ($\delta^{18}O$)– Deuterium ($\delta^{2}H$) Cross-Plot for Select WP02 and WP07 Water Samples. GMWL = global meteoric water line, LEL = local evaporation line for Lake Huron (Longstaffe et al. n.d). Both primary and duplicate results for GW samples are shown.**

3.4.2 Drill Water (DW) Results

Table 6 provides a summary of key parameters for drill water (DW) samples collected as part of OGW (WP07) activities. The six DW samples that are discussed in this report are the pre-purging samples that were collected from the drill fluid at the start of each OGW sampling event. Several other DW samples were collected as part of drilling (WP02) but were archived without laboratory analyses, so they are not discussed in this data report. Complete results tables for the DW samples are provided in Appendix B.2.

Comparison of the DW sample chemistry shows two distinct compositional groupings: the first group of DW samples are pre-purge samples from OGW1 to OGW4 (SB_BH02_DW002, SB_BH02_DW003, SB_BH02_DW006, SB_BH02_DW008) when a fresh water drill fluid was used. These DW samples have fluorescein concentrations (87.50-98.90 ppb) near the targeted drill water tracer concentration of 100 ± 10 ppb and relatively low TDS (<2 g/L).

The second group of DW samples are from OGW5 and OGW6 (SB_BH02_DW031, SB_BH02_DW032) that were collected approximately 6 months post-drilling. Due to the delay between drilling activities and sampling, these DW samples are a mix of high TDS brine that was used for drilling of the main hole (~200 g/L) and moderate TDS formation water.

On a piper plot (Figure 2), the fresh-water based DW samples from OGW1 to OGW4 (open green circles) show a significant spread in composition, which reflects generally low, but highly variable relative proportions of major ions. The ionic composition of the brine based DW samples (solid green circles) from OGW5 (SB_BH02_DW032) and OGW6 (SB_BH02_DW031) were dominated by chloride and sodium, with relatively smaller proportions of calcium and sulfate.

DW samples from OGW1 (SB_BH02_DW002), OGW2 (SB_BH02_DW003), and OGW3 (SB_BH02_DW006) had high pH (11.9-12.6) and total alkalinity (130-290 mg/L) that were caused by drilling through cement plugs shortly before sample collection.

Table 6 Select Water Chemistry Results – Pre-Purge Drill Water (DW) Samples

Analyte	Units	Fresh DW Samples				Brine DW Samples	
		SB_BH02_DW002	SB_BH02_DW003	SB_BH02_DW006	SB_BH02_DW008	SB_BH02_DW032	SB_BH02_DW031
Select Field Parameters and In-Field Test Analyses							
Fluorescein	ppb	98.90	83.57	96.55	87.50	35.68	13.08
pH	--	12.3	11.9	12.6	9.2	6.4	5.4
Electrical Conductivity (EC)	mS/cm	1.99	1.39	2.96	0.33	243	227
Dissolved Oxygen	mg/L	9.08	9.39	11.24	8.42	0.49	0.86
Total Dissolved Solids (EC Calculated)	g/L	1.29	0.90	1.92	0.21	145.8	136.2
Specific Gravity	--	0.998	0.997	0.999	1.000	1.092	1.06
Total Alkalinity (as $CaCO_3$)	mg/L	375	270	290	130	17	24
Select Non-Isotopic Analytes							
Chloride (Cl)	mg/L	40	69	310	60	79,000	56,000
Sulphate (SO_4)	mg/L	50	65	61	51	1,200	1,200
Calcium (Ca)	mg/L	160	100	190	27	13,000	8,700
Sodium (Na)	mg/L	25	40	150	26	37,000	25,000
Select Isotopic Analytes							
^{3}H (Tritium)	TU	37.9	46.1	40.3	45.7	29.7	46.8
^{14}C	pmC	69.09	64.41	62.00	93.56	98.47	92.92
$\delta^{18}O$	‰ VSMOW	-7.3	-7.3	-7.5	-3.6[1]	-7.0	-7.2
$\delta^{2}H$ (Deuterium)	‰ VSMOW	-55.0	-54.2	-55.5	-48.3[1]	-58.6	-57.1
^{129}I	atoms/kg	3.6E+07	3.4E+07	2.4E+07	4.0E+07	4.80E+07	7.80E+07
$^{3}He/^{4}He$ (air-normalized)	--	1.1E+00	1.0E+00	1.3E+00	1.0E+00	6.0E-02	5.4E-02

1. Results for ^{18}O and ^{2}H for sample SB_BH02_DW008 have contamination flag assigned by laboratory.

Radioisotope data for the drill water samples show proportions of ^{14}C (62.00-98.58 pmC) and concentrations of tritium (37.9-46.8 TU) that are within typical ranges of modern surface waters in Southwestern Ontario and are similar to results for the water source samples. ^{129}I concentrations in the drill water samples ($2.4x10^{7}$ to $7.8x10^{7}$ atoms/kg) are consistent with concentrations of ^{129}I in water source samples.

Air normalized helium isotope ratios show a stark contrast between the fresh water DW samples and the DW samples from OGW5 and OGW6. The fresh water DW samples show air-normalized $^{3}H/^{4}H$ ratios equal to, or enriched in ^{3}H, relative to air. In contrast, the $^{3}H/^{4}H$ ratios for the OGW5 and OGW6 DW samples were much lower (0.060 to 0.054) and are comparable to helium ratios for groundwater samples. The low $^{3}H/^{4}H$ ratios in the pre-purge DW samples for OGW5 and OGW6 provide additional evidence for mixing of formation water within the open borehole during the 6-month period between the end of drilling and sample collection.

On an oxygen ($\delta^{18}O$)-deuterium ($\delta^{2}H$) cross plot (Figure 3, Section 3.4.1), the fresh water DW samples from OGW1 to OGW4 plot in a tight grouping with the water source samples below the global meteoric water line (GWML) and near the Lake Huron LEL, with $\delta^{18}O$ and $\delta^{2}H$ values between -7.5 ‰ to -7.3 ‰ and -55.5 ‰ to -54.2 ‰ VSMOW, respectively. The DW samples from OGW5 and OGW6 plot below

and to the right of the Lake Huron LEL, with less depleted $\delta^{18}O$ (-7.2 ‰ to 7.0 ‰) and more depleted $\delta^{2}H$ (-57.1‰ to -58.6 ‰) than the other DW samples. Oxygen-deuterium results for the OGW4 pre-purge sample (SB_BH02_DW008) are not shown in Figure 3 because the reported values were outside of the expected range and were likely contaminated at the laboratory during sample processing.

3.4.3 Groundwater (GW) Results

This section presents field and laboratory results for the primary groundwater samples that were collected from the six OGW intervals at SB_BH02. Unless specifically noted, results presented for the groundwater samples in this report have not been corrected for drill water contamination (see Section 3.3). Corrected results are provided separately in Appendix C. Complete results tables for all GW samples are provided in Appendix B.3.

Purge water archive samples and QA/QC samples were also assigned GW sample identification codes, but are not discussed in this section because no laboratory analyses were completed on the purge water archive samples and the QA/QC sample results are discussed separately in Section 3.4.4.

Table 7 and Figure 4 provide a summary of key parameters for the six primary GW samples collected at SB_BH02. Detailed comparison of trends with depth based on uncorrected results should be interpreted with caution due to limitations of the results for GW samples collected from the OGW5 and OGW6 intervals. The OGW5 and OGW6 GW samples were collected after a prolonged period of open borehole conditions (~6 months), during which time vertical cross-connection between formations with different chemistry and pressures likely occurred. Evidence for mixing within the borehole is provided by fluorescein measurements from the pre-purging DW samples that show greatly reduced concentrations at the start of purging for OGW5 (13.08 ppb) and OGW6 (35.68 ppb) relative to the drill water concentration that was maintained throughout drilling operations (100 ± 10 ppb).

Acknowledging the above limitation, the uncorrected GW sample results show an increase in total dissolved solids with depth, representing a transition from brackish water in the shallow bedrock (OGW1-OGW3), to saline water (OGW4 & OGW5) in the Bass Island and Salina Group, and brine in the Guelph Formation (OGW6). None of the GW samples collected at SB_BH02 were fresh water, with all samples having conductivity-calculated TDS concentrations that exceeded 1 g/L.

Based on the trends in water chemistry that are observed, detailed discussions of the GW sample results are presented separately for the samples from the shallow bedrock (OGW1 to OGW4), the Salina A2/A1 sample (OGW5), and the Guelph Formation sample (OGW6).

Table 7 Select Water Chemistry Results – Primary/Final Groundwater (GW) Samples

Analyte	OGW Event	OGW1	OGW2	OGW3	OGW4	OGW5	OGW6
	Interval (m)	70.82-84.54	90.02-99.54	145.50-153.54	180.02-186.54	331.71-339.97	386.00-394.26
	Units	SB_BH02_GW004	SB_BH02_GW013	SB_BH02_GW019	SB_BH02_GW030	SB_BH02_GW053	SB_BH02_GW042
Select Field Parameters and In-Field Test Analyses							
Fluorescein	ppb	1.05	1.46	4.05	2.22	14.82	5.66
Calculated P_{GW}		0.99	0.98	0.96	0.97	0.85[1]	0.94[1]
pH	--	7.6	7.5	7.7	7.3	7.3	6.9
Electrical Conductivity (EC)	mS/cm	7.07	7.04	12.1	15.9	69.9	375
ORP		-108	-32	-78	-74	-47	-58
Total Dissolved Solids (EC Calculated)	g/L	5.20	5.17	8.89	11.7	51.4	225
Specific Gravity	--	1	1.002	1.005	1.01	1.038	1.142
Field Dissolved Oxygen	mg/L	0	0	0	0	0.875[2]	0.2
Field Sulfide (S^{2-})	mg/L	0	0	0	0	0.4	0.21
Total Alkalinity (as $CaCO_3$)	mg/L	179	225	148	206	179	68
Select Non-Isotopic Analytes							
Chloride (Cl)	mg/L	1,400	1,600	3,200	6,900	28,000	130,000
Sulphate (SO_4)	mg/L	1,100	1,200	1,700	1,800	2,200	2400
Calcium (Ca)	mg/L	320	310	380	590	4,200	5300
Magnesium (Mg)	mg/L	110	150	150	230	360	220
Sodium (Na)	mg/L	830	1,000	1,800	4,100	14,000	75,000
Select Isotopic Analytes							
^{3}H (Tritium)	TU	1.6	0.9	3.8	1.7	14.8	16.4
^{14}C	pmC	13.91	7.60	4.66	1.17	1.44	1.68
$\delta^{18}O$	‰ VSMOW	-11.8	-11.9	-11.3	-11.3	-10.8	-10.3
$\delta^{2}H$ (Deuterium)	‰ VSMOW	-78.9	-79.6	-75.8	-77.8	-76.1	-76.8
^{129}I	atoms/kg	9.3E+06	7.8E+06	1.2E+07	9.7E+06	4.3E+07	2.8E+07
$^{3}He/^{4}He$ (air-normalized)	--	6.5E-02	5.4E-02	4.5E-02	3.7E-01	1.3E-01	5.0E-02

1. P_{GW} is the proportion of groundwater in the OGW sample, calculation of P_{GW} is described in section 3.3. P_{GW} for OGW5 and OGW6 samples was calculated assuming assumed initial drill water fluorescein concentration of 100 ppb.
2. Reported field DO are from multiparameter probe readings, except for sample SB_BH02_GW053 where the field testing DO result (by colorimeter) is reported.

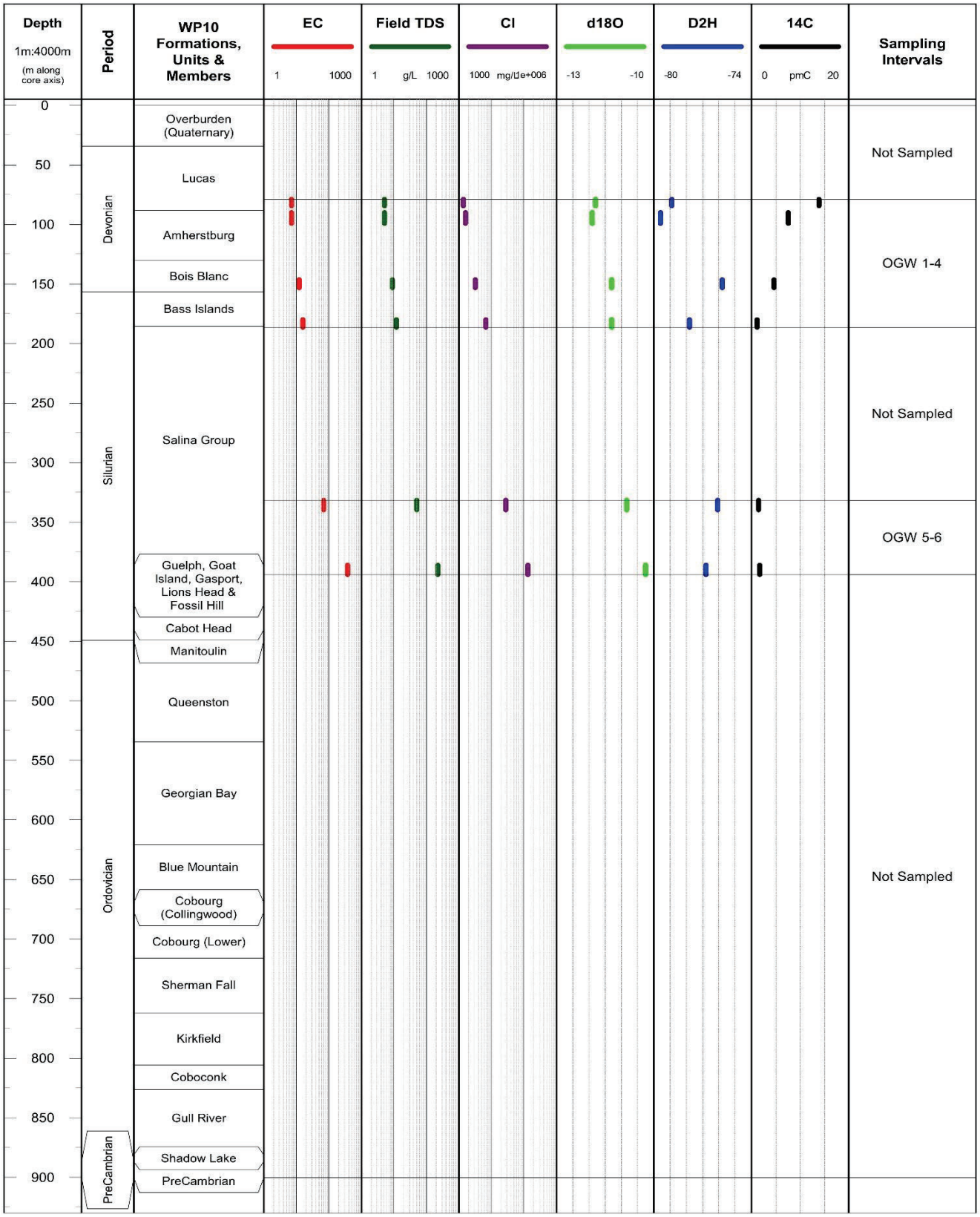


Figure 4 **SB_BH02 Groundwater Sample Locations, calculated EC (conductivity), TDS (total dissolved solids), Cl (chloride), and isotopic ratios (^{18}O, ^{2}H, and ^{14}C).**

3.4.3.1 *Shallow Groundwater Results – OGW1 (Lucas Fm.), OGW2 (Amherstburg Fm.), OGW3 (Bois Blanc Fm.) and OGW4 (Bass Islands Fm. & Salina G)*

Four OGW samples collected at SB_BH02 were from intervals in the shallow bedrock above the Salina Group. The targeted shallow bedrock intervals included the Lucas Formation (OGW1, 78.82-84.54 m), Amherstburg Formation (OGW2, 90.02-99.54 m), Bois Blanc Formation (OGW3, 145.50-153.54 m), and the Bass Island Formation (OGW4, 180.02-186.54 m). The OGW4 interval also included approximately 0.8 m from the top of the Salina Group, G Unit.

Primary GW samples for the four OGW intervals in the shallow bedrock were collected after purging to less than 5% drill water by sample volume (P_{GW} >0.95). These four samples consisted of brackish to saline water, with moderate total dissolved solids (5.2-11.7 g/L), moderate electrical conductivity (7.1-15.9 mS/cm), and specific gravity between 1.00-1.01 (Table 7).

Dissolved oxygen (DO) measurements recorded using a flow through cell and a Horiba multiparameter probe were 0.0 mg/L for all four shallow groundwater samples. The four shallow GW samples were reducing, with ORP measurements between -32 to -108 mV. No sulphide was detected in the shallow GW samples by both field and laboratory testing methods.

Shown by dark blue triangles on a piper plot (Figure 2), the shallow GW samples have a distinct ionic chemistry from the other sample types collected at SB_BH02. The most abundant anion in these samples was chloride (1,400-6,900 mg/L), with lesser proportions of sulphate (1,100-1,800 mg/L) and bicarbonate (180-256 mg/L). The most abundant cation in the shallow GW samples was sodium (830-4,100 mg/L), with lesser proportions of calcium (310-590 mg/L) and magnesium (110-230 mg/L).

The shallow GW samples are the most depleted in oxygen ($\delta^{18}O$) and deuterium ($\delta^{2}H$) of the water samples that were collected at SB_BH02. On a cross plot (Figure 3), the four shallow groundwater samples plot in a grouping above and to the left of the GMWL, with $\delta^{18}O$ values between -11.8 ‰ to -11.3 ‰ VSMOW and $\delta^{2}H$ values between -79.6 ‰ to -75.8 ‰ VSMOW.

Tritium (^{3}H) in the shallow GW samples was between 0.9 to 3.8 TU and showed no trend with depth (Table 7). ^{14}C decreased with depth from 13.91 to 1.17 pmC in four shallow GW samples (Figure 4). When corrected for drill water contamination (Appendix C), tritium concentrations in the shallow groundwater samples were between 0.1-2.2 TU, with the corrected values for OGW2 and OGW4 samples both below the laboratory method detection limit of 0.8 TU.

^{129}I concentrations in the shallow GW samples ($7.8x10^{6}$ to $1.2x10^{7}$ atoms/kg) were lower than concentrations reported for the DW and WS samples. The shallow groundwater samples had air-normalized $^{3}He/^{4}He$ ratios between 0.04-0.37.

3.4.3.2 *OGW5 (Salina Group, A2 Anhydrite and A1 Carbonate Units)*

The OGW5 sample was obtained from an 8.26 m interval that spanned the contact between the Salina A2 and A1 units from 331.71-339.97 m. Of the six OGW intervals sampled at SB_BH02, the final/primary GW sample that was collected as part of OGW5 (SB_BH02_GW053) had the highest percentage of drill water contamination, estimated at 15% of the sample volume based on fluorescein concentration (Table 7). Due to the drill water contamination and potential mixing in the open borehole prior to collection of

the GW sample (discussed in Section 3.4.3) results for the OGW5 GW sample are more uncertain than results from the other five primary GW samples at SB_BH02.

The GW sample from OGW5 consisted of saline water with moderate TDS (51.4 g/L), electrical conductivity (69.9 mS/cm), and specific gravity (1.038). It was difficult to obtain an accurate measurement of dissolved oxygen for this sample due to the sample collection method (swabbing): the recorded field DO value was 0.875 mg/L. The sample was reducing (ORP = -47 mV), and had a low concentration of sulfide (0.4 mg/L)

Shown by red stars on a piper plot (Figure 2), the primary and duplicate OGW5 GW samples have a distinct ionic chemistry that is similar to the brine based DW samples. The most abundant anion in the OGW5 GW sample was chloride (28,000 mg/L), with much lower concentrations of sulfate (2,200 mg/L) and bicarbonate (158 mg/L). The most abundant cation was sodium (14,00 mg/L), with much lower concentrations of calcium (4,200 mg/L) and magnesium (360 mg/L).

Isotopic results for the OGW5 groundwater sample are impacted by the DW contamination. On an oxygen and deuterium cross plot (Figure 3), the GW samples from OGW5 plot below the GMWL, with $\delta^{18}O$ and $\delta^{2}H$ values of -76.1 ‰ and -10.8 ‰ VSMOW, respectively. The tritium (^{3}H) concentration was 14.8 TU, with a relatively low ^{14}C ratio of 1.44 pmC.

The ^{129}I concentration in the OGW5 groundwater sample was $4.3x10^{7}$ atoms/kg and was comparable to ^{129}I concentrations recorded for DW samples. In contrast, the air-normalized $^{3}He/^{4}He$ ratio (0.13) for the OGW5 GW sample was lower than air-equivalent (~1.0) ratio recorded for the DW samples.

3.4.3.3 *OGW6 (Guelph Formation)*

The OGW6 sample was obtained from an 8.26 m interval (386.00-394.26 m) that targeted the Guelph Formation, but also included approximately 0.84 m of the overlying Salina A0 Unit and 2.4 m of the underlying Goat Island Formation. The final/primary GW sample collected as part of OGW6 had approximately 6% drill water by sample volume based on the final fluorescein concentrations (Table 7). Despite relatively little drill water contamination, it is possible that the GW sample for OGW6 was impacted by vertical mixing of formation water in the borehole prior to purging.

The GW sample from OGW6 consisted of brine with high TDS (225 g/L), electrical conductivity (375 mS/cm), and specific gravity (1.142) relative to the other GW samples at SB_BH02. It was difficult to obtain an accurate measurement of dissolved oxygen due to the sample collection method (swabbing): the recorded DO value was 0.2 mg/L. The sample was reducing (ORP = -58 mV) and had a low concentration of sulfide (0.21 mg/L)

Shown by inverted blue triangles on the piper plot (Figure 2), the OGW6 GW samples have a distinct ionic chemistry. The most abundant anion in the OGW6 GW sample was chloride (130,000 mg/L), with lower concentrations of sulfate (2,400 mg/L) and bicarbonate (95 mg/L). The most abundant cation was sodium (75,000 mg/L), with much lower concentrations of calcium (2,400 mg/L) and magnesium (220 mg/L).

Isotopic results for the OGW6 groundwater sample showed some minor impacts from drill water contamination. On an oxygen and deuterium cross plot (Figure 3), the GW samples from OGW6 plot

near the GMWL, exhibiting less depleted ^{18}O and ^{2}H isotopic signatures than other groundwater samples (OGW1 to OGW4). The $\delta^{18}O$ and $\delta^{2}H$ ratios for the OGW6 sample were -76.8 ‰ and -10.3 ‰ VSMOW, respectively. The tritium (^{3}H) concentration was 16.4 TU, and the sample had a relatively low ^{14}C ratio of 1.68 pmC.

The ^{129}I concentration in the OGW6 groundwater sample was $2.8x10^{7}$ atoms/kg and was similar to ^{129}I concentrations recorded for DW samples. The air-normalized $^{3}He/^{4}He$ ratio for the OGW6 GW was 0.05.

3.4.4 QA/QC Sample Results

Results from the QA/QC sampling completed by Geofirma are presented for duplicate groundwater samples, tritium free blanks, and rinsate blanks. Additional QA/QC activities that were completed by the University of Ottawa, Bureau Veritas Laboratories, and SGS Laboratories as part of their internal quality management programs are not presented in this report but are provided as part of the laboratory reports that were delivered separately to the NWMO with the accompanying SB_BH02 WP07 data delivery.

3.4.4.1 *Duplicate Sample Results*

Table 8 provides a summary of average RPD that were calculated for each major analyte group based on the laboratory data from primary/duplicate sample sets that were collected as part of each OGW event. Complete RPD results are provided in Appendix D.

Table 8 Calculated RPD, by Analyte Group, for Primary/Duplicate Sample Sets

Lab and Analyte Group	OGW1 Set	OGW2 Set	OGW3 Set	OGW4 Set	OGW5 Set	OGW6 Set
	Average RPD (%), by Lab/Analyte Group					
BVL – Radionuclides	15	47	10	14	55	20
BVL – Anions and Inorganics	2	0	15	3	20	4
BVL -Metals	1	4	4	3	1	4

Samples pairs where the average concentration was below 5x the detection limit were not considered as part of the RPD assessment (MECP 2021). In general, calculated RPD for analyses completed at Bureau Veritas Laboratories (RPD) show acceptable precision (RPD <30%). Metals and anion/inorganic parameters showed very consistent results, with RPD values <15% for most parameters. RPD values calculated for radionuclide parameters at BVL showed less precision, which in part was caused by low concentrations of these radionuclides relative to their method detection limits. Parameters where BVL-reported results for duplicate sets had calculated RPD >30% included:

- OGW1 – Gross Alpha
- OGW2 – Gross Alpha
- OGW5 - ^{238}U, Total Phosphorous, Reactive Silica
- OGW6 – Aluminum

The RPD method for comparison of duplicate samples is not generally suitable for assessment of isotopic analyses completed by the University of Ottawa, where the results are typically presented as isotopic ratios, or the measured parameters are close to the method detection limits. When assessed

qualitatively, the isotopic results from University of Ottawa were generally consistent between the primary and duplicate samples.

3.4.4.2 Tritium Free Blank Sample Results

Table 9 provides a summary of the tritium results for tritium free blank samples that were collected during OGW sampling activities at SB_BH02. Tritium concentrations were at or below the method detection limit (0.8 TU) for blank samples from the OGW4, OGW5 and OGW6 events, indicating that there was insignificant exposure of the blank samples and associated primary GW samples to the atmosphere during sampling, transport, and analyses.

The three tritium blank samples associated with the OGW1-3 sampling events had low detectable concentrations of tritium between 0.9-1.3 TU that were at or below the concentrations in the associated primary GW samples. For the OGW2 event, the primary groundwater sample (SB_BH02_GW013) had the same concentration as the field blank (SB_BH02_GW012).

Table 9 Tritium Free Blank Results Summary

Analyte	OGW Event	OGW1	OGW2	OGW3	OGW4	OGW5	OGW6
	Units	SB_BH02_GW006	SB_BH02_GW012	SB_BH02_GW021	SB_BH02_GW032	SB_BH02_GW045	SB_BH02_GW056
^{3}H (Tritium)	TU	1.0	0.9	1.3	0.8	<0.8	<0.8

3.4.4.3 Rinsate Blank Sample Results

Table 10 provides a summary of the results for rinsate blank samples that were collected during OGW sampling activities at SB_BH02. Chloride, calcium, iron, sodium, and strontium were detected in at least one of the six rinsate blank samples that submitted. The concentrations of the ions that were detected in the rinsate samples were low and were several orders of magnitude lower than the concentrations of the same ions in the associated primary GW samples. All other analyzed parameters were not detected in the rinsate blank samples.

Table 10 Rinsate Blank Sample Results (Detections Bolded)

Analyte	OGW Event	OGW1	OGW2	OGW3	OGW4	OGW5	OGW6
	Units	SB_BH02_GW007	SB_BH02_GW011	SB_BH02_GW015	SB_BH02_GW026	SB_BH02_GW055	SB_BH02_GW044
Physiochemical Parameters, Anions, and Nutrients							
Bromide (Br)	mg/L	<1.0	<1.0	--	<1.0	<1.0	<1.0
Chloride (Cl)	mg/L	<1.0	<1.0	--	**1.2**	<1.0	**1.4**
Fluoride (F)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Iodide (I)	mg/L	<0.10	<0.10		--	<0.10	<0.10
Nitrate (NO3)	mg/L	<0.10	<0.10	--	<0.10	<0.10	<0.10
Nitrite (NO2)	mg/L	<0.010	<0.010	--	<0.010	<0.010	<0.010
Nitrate + Nitrite	mg/L	<0.10	<0.10	--	<0.10	<0.10	<0.10
OrthoPhosphate (PO4)	mg/L	<0.010	<0.010	--	<0.010	<0.010	<0.010
Sulphate (SO4)	mg/L	<1.0	<1.0	--	<1.0	<1.0	1.5
Sulfur (S)	mg/L	<0.5	<0.5	--	<0.5	<0.5	<5
Metals							
Aluminum (Al)	mg/L	<0.0049	<0.0049	--	<0.0049	<0.0049	<0.0049
Boron (B)	mg/L	<0.010	<0.010	--	<0.010	<0.010	<0.010
Calcium (Ca)	mg/L	<0.200	<0.200	--	**0.46**	<0.200	<0.200
Iron (Fe)	mg/L	<0.02	**0.03**	--	<0.02	<0.02	<0.2
Lithium (Li)	mg/L	<0.0050	<0.0050	--	<0.0050	<0.0050	<0.0050
Magnesium (Mg)	mg/L	<0.050	<0.050	--	<0.050	<0.050	<0.050
Potassium (K)	mg/L	<0.200	<0.200	--	<0.200	<0.200	<0.200
Ruthenium (Ru)	mg/L	<0.0020	<0.0020	--	<0.0020	<0.0020	<0.0020
Silicon (Si)	mg/L	<0.050	<0.050	--	<0.050	<0.050	<0.050
Sodium (Na)	mg/L	**0.22**	<0.100	--	**0.11**	<0.100	**0.25**
Strontium (Sr)	mg/L	**0.0011**	<0.0010	--	**0.0056**	**0.0015**	**0.0023**

4 CONCLUSIONS

Geofirma Engineering Ltd. completed sampling of source water, drill water, and groundwater as part of drilling (WP02) and opportunistic groundwater sampling (WP07) activities at SB_BH02, the second of two boreholes at the South Bruce site that were drilled as part of the NWMO's Phase 2 Geoscientific Preliminary Field Investigations. All water sampling activities were completed by Geofirma, with the laboratory analyses completed by the University of Ottawa, Bureau Veritas Laboratories, and SGS Laboratories. The University of Ottawa subcontracted select isotopic analyses to the IT^2 laboratory in Waterloo, Ontario, the Eidgenössische Technische Hochschule (ETH) in Zurich, the Lawrence Livermore National Laboratory in California, and the University of Utah.

A total of 102 water samples were collected at SB_BH02, including 14 water source (WS) samples, 32 drill water (DW) samples, and 56 groundwater (GW) samples. Six primary groundwater samples were collected, with the rest of the GW-assigned samples consisting of duplicates (6), tritium free blanks (6), rinsate blanks (6), and archive samples collected during purging (32).

Four intervals (OGW1 to OGW4) were selected and sampled during drilling based on evidence from core and drilling indicators. Two additional intervals (OGW5 and OGW6) were selected for sampling post-drilling based on core, hydraulic testing, and geophysical logging results. The post-drilling intervals were sampled approximately six months after drilling and borehole testing. Total purge volumes were between 6,700 L to 24,000 L per interval. The six intervals that were selected for OGW sampling activities at SB_BH02 were the following:

- Four intervals in the shallow bedrock above the Salina Group
    - OGW1: Lucas Formation (78.82-84.54 m)
    - OGW2: Amherstburg Formation (90.02-99.54 m)
    - OGW3: Bois Blanc Formation (145.50-153.54 m)
    - OGW4: Bass Islands Formation (180.02-186.54 m)
- Two intervals in the intermediate-depth bedrock
    - OGW5: Salina A2 Anhydrite and A1 Carbonate Units (331.71-339.97 m)
    - OGW6: Guelph Formation (386.00-394.26 m)

Except for one sample, SB_BH02_WS003, all water source samples had consistent field parameter, ionic compositions, and isotopic ratios that were typical for surface water in Southwestern Ontario. The WS samples had elevated dissolved oxygen (>5 mg/L), were oxidizing (+ ORP), and had low TDS (<0.2 g/L). Tritium and ^{14}C in the water source samples were between 33.9-64.5 TU and 97.57-100.15 pmC, respectively. Oxygen ($\delta^{18}O$) and deuterium ($\delta^{2}H$) for the water source samples plot in a tight grouping near the Lake Huron LEL, with $\delta^{18}O$ values between -7.5 ‰ to -6.8 ‰ VSMOW and $\delta^{2}H$ values between -57.0 ‰ to -52.3 ‰ VSMOW. Sample SB_BH02_WS003 was an outlier among water source samples, with elevated TDS and a higher tritium concentration (123 TU).

Drill water samples from SB_BH02 could be assigned to two distinct groups based on their chemical composition. The first group of drill water samples were from a fresh water drill fluid: these samples

were like the water source samples, with low TDS (0.21-1.92 g/L) and EC (0.33-2.96 mS/cm). The second group of drill water samples were from a brine-based drill fluid: these samples had higher TDS (136-146 g/L) and EC (227-243 mS/cm). Tritium and ^{14}C in the drill water samples were between 29.7-46.8 TU and 62.00-98.47 pmC, respectively. Oxygen ($\delta^{18}O$) and deuterium ($\delta^{2}H$) for the drill water samples plot in a grouping close to the water source samples and near the Lake Huron LEL, with $\delta^{18}O$ values between -7.5 ‰ to -7.0 ‰ VSMOW and $\delta^{2}H$ values between -58.6 ‰ to -54.2 ‰ VSMOW.

Groundwater samples from SB_BH02 show a transition with depth from brackish water in OGW1, OGW2, and OGW3, to saline water in OGW4 and OGW5, and high TDS brine in OGW6. None of the GW samples collected at SB_BH02 were fresh water, with all samples having conductivity-calculated TDS concentrations that exceeded 1 g/L. Notable results for the groundwater samples included:

- Groundwater samples from OGW1, OGW2, OGW3, and OGW4 were collected from the shallow bedrock above the Salina Group. The shallow groundwater samples were composed of brackish to saline water with relatively low total dissolved solids (5.20-11.7 g/L), electrical conductivity (7.07-15.9 mS/cm), and specific gravity (1.00-1.01) that increased with depth. ^{14}C in the shallow groundwater samples decreased with depth from 13.9 to 1.17 pmC. Tritium concentrations were between 0.9-3.8 TU and showed no trend with depth. $\delta^{18}O$ and $\delta^{2}H$ values for the shallow groundwater samples were between -11.9 ‰ to -11.3 ‰ and -79.6 ‰ to -75.8 ‰ VSMOW, respectively.

- Groundwater samples collected at intermediate depths include saline water from OGW5 (Salina Group A2 Unit) and a high TDS brine from OGW6 (Guelph Formation). These samples were collected approximately six months after drilling, during which time the borehole was open for geophysical logging (WP05) and hydraulic testing (WP06). The results for the OGW5 and OGW6 groundwater samples indicate that the samples were impacted by mixing that occurred in the open borehole prior to sampling. The residual drill water contamination was most significant for the OGW5 groundwater sample, with an estimated 15% drill water by sample volume based on fluorescein measurements.

- The intermediate depth groundwater samples from OGW5 and OGW6 had higher total dissolved solids (51.4 and 225 g/L), electrical conductivity (69.9 and 375 mS/cm), and specific gravity (1.04 and 1.14) than the groundwater samples collected at shallower depths from OGW1-4. Tritium and ^{14}C concentrations for these samples were between 14.8-16.4 TU, and 1.41-1.68 pmC, respectively. $\delta^{18}O$ and $\delta^{2}H$ values were -10.8 ‰ and -76.1‰ for OGW5 and -10.3 ‰ and -76.8 ‰ for OGW6.

- ^{129}I concentrations for the shallow groundwater samples (OGW1-4) were approximately 1 order of magnitude lower than concentrations reported for the drill water and water source samples. Drill water impacted groundwater samples from OGW5 and OGW6 had ^{129}I concentrations that were comparable to the drill water samples.

- Air-normalized $^{3}He/^{4}He$ ratios were between 0.05-0.37 for the shallow groundwater samples, 0.13 for OGW5, and 0.05 for OGW6.

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Appendix A

List of Samples Collected at SB_BH02

Appendix A - List of Samples Collected at SB_BH02

Sample ID	Work Package	From (m)	To (m)	Date Sampled	Comments
SB_BH02_DW001	2	48.53	51.53	25-Oct-21	50m Drill Water Archive Sample (#1)
SB_BH02_DW002	7	78.82	84.54	14-Nov-21	OGW1 Pre-purge Sample
SB_BH02_DW003	7	90.02	99.54	16-Nov-21	OGW2 Pre-purge Sample
SB_BH02_DW004	2	99.54	102.54	18-Nov-21	100m Drill Water Archive Sample (#2)
SB_BH02_DW005	2	153.54	153.54	20-Nov-21	150m Drill Water Archive Sample (#3)
SB_BH02_DW006	7	153.54	153.54	20-Nov-21	OGW3 pre-purge Sample
SB_BH02_DW007	7	165.02	174.54	23-Nov-21	Samples collected from main drilling half round as pre-purge Sample for OGW4A
SB_BH02_DW008	7	180.02	186.54	24-Nov-21	OGW4 Pre-purge Sample
SB_BH02_DW009	2	198.54	198.54	26-Nov-21	200m Drill Water Archive Sample (#4)
SB_BH02_DW010	2	246.54	249.54	1-Jan-22	250m Drill Water Archive Sample (#5)
SB_BH02_DW011	2	297.54	300.54	2-Jan-22	300m Drill Water Archive Sample (#6)
SB_BH02_DW012	2	345.54	348.54	3-Jan-22	350m Drill Water Archive Sample (#7)
SB_BH02_DW013	2	396.54	399.54	5-Jan-22	400m Drill Water Archive Sample (#8)
SB_BH02_DW014	2	449.11	450.54	6-Jan-22	450m Drill Water Archive Sample (#9)
SB_BH02_DW015	2	498.57	501.57	1-Mar-22	500m Drill Water Archive Sample (#10)
SB_BH02_DW016	2	546.57	549.57	5-Mar-22	550m Drill Water Archive Sample (#11)
SB_BH02_DW017	2	579.57	582.65	8-Mar-22	MICROBIO. Associated with SB_BH01_MB001 and SB_BH01_MB002.
SB_BH02_DW018	2	582.65	582.65	8-Mar-22	MICROBIO. Associated with SB_BH01_MB001 and SB_BH01_MB002.
SB_BH02_DW019	2	597.57	600.57	9-Mar-22	600m Drill Water Archive Sample (#12)
SB_BH02_DW020	2	648.57	651.57	11-Mar-22	650m Drill Water Archive Sample (#13)
SB_BH02_DW021	2	681.57	684.57	13-Mar-22	MICROBIO. Associated with SB_BH02_MB003 and SB_BH02_MB004.
SB_BH02_DW022	2	684.57	684.57	13-Mar-22	MICROBIO. Associated with SB_BH02_MB003 and SB_BH02_MB004.
SB_BH02_DW023	2	699.57	702.57	13-Mar-22	700m Drill Water Archive Sample (#14)
SB_BH02_DW024	2	747.57	750.57	16-Mar-22	750m Drill Water Archive Sample (#15)
SB_BH02_DW025	2	798.57	801.57	18-Mar-22	800m Drill Water Archive Sample (#16)
SB_BH02_DW026	2	849.57	850.57	20-Mar-22	850m Drill Water Archive Sample (#17)
SB_BH02_DW027	2	850.57	851.57	20-Mar-22	MICROBIO. Associated with SB_BH02_MB005 and SB_BH02_MB006.
SB_BH02_DW028	2	851.57	852.57	20-Mar-22	MICROBIO. Associated with SB_BH02_MB005 and SB_BH02_MB006.
SB_BH02_DW029	2	897.57	898.18	22-Mar-22	900m Drill Water Archive Sample (#18)
SB_BH02_DW030	7	319.84	339.97	26-Aug-22	OGW5 Pre-purge Sample, Initial Attempt
SB_BH02_DW031	7	386.00	394.26	3-Sep-22	OGW6 Pre-purge Sample
SB_BH02_DW032	7	331.71	339.97	11-Sep-22	OGW5 Pre-purge Sample
SB_BH02_GW001	7	78.82	84.54	14-Nov-21	OGW1 Purge Archive #1
SB_BH02_GW002	7	78.82	84.54	15-Nov-21	OGW1 Purge Archive #2
SB_BH02_GW003	7	78.82	84.54	15-Nov-21	OGW1 Purge Archive #3
SB_BH02_GW004	7	78.82	84.54	15-Nov-21	OGW1 Primary Sample
SB_BH02_GW005	7	78.82	84.54	15-Nov-21	OGW1 Duplicate Sample
SB_BH02_GW006	7	78.82	84.54	15-Nov-21	OGW1 Field Blank
SB_BH02_GW007	7	78.82	84.54	14-Nov-21	OGW1 Rinsate Blank
SB_BH02_GW008	7	90.02	99.54	17-Nov-21	OGW2 Purge arvhive #1
SB_BH02_GW009	7	90.02	99.54	18-Nov-21	OGW2 Purge Archive #2
SB_BH02_GW010	7	90.02	99.54	18-Nov-21	OGW2 Purge Archive #3
SB_BH02_GW011	7	90.02	99.54	16-Nov-21	OGW2 Rinsate Blank
SB_BH02_GW012	7	90.02	99.54	18-Nov-21	OGW2 Field Blank
SB_BH02_GW013	7	90.02	99.54	18-Nov-21	OGW2 Primary Sample
SB_BH02_GW014	7	90.02	99.54	18-Nov-21	OGW2 Duplicate Sample
SB_BH02_GW015	7	146.50	153.54	20-Nov-21	OGW3 Rinsate Blank
SB_BH02_GW016	7	146.50	153.54	20-Nov-21	OGW3 Purge Archive #1
SB_BH02_GW017	7	146.50	153.54	20-Nov-21	OGW3 Purge Archive #2
SB_BH02_GW018	7	146.50	153.54	21-Nov-21	OGW3 Purge Archive #3
SB_BH02_GW019	7	146.50	153.54	22-Nov-21	OGW 3 Primary Sample
SB_BH02_GW020	7	146.50	153.54	22-Nov-21	OGW3 Duplicate Sample
SB_BH02_GW021	7	146.50	153.54	22-Nov-21	OGW3 Field Blank Sample
SB_BH02_GW022	7	146.50	153.54	21-Nov-21	OGW3 Purge Archive #4
SB_BH02_GW023	7	146.50	153.54	21-Nov-21	OGW3 Purge Archive #5
SB_BH02_GW024	7	146.50	153.54	22-Nov-21	OGW3 Purge Archive #6
SB_BH02_GW025	7	146.50	153.54	22-Nov-21	OGW3 Purge Archive #7
SB_BH02_GW026	7	180.02	186.54	23-Nov-21	OGW4 Rinsate Blank
SB_BH02_GW027	7	180.02	186.54	24-Nov-21	OGW4 Purge Archive #1
SB_BH02_GW028	7	180.02	186.54	25-Nov-21	OGW4 Purge Archive #2
SB_BH02_GW029	7	180.02	186.54	25-Nov-21	OGW4 Purge Archive #3
SB_BH02_GW030	7	180.02	186.54	23-Nov-21	OGW4 Primary Sample
SB_BH02_GW031	7	180.02	186.54	23-Nov-21	OGW4 Duplicate Sample
SB_BH02_GW032	7	180.02	186.54	25-Nov-21	OGW4 Field Blank
SB_BH02_GW033	7	319.84	339.97	29-Aug-22	OGW5 Archive (intial attempt)

Appendix A - List of Samples Collected at SB_BH02

Sample ID	Work Package	From (m)	To (m)	Date Sampled	Comments
SB_BH02_GW034	7	386.00	394.26	4-Sep-22	OGW6 Purge Archive #1
SB_BH02_GW035	7	386.00	394.26	4-Sep-22	OGW6 Purge Archive #2
SB_BH02_GW036	7	386.00	394.26	5-Sep-22	OGW6 Purge Archive #3
SB_BH02_GW037	7	386.00	394.26	5-Sep-22	OGW6 Purge Archive #4
SB_BH02_GW038	7	386.00	394.26	6-Sep-22	OGW6 Interim Primary Sample
SB_BH02_GW039	7	386.00	394.26	7-Sep-22	OGW6 Purge Archive #5
SB_BH02_GW040	7	386.00	394.26	8-Sep-22	OGW6 Purge Archive #6
SB_BH02_GW041	7	386.00	394.26	9-Sep-22	OGW6 Purge Archive #7
SB_BH02_GW042	7	386.00	394.26	10-Sep-22	OGW6 Primary Sample
SB_BH02_GW043	7	386.00	394.26	10-Sep-22	OGW6 Duplicate Sample
SB_BH02_GW044	7	386.00	394.26	9-Sep-22	OGW6 Rinsate Sample
SB_BH02_GW045	7	386.00	394.26	9-Sep-22	OGW6 Field Blank
SB_BH02_GW046	7	331.71	339.97	12-Sep-22	OGW5 Archive Sample #1
SB_BH02_GW047	7	331.71	339.97	13-Sep-22	OGW5 Archive Sample #2
SB_BH02_GW048	7	331.71	339.97	14-Sep-22	OGW5 Archive Sample #3
SB_BH02_GW049	7	331.71	339.97	15-Sep-22	OGW5 Interim Primary Sample
SB_BH02_GW050	7	331.71	339.97	15-Sep-22	OGW5 Interim Duplicate Sample
SB_BH02_GW051	7	331.71	339.97	16-Sep-22	OGW5 Purge Archive #4
SB_BH02_GW052	7	331.71	339.97	17-Sep-22	OGW5 Archive Sample #5
SB_BH02_GW053	7	331.71	339.97	18-Sep-22	OGW5 Primary Sample
SB_BH02_GW054	7	331.71	339.97	18-Sep-22	OGW5 Duplicate Sample
SB_BH02_GW055	7	331.71	339.97	18-Sep-22	OGW5 Rinsate Sample
SB_BH02_GW056	7	331.71	339.97	18-Sep-22	OGW5 Field Blank
SB_BH02_WS001	2	--	--	18-Aug-21	Water Source Sample
SB_BH02_WS002	2	--	--	29-Sep-21	Water Source Sample
SB_BH02_WS003	2	--	--	22-Oct-21	Water Source Sample
SB_BH02_WS004	2	--	--	28-Oct-21	Water Source Sample
SB_BH02_WS005	2	--	--	13-Nov-21	Water Source Sample
SB_BH02_WS006	2	--	--	24-Nov-21	Water Source Sample
SB_BH02_WS007	2	--	--	5-Dec-21	Water Source Sample
SB_BH02_WS008	2	--	--	5-Dec-21	Water Source Sample
SB_BH02_WS009	2	--	--	7-Dec-21	Water Source Sample
SB_BH02_WS010	2	--	--	23-Dec-21	Water Source Sample
SB_BH02_WS011	2	--	--	2-Mar-22	Water Source Sample
SB_BH02_WS012	2	--	--	16-Mar-22	Water Source Sample
SB_BH02_WS013	2	--	--	22-Mar-22	Water Source Sample
SB_BH02_WS014	2	--	--	18-Sep-22	Water Source Sample

-- = no depth assigned for water source samples

Appendix B

SB_BH02 Water Chemistry Results Tables

B.1. Water Source (WS) Samples
B.2. Drill Water (DW) Samples
B.3. Groundwater (GW) Samples

			Sample ID	SB_BH02_WS001	SB_BH02_WS002	SB_BH02_WS003	SB_BH02_WS004	SB_BH02_WS005	SB_BH02_WS006	SB_BH02_WS007	SB_BH02_WS008	SB_BH02_WS009	SB_BH02_WS010	SB_BH02_WS011	SB_BH02_WS012	SB_BH02_WS013
	Units	Method	Detection Limit/Range	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full	Full
Field Measurements																
Field pH	units	JIS Z 8802 pH measurement method	0 to 14	7.5	7.6	7.5	7.2	7.5	7.0	6.6	7.2	6.1	6.4	6.4	6.9	7.3
Field Temp	Degrees C	--	-10 to 55	23.9	16.9	14.4	14.0	12.6	10.0	8.3	5.3	11.2	7.5	2.9	3.6	7.7
Field EC	mS/cm	4-AC-Electrode method	100	0.207	0.255	0.649	0.241	0.291	0.258	0.252	0.285	0.275	0.273	0.258	0.257	0.250
Field ORP	mV	Electrode Equilibrium Analysis	2000	595	128	296	578	379	491	632	494	658	782	679	686	508
Field Multimeter Dissolved Oxygen[1]	mg/L	3-Electrode Polarographic Method	50	9.35	11.3	6.48	5.63	8.51	8.04	8.82	12.33	10.72	7.62	7.62	6.98	13.08
Field Turbidity	NTU	Transmitting and Scattering Method	800	0	0	8.4	0	0	8.8	5.7	8.7	0	2.4	0	3.8	0
Field TDS	g/L	Calculated from EC	--	0.135	0.166	0.422	0.157	0.189	0.168	0.164	0.185	0.179	0.177	0.168	0.167	0.163
Field Fluorescein	ppb	Fluorometer	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Field Alkalinity	mg/L CaCO3	Phenolphthalein & Total Alkalinity (HACH 8203)	10 to 4000	65	79	69	78	69	73	65	74	65	80	71	95	100
Field Density	SG	Gravimetric by Hydrometer	--	--	0.998	1.002	1	1	1	--	--	--	0.996	0.998	1	1
Field Analy. Ferrous Iron	mg/L	1,10-Phenanthroline Method (HACH 8146)	3	0.04	0.02	0.02	0.01	0.01	0	0.05	0	0.07	0	0	0.023	0.05
Field Analy. Sulphide	mg/L	USEPA Methylene Blue Method (HACH 8131)	0.7	--	0	0	0	0	0	0	0	0.01	0.01	0.003	0	0
Laboratory Measurements - Physicochemical Parameters, Major Anions, and Nutrients																
pH-Lab	units	SM 4500H+ B m	--	7.81	7.82	7.81	7.74	7.72	7.59	7.98	7.96	7.85	7.68	7.66	7.66	7.67
Alkalinity-Bicarbonate	mg/L	SM 23 2320 B m	1	65	73	78	70	70	77	76	75	76	84	74	74	73
Alkalinity Total as CaCO3	mg/L	SM 23 2320 B m	1	66	73	78	70	70	77	77	76	77	84	74	74	74
Total Ammonia as N (NH4+NH3)	mg/L	USGS I-2522-90 m	0.05	<0.050	<0.050	<0.050	<0.050	<0.050	0.053	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Dissolved Bromide (Br)	mg/L	SM 23 4110 B m	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Chloride (Cl)	mg/L	SM 23 4110 B m	1	9.8	12	130	11	12	12	11	11	11	14	2.5	13	11
Fluoride (F)	mg/L	SM 23 4500-F C m	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dissolved Iodide (I)	mg/L	Dionex #03035 R09 m	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrate (NO3)	mg/L	SM 23 4500NO31/NO2B	0.1	0.3	0.54	0.49	0.52	0.37	0.73	0.60	0.58	0.81	0.95	0.5	0.58	0.52
Nitrite (NO2)	mg/L	SM 23 4500NO31/NO2B	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrate + Nitrite	mg/L	SM 23 4500NO31/NO2B	0.1	0.3	0.54	0.49	0.52	0.37	0.73	0.60	0.58	0.81	0.95	0.5	0.58	0.52
Total Kjeldahl Nitrogen	mg/L	OMOE E3516 m	0.1	<0.10	<0.10	0.14	0.1	0.19	0.14	<0.10	<0.10	0.14	<0.10	<0.10	0.14	0.15
Total Nitrogen	mg/L	Calculated from Nitrogen Species	0.1	0.3	0.54	0.63	0.62	0.56	0.87	0.60	0.58	0.95	0.95	0.5	0.72	0.67
OrthoPhosphate (PO4)	mg/L	EPA 365.1 m	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Total Phosphorus (Ptot)	mg/L	SM 23 4500 P B H m	0.004	<0.004	<0.004	0.005	<0.004	<0.004	<0.020	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.004
Dissolved Sulphate (SO4)	mg/L	SM 23 4410 B m	1	27	30	34	30	27	33	30	33	34	37	6.2	31	30
Sulphide as S	mg/L	SM 23 4500-S G m	0.02	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Dissolved Sulfur (S)	mg/L	EPA 6010D m	0.5	9	9.9	10	9.4	9.2	11	10	11	11	12	11	9.9	9.9
Dissolved Organic Carbon (DOC)	mg/L	SM 23 5310 B m	0.4	1.2	1.2	1.8	1	1.0	1.1	1.2	1.2	1.1	1.1	1.1	1.5	1.2
Total Organic Carbon (TOC)	mg/L	SM 23 5310B m	0.4	1.2	1.3	1.8	1.2	1.3	1.2	1.2	1.2	1.2	1.1	1.2	1.4	1.4
Reactive Silica (SiO2)	mg/L	EPA370.1 R1978 m	0.05	1.8	2.1	2.3	2.2	1.9	2.0	2.1	3.2	2.2	2.3	2.3	2.2	2.2
Laboratory Measurements - Metals																
Dissolved Aluminum (Al)	mg/L	EPA 6020B m	0.0049	0.053	0.059	0.039	0.041	0.042	0.026	0.025	0.037	0.025	0.038	0.021	0.016	0.032
Dissolved Boron (B)	mg/L	EPA 6020B m	0.01	0.013	0.015	0.031	0.014	0.014	0.015	0.013	0.013	0.013	0.015	0.014	0.014	0.017
Dissolved Calcium (Ca)	mg/L	EPA 6020B m	0.2	24	29	71	28	27	31	30	30	32	36	30	30	30
Dissolved Iron (Fe)	mg/L	EPA 6020B m	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	0.03	<0.02
Dissolved Lithium (Li)	mg/L	EPA 6020B m	0.005	<0.0050	<0.0050	0.04	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved Magnesium (Mg)	mg/L	EPA 6020B m	0.05	7	8.1	8.2	7.5	7.4	8.3	7.7	7.8	8.6	10	8.3	8.3	8.7
Dissolved Potassium (K)	mg/L	EPA 6020B m	0.2	0.91	1.1	2.6	1	1	1	1.1	1	1.1	1.2	1.1	1	1.1
Total Ruthenium (Ru)	mg/L	MA.200-Met.1.2 R7 m	0.002	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Dissolved Silicon (Si)	mg/L	EPA 6020B m	0.05	0.74	0.98	0.96	0.91	0.85	0.98	0.89	0.88	0.95	1	0.98	0.97	0.99
Dissolved Sodium (Na)	mg/L	EPA 6020B m	0.1	4.4	4.9	37	4.9	4.6	4.7	5.1	4.9	5.2	5.7	5.5	6.6	6
Dissolved Strontium (Sr)	mg/L	EPA 6020B m	0.001	0.11	0.14	0.76	0.13	0.12	0.14	0.13	0.13	0.13	0.17	0.14	0.14	0.13
Dissolved Cerium (CE)	ug/L	MA.200-Met.1.2 R5 m	0.3	<0.30	<2.0	--	<2.0	--	--	--	--	--	--	--	--	--
Dissolved Praesedymium (Pr)	ug/L	MA.200-Met.1.2 R5 m	0.4	<0.40	<0.40	--	<0.40	--	--	--	--	--	--	--	--	--
Dissolved Neodymium (Nd)	ug/L	MA.200-Met.1.2 R5 m	3	<3.0	<3.0	--	<3.0	--	--	--	--	--	--	--	--	--
Dissolved Samarium (Sm)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	<2.0	--	<2.0	--	--	--	--	--	--	--	--	--
Dissolved Europium (Eu)	ug/L	MA.200-Met.1.2 R5 m	0.4	<0.40	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Gadolinium (Gd)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Terbium (Tb)	ug/L	MA.200-Met.1.2 R5 m	1	<1.0	<1.0	--	<1.0	--	--	--	--	--	--	--	--	--
Dissolved Disprosium (Dy)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Holmium (Ho)	ug/L	MA.200-Met.1.2 R5 m	0.4	<0.40	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Erbium (Er)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	--	--	--	--	--	--	--	--	--	--	--	--
Dissolved Thulium (Tm)	ug/L	MA.200-Met.1.2 R5 m	0.4	<0.40	<0.40	--	<0.40	--	--	--	--	--	--	--	--	--
Dissolved Ytterbium (Yb)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	<2.0	--	<2.0	--	--	--	--	--	--	--	--	--
Laboratory Measurements - Isotopes																
Potassium-40 (40K)	Bq/kg	Calculated from Total K	0.006	0.029	0.035	0.082	0.032	0.032	0.032	0.035	0.032	0.035	0.038	0.035	0.032	0.035
Radon-222 (222Rn)	Bq/kg	Gamma Spectrometry	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	--	--	--
Total alpha activity	Bq/kg	Gas Flow Proportional Counter (GFPC)	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--	--	--
Total beta activity	Bq/kg	Gas Flow Proportional Counter (GFPC)	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--	--	--
Uranium-234 (234U)	Bq/kg	Alpha Spectrometry	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	--	--	--
Uranium-238 (238U)	Bq/kg	Alpha Spectrometry	0.01	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	--	--	--
Oxygen-18 of water (d18O)	‰ VSMOW	Integrated Cavity Output Spectroscopy (ICOS)	--	-7.3	-7.0	-7.1	-6.8	-6.8	-7.1	-7.2	-7.4	-7.5	-7.3	-7.3	-7.4	-7.4
Deuterium of water (d2H)	‰ VSMOW	Integrated Cavity Output Spectroscopy (ICOS)	--	-54.4	-52.3	-52.7	-52.6	-52.7	-53.1	-53.1	-53.4	-57.0	-53.1	-54.0	-55.8	-55.4
Tritium (3H)	TU	Liquid Scintillation Spectroscopy	0.8	46.4	56.2	123.4	64.5	50.8	35.8	34.5	33.9	37.9	36.9	44.2	45.4	46.9
Carbon-13 of DIC (d13C-DIC)	‰ VPDB	OI Analytical Model TIC/TOC Analyzer	--	2.69	0.28	-1.02	0.28	0.38	-1.08	-0.79	-0.73	-0.82	-1.86	-0.87	-1.02	-1.28
Carbon-14 of DIC (14C-DIC)	pmC	Accelerator Mass Spectrometer (AMS)	0.53	100.07	100.15	97.95	99.34	99.36	98.33	98.81	98.56	98.77	97.57	98.75	98.56	98.69
Chlorine-37 (d37Cl)	‰ VPDB	Isotope Ratio Mass Spectrometry (IRMS)	--	-0.19	-0.07	-0.24	0.01	0.07	0.04	-0.47	-0.45	-0.27	-0.34	0.13	0.32	0.36
Chlorine-36 (36Cl/Cl)	--	Accelerator Mass Spectrometer (AMS)	--	2.77E-13	2.51E-13	2.36E-14	2.63E-13	2.66E-13	2.38E-13	2.55E-13	2.51E-13	2.50E-13	2.18E-13	2.44E-13	2.12E-13	2.31E-13
Iodine-129 (129I)	atoms/kg	Accelerator Mass Spectrometer (AMS)	--	6.11E+07	5.21E+07	6.19E+07	5.51E+07	5.60E+07	5.53E+07	4.05E+07	5.42E+07	4.88E+07	4.42E+07	6.77E+07	6.56E+07	6.13E+07
Strontium isotope ratio (87Sr/86Sr)	--	Thermal Ionization Mass Spectrometry (TIMS)	--	0.7093	0.7093	0.7081	0.7090	0.7091	0.7093	0.7093	0.7093	0.7094	0.7091	0.7093	0.7095	0.7096

-- = Not reported or no value measured

1. Reported dissolved oxygen for several WS samples exceed the theoretical saturation limit. These exceedances may be caused by aeration of the water when it was offloaded from the tanker vehicles prior to collection of field measurements

			Sample ID	SB_BH02_DW002	SB_BH02_DW003	SB_BH02_DW006	SB_BH02_DW008	SB_BH02_DW031	SB_BH02_DW032
	Comments:	Method	Detection Limit/Range	OGW1 Pre-purge sample	OGW2 Pre-purge sample	OGW3 pre-purge sample	OGW4 Pre-purge sample	OGW6 Pre-purge sample	OGW5 Pre-purge sample
Field Measurements									
Field pH	units	JIS Z 8802 pH measurement method	0 to 14	12.3	11.9	12.6	9.2	5.4	6.4
Field Temp	Degrees C	--	-10 to 55	13.6	10.0	5.9	6.4	14.0	12.0
Field EC[2]	mS/cm	4-AC-Electrode method	100	1.99	1.39	2.96	0.330	22.7	24.3
Field ORP	mV	Electrode Equilibrium Analysis	2000	59	47	54	318	82	-15
Field Multimeter Dissolved Oxygen	mg/L	3-Electrode Polarographic Method	50	9.08	9.39	11.24	8.42	0.86	0.49
Field Turbidity	NTU	Transmitting and Scattering Method	800	>800	238	701	>800	390	>800
Field TDS	g/L	Calculated from EC	--	1.29	0.90	1.92	0.21	136.2	145.8
Field Fluorescein	ppb	Fluorometer	0.4	98.9	83.57	96.55	87.5	13.08	35.68
Field Alkalinity	mg/L CaCO3	Phenolphthalein & Total Alkalinity (HACH 8203)	10 to 4000	375	270	290	130	24	17
Field Density	SG	Gravimetric by Hydrometer	--	0.998	0.997	0.999	1	1.06	1.092
Field Analy. Ferrous	mg/L	1,10-Phenanthroline Method (HACH 8146)	3	0.61	1.68	2.66	0.2	13.08	5.42
Field Analy. Sulphide	mg/L	USEPA Methylene Blue Method (HACH 8131)	0.7	0.02	0.1	0	0.25	0.327	0.1
Laboratory Measurements - Physicochemical Parameters, Major Anions, and Nutrients									
pH-Lab	units	SM 4500H+ B m	--	11.8	11.5	--	8.82	4.94	6.15
Alkalinity-Bicarbonate	mg/L	SM 23 2320 B m	1	1.4	1.3	--	15	<1.0	12
Alkalinity Total as CaCO3	mg/L	SM 23 2320 B m	1	370	190	--	17	<1.0	12
Total Colloids	ug/L	By Filtration	<2	2	<3	<2	10	22.6	23.7
Total Ammonia as N (NH4+NH3)	mg/L	USGS I-2522-90 m	0.05	<0.050	<0.050	--	0.063	5.0	5.3
Dissolved Bromide (Br)	mg/L	SM 23 4110 B m	1	<1.0	<1.0	<5.0	<1.0	220	330
Dissolved Chloride (Cl)	mg/L	SM 23 4110 B m	1	40	69	310	60	56000	79000
Fluoride (F)	mg/L	SM 23 4500-F C m	0.1	0.35	0.42	0.089	0.18	<0.10	0.14
Dissolved Iodide (I)	mg/L	Dionex #03035 R09 m	0.1	<0.10	<0.10	--	<0.10	<10	<10
Nitrate (NO3)	mg/L	SM 23 4500NO31/NO2B	0.1	0.34	0.38	0.33	0.43	<0.10	<1.0
Nitrite (NO2)	mg/L	SM 23 4500NO31/NO2B	0.01	<0.010	<0.010	<0.010	<0.010	0.058	<0.10
Nitrate + Nitrite	mg/L	SM 23 4500NO31/NO2B	0.1	0.34	0.38	0.33	0.43	<0.10	<1.0
Total Kjeldahl Nitrogen	mg/L	OMOE E3516 m	0.1	0.26	0.16	<0.10	0.31	10	9.1
Total Nitrogen	mg/L	Calculated from Nitrogen Species	0.1	0.60	0.54	--	0.73	10	9.1
OrthoPhosphate (PO4)	mg/L	EPA 365.1 m	0.01	<0.010	<0.010	<0.010	<0.010	<0.100	<0.010
Total Phosphorus (Ptot)	mg/L	SM 23 4500 P B H m	0.004	0.023	0.024	0.042	0.11	0.26	0.10
Dissolved Sulphate (SO4)	mg/L	SM 23 4410 B m	1	50	65	61	51	1200	1200
Sulphide as S	mg/L	SM 23 4500-S G m	0.02	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Dissolved Sulfur (S)	mg/L	EPA 6010D m	0.5	20	24	21	18	310	340
Dissolved Organic Carbon (DOC)	mg/L	SM 23 5310 B m	0.4	1.3	0.96	<0.10	50	33	19
Total Organic Carbon (TOC)	mg/L	SM 23 5310B m	0.4	1.5	1.3	1.3	50	69	20
Reactive Silica (SiO2)	mg/L	EPA370.1 R1978 m	0.05	<0.050	18	9	9.7	4.6	9.9
Cation/Anion Difference	--	Calculated	--	18.25	3.92	--[1]	2.51	-0.185	0.75
Laboratory Measurements - Metals									
Dissolved Aluminum (Al)	mg/L	EPA 6020B m	0.0049	0.12	0.24	0.66	0.12	<0.049	<0.250
Dissolved Boron (B)	mg/L	EPA 6020B m	0.01	<0.010	0.041	<0.010	0.026	0.73	2.8
Dissolved Calcium (Ca)	mg/L	EPA 6020B m	0.2	160	100	190	27	8700	13000
Dissolved Iron (Fe)	mg/L	EPA 6020B m	0.02	0.03	0.02	0.05	2.9	210	11
Dissolved Lithium (Li)	mg/L	EPA 6020B m	0.005	0.033	0.021	0.067	0.0087	5.8	9
Dissolved Magnesium (Mg)	mg/L	EPA 6020B m	0.05	0.49	0.19	0.061	6.1	77	170
Dissolved Potassium (K)	mg/L	EPA 6020B m	0.2	30	11	32	3.4	400	570
Total Ruthenium (Ru)	mg/L	MA.200-Met.1.2 R7 m	0.002	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Dissolved Silicon (Si)	mg/L	EPA 6020B m	0.05	7.5	8.3	4.5	4.2	<0.50	<2.5
Dissolved Sodium (Na)	mg/L	EPA 6020B m	0.1	25	40	150	26	25000	37000
Dissolved Strontium (Sr)	mg/L	EPA 6020B m	0.001	0.99	0.67	1.7	0.36	150	220
Dissolved Cerium (CE)	ug/L	MA.200-Met.1.2 R5 m	0.3	0.86	0.31	0.57	--	<0.30	<0.30
Dissolved Praesedymium (Pr)	ug/L	MA.200-Met.1.2 R5 m	0.4	<0.40	<0.40	<0.40	--	<0.40	<0.40
Dissolved Neodymium (Nd)	ug/L	MA.200-Met.1.2 R5 m	3	<3.0	<3.0	<3.0	--	<3.0	<3.0
Dissolved Samarium (Sm)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	<2.0	<2.0	--	<2.0	<2.0
Dissolved Europium (Eu)	ug/L	MA.200-Met.1.2 R5 m	0.4	<0.40	<0.40	<0.40	--	<0.40	<0.40
Dissolved Gadolinium (Gd)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	<2.0	<2.0	--	<2.0	<2.0
Dissolved Terbium (Tb)	ug/L	MA.200-Met.1.2 R5 m	1	<1.0	<1.0	<1.0	--	<1.0	<1.0
Dissolved Disprosium (Dy)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	<2.0	<2.0	--	<2.0	<2.0
Dissolved Holmium (Ho)	ug/L	MA.200-Met.1.2 R5 m	0.4	<0.40	<0.40	<0.40	--	<0.40	<0.40
Dissolved Erbium (Er)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	<2.0	<2.0	--	<2.0	<2.0
Dissolved Thulium (Tm)	ug/L	MA.200-Met.1.2 R5 m	0.4	<0.40	<0.40	<0.40	--	<0.40	<0.40
Dissolved Ytterbium (Yb)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	<2.0	<2.0	--	<2.0	<2.0
Laboratory Measurements - Isotopes									
Potassium-40 (40K)	Bq/kg	Calculated from Total K	0.006	0.95	0.35	1.02	0.11	11.98	16.57
Radon-222 (222Rn)	Bq/kg	Gamma Spectrometry	10	<10	<10	<10	<10	<10	13
Total alpha activity	Bq/kg	Gas Flow Proportional Counter (GFPC)	0.1	<0.10	<0.10	<0.10	<0.10	<12	<7.1
Total beta activity	Bq/kg	Gas Flow Proportional Counter (GFPC)	0.1	1.00	0.28	0.83	0.16	<6.6	<4.6
Uranium-234 (234U)	Bq/kg	Alpha Spectrometry	0.01	<0.010	<0.010	<0.010	0.017	0.015	0.410
Uranium-238 (238U)	Bq/kg	Alpha Spectrometry	0.01	<0.010	<0.010	<0.010	0.017	0.01	0.27
Oxygen-18 of water (d18O)	‰ VSMOW	Integrated Cavity Output Spectroscopy (ICOS)	--	-7.3	-7.3	-7.5	-3.6	-7.2	-7.0
Deuterium of water (d2H)	‰ VSMOW	Integrated Cavity Output Spectroscopy (ICOS)	--	-55.0	-54.2	-55.5	-48.3	-57.1	-58.6
Tritium (3H)	TU	Liquid Scintillation Spectroscopy	0.8	37.9	46.1	40.3	45.7	46.8	29.7
Carbon-13 of DIC (d13C-DIC)	‰ VPDB	OI Analytical Model TIC/TOC Analyzer	--	-12.4	-11.9	-14.7	-3.6	-13.1	-2.6
Carbon-14 of DIC (14C-DIC)	pmC	Accelerator Mass Spectrometer (AMS)	0.53	69.09	64.41	61.97	93.56	92.92	19.20
Chlorine-37 (d37Cl)	‰ VPDB	Isotope Ratio Mass Spectrometry (IRMS)	--	0.1	-0.14	-0.41	-0.07	-0.11	-0.13
Chlorine-36 (36Cl/Cl)	--	Accelerator Mass Spectrometer (AMS)	--	6.86E-14	4.09E-14	9.00E-15	5.19E-14	5.62E-15	5.13E-15
Iodine-129 (129I)	atoms/kg	Accelerator Mass Spectrometer (AMS)	--	3.60E+07	3.44E+07	2.42E+07	4.01E+07	7.77E+07	4.75E+07
Strontium isotope ratio (87Sr/86Sr)	--	Thermal Ionization Mass Spectrometry (TIMS)	--	0.7089	0.7089	0.7083	0.7089	0.7083	0.7084
Noble Gas Isotopes									
3He	cc/g	Mass Spectrometry	--	1.4E-13	5.8E-13	2.2E-14	2.3E-13	4.5E-13	2.1E-14
4He	cc/g	Mass Spectrometry	--	9.2E-08	4.1E-07	1.2E-08	1.7E-07	6.2E-06	2.6E-07
He Total	cc/g	Mass Spectrometry	--	9.2E-08	4.1E-07	1.2E-08	1.7E-07	6.2E-06	2.6E-07
20Ne	cc/g	Mass Spectrometry	--	3.3E-07	1.7E-06	8.7E-08	5.3E-07	4.7E-07	6.7E-08
22Ne	cc/g	Mass Spectrometry	--	3.3E-08	1.7E-07	8.7E-09	5.2E-08	4.7E-08	6.1E-09
Ne Total	cc/g	Mass Spectrometry	--	3.6E-07	1.9E-06	9.6E-08	5.8E-07	5.2E-07	7.3E-08
36Ar	cc/g	Mass Spectrometry	--	1.8E-06	1.8E-06	9.6E-07	1.2E-06	1.3E-06	2.1E-07
40Ar	cc/g	Mass Spectrometry	--	5.6E-04	9.7E-04	2.8E-04	3.7E-04	3.4E-04	7.9E-05
Ar Total	cc/g	Mass Spectrometry	--	5.7E-04	9.8E-04	2.8E-04	3.7E-04	3.5E-04	8.0E-05
Kr Total	cc/g	Mass Spectrometry	--	1.2E-07	1.5E-07	5.9E-08	4.6E-08	6.7E-08	1.7E-08
Xe Total	cc/g	Mass Spectrometry	--	1.7E-08	1.5E-08	7.5E-09	4.9E-09	7.2E-09	2.4E-09

-- = Not reported or no value measured

1. = Cation/Anion Difference not calculated because bicarbonate alkalinity was not measured/calculated

2.= Samples with EC > 100 mS/cm were diluted with de-ionized water. Reported value has been corrected by dilution factor.

			Sample ID	SB_BH02_GW004	SB_BH02_GW005	SB_BH02_GW006	SB_BH02_GW007	SB_BH02_GW011	SB_BH02_GW012	SB_BH02_GW013	SB_BH02_GW014	SB_BH02_GW015	SB_BH02_GW019	SB_BH02_GW020	SB_BH02_GW021	SB_BH02_GW026	SB_BH02_GW030	SB_BH02_GW031
	Comments	Method	Detection Limit/Range	OGW1 Primary	OGW1 Duplicate	OGW1 Field Blank	OGW1 Rinsate	OGW2 Rinsate	OGW2 Field Blank	OGW2 Primary	OGW2 Duplicate	OGW3 Rinsate	OGW3 Primary	OGW3 Duplicate	OGW3 Field Blank	OGW4 Rinsate	OGW4 Primary	OGW4 Duplicate
Field Measurements																		
Field pH	units	JIS Z 8802 pH measurement method	0 to 14	7.6	7.6	–	--	--	--	7.5	7.5	--	7.7	7.7	--	--	7.3	7.3
Field Temp	Degrees C	--	-10 to 55	10.3	10.3	–	--	--	--	9.8	9.8	--	8.5	8.5	--	--	10.1	10.1
Field EC[1]	mS/cm	4-AC-Electrode method	100	7.07	7.07	–	--	--	--	7.04	7.04	--	12.1	12.1	--	--	15.9	15.9
Field ORP	mV	Electrode Equilibrium Analysis	2000	-108	-108	–	--	--	--	-32	-32	--	-78	-78	--	--	-74	-74
Field Multimeter Dissolved Oxygen	mg/L	3-Electrode Polarographic Method	50	0	0	–	--	--	--	0	0	--	0	0	--	--	0	0
Field Turbidity	NTU	Transmitting and Scattering Method	800	0	0	–	--	--	--	0	0	--	0	0	--	--	0	0
Field TDS	g/L	Calculated from EC	--	5.20	5.20	--	--	--	--	5.17	5.17	--	8.89	8.89	–	--	11.7	11.7
Field Fluorescein	ppb	Fluorometer	0.4	1.053	1.053	–	--	--	--	1.461	1.461	--	4.046	4.046	--	--	2.219	2.219
Field Alkalinity	mg/L CaCO3	Phenolphthalein & Total Alkalinity (HACH 8203)	10 to 4000	179	179	–	--	--	--	225	225	--	148	148	--	--	206	206
Field Density	SG	Gravimetric by Hydrometer	--	1	1	–	--	--	--	1.002	1.002	--	1.005	1.005	--	--	1.01	1.01
Field Analy. Dissolved Oxygen	ug/L	Indigo Carmine Method (HACH Method 8316)	10 to 1000	0.826	0.826	–	--	--	--	--	--	--	0.804	0.804	--	--	0.27	0.27
Field Analy. Ferrous	mg/L	1,10-Phenanthroline Method (HACH 8146)	3	1.1	1.1	–	--	--	--	0.46	0.46	--	1	1	--	--	1.38	1.38
Field Analy. Sulphide	mg/L	USEPA[1] Methylene Blue Method (HACH 8131)	0.7	0	0	–	--	--	--	0	0	--	0	0	--	--	0	0
Laboratory Measurements - Physicochemical Parameters, Major Anions and Nutrients																		
pH-Lab	units	SM 4500H+ B m	--	7.78	7.64	–	--	--	--	7.79	7.81	6.21	<1.68	<1.68	--	6.61	7.51	7.52
Alkalinity-Bicarbonate	mg/L	SM 23 2320 B m	1	190	180	–	--	--	--	200	200	1.3	<1.0	<1.0	–	1.8	210	210
Alkalinity Total as CaCO3	mg/L	SM 23 2320 B m	1	190	190	–	--	--	--	200	200	1.4	<1.0	<1.0	--	1.8	210	210
Total Colloid	ug/L	By Filtration	<2	4	4	–	--	--	--	6	3	--	6	4	--	--	< 3	< 3
Total Ammonia as N (NH4+NH3)	mg/L	USGS I-2522-90 m	0.05	0.18	0.12	--	--	--	--	0.14	0.14	--	0.42	0.28	--	--	0.64	0.63
Dissolved Bromide (Br)	mg/L	SM 23 4110 B m	1	<10	<10	–	<1.0	<1.0	--	<10	<10	--	<50	<50	–	<1.0	<20	<20
Dissolved Chloride (Cl)	mg/L	SM 23 4110 B m	1	1400	1400	–	<1.0	<1.0	--	1600	1600	--	3200	2900	–	1.2	6900	6800
Fluoride (F)	mg/L	SM 23 4500-F C m	0.1	1.6	1.6	--	<0.10	<0.10	--	1.8	1.8	--	1.7	1.5	--	<0.10	1.7	1.8
Dissolved Iodide (I)	mg/L	Dionex #03035 R09 m	0.1	<0.10	<0.10	--	<0.10	<0.10	--	<0.10	<0.10	<0.10	<0.10	<0.10	–	--	<0.10	<0.10
Nitrate (NO3)	mg/L	SM 23 4500NO3I/NO2B	0.1	<0.10	<0.10	–	<0.10	<0.10	--	<0.10	<0.10	--	<0.10	<0.10	--	<0.10	<0.10	<0.10
Nitrite (NO2)	mg/L	SM 23 4500NO3I/NO2B	0.01	<0.010	<0.010	–	<0.010	<0.010	--	<0.010	<0.010	--	<0.010	<0.010	–	<0.010	<0.010	<0.010
Nitrate + Nitrite	mg/L	SM 23 4500NO3I/NO2B	0.1	<0.10	<0.10	–	<0.10	<0.10	--	<0.10	<0.10	--	<0.10	<0.10	--	<0.10	<0.10	<0.10
Total Kjeldahl Nitrogen	mg/L	OMOE E3516 m	0.1	0.47	0.25	--	--	--	--	0.5	0.48	--	0.73	0.72	–	--	0.99	0.92
Total Nitrogen	mg/L	Calculated from Nitrogen Species	0.1	0.47	0.25	--	--	--	--	0.5	0.48	<1.0	0.73	0.72	--	--	0.99	0.92
OrthoPhosphate (PO4)	mg/L	EPA 365.1 m	0.01	<0.010	<0.010	--	<0.010	<0.010	--	<0.010	<0.010	--	<0.010	<0.010	–	<0.010	<0.010	<0.010
Total Phosphorus (Ptot)	mg/L	SM 23 4500 P B H m	0.004	0.012	0.01	--	--	--	--	<0.004	<0.004	--	<0.020	<0.020	--	--	<0.020	<0.020
Dissolved Sulphate (SO4)	mg/L	SM 23 4410 B m	1	1100	1100	--	<1.0	<1.0	--	1200	1200	--	1700	1500	–	<1.0	1800	1900
Sulphide as S	mg/L	SM 23 4500-S G m	0.02	<0.020	<0.020	--	--	--	--	<0.020	<0.020	--	<0.020	<0.020	–	--	<0.020	<0.020
Dissolved Sulfur (S)	mg/L	EPA 6010D m	0.5	370	370	–	<0.5	<0.5	--	440	450	--	560	560	--	<0.5	700	700
Dissolved Organic Carbon (DOC)	mg/L	SM 23 5310 B m	0.4	0.6	0.63	--	--	--	--	0.56	0.55	--	0.57	0.57	--	--	1.4	1.4
Total Organic Carbon (TOC)	mg/L	SM23 5310B m	0.4	0.84	0.6	--	--	--	--	0.59	0.55	--	0.71	0.69	--	--	1.5	1.5
Reactive Silica (SiO2)	mg/L	EPA370.1 R1978 m	0.05	8.5	8.5	–	--	--	--	7.6	7.6	--	8.5	8.5	--	--	7.9	7.5
Cation/Anion Difference	--	Calculated	--	-3.15	-0.74	--	--	--	--	-1.26	1.9	--	-6.51	1.09	--	--	-1.73	-0.91
Laboratory Measurements - Metals																		
Dissolved Aluminum (Al)	mg/L	EPA 6020B m	0.0049	<0.0049	<0.0049	–	<0.0049	<0.0049	--	0.0063	0.0066	--	0.0051	<0.0049	--	<0.0049	0.7	0.7
Dissolved Boron (B)	mg/L	EPA 6020B m	0.01	0.31	0.31	–	<0.010	<0.010	--	0.41	0.41	--	0.45	0.46	--	<0.010	0.48	0.44
Dissolved Calcium (Ca)	mg/L	EPA 6020B m	0.2	320	320	–	<0.200	<0.200	--	310	300	--	380	400	--	0.46	590	580
Dissolved Iron (Fe)	mg/L	EPA 6020B m	0.02	0.86	0.87	–	<0.02	0.03	--	0.39	0.45	--	1.8	1.5	--	<0.02	2.0	2.3
Dissolved Lithium (Li)	mg/L	EPA 6020B m	0.005	0.035	0.035	–	<0.0050	<0.0050	--	0.041	0.041	--	0.059	0.061	--	<0.0050	0.1	0.1
Dissolved Magnesium (Mg)	mg/L	EPA 6020B m	0.05	110	120	–	<0.050	<0.050	--	150	160	--	150	150	--	<0.050	230	220
Dissolved Potassium (K)	mg/L	EPA 6020B m	0.2	9.9	10	–	<0.200	<0.200	--	4.2	4.3	--	11	11	--	<0.200	14	14
Total Ruthenium (Ru)	mg/L	MA.200-Met.1.2 R7 m	0.002	<0.0020	<0.0020	–	<0.0020	<0.0020	--	<0.0020	<0.0020	--	<0.0020	<0.0020	--	<0.0020	<0.0020	<0.0020
Dissolved Silicon (Si)	mg/L	EPA 6020B m	0.05	3.9	3.9	–	<0.050	<0.050	--	3.5	3.6	--	3.5	3.6	--	<0.050	3.4	3.5
Dissolved Sodium (Na)	mg/L	EPA 6020B m	0.1	830	830	–	0.22	<0.100	--	1000	1100	--	1800	1900	--	0.11	4100	4200
Dissolved Strontium (Sr)	mg/L	EPA 6020B m	0.001	7.8	8	–	0.0011	<0.0010	--	10	10	--	15	14	--	0.0056	22	22
Dissolved Cerium (CE)	ug/L	MA.200-Met.1.2 R5 m	0.3	<0.30	<0.30	–	--	--	--	<0.30	<0.30	--	<0.30	<0.30	--	<0.30	<0.30	<0.30
Dissolved Praseodymium (Pr)	ug/L	MA.200-Met.1.2 R5 m	0.4	<0.40	<0.40	–	--	--	--	<0.40	<0.40	--	<0.40	<0.40	--	<0.40	<0.40	<0.40
Dissolved Neodymium (Nd)	ug/L	MA.200-Met.1.2 R5 m	3	<3.0	<3.0	–	--	--	--	<3.0	<3.0	--	<3.0	<3.0	--	<3.0	<3.0	<3.0
Dissolved Samarium (Sm)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	<2.0	–	--	--	--	<2.0	<2.0	--	<2.0	<2.0	--	<2.0	<2.0	<2.0
Dissolved Europium (Eu)	ug/L	MA.200-Met.1.2 R5 m	0.4	<0.40	<0.40	–	--	--	--	<0.40	<0.40	--	<0.40	<0.40	--	<0.40	<0.40	<0.40
Dissolved Gadolinium (Gd)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	<2.0	–	--	--	--	<2.0	<2.0	--	<2.0	<2.0	--	<2.0	<2.0	<2.0
Dissolved Terbium (Tb)	ug/L	MA.200-Met.1.2 R5 m	1	<1.0	<1.0	–	--	--	--	<1.0	<1.0	--	<1.0	<1.0	--	<1.0	<1.0	<1.0
Dissolved Disprosium (Dy)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	<2.0	–	--	--	--	<2.0	<2.0	--	<2.0	<2.0	--	<2.0	<2.0	<2.0
Dissolved Holmium (Ho)	ug/L	MA.200-Met.1.2 R5 m	0.4	<0.40	<0.40	–	--	--	--	<0.40	<0.40	--	<0.40	<0.40	--	<0.40	<0.40	<0.40
Dissolved Erbium (Er)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	<2.0	–	--	--	--	<2.0	<2.0	--	<2.0	<2.0	--	<2.0	<2.0	<2.0
Dissolved Thulium (Tm)	ug/L	MA.200-Met.1.2 R5 m	0.4	<0.40	<0.40	–	--	--	--	<0.40	<0.40	--	<0.40	<0.40	--	<0.40	<0.40	<0.40
Dissolved Ytterbium (Yb)	ug/L	MA.200-Met.1.2 R5 m	2	<2.0	<2.0	–	--	--	--	<2.0	<2.0	--	<2.0	<2.0	--	<2.0	<2.0	<2.0
Laboratory Measurements - Isotopes																		
Potassium-40 (40K)	Bq/kg	Calculated from Total K	0.006	0.314	0.317	–	<0.006	<0.006	--	0.133	0.136	<0.006	0.347	0.347	--	<0.006	0.440	0.440
Radon-222 (222Rn)	Bq/kg	Gamma Spectrometry	10	16	15	–	--	--	--	43	40	--	38	35	--	--	19	<10
Total alpha activity	Bq/kg	Gas Flow Proportional Counter (GFPC)	0.1	1	1.4	–	--	--	--	1.1	0.4	--	<1.9	1.3	--	--	<0.29	<0.51
Total beta activity	Bq/kg	Gas Flow Proportional Counter (GFPC)	0.1	<0.10	<0.12	–	--	--	--	<0.10	0.5	--	<2.3	<0.70	--	--	<1.2	<1.2
Uranium-234 (234U)	Bq/kg	Alpha Spectrometry	0.01	0.5	0.47	–	--	--	--	0.085	0.086	--	0.22	0.2	--	--	0.410	0.380
Uranium-238 (238U)	Bq/kg	Alpha Spectrometry	0.01	0.18	0.17	–	--	--	--	0.025	0.027	--	0.063	0.057	--	--	0.090	0.110
Oxygen-18 of water (d18O)	‰ VSMOW	Integrated Cavity Output Spectroscopy (ICOS)	--	-11.8	-11.8	–	--	--	--	-11.9	-11.8	--	-11.3	-11.6	--	--	-11.3	-11.2
Deuterium of water (d2H)	‰ VSMOW	Integrated Cavity Output Spectroscopy (ICOS)	--	-78.9	-79.2	–	--	--	--	-79.6	-78.2	--	-75.8	-78.1	--	--	-77.8	-77.3
Tritium (3H)	TU	Liquid Scintillation Spectroscopy	0.8	1.6	2.0	1.0	--	--	0.9	0.9	2.0	--	3.8	3.2	1.3	--	1.7	1.8
Carbon-13 of DIC (d13C-DIC)	‰ VPDB	OI Analytical Model TIC/TOC Analyzer	--	-5.7	-5.4	–	--	--	--	-3.9	3.6	--	-4.1	-4.2	--	--	-4.8	-5
Carbon-14 of DIC (14C-DIC)	pmC	Accelerator Mass Spectrometer (AMS)	0.53	13.91	13.88	40.24	--	--	38.4	7.6	7.65	--	4.66	4.73	38.49	--	1.17	0.85
Chlorine-37 (d37Cl)	‰ VPDB	Isotope Ratio Mass Spectrometry (IRMS)	--	-0.08	-0.33	–	--	--	--	-0.24	-0.15	--	-0.65	-0.57	--	--	-0.71	-0.76
Chlorine-36 (36Cl/Cl)	--	Accelerator Mass Spectrometer (AMS)	--	9.87E-16	7.09E-16	–	--	--	--	1.37E-15	1.40E-15	--	1.27E-15	1.20E-15	--	--	1.27E-15	1.27E-15
Iodine-129 (129I)	atoms/kg	Accelerator Mass Spectrometer (AMS)	--	9.26E+06	1.05E+07	–	--	--	--	7.77E+06	9.80E+06	--	1.18E+07	7.84E+06	--	--	9.70E+06	1.16E+07
Strontium isotope ratio (87Sr/86Sr)	--	Thermal Ionization Mass Spectrometry (TIMS)	--	0.70851	0.70919	–	--	--	--	0.70870	0.70858	--	0.70825	0.70877	–	--	0.70848	0.70844
Laboratory Measurements - Noble Gas Isotopes																		
3He	cc/g	Mass Spectrometry	--	4.5E-15	6.0E-15	–	--	--	--	3.0E-15	3.0E-15	--	6.7E-15	8.3E-13	--	--	5.1E-14	8.3E-13
4He	cc/g	Mass Spectrometry	--	5.0E-08	7.7E-08	–	--	--	--	4.2E-08	4.1E-08	--	1.1E-07	6.1E-07	--	--	1.0E-07	6.3E-07
He Total	cc/g	Mass Spectrometry	--	5.0E-08	7.7E-08	–	--	--	--	4.2E-08	4.1E-08	--	1.1E-07	6.1E-07	--	--	1.0E-07	6.3E-07
20Ne	cc/g	Mass Spectrometry	--	2.5E-08	3.1E-08	–	--	--	--	1.8E-08	2.0E-08	--	2.5E-08	3.1E-06	--	--	1.2E-07	3.0E-06
22Ne	cc/g	Mass Spectrometry	--	2.6E-09	2.9E-09	–	--	--	--	1.8E-09	1.8E-09	--	2.5E-09	2.9E-07	--	--	1.1E-08	2.7E-07
Ne Total	cc/g	Mass Spectrometry	--	2.8E-08	3.4E-08	–	--	--	--	2.0E-08	2.1E-08	--	2.8E-08	3.4E-06	--	--	1.3E-07	3.2E-06
36Ar	cc/g	Mass Spectrometry	--	3.7E-07	3.5E-07	–	--	--	--	1.6E-05	2.7E-07	--	3.5E-07	7.8E-04	--	--	2.7E-07	6.1E-06
40Ar	cc/g	Mass Spectrometry	--	8.7E-05	1.1E-04	–	--	--	--	7.2E-05	6.5E-05	--	7.2E-05	1.8E-03	--	--	8.6E-05	1.6E-03
Ar Total	cc/g	Mass Spectrometry	--	8.7E-05	1.1E-04	–	--	--	--	8.9E-05	6.6E-05	--	7.2E-05	2.6E-03	--	--	8.6E-05	1.6E-03
Kr Total	cc/g	Mass Spectrometry	--	2.6E-08	3.0E-08	–	--	--	--	2.3E-08	2.3E-08	--	2.0E-08	2.3E-07	--	--	1.9E-08	2.0E-07
Xe Total	cc/g	Mass Spectrometry	--	4.3E-09	5.0E-09	–	--	--	--	4.3E-09	4.4E-09	--	3.3E-09	2.1E-08	--	--	3.1E-09	1.7E-08

-- = Not reported or no value measured

1. = samples with EC > 100 mS/cm were diluted with de-ionized water. Reported value has been corrected by dilution factor.

			Sample ID	SB_BH02_GW032	SB_BH02_GW038	SB_BH02_GW042	SB_BH02_GW043	SB_BH02_GW044	SB_BH02_GW045	SB_BH02_GW049	SB_BH02_GW050	SB_BH02_GW053	SB_BH02_GW054	SB_BH02_GW055	SB_BH02_GW056
	Comments	Method	Detection Limit/Range	OGW4 Field Blank	OGW6 Interim	OGW6 Primary	OGW6 Duplicate	OGW6 Rinsate	OGW6 Field Blank	OGW5 Interim primary	OGW5 Iterim duplicate	OGW5 Primary	OGW5 Duplicate	OGW5 Rinsate	OGW5 Field Blank
Field Measurements															
Field pH	units	JIS Z 8802 pH measurement method	0 to 14	--	7.0	6.9	6.9	--	--	6.5	6.5	7.3	7.3	--	--
Field Temp	Degrees C	--	-10 to 55	--	11.7	13.0	13.0	--	--	20.4	20.4	11.0	11.0	--	--
Field EC[1]	mS/cm	4-AC-Electrode method	100	--	305	375	375	--	--	145	145	69.9	69.9	--	--
Field ORP	mV	Electrode Equilibrium Analysis	2000	--	-77	-58	-58	--	--	-35	-35	-47	-47	--	--
Field Multimeter Dissolved Oxygen	mg/L	3-Electrode Polarographic Method	50	--	1.47	0.2	0.2	--	--	0.2	0.2	2.47	2.47	--	--
Field Turbidity	NTU	Transmitting and Scattering Method	800	--	19.9	22.7	22.7	--	--	0	0	266	266	--	--
Field TDS	g/L	Calculated from EC	--	--	183	225	225	--	--	107	107	51.4	51.4	--	--
Field Fluorescein	ppb	Fluorometer	0.4	--	9.492	5.657	5.657	--	--	24.93	24.93	14.82	14.82	--	--
Field Alkalinity	mg/L CaCO3	Phenolphthalein & Total Alkalinity (HACH 8203)	10 to 4000	--	54	68	68	--	--	89	89	179	179	--	--
Field Density	SG	Gravimetric by Hydrometer	--	--	1.131	1.142	1.142	--	--	1.067	1.067	1.038	1.038	--	--
Field Analy. Dissolved Oxygen	ug/L	Indigo Carmine Method (HACH Method 8316)	10 to 1000	--	0.601	1.027	1.027	--	--	--	--	0.875	0.875	--	--
Field Analy. Ferrous	mg/L	1,10-Phenanthroline Method (HACH 8146)	3	--	16	7.883	7.883	--	--	2.72	2.72	2.29	2.29	--	--
Field Analy. Sulphide	mg/L	USEPA[1] Methylene Blue Method (HACH 8131)	0.7	--	0.08	0.208	0.208	--	--	0.69	0.69	0.4	0.4	--	--
Laboratory Measurements - Physicochemical Parameters, Major Anions and Nutrients															
pH-Lab	units	SM 4500H+ B m	--	--	6.54	6.68	6.75	6.50	--	6.86	6.86	7.26	7.25	6.28	--
Alkalinity-Bicarbonate	mg/L	SM 23 2320 B m	1	--	54	78	79	2.3	--	64	64	130	140	<1.0	--
Alkalinity Total as CaCO3	mg/L	SM 23 2320 B m	1	--	54	78	79	2.3	--	64	64	130	140	<1.0	--
Total Colloid	ug/L	By Filtration	<2	--	390	344	369	--	--	192	208	101	102	--	--
Total Ammonia as N (NH4+NH3)	mg/L	USGS I-2522-90 m	0.05	--	3.8	3.8	3.9	--	--	2.3	2.3	1.4	1.5	--	--
Dissolved Bromide (Br)	mg/L	SM 23 4110 B m	1	--	130	110	110	<1.0	--	190	200	87	86	<1.0	--
Dissolved Chloride (Cl)	mg/L	SM 23 4110 B m	1	--	120000	130000	130000	1.4	--	56000	57000	28000	28000	<1.0	--
Fluoride (F)	mg/L	SM 23 4500-F C m	0.1	--	0.24	0.26	0.29	<0.10	--	0.49	0.47	0.91	0.94	<0.10	--
Dissolved Iodide (I)	mg/L	Dionex #03035 R09 m	0.1	--	<10	<10	<10	<0.10	--	<100	<100	<10	<10	<0.10	--
Nitrate (NO3)	mg/L	SM 23 4500NO31/NO2B	0.1	--	<1.0	<1.0	<1.0	<0.10	--	0.34	0.26	<0.50	<0.50	<0.10	--
Nitrite (NO2)	mg/L	SM 23 4500NO31/NO2B	0.01	--	<0.10	<0.10	0.11	<0.010	--	0.094	0.094	<0.050	<0.050	<0.010	--
Nitrate + Nitrite	mg/L	SM 23 4500NO31/NO2B	0.1	--	<1.0	<1.0	<1.0	<0.10	--	0.43	0.35	<0.50	<0.50	<0.10	--
Total Kjeldahl Nitrogen	mg/L	OMOE E3516 m	0.1	--	6.9	5.2	5.8	--	--	5.6	5.7	2.7	2.4	--	--
Total Nitrogen	mg/L	Calculated from Nitrogen Species	0.1	--	6.9	5.2	5.9	--	--	6.1	6.0	2.7	2.4	--	--
OrthoPhosphate (PO4)	mg/L	EPA 365.1 m	0.01	--	<0.10	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	<0.010	--
Total Phosphorus (Ptot)	mg/L	SM 23 4500 P B H m	0.004	--	0.12	0.24	0.11	--	--	0.051	0.042	0.10	0.09		--
Dissolved Sulphate (SO4)	mg/L	SM 23 4410 B m	1	--	1900	2400	2400	1.5	--	1600	1700	2200	2200	<1.0	--
Sulphide as S	mg/L	SM 23 4500-S G m	0.02	--	<0.020	<0.020	<0.020	--	--	<0.020	<0.020	<0.020	<0.020	--	--
Dissolved Sulfur (S)	mg/L	EPA 6010D m	0.5	--	830	850	860	<5	--	520	520	830	830	<0.5	--
Dissolved Organic Carbon (DOC)	mg/L	SM 23 5310 B m	0.4	--	16	12	13	--	--	25	25	8.1	8.3	--	--
Total Organic Carbon (TOC)	mg/L	SM 23 5310B m	0.4	--	16	13	12	--	--	25	25	10	9.4	--	--
Reactive Silica (SiO2)	mg/L	EPA370.1 R1978 m	0.05	--	6.2	16	5.1	--	--	43	6.9	9.9	9.4	<0.050	--
Cation/Anion Difference	--	Calculated	--	--	-6	-2.29	-1.08	--	--	-2.08	-1.35	0.96	0.7	--	--
Laboratory Measurements - Metals															
Dissolved Aluminum (Al)	mg/L	EPA 6020B m	0.0049	--	0.41	<0.250	<0.250	<0.0049	--	0.089	<0.049	0.059	0.089	<0.0049	--
Dissolved Boron (B)	mg/L	EPA 6020B m	0.01	--	3	3.1	3.2	<0.010	--	2	2	1.5	1.5	<0.010	--
Dissolved Calcium (Ca)	mg/L	EPA 6020B m	0.2	--	7200	5300	5300	<0.200	--	7700	7900	4200	4100	<0.200	--
Dissolved Iron (Fe)	mg/L	EPA 6020B m	0.02	--	18	12	12	<0.2	--	11	10	13	13	<0.02	--
Dissolved Lithium (Li)	mg/L	EPA 6020B m	0.0005	--	4.8	3.2	3.1	<0.0050	--	4.8	5.1	2.7	2.6	<0.0050	--
Dissolved Magnesium (Mg)	mg/L	EPA 6020B m	0.05	--	190	220	220	<0.050	--	270	260	360	370	<0.050	--
Dissolved Potassium (K)	mg/L	EPA 6020B m	0.2	--	300	240	240	<0.200	--	370	370	190	190	<0.200	--
Total Ruthenium (Ru)	mg/L	MA.200-Met.1.2 R7 m	0.002	--	<0.0020	<0.0020	<0.0020	<0.0020	--	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	--
Dissolved Silicon (Si)	mg/L	EPA 6020B m	0.05	--	<2.5	<2.5	<2.5	<0.050	--	1.5	1.5	3.2	3.2	<0.050	--
Dissolved Sodium (Na)	mg/L	EPA 6020B m	0.1	--	61000	75000	77000	0.25	--	26000	27000	14000	14000	<0.100	--
Dissolved Strontium (Sr)	mg/L	EPA 6020B m	0.001	--	120	92	94	0.0023	--	140	140	72	72	0.0015	--
Dissolved Cerium (CE)	ug/L	MA.200-Met.1.2 R5 m	0.3	--	<0.30	<0.30	<0.30	--	--	<0.30	<0.30	<0.30	<0.30	--	--
Dissolved Praseodymium (Pr)	ug/L	MA.200-Met.1.2 R5 m	0.4	--	<0.40	<0.40	<0.40	--	--	<0.40	<0.40	<0.40	<0.40	--	--
Dissolved Neodymium (Nd)	ug/L	MA.200-Met.1.2 R5 m	3	--	<3.0	<3.0	<3.0	--	--	<3.0	<3.0	<3.0	<3.0	--	--
Dissolved Samarium (Sm)	ug/L	MA.200-Met.1.2 R5 m	2	--	<2.0	<2.0	<2.0	--	--	<2.0	<2.0	<2.0	<2.0	--	--
Dissolved Europium (Eu)	ug/L	MA.200-Met.1.2 R5 m	0.4	--	<0.40	<0.40	<0.40	--	--	<0.40	<0.40	<0.40	<0.40	--	--
Dissolved Gadolinium (Gd)	ug/L	MA.200-Met.1.2 R5 m	2	--	<2.0	<2.0	<2.0	--	--	<2.0	<2.0	<2.0	<2.0	--	--
Dissolved Terbium (Tb)	ug/L	MA.200-Met.1.2 R5 m	1	--	<1.0	<1.0	<1.0	--	--	<1.0	<1.0	<1.0	<1.0	--	--
Dissolved Disprosium (Dy)	ug/L	MA.200-Met.1.2 R5 m	2	--	<2.0	<2.0	<2.0	--	--	<2.0	<2.0	<2.0	<2.0	--	--
Dissolved Holmium (Ho)	ug/L	MA.200-Met.1.2 R5 m	0.4	--	<0.40	<0.40	<0.40	--	--	<0.40	<0.40	<0.40	<0.40	--	--
Dissolved Erbium (Er)	ug/L	MA.200-Met.1.2 R5 m	2	--	<2.0	<2.0	<2.0	--	--	<2.0	<2.0	<2.0	<2.0	--	--
Dissolved Thulium (Tm)	ug/L	MA.200-Met.1.2 R5 m	0.4	--	<0.40	<0.40	<0.40	--	--	<0.40	<0.40	<0.40	<0.40	--	--
Dissolved Ytterbium (Yb)	ug/L	MA.200-Met.1.2 R5 m	2	--	<2.0	<2.0	<2.0	--	--	<2.0	<2.0	<2.0	<2.0	--	--
Laboratory Measurements - Isotopes															
Potassium-40 (40K)	Bq/kg	Calculated from Total K	0.006	--	8.457	6.718	6.718	<0.006	--	11.007	11.007	5.810	5.810	<0.006	--
Radon-222 (222Rn)	Bq/kg	Gamma Spectrometry	10	--	<10	<10	<10	--	--	17	18	16	12	--	--
Total alpha activity	Bq/kg	Gas Flow Proportional Counter (GFPC)	0.1	--	<5.1	<21	<18	--	--	<16	<15	<6.2	<7.7	--	--
Total beta activity	Bq/kg	Gas Flow Proportional Counter (GFPC)	0.1	--	<3.6	<3.3	<1.9	--	--	<6.7	<5.0	<6.0	<0.95	--	--
Uranium-234 (234U)	Bq/kg	Alpha Spectrometry	0.01	--	0.12	0.08	0.1	--	--	0.330	0.310	0.140	0.120	--	--
Uranium-238 (238U)	Bq/kg	Alpha Spectrometry	0.01	--	0.069	0.03	0.077	--	--	0.100	0.090	0.045	0.058	--	--
Oxygen-18 of water (d18O)	‰ VSMOW	Integrated Cavity Output Spectroscopy (ICOS)	--	--	-9.4	-10.3	-10.6	--	--	-8.1	-8.2	-10.8	-10.4	--	--
Deuterium of water (d2H)	‰ VSMOW	Integrated Cavity Output Spectroscopy (ICOS)	--	--	-72.5	-76.8	-78.8	--	--	-64.8	-66.0	-76.1	-73.0	--	--
Tritium (3H)	TU	Liquid Scintillation Spectroscopy	0.8	0.8	22.7	16.4	17.0	--	<0.8	25.1	30.0	14.8	13.4	--	<0.8
Carbon-13 of DIC (d13C-DIC)	‰ VPDB	OI Analytical Model TIC/TOC Analyzer	--	--	-2.1	-3.1	-3	--	--	-1.7	-1.6	-1.5	-1.4	--	--
Carbon-14 of DIC (14C-DIC)	pmC	Accelerator Mass Spectrometer (AMS)	0.53	38.29	1.99	1.68	1.62	--	39.06	3.25	3.14	1.44	1.42	--	42.4
Chlorine-37 (d37Cl)	‰ VPDB	Isotope Ratio Mass Spectrometry (IRMS)	--	--	-0.12	-0.10	0.00	--		-0.17	-0.21	-0.14	-0.10	--	--
Chlorine-36 (36Cl/Cl)	--	Accelerator Mass Spectrometer (AMS)	--	--	4.09E-15	5.34E-15	4.38E-15	--	--	3.31E-15	3.10E-15	3.65E-15	3.48E-15	--	--
Iodine-129 (129I)	atoms/kg	Accelerator Mass Spectrometer (AMS)	--	--	3.69E+07	2.79E+07	4.08E+05	--	--	9.44E+07	5.50E+07	4.28E+07	3.76E+07	--	--
Strontium isotope ratio (87Sr/86Sr)	--	Thermal Ionization Mass Spectrometry (TIMS)	--	--	0.70833	0.70844	0.70841	--	--	0.70832	0.70832	0.70838	0.70841	--	--
Laboratory Measurements - Noble Gas Isotopes															
3He	cc/g	Mass Spectrometry	--	--	2.1E-13	2.1E-12	4.5E-14	--	--	2.8E-13	3.2E-14	6.0E-14	4.3E-13	--	--
4He	cc/g	Mass Spectrometry	--	--	5.4E-06	3.0E-05	9.8E-07	--	--	5.0E-07	3.9E-08	3.6E-07	8.0E-06	--	--
He Total	cc/g	Mass Spectrometry	--	--	5.4E-06	3.0E-05	9.8E-07	--	--	5.0E-07	3.9E-08	3.6E-07	8.0E-06	--	--
20Ne	cc/g	Mass Spectrometry	--	--	1.2E-07	3.3E-06	4.8E-08	--	--	1.0E-06	8.6E-08	2.0E-07	3.7E-07	--	--
22Ne	cc/g	Mass Spectrometry	--	--	1.2E-08	3.0E-07	4.7E-09	--	--	9.4E-08	8.6E-09	1.9E-08	3.7E-08	--	--
Ne Total	cc/g	Mass Spectrometry	--	--	1.4E-07	3.6E-06	5.3E-08	--	--	1.1E-06	9.5E-08	2.2E-07	4.1E-07	--	--
36Ar	cc/g	Mass Spectrometry	--	--	3.1E-07	5.2E-06	1.1E-07	--	--	2.2E-06	1.8E-07	3.6E-07	1.8E-06	--	--
40Ar	cc/g	Mass Spectrometry	--	--	1.1E-04	1.4E-03	4.6E-05	--	--	6.0E-04	7.1E-05	1.6E-04	5.6E-04	--	--
Ar Total	cc/g	Mass Spectrometry	--	--	1.1E-04	1.4E-03	4.7E-05	--	--	6.0E-04	7.2E-05	1.6E-04	5.7E-04	--	--
Kr Total	cc/g	Mass Spectrometry	--	--	2.1E-08	1.6E-07	9.7E-09	--	--	Measurable Amounts	1.4E-08	2.8E-08	1.3E-07	--	--
Xe Total	cc/g	Mass Spectrometry	--	--	2.6E-09	1.6E-08	1.3E-09	--	--	were not present	1.9E-09	4.1E-09	1.7E-08	--	--

-- = Not reported or no value measured

1. = samples with EC > 100 mS/cm were diluted with de-ionized water. Reported value has been corrected by dilution factor.

Appendix C

Groundwater Results
Drill Water Contamination Correction

	Sample Type	Drill Water Corrected Results for Primary Groundwater (GW) Samples					
	Sample ID	SB_BH02_GW004	SB_BH02_GW013	SB_BH02_GW019	SB_BH02_GW030	SB_BH02_GW053	SB_BH02_GW042
	Comments	OGW 1 primary	OGW 2 primary	OGW 3 primary	OGW 4 primary	OGW 5 primary	OGW 6 primary
Calculated Proportion of Groundwater							
P_{GW}	--	0.99	0.98	0.96	0.97	0.85	0.94
Field Measurements							
Field pH	units	*7.07*	*7.04*	*12.1*	*15.9*		
Field Temp	Degrees C	*10.28*	*9.82*	*8.47*	*10.05*		
Field EC	mS/cm	*7.07*	*7.04*	*12.1*	*15.9*		
Field ORP	mV	*-108*	*-32*	*-78*	*-74*		
Field MM DO	mg/L	*0*	*0*	*0*	*0*		
Field Turbidity	NTU	*0*	*0*	*0*	*0*		
Field TDS (EC Calculated)	g/L	*5.20*	*5.17*	*8.89*	*11.69*		
Field Alkalinity	mg/L CaCO3	*179*	*225*	*148*	*206*		
Field Density	SG	1.00	1.00	1.01	1.01		
Field Analy. DO	mg/L	*0.83*	--	*0.80*	*0.27*		
Field Analy. Ferrous	mg/L	1.11	0.44	0.93	1.41		
Field Analy. Sulphide	mg/L	0.00	0.00	0.00	0.00		
Total Colloid	mg/L	*4*	*6*	*6*	*< 3*		
Laboratory Measurements - Physiochemical Parameters, Major Anions, and Nutrients							
pH-Lab	units	*7.78*	*7.79*	*7.66*	*7.51*		
Alkalinity Total (as CaCO3)	mg/L	*190*	*200*	*148*	*210*		
Total Ammonia as N (NH4+NH3)	mg/L	N/A	N/A	N/A	0.655		
Bromide (Br)	mg/L	<10	<10	<50	<20		
Chloride (Cl)	mg/L	1415	1627	3326	7078		
Fluoride (F)	mg/L	1.6	1.8	1.8	1.7		
Iodide (I)	mg/L	<0.10	<0.10	<0.10	<0.10		
Nitrate (NO3)	mg/L	<0.10	<0.10	<0.10	<0.10		
Nitrite (NO2)	mg/L	<0.010	<0.010	<0.010	<0.010		
Nitrate + Nitrite	mg/L	<0.10	<0.10	<0.10	<0.10		
Total Kjeldahl Nitrogen	mg/L	0.47	0.51	N/A	1.01		
Total Nitrogen	mg/L	0.47	0.50	N/A	1.00		
OrthoPhosphate (PO4)	mg/L	<0.010	<0.010	<0.010	<0.010		
Total Phosphorus (Ptot)	mg/L	0.012	<0.004	<0.020	<0.020		
Sulphate (SO4)	mg/L	1111.3	1220.2	1771.7	1845.5		
Sulphide as S	mg/L	<0.020	<0.020	<0.020	<0.020		
Sulfur (S) diss	mg/L	374	447	584	718		
Dissolved Organic Carbon (DOC)	mg/L	0.59	0.55	N/A	0.14		
Total Organic Carbon (TOC)	mg/L	0.83	0.58	0.68	0.24		
Reactive Silica (SiO2)	mg/L	N/A	7.41	8.48	7.85		
Laboratory Measurements - Metals							
Aluminum (Al) diss.	mg/L	<0.0049	0.0021	0.0000	0.7151		
Boron (B) diss.	mg/L	N/A	0.42	N/A	0.49		
Calcium (Ca) diss.	mg/L	322	314	388	605		
Iron (Fe) diss.	mg/L	0.9	0.4	1.9	2.0		
Lithium (Li) diss.	mg/L	0.04	0.04	0.06	0.10		
Magnesium (Mg) diss.	mg/L	111.2	152.7	156.6	235.8		
Potassium (K) diss.	mg/L	9.7	4.1	10.1	14.3		
Ruthenium (Ru) diss.	mg/L	<0.0020	<0.0020	<0.0020	<0.0020		
Silicon (Si) diss	mg/L	3.9	3.4	3.5	3.4		
Sodium (Na) diss.	mg/L	839	1017	1872	4206		
Strontium (Sr) diss.	mg/L	7.9	10.2	15.6	22.6		
Cerium (CE)	ug/L	<0.30	<0.30	<0.30	<0.30		
Praesedymium (Pr)	ug/L	<0.40	<0.40	<0.40	<0.40		
Neodymium (Nd)	ug/L	<3.0	<3.0	<3.0	<3.0		
Samarium (Sm)	ug/L	<2.0	<2.0	<2.0	<2.0		
Europium (Eu)	ug/L	<0.40	<0.40	<0.40	<0.40		
Gadolinium (Gd)	ug/L	<2.0	<2.0	<2.0	<2.0		
Terbium (Tb)	ug/L	<1.0	<1.0	<1.0	<1.0		
Disprosium (Dy)	ug/L	<2.0	<2.0	<2.0	<2.0		
Holmium (Ho)	ug/L	<0.40	<0.40	<0.40	<0.40		
Erbium (Er)	ug/L	<2.0	<2.0	<2.0	<2.0		
Thulium (Tm)	ug/L	<0.40	<0.40	<0.40	<0.40		
Ytterbium (Yb)	ug/L	<2.0	<2.0	<2.0	<2.0		
Laboratory Measurements - Isotopes							
Potassium-40 (40K)	Bq/kg	0.307	0.129	0.318	0.449		
Radon-222 (222Rn)	Bq/kg	N/A	N/A	N/A	N/A		
Total alpha activity	Bq/kg	N/A	N/A	<1.9	<0.29		
Total beta activity	Bq/kg	<0.10	<0.10	<2.3	<1.2		
Uranium-234 (234U)	Bq/kg	N/A	N/A	N/A	0.420		
Uranium-238 (238U)	Bq/kg	N/A	N/A	N/A	0.092		
Oxygen-18 of water (d18O)	‰ VSMOW	-11.8	-12.0	-11.5	-11.5		
Deuterium of water (d2H)	‰ VSMOW	-79.2	-80.1	-76.7	-78.5		
Tritium (3H)	TU	1.2	0.1	2.2	0.5		
Carbon-13 of DIC (d13C-DIC)	‰ VPDB	-5.63	-3.76	-3.64	-4.83		
Carbon-14 of DIC (14C-DIC)	pmC	13.32	6.59	2.15	0.00		
Chlorine-37 (d37Cl)	‰ VPDB	-0.08	-0.24	-0.66	-0.73		
Chlorine-36 (36Cl/Cl)	--	2.60E-16	6.64E-16	9.32E-16	-5.25E-17		
Iodine-129 (129I)	atoms/kg	8.97E+06	7.30E+06	1.13E+07	8.91E+06		
Strontium isotope ratio (87Sr/86Sr)	--	0.7085	0.7087	0.7082	0.7085		

Notes:

N/A	= detected in GW sample but concentration in DW sample is below method detection limit, GW value cannot be corrected
< ##	= concentration below method detection limit in GW sample.
##	= no correction applied, GW sample result shown
##	= Pgw for OGW5 and OGW6 GW samples calculated assuming initial concentration of fluorescein in DW = 100 ppb

= Drill water corrected values for OGW5 and OGW6 GW samples were not calculated because the correction assumes that the initial pre-purge DW sample consists of 100% drill water. For these OGW events, the proportion of drill water in the pre-purge DW samples was estimated to be 36% and 13%. The reduced fluorescein in pre-purge drillwater samples below the ~100 ppb used in during drilling indicate that mixing occured in the open borehole between the end of drilling and the OGW5/6 sampling approximately 7 months later.

Appendix D

Relative Percent Difference (RPD) Calculations

Parameter	Units	RDL	OGW1						OGW2					
			SB_BH02_GW004	SB_BH02_GW005	Difference	Average	5 X RDL	RPD %	SB_BH02_GW013	SB_BH02_GW014	Difference	Average	5 X RDL	RPD %
Laboratory Measurements - Radionuclides														
Gross Alpha	Bq/L	0.10	1	1.4	0.4	1.2	0.5	33	1.1	0.4	0.7	0.75	0.5	93
Gross Beta	Bq/L	0.10	<0.10	<0.12	--	--	0.5	--	<0.10	0.5	--	--	0.5	--
Radon-222	Bq/L	10	16	15	1	15.5	50	--	43	40	3	41.5	50	--
Uranium-234	Bq/L	0.010	0.5	0.47	0.03	0.485	0.05	6	0.085	0.086	0.001	0.0855	0.05	1
Uranium-235	Bq/L	0.010	<0.010	<0.010	--	--	0.05	--	<0.010	<0.010	--	--	0.05	--
Uranium-238	Bq/L	0.010	0.18	0.17	0.01	0.175	0.05	6	0.025	0.027	0.002	0.026	0.05	--
Laboratory - Calculated Parameters														
Total Nitrogen (N)	mg/L	0.10	0.47	0.25	0.22	0.36	0.5	--	0.5	0.48	0.02	0.49	0.5	--
Laboratory Measurments - Rare Earth Metals														
Total Cerium (Ce)	ug/L	0.30	<0.30	<0.30	--	--	1.5	--	<0.30	<0.30	--	--	1.5	--
Total Dysprosium (Dy)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Erbium (Er)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Europium (Eu)	ug/L	0.40	<0.40	<0.40	--	--	2	--	<0.40	<0.40	--	--	2	--
Total Gadolinium (Gd)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Holmium (Ho)	ug/L	0.40	<0.40	<0.40	--	--	2	--	<0.40	<0.40	--	--	2	--
Total Lanthanum (La)	ug/L	0.50	<0.50	<0.50	--	--	2.5	--	<0.50	<0.50	--	--	2.5	--
Total Lutetium (Lu)	ug/L	1.0	<1.0	<1.0	--	--	5	--	<1.0	<1.0	--	--	5	--
Total Neodymium (Nd)	ug/L	3.0	<3.0	<3.0	--	--	15	--	<3.0	<3.0	--	--	15	--
Total Praseodymium (Pr)	ug/L	0.40	<0.40	<0.40	--	--	2	--	<0.40	<0.40	--	--	2	--
Total Ruthenium (Ru)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Samarium (Sm)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Scandium (Sc)	ug/L	5.0	<5.0	<5.0	--	--	25	--	<5.0	<5.0	--	--	25	--
Total Terbium (Tb)	ug/L	1.0	<1.0	<1.0	--	--	5	--	<1.0	<1.0	--	--	5	--
Total Thulium (Tm)	ug/L	0.40	<0.40	<0.40	--	--	2	--	<0.40	<0.40	--	--	2	--
Total Ytterbium (Yb)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Yttrium (Y)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Laboratory Measurements - Physiochemical Parameters, Anions, and Nutrients														
Total Ammonia-N	mg/L	0.050	0.18	0.12	0.06	0.15	0.25	--	0.14	0.14	0	0.14	0.25	--
Fluoride (F-)	mg/L	0.10	1.6	1.6	0	1.6	0.5	0	1.8	1.8	0	1.8	0.5	0
Dissolved Iodide	mg/L	0.10	<0.10	<0.10	--	--	0.5	--	<0.10	<0.10	--	--	0.5	--
Total Kjeldahl Nitrogen (TKN)	mg/L	N/A	0.47	0.25	0.22	0.36	--	--	0.5	0.48	0.02	0.49	--	--
Dissolved Organic Carbon	mg/L	0.40	0.60	0.63	0.03	0.615	2	--	0.56	0.55	0.01	0.555	2	--
Total Organic Carbon (TOC)	mg/L	0.40	0.84	0.6	0.24	0.72	2	--	0.59	0.55	0.04	0.57	2	--
Orthophosphate (P)	mg/L	0.010	<0.010	<0.010	--	--	0.05	--	<0.010	<0.010	--	--	0.05	--
pH	pH		7.78	7.64	0.14	7.71	0	2	7.79	7.81	0.02	7.8	0	0
Total Phosphorus	mg/L	0.004	0.012	0.01	0.002	0.011	0.02	--	<0.004	<0.004	--	--	0.02	--
Reactive Silica (SiO2)	mg/L	0.10	8.5	8.5	0	8.5	0.5	0	7.6	7.6	0	7.6	0.5	0
Sulphide	mg/L	0.020	<0.020	<0.020	--	--	0.1	--	<0.020	<0.020	--	--	0.1	--
Dissolved Sulphur (S)	mg/L	0.5	370	370	0	370	2.5	0	440	450	10	445	2.5	2
Alkalinity (Total as CaCO3)	mg/L	1.0	190	190	0	190	5	0	200	200	0	200	5	0
Nitrite (N)	mg/L	0.010	<0.010	<0.010	--	--	0.05	--	<0.010	<0.010	--	--	0.05	--
Dissolved Chloride (Cl-)	mg/L	1.0	1,400.0	1400	0	1400	5	0	1,600.0	1,600.0	0	1600	5	0
Nitrate (N)	mg/L	0.10	<0.10	<0.10	--	--	0.5	--	<0.10	<0.10	--	--	0.5	--
Nitrate + Nitrite (N)	mg/L	0.10	<0.10	<0.10	--	--	0.5	--	<0.10	<0.10	--	--	0.5	--
Dissolved Bromide (Br-)	mg/L	1.0	<10	<10	--	--	5	--	<10	<10	--	--	5	--
Dissolved Sulphate (SO4)	mg/L	1.0	1100	1000	100	1050	5	10	1200	1200	0	1200	5	0
Laboratory Measurements - Metals							0						0	
Dissolved Iron (Fe)	mg/L	0.02	0.86	0.87	0.01	0.865	0.1	1	0.39	0.45	0.06	0.42	0.1	14
Dissolved Aluminum (Al)	ug/L	4.9	<4.9	<4.9	--	--	24.5	--	6.3	6.6	0.3	6.45	24.5	--
Dissolved Boron (B)	ug/L	10	310	310	0	310	50	0	410	410	0	410	50	0
Dissolved Calcium (Ca)	ug/L	400	320000	320000	0	320000	2000	0	310000	300000	10000	305000	2000	3
Dissolved Lithium (Li)	ug/L	5.0	35	35	0	35	25	0	41	41	0	41	25	0
Dissolved Magnesium (Mg)	ug/L	50	110000	120000	10000	115000	250	9	150000	160000	10000	155000	250	6
Dissolved Potassium (K)	ug/L	200	9900	10000	100	9950	1000	1	4200	4300	100	4250	1000	2
Dissolved Silicon (Si)	ug/L	50	3900	3900	0	3900	250	0	3500	3600	100	3550	250	3
Dissolved Sodium (Na)	ug/L	100	830000	830000	0	830000	500	0	1000000	1100000	100000	1050000	500	10
Dissolved Strontium (Sr)	ug/L	1.0	7800	8000	200	7900	5	3	10000	10000	0	10000	5	0

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

Parameter	Units	RDL	OGW3						OGW4					
			SB_BH02_GW019	SB_BH02_GW020	Difference	Average	5 X RDL	RPD %	SB_BH02_GW030	SB_BH02_GW031	Difference	Average	5 X RDL	RPD %
Laboratory Measurements - Radionuclides														
Gross Alpha	Bq/L	0.10	<1.9	1.3	--	--	0.5	--	<0.29	<0.51	--	--	0.5	--
Gross Beta	Bq/L	0.10	<2.3	<0.70	--	--	0.5	--	<1.2	<1.2	--	--	0.5	--
Radon-222	Bq/L	10	38	35	3	36.5	50	--	19	<10	--	--	50	--
Uranium-234	Bq/L	0.010	0.22	0.2	0.02	0.21	0.05	10	0.41	0.38	0.03	0.395	0.05	8
Uranium-235	Bq/L	0.010	<0.010	<0.010	--	--	0.05	--	<0.010	<0.012	--	--	0.05	--
Uranium-238	Bq/L	0.010	0.063	0.057	0.006	0.06	0.05	10	0.09	0.11	0.02	0.1	0.05	20
Laboratory - Calculated Parameters														
Total Nitrogen (N)	mg/L	0.10	0.73	0.72	0.01	0.725	0.5	1	0.99	0.92	0.07	0.955	0.5	7
Laboratory Measurments - Rare Earth Metals														
Total Cerium (Ce)	ug/L	0.30	<0.30	<0.30	--	--	1.5	--	<0.30	<0.30	--	--	1.5	--
Total Dysprosium (Dy)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Erbium (Er)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Europium (Eu)	ug/L	0.40	<0.40	<0.40	--	--	2	--	<0.40	<0.40	--	--	2	--
Total Gadolinium (Gd)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Holmium (Ho)	ug/L	0.40	<0.40	<0.40	--	--	2	--	<0.40	<0.40	--	--	2	--
Total Lanthanum (La)	ug/L	0.50	<0.50	<0.50	--	--	2.5	--	<0.50	<0.50	--	--	2.5	--
Total Lutetium (Lu)	ug/L	1.0	<1.0	<1.0	--	--	5	--	<1.0	<1.0	--	--	5	--
Total Neodymium (Nd)	ug/L	3.0	<3.0	<3.0	--	--	15	--	<3.0	<3.0	--	--	15	--
Total Praseodymium (Pr)	ug/L	0.40	<0.40	<0.40	--	--	2	--	<0.40	<0.40	--	--	2	--
Total Ruthenium (Ru)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Samarium (Sm)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Scandium (Sc)	ug/L	5.0	<5.0	<5.0	--	--	25	--	<5.0	<5.0	--	--	25	--
Total Terbium (Tb)	ug/L	1.0	<1.0	<1.0	--	--	5	--	<1.0	<1.0	--	--	5	--
Total Thulium (Tm)	ug/L	0.40	<0.40	<0.40	--	--	2	--	<0.40	<0.40	--	--	2	--
Total Ytterbium (Yb)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Yttrium (Y)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Laboratory Measurements - Physiochemical Parameter														
Total Ammonia-N	mg/L	0.050	0.42	0.28	0.14	0.35	0.25	40	0.64	0.63	0.01	0.635	0.25	2
Fluoride (F-)	mg/L	0.10	1.7	1.5	0.2	1.6	0.5	13	1.7	1.8	0.1	1.75	0.5	6
Dissolved Iodide	mg/L	0.10	<0.10	<0.10	--	--	0.5	--	<0.10	<0.10	--	--	0.5	--
Total Kjeldahl Nitrogen (TKN)	mg/L	N/A	0.73	0.72	0.01	0.725	--	--	0.99	0.92	0.07	0.955	--	--
Dissolved Organic Carbon	mg/L	0.40	0.57	0.57	0	0.57	2	--	1.40	1.4	0	1.4	2	--
Total Organic Carbon (TOC)	mg/L	0.40	0.71	0.69	0.02	0.7	2	--	1.50	1.5	0	1.5	2	--
Orthophosphate (P)	mg/L	0.010	<0.010	<0.010	--	--	0.05	--	<0.010	<0.010	--	--	0.05	--
pH	pH		<1.68	<1.68	--	--	0	--	7.51	7.52	0.01	7.515	0	0
Total Phosphorus	mg/L	0.004	<0.020	<0.020	--	--	0.02	--	<0.020	<0.020	--	--	0.02	--
Reactive Silica (SiO2)	mg/L	0.10	8.5	8.5	0	8.5	0.5	0	7.9	7.5	0.4	7.7	0.5	5
Sulphide	mg/L	0.020	<0.020	<0.020	--	--	0.1	--	<0.020	<0.020	--	--	0.1	--
Dissolved Sulphur (S)	mg/L	0.5	560	560	0	560	2.5	0	700	700	0	700	2.5	0
Alkalinity (Total as CaCO3)	mg/L	1.0	<1.0	<1.0	--	--	5	--	210	210	0	210	5	0
Nitrite (N)	mg/L	0.010	<0.010	<0.010	--	--	0.05	--	<0.010	<0.010	--	--	0.05	--
Dissolved Chloride (Cl-)	mg/L	1.0	3200	2900	300	3050	5	10	6,900.0	6800	100	6850	5	1
Nitrate (N)	mg/L	0.10	<0.10	<0.10	--	--	0.5	--	<0.10	<0.10	--	--	0.5	--
Nitrate + Nitrite (N)	mg/L	0.10	<0.10	<0.10	--	--	0.5	--	<0.10	<0.10	--	--	0.5	--
Dissolved Bromide (Br-)	mg/L	1.0	<50	<50	--	--	5	--	<20	<20	--	--	5	--
Dissolved Sulphate (SO4)	mg/L	1.0	1700	1500	200	1600	5	13	1800	1900	100	1850	5	5
Laboratory Measurements - Metals							0						0	
Dissolved Iron (Fe)	mg/L	0.02	1.8	1.5	0.3	1.65	0.1	18	2	2.3	0.3	2.15	0.1	14
Dissolved Aluminum (Al)	ug/L	4.9	5.1	<4.9	--	--	24.5	--	<25	<25	--	--	24.5	--
Dissolved Boron (B)	ug/L	10	450	460	10	455	50	2	480	440	40	460	50	9
Dissolved Calcium (Ca)	ug/L	400	380000	400000	20000	390000	2000	5	590000	580000	10000	585000	2000	2
Dissolved Lithium (Li)	ug/L	5.0	59	61	2	60	25	3	100	100	0	100	25	0
Dissolved Magnesium (Mg)	ug/L	50	150000	150000	0	150000	250	0	230000	220000	10000	225000	250	4
Dissolved Potassium (K)	ug/L	200	11000	11000	0	11000	1000	0	14000	14000	0	14000	1000	0
Dissolved Silicon (Si)	ug/L	50	3500	3600	100	3550	250	3	3400	3500	100	3450	250	3
Dissolved Sodium (Na)	ug/L	100	1800000	1900000	100000	1850000	500	5	4100000	4200000	100000	4150000	500	2
Dissolved Strontium (Sr)	ug/L	1.0	15000	14000	1000	14500	5	7	22000	22000	0	22000	5	0

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

Parameter	Units	RDL	OGW5						OGW6					
			SB_BH02_GW042	SB_BH02_GW043	Difference	Average	5 X RDL	RPD %	SB_BH02_GW053	SB_BH02_GW054	Difference	Average	5 X RDL	RPD %
Laboratory Measurements - Radionuclides														
Gross Alpha	Bq/L	0.10	<21	<18	--	--	0.5	--	<6.2	<7.7	--	--	0.5	--
Gross Beta	Bq/L	0.10	<3.3	<1.9	--	--	0.5	--	<6.0	<0.95	--	--	0.5	--
Radon-222	Bq/L	10	<10	<10	--	--	50	--	16	12	4	14	50	--
Uranium-234	Bq/L	0.010	0.08	0.1	0.02	0.09	0.05	22	0.14	0.12	0.02	0.13	0.05	15
Uranium-235	Bq/L	0.010	<0.010	<0.010	--	--	0.05	--	<0.010	<0.010	--	--	0.05	--
Uranium-238	Bq/L	0.010	0.03	0.077	0.047	0.0535	0.05	88	0.045	0.058	0.013	0.0515	0.05	25
Laboratory - Calculated Parameters														
Total Nitrogen (N)	mg/L	0.10	5.2	5.9	0.7	5.55	0.5	13	2.7	2.4	0.3	2.55	0.5	12
Laboratory Measurments - Rare Earth Metals														
Total Cerium (Ce)	ug/L	0.30	<0.30	<0.30	--	--	1.5	--	<0.30	21	--	--	1.5	--
Total Dysprosium (Dy)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Erbium (Er)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Europium (Eu)	ug/L	0.40	<0.40	<0.40	--	--	2	--	<0.40	<0.40	--	--	2	--
Total Gadolinium (Gd)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Holmium (Ho)	ug/L	0.40	<0.40	<0.40	--	--	2	--	<0.40	<0.40	--	--	2	--
Total Lanthanum (La)	ug/L	0.50	<0.50	<0.50	--	--	2.5	--	<0.50	7.7	--	--	2.5	--
Total Lutetium (Lu)	ug/L	1.0	<1.0	<1.0	--	--	5	--	<1.0	<1.0	--	--	5	--
Total Neodymium (Nd)	ug/L	3.0	<3.0	<3.0	--	--	15	--	<3.0	5.9	--	--	15	--
Total Praseodymium (Pr)	ug/L	0.40	<0.40	<0.40	--	--	2	--	<0.40	1.7	--	--	2	--
Total Ruthenium (Ru)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Samarium (Sm)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Scandium (Sc)	ug/L	5.0	<5.0	<5.0	--	--	25	--	<5.0	<5.0	--	--	25	--
Total Terbium (Tb)	ug/L	1.0	<1.0	<1.0	--	--	5	--	<1.0	<1.0	--	--	5	--
Total Thulium (Tm)	ug/L	0.40	<0.40	<0.40	--	--	2	--	<0.40	<0.40	--	--	2	--
Total Ytterbium (Yb)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	<2.0	--	--	10	--
Total Yttrium (Y)	ug/L	2.0	<2.0	<2.0	--	--	10	--	<2.0	2.8	--	--	10	--
Laboratory Measurements - Physiochemical Parameter														
Total Ammonia-N	mg/L	0.050	3.8	3.9	0.1	3.85	0.25	3	1.4	1.5	0.1	1.45	0.25	7
Fluoride (F-)	mg/L	0.10	0.3	0.29	0.03	0.275	0.5	--	0.9	0.94	0.03	0.925	0.5	3
Dissolved Iodide	mg/L	0.10	<10	<10	--	--	0.5	--	<10	<10	--	--	0.5	--
Total Kjeldahl Nitrogen (TKN)	mg/L	N/A	5.2	5.8	0.6	5.5	--	--	2.7	2.4	0.3	2.55	--	--
Dissolved Organic Carbon	mg/L	0.40	12.00	13	1	12.5	2	8	8.10	8.3	0.2	8.2	2	2
Total Organic Carbon (TOC)	mg/L	0.40	13.00	12	1	12.5	2	8	10.00	9.4	0.6	9.7	2	6
Orthophosphate (P)	mg/L	0.010	<0.010	<0.010	--	--	0.05	--	<0.010	<0.010	--	--	0.05	--
pH	pH		6.68	6.75	0.07	6.715	0	1	7.26	7.25	0.01	7.255	0	0
Total Phosphorus	mg/L	0.004	0.240	0.11	0.13	0.175	0.02	74	0.100	0.09	0.01	0.095	0.02	11
Reactive Silica (SiO2)	mg/L	0.10	16.0	5.1	10.9	10.55	0.5	103	9.9	9.4	0.5	9.65	0.5	5
Sulphide	mg/L	0.020	<0.020	<0.020	--	--	0.1	--	<0.020	<0.020	--	--	0.1	--
Dissolved Sulphur (S)	mg/L	0.5	850	860	10	855	2.5	1	830	830	0	830	2.5	0
Alkalinity (Total as CaCO3)	mg/L	1.0	78	79	1	78.5	5	1	130	140	10	135	5	7
Nitrite (N)	mg/L	0.010	<0.10	0.11	--	--	0.05	--	<0.050	<0.050	--	--	0.05	--
Dissolved Chloride (Cl-)	mg/L	1.0	130000	130000	0	130000	5	0	28000	28000	0	28000	5	0
Nitrate (N)	mg/L	0.10	<1.0	<1.0	--	--	0.5	--	<0.50	<0.50	--	--	0.5	--
Nitrate + Nitrite (N)	mg/L	0.10	<1.0	<1.0	--	--	0.5	--	<0.50	<0.50	--	--	0.5	--
Dissolved Bromide (Br-)	mg/L	1.0	110	110	0	110	5	0	87	86	1	86.5	5	1
Dissolved Sulphate (SO4)	mg/L	1.0	2400	2400	0	2400	5	0	2200	2200	0	2200	5	0
Laboratory Measurements - Metals							0						0	
Dissolved Iron (Fe)	mg/L	0.02	12	12	0	12	0.1	0	13	13	0	13	0.1	0
Dissolved Aluminum (Al)	ug/L	4.9	<250	<250	--	--	24.5	--	59	89	30	74	24.5	41
Dissolved Boron (B)	ug/L	10	3100	3200	100	3150	50	3	1500	1500	0	1500	50	0
Dissolved Calcium (Ca)	ug/L	400	5300000	5300000	0	5300000	2000	0	4200000	4100000	100000	4150000	2000	2
Dissolved Lithium (Li)	ug/L	5.0	3200	3100	100	3150	25	3	2700	2600	100	2650	25	4
Dissolved Magnesium (Mg)	ug/L	50	220000	220000	0	220000	250	0	360000	370000	10000	365000	250	3
Dissolved Potassium (K)	ug/L	200	240000	240000	0	240000	1000	0	190000	190000	0	190000	1000	0
Dissolved Silicon (Si)	ug/L	50	<2500	<2500	--	--	250	--	3200	3200	0	3200	250	0
Dissolved Sodium (Na)	ug/L	100	75000000	77000000	2000000	76000000	500	3	14000000	14000000	0	14000000	500	0
Dissolved Strontium (Sr)	ug/L	1.0	92000	94000	2000	93000	5	2	72000	72000	0	72000	5	0

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