

Site C Clean Energy Project

Fisheries and Aquatic Habitat Monitoring and Follow-up Program

Peace River and Site C Reservoir Water and Sediment Quality Monitoring Programs (Mon-8 and Mon-9)

Construction Year 4 (2018)

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Peace River and Site C Reservoir 2018 Water and Sediment Quality Monitoring Programs



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EXECUTIVE SUMMARY

As part of the Water and Sediment Quality Monitoring Programs, the Saulteau EBA Environmental Services Joint Venture (SEES JV) conducted the water and sediment quality sampling program associated with the Site C Clean Energy Project (the Project) on behalf of the BC Hydro and Power Authority (BC Hydro). The Project is located along the Peace River near the City of Fort St. John between the Districts of Hudson's Hope and Taylor, BC.

In accordance with the Provincial Environmental Assessment Certificate Condition No. 7 for the Project, BC Hydro has developed the Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP). The FAHMFP includes two monitoring programs focused on assessing the effects of the Project on water and sediment quality:

- Site C Mon-8 – Site C Reservoir Water and Sediment Quality Monitoring Program. This program will investigate the effects of reservoir formation on water and sediment quality; and
- Site C Mon-9 – Peace River Water and Sediment Quality Monitoring Program. This program will investigate the effects of the Project on water and sediment quality in the Peace River downstream of the Project.

Mon-8 and Mon-9 were developed to monitor water and sediment quality in the Site C Reservoir and Peace River and to address the management questions listed in the FAHMFP; several years of data collection are required before the questions can be definitively addressed. This report presents the third year of data collection for these two monitoring programs under the FAHMFP.

The Mon-8 study area includes monthly monitoring from May to October at eight stations within the Site C reach, defined as the portion of the Peace River that will be inundated by the Project and includes the Peace River from the Peace Canyon Dam downstream to the Site C Dam, and those sections of the Halfway and Moberly rivers that will be inundated following reservoir creation. Four reference stations were selected for monthly monitoring (May to October) to monitor water flowing into the Site C reach and are located near the Dinosaur and Williston reservoir outlets. The Mon-9 study area includes monthly monitoring from May to October at nine stations within the Peace River downstream of the Project to Many Islands, Alberta.

Similar to 2017, dissolved organic carbon (DOC) concentrations in 2018 were occasionally elevated above total organic carbon (TOC) concentrations. DOC concentrations of field blank samples collected during all sampling periods were reported to be below detection in field-filtered deionized water provided by the lab, which indicates field methodologies are not introducing cross contamination between samples. In 2018, SEES JV continued to flush field equipment to reduce the incidence of false positives for DOC. Although this still has not fully resolved the concern of organic carbon impacts from field equipment, improvements continued to be seen in 2018. The TOC concentrations are considered stable and mostly within natural levels for a lotic/lentic system with elevated background turbidity conditions (BC MELP 1998).

Overall, water quality parameters were consistently below the applicable BC Approved Water Quality Guidelines for water. During the May sampling period, regular exceedances of total arsenic, total copper, total iron and dissolved aluminum and intermittent exceedances of total silver, total zinc and dissolved iron were observed. During the October sampling period, intermittent exceedances of total and dissolved iron and dissolved aluminum were observed. During the June, July and August sampling periods, regular exceedances of temperature were observed and during the June sampling period one exceedance of pH was observed. Sediment quality parameters were consistently below the applicable BC Working Water Quality Guidelines for sediments except for regular exceedances of arsenic and nickel and intermittent exceedances of cadmium and iron. Source(s) of the exceeded parameters could not be conclusively determined. Many Peace River tributaries are large systems characterized by high, vertical banks composed of fine materials which are subject to erosion during high flow periods. Given the location and parameters involved, it is possible that the exceedances are the result of natural

processes (i.e., regional geology and erosion) and process error (i.e., natural variability among years). The 2018 results are comparable to 2016 and 2017 results in that most parameters were below the guidelines with some exceedances in water metals parameters (i.e., iron, copper, zinc, silver and aluminum) and some exceedances in sediment metals parameters (i.e., arsenic, cadmium, iron and nickel).

Each of the broad geospatial groups (Peace River, tributaries and reservoir) have unique geological and limnological characteristics that likely contribute to their water quality characteristics. Most notably:

- Reservoir sites are more lentic, which tends to be warmer, less oxygenated and less turbid (particulate matter has time to settle out). Parameter concentrations at the reservoir sites were generally lower than the Peace River or tributary sites which are located downstream of the Dinosaur Reservoir; and
- Tributary sites are located on tributaries to the Peace River which tend to flow through more erodible material. Notwithstanding other factors, water flowing over erodible surfaces tend to accumulate larger sediment loads and consequently may have higher total and dissolved mineral components.

May typically showed the greatest variability or spread for all parameters in all groups. The most extreme minimum and maximum values usually appeared in May through June; August also showed frequent extremes and outliers. Median concentrations of all parameters in all groups were also typically highest in May. May's variability and extreme values are likely the influence of spring freshet.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	I
1.0 BACKGROUND	1
1.1 Program Objectives	2
1.2 Management Hypotheses	2
2.0 METHODS	3
2.1 Field Methods	3
2.2 Boxplot Analysis Methods	7
3.0 REGULATORY GUIDELINES	8
4.0 RESULTS	9
4.1 Williston and Dinosaur Reservoirs Water and Sediment Quality Results	9
4.2 Peace River Water Quality Results: Site C Reservoir	11
4.3 Peace River Water Quality Results: Downstream Reach	13
4.4 Quality Assurance and Quality Control	16
5.0 DISCUSSION	17
5.1 Management Hypotheses	17
5.2 Discussion of Results	17
5.3 Boxplots	18
5.4 Quality Assurance and Quality Control	18
6.0 CLOSURE	19
REFERENCES	20

TABLES IN TEXT

Table 2-1. Laboratory Analyzed Parameters and Sampling Collection Periods	6
Table 2-2: Included Sites for Boxplot Representation	7
Table 3-1. Application of Regulatory Guidelines within the Program	8

APPENDIX SECTIONS

TABLES

Table 1	Summary of Surface Water Quality Parameters Compared to BC Approved Water Quality Guidelines
Table 2	Summary of Sediment Quality Parameters Compared to BC Working Water Quality Guidelines
Table 3	Williston Reservoir Water Quality Depth Profile Summary
Table 4	Dinosaur Reservoir Water Quality Depth Profile Summary



Table 5	Summary of October Sediment Quality Results
Table 6	May 2018 Surface Water Quality Results Summary
Table 7	June 2018 Surface Water Quality Results Summary
Table 8	July 2018 Surface Water Quality Results Summary
Table 9	August 2018 Surface Water Quality Results Summary
Table 10	September 2018 Surface Water Quality Results Summary
Table 11	October 2018 Surface Water Quality Results Summary
Table 12	2018 Surface Water Quality Results Summary for Duplicate Analysis (May, June, July, August, September and October)
Table 13	October 2018 Sediment Quality Results Summary for Duplicate Analysis
Table 14	2018 Surface Water Quality Results Summary for Blank Analysis (May, June, July, August, September and October)
Table 15	Summary Statistics

PHOTOS

Photos 1 to 17

FIGURES

Figure 1	Site Location
Figure 2a	Water Quality Monitoring Station Location Plan
Figure 2b	Water Quality Monitoring Station Location Plan
Figure 3a	Descriptive Analysis of Chlorophyll <i>a</i>
Figure 3b	Descriptive Analysis of Iron
Figure 3c	Descriptive Analysis of Nitrogen
Figure 3d	Descriptive Analysis of Phosphorus
Figure 3e	Descriptive Analysis of TOC

APPENDICES

Appendix A	Limitations on the Use of this Document
Appendix B	Laboratory Reports

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of British Columbia Hydro and Power Authority and their agents. Saulteau EBA Environmental Services Joint Venture (SEES JV) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than British Columbia Hydro and Power Authority, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in Appendix A or Contractual Terms and Conditions executed by both parties.

1.0 BACKGROUND

As part of the Water and Sediment Quality Monitoring Programs, the Saulteau EBA Environmental Services Joint Venture (SEES JV) conducted water and sediment quality sampling (May to October 2018) associated with the Site C Clean Energy Project (the Project) on behalf of the BC Hydro and Power Authority (BC Hydro).

Historical baseline data collected in 2007, 2008, 2010, 2011, and 2015 were used as a design template to establish site locations, sampling frequency, and parameters analyzed for the Project. Historical data is documented within the “Site C Clean Energy Project Environmental Impact Statement Technical Appendix: Water Quality Baseline Conditions in the Peace River Volume 2 Appendix E” (Golder 2012). Upon collection of 2018 field data, SEES JV, in consultation with BC Hydro, determined that the data volume was sufficient to graphically represent within boxplots and provide a basic qualitative discussion of temporal and spatial results. The analysis incorporated historical baseline data for comparative purposes.

In accordance with Provincial Environmental Assessment Certificate Condition No. 7¹ for the Project, BC Hydro produced the Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP²). The FAHMFP includes two monitoring programs focused on assessment of Project effects on water and sediment quality:

- Site C Mon-8 – Site C Reservoir Water and Sediment Quality Monitoring Program. This program will investigate the effects of reservoir formation on water and sediment quality; and
- Site C Mon-9 – Peace River Water and Sediment Quality Monitoring Program. This program will investigate the effects of the Project on water and sediment quality in the Peace River downstream of the Project.

Mon-8 and Mon-9 conduct sampling in Construction Years 2 to 10 (2016 to 2024) and Operation Years 1 to 10 (2024 to 2033). This report is an overview of the Mon-8 and Mon-9 sampling conducted in Construction Year 4 (2018) from May to October.

The Project is located along the Peace River near the City of Fort St. John between the Districts of Hudson's Hope and Taylor, BC, accessible via Highways 97 and 29. A station location map is provided as Figure 1. All surface water monitoring stations (stations) are accessible by boat via public boat launch (road accessible). Station locations are shown in Figures 2a and 2b.

The Mon-8 study area includes monthly monitoring from May to October at eight stations within the Site C reach, defined as the portion of the Peace River that will be inundated by the Project and includes the Peace River from the Peace Canyon Dam downstream to the Site C Dam, and those sections of the Halfway and Moberly rivers that will be inundated following reservoir creation (approximately 10 km sections). Two of the eight stations are in the upstream reaches of the Halfway and Moberly rivers and will be sampled following reservoir filling in 2023 and 2024. Four reference stations (two shallow and two deep) were selected for monthly monitoring (May to October) to monitor water flowing into the Site C reach and are located near the Dinosaur and Williston reservoir outlets.

The Mon-9 study area includes monthly monitoring from May to October at nine stations within the Peace River from the Project downstream to the Many Islands area in Alberta, approximately 120 km.

¹ The EAC Holder must develop a Fisheries and Aquatic Habitat Monitoring and Follow-up Program to assess the effectiveness of measures to mitigate Project effects on healthy fish populations in the Peace River and tributaries, and, if recommended by a QEP or FLNR, to assess the need to adjust those measures to adequately mitigate the Project's effects.

² Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program available at <https://www.sitecproject.com/document-library/environmental-management-plans-and-reports>

1.1 Program Objectives

The objectives of Mon-8 and Mon-9 in 2018 were to:

- Provide a qualitative description of the field site conditions, including representative photographs and geospatially referenced locations of each station;
- Collect field-measured and laboratory-analyzed parameters at each station;
- Provide a description of potential sources of error and steps taken as part of quality assurance; and
- Present the tabulated data in comparison to guidelines considered applicable to the monitoring programs.

Sampling under these programs will contribute to the information used to address the following primary fisheries management questions listed in the FAHMFP:

- Mon-8: Does the construction and operation of the Project affect fish and fish habitat (as measured through water and sediment quality) in the reservoir and lower sections of reservoir tributaries?
- Mon-9: Does the construction and operation of the Project affect fish and fish habitat (as measured through water and sediment quality) in the Peace River downstream of the Project?

These broad questions require several smaller questions to be answered because of the various ways that the Project can affect fish and fish habitat:

Mon-8:

1. Is there a change in water or sediment quality in the Site C reach during the construction of the Project?
2. Is there a change in water or sediment quality in the Site C reach during the operation of the Project?
3. How effective are proposed mitigation methods in maintaining/protecting water and sediment quality in the Site C reach?

Mon-9:

1. Is there a change in water or sediment quality in the Peace River between the Site C dam site and the Many Islands area in Alberta during the construction of the Project?
2. Is there a change in water or sediment quality in the Peace River between the Site C dam site and the Many Islands area in Alberta during the operation of the Project?
3. How effective are proposed mitigation methods in maintaining/protecting water and sediment quality in the Peace River between the Site C dam site and the Many Islands area in Alberta?

1.2 Management Hypotheses

To address the fisheries management questions, the programs will test the following hypotheses, as provided in the monitoring plan:

Mon-8:

- H₁: During construction, modeled water quality predictions presented in the Environmental Impact Statement (EIS) are like measured water quality in the Site C reach;

H₂: During operation, modeled water quality predictions presented in the EIS are like measured water quality in the Site C reach;

H₃: During construction, water and sediment quality for non-modeled parameters remain within background ranges of concentrations or comply with relevant environmental guidelines in the Site C reach; and

H₄: During operation, water and sediment quality for non-modeled parameters remain within background ranges of concentrations or comply with relevant environmental guidelines in the Site C reach.

Two hypotheses related to the effectiveness of mitigation measures for water and sediment quality are:

H₅: During construction, mitigation methods employed are effective in maintaining/protecting water and sediment quality in the Site C reach; and

H₆: During operation, mitigation methods employed are effective in maintaining/protecting water and sediment quality in the Site C reach.

Mon-9:

H₁: During construction, modeled water quality predictions presented in the EIS are similar to measured water quality in the Peace River between the Site C dam site and the Many Islands area in Alberta;

H₂: During operation, modeled water quality predictions presented in the EIS are similar to measured water quality in the Peace River between the Site C dam site and the Many Islands area in Alberta;

H₃: During construction, water and sediment quality for non-modeled parameters remain within background ranges of concentrations or comply with relevant environmental guidelines in the Peace River between the Site C dam site and the Many Islands area in Alberta; and

H₄: During operation, water and sediment quality for non-modeled parameters remain within background ranges of concentrations or comply with relevant environmental guidelines in the Peace River between the Site C dam site and the Many Islands area in Alberta.

Two hypotheses related to the effectiveness of mitigation measures for water and sediment quality are:

H₅: During construction, mitigation methods employed are effective in maintaining/protecting water and sediment quality in the Peace River between the Site C dam site and the Many Islands area in Alberta; and

H₆: During operation, mitigation methods employed are effective in maintaining/protecting water and sediment quality in the Peace River between the Site C dam site and the Many Islands area in Alberta.

The fisheries management questions and management hypotheses require several years of data to be collected before the questions can be definitively addressed. This report is the third year of data collection for these programs under the FAHMFP.

2.0 METHODS

2.1 Field Methods

To maintain compliance with the objectives listed in the FAHMFP, we developed field sampling methodology for collecting water and sediment quality data representative of 17 stations included within the program. Standard practices available from the British Columbia Field Sampling Manual (BC MOE 2013) were used to develop the following procedures:

- Sampling within surface water flow and away from the watercourse banks provides information on the quality of the channel flow and a general overview of water quality in the system. Areas of unusual flow characteristics (e.g., eddies or backwater areas) or floating debris were avoided;
- Samples were collected from near the bow via the side access of a jet engine boat, pointing the vessel upstream to collect upstream flow representative samples and to avoid contamination that could be introduced to the sample from the vessel;
 - In September 2017, as per BC Hydro direction, collection by grab sampling (i.e., submerging sample bottle directly into flow 0.2 m below surface from the side of the vessel) was replaced by a peristaltic pump and HDPE tubing with a 5 m intake length. In October 2017, the peristaltic pump was replaced with an electric diaphragm-operated pump (Pentair Shurflo; Model 4048-153-E75) and inert platinum-rinsed silicone tubing operating at 15 L/minute. The purpose of this apparatus was for collecting and analyzing low-level concentrations of dissolved and total forms of mercury and methylmercury but was inherently used for collecting all water samples. The extension of the tubing allowed samples to be collected at least 5 m away from the aluminum hull of the jet boat, which could impact the results of low-level metals analysis.
- All samples were collected by boat, except for instances of low water conditions preventing boat access. In this case, samples were collected from the shore either by wading into the water towards the centre of channel or using a telescopic metal pole with a plastic container attached for collecting the water sample from flowing water conditions within the channel;
- Water quality samples were collected from each station within 0.2 m depth from surface;
- Water quality samples within the reservoirs were collected at least 25 m from the shoreline, within the middle of the reservoir towards the outlet. The shallow samples to be submitted for laboratory analysis from the reservoirs were collected within 0.2 m depth from the surface while the deep samples were collected at a depth of 5.0 m. Depth profiles were determined by measuring field parameters throughout the water column. Depth profile sample data were recorded at 0.5 m increments between 0.2 m and 5.0 m;
- Water quality samples were collected monthly from each station between May and October 2018; the first and final sampling periods included more extensive analytical testing than others;
- Sediment quality samples were collected from nearshore depositional areas of each lotic and lentic station during the October sampling period using primarily an Ekman sampling device. However, if field conditions weren't conducive for use of this device, a small spaded shovel was used to collect samples from the nearshore. Depths of samples were determined in the field resulting from accessibility and obtaining samples representative of adequate quantities of sediment deposition within the water body (i.e., low coarse material content). Sediment collected with either the Eckman or shovel were composited within a Rubbermaid tote and samples placed in laboratory supplied jars/bags;
- *In situ* surface water quality measurements were determined using with a YSI ProDSS Multimeter or YSI EXO Multimeter, both of which record sample depth, specific conductivity, electrical conductivity, pH, temperature, dissolved oxygen, salinity, Total Dissolved Solids (TDS) and turbidity of the source water;
- Water transparency within the reservoirs was recorded by measuring the depth of visibility of a Secchi disk;
- Where possible, laboratory analyte bottles were filled directly from the water source and/or tube sampling port to minimize cross contamination of samples collected at each station (i.e., surface water). Where additional handling was required, a new 1 L plastic bottle (i.e., routine sample bottle) was filled from the source, and sample water was decanted into other laboratory analysis bottles or filters. Depth profile samples were collected by weighing tubing down to the required depth by use of buoy and weight. The introduction of the diaphragm pump collection method made direct filling of each laboratory analyte bottle possible without

additional handling, including deep-water sample collection. The methodology for collecting depth profile measurements was developed in consultation with BC Hydro and with reference to the British Columbia Field Sampling Manual (BC MOE 2013);

- Decontamination of tubing was completed at each site by running source water through the tubing for a minimum of 10 minutes prior to sampling. When grab sampling was required, decontamination of sampling equipment between monitoring locations was completed by triple rinsing field sample collecting equipment;
- The use of clean, new nitrile gloves and filters at each new monitoring location during all water sampling;
- Required preservatives were added into the sample containers (e.g., dissolved metals and total metals – nitric acid, dissolved and total nutrients – sulfuric acid, dissolved and total mercury – hydrochloric acid);
- Dissolved parameters were filtered in the field using new high capacity Waterra filters and then were field preserved after filtration;
- The sample ID, date and location on container label were recorded using water resistant labelling;
- One blind duplicate sample was submitted per every 10 ambient samples submitted;
- One trip blank and one field blank were submitted per sampling period, unless otherwise noted;
- Samples were stored in a cooler with ice packs to lower temperature and maintain them below 4°C;
- All field activities were recorded on formatted field data sheets concurrently with ongoing field activities and supported by GPS referencing at each monitoring station;
- Chain-of-custody forms including analytical selection were completed for the samples. The analytical testing for the 2018 monitoring Program is derived from the British Columbia Approved and Working Water Quality Guidelines (BC MOE 2017 and 2018); and
- Samples were delivered to the ALS Environmental laboratory depot in Fort St. John, BC.

Tables 1 and 2 in the Appendix summarize selected parameters from the program; the list is based on sampled parameters represented by available BC Water Quality Guidelines (BC WQG), subsequently discussed within the Results (Section 4.0). Note that the BC WQG does not include guidelines for all parameters included in the program (BC MOE 2018).

Field parameter measurements and laboratory analytical results have been compiled in Tables 3 to 11 in the Appendix; Laboratory Certificates of Analysis are included in Appendix B. Table 2-1 summarizes parameters sampled and collection periods for the program.

Table 2-1. Laboratory Analyzed Parameters and Sampling Collection Periods

Parameters Sampled	Sampling Period					
	May 8 to 11, 2018	June 18 to 23, 2018	July 16 to 19, 2018	July 30 to August 2, 2018	September 10 to 13, 2018	October 17 to 20, 2018
Surface Water Parameters Sampled: Colour, alkalinity, pH, total dissolved solids, total suspended solids, dissolved organic carbon, total organic carbon, ammonia, nitrate, nitrite, total Kjeldahl nitrogen, total nitrogen, total phosphorus, total dissolved phosphorus, soluble reactive phosphorus	All Stations	All Stations	All Stations	All Stations	All Stations	All Stations
Surface Water Parameters Sampled: Major ions (calcium, magnesium, potassium, sodium), total and dissolved metals and metalloids (aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, methylmercury, molybdenum, nickel, selenium, silver, thallium, tin, titanium, uranium, vanadium, and zinc)	All Stations					All Stations
Surface Water Parameters Sampled: Low-level analysis of total and dissolved forms of mercury and methylmercury	All Stations					All Stations
Surface Water Parameters Sampled: Chlorophyll a	W1 and D1 (Deep and Shallow)	W1 and D1 (Deep and Shallow)	W1 and D1 (Deep and Shallow)	W1 and D1 (Deep and Shallow)	W1 and D1 (Deep and Shallow)	W1 and D1 (Deep and Shallow)
Sediment Parameters Sampled: Particle size, nutrients, and total metals (aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, tin, titanium, uranium, vanadium, and zinc)						All Stations



2.2 Boxplot Analysis Methods

Boxplots, constructed using Microsoft Excel 2016 (attached Figures 3a to 3e), were used to graphically depict the water quality data. In consultation with BC Hydro, five of the 19 parameters were selected for plotting: total nitrogen, total phosphorus, total organic carbon (TOC), total iron and chlorophyll *a*. A total of 19 sites were divided into five groups based on location (Table 2-2):

Table 2-2: Included Sites for Boxplot Representation

Reservoir	Peace River		Tributaries	
	Upstream of Dam	Downstream of Dam	Upstream of Dam	Downstream or Dam
Williston Deep (W1-Deep)	Peace Canyon Dam (PC1)	Peace at Pine (PD1)	Halfway River-Downstream (HD)	Pine River (PINE)
Williston Shallow (W1-Shallow)	Peace 1: Site C Reservoir (PR1)	Peace at Beatton (PD2)	Moberly River – Downstream (MD)	Beatton River (BEA)
Dinosaur Deep (D1-Deep)	Peace 2: Middle Site C Reservoir (PR2)	Peace at Kiskatinaw (PD3)		Kiskatinaw River (KR)
Dinosaur Shallow (D1-Shallow)	Peace 3: Lower Site C Reservoir (PR3)	Peace at Pouce Coupe (PD4)		Pouce Coupe River (POUCE)
		Peace at Many Islands (PD5)		

Data from each group were divided into Pre-Construction phase (July 27, 2015 and earlier) and Construction phase (after July 27, 2015). Where available, data for sampling conducted between May and October were included for each phase, where results from each month are referred to as “periods”.

The following data sets were plotted:

- Pre-Construction phase:
 - Data collected in 2007, 2008, 2010, 2011 and 2015 sourced from: “Site C Clean Energy Project Environmental Impact Statement Technical Appendix: Water Quality Baseline Conditions in the Peace River Volume 2, Appendix E” (Golder 2012).
- Construction phase:
 - Data collected in 2016 sourced from: “Peace River and Site C Reservoir 2016 Water and Sediment Quality Monitoring Programs” (SEES JV 2017);
 - Data collected in 2017 sourced from: “Peace River Water Quality in the Vicinity of the Confluence with the Moberly River – Seasonal Trends in Metals that have British Columbia Water Quality Guidelines for the Protection of Aquatic Life” (Ecofish 2017);
 - Data collected in 2017 sourced from: “Peace River and Site C Reservoir 2017 Water and Sediment Quality Monitoring Programs” (SEES JV 2018); and
 - SEES JV’s 2018 water quality data.



3.0 REGULATORY GUIDELINES

“The British Columbia Water Quality Guidelines (WQG) provide policy direction to those making decisions affecting water quality. Although WQGs do not have any direct legal standing, once approved, WQGs must be considered in any decision affecting water quality made within the British Columbia Ministry of Environment (BC MOE). WQGs are used to assess water quality and may be used as the basis for determining the allowable limits in waste discharge authorizations. Exceeding a WQG does not imply that unacceptable risk exists, but rather that the potential for adverse effects may be increased and additional investigation may be required” (BC MOE 2018).

Table 3-1 describes the application of the regulatory guidelines used in comparison with the Program data.

Table 3-1. Application of Regulatory Guidelines within the Program

Regulatory Guideline	Monitoring Program Results Guidelines were Compared With	Rationale for Use
British Columbia Approved Water Quality Guidelines (BC AWQG), for freshwater aquatic life and short-term maximums (BC MOE 2018)	All surface water quality results	The overall guidelines were developed to represent safe levels of substances that protect different water uses, including: drinking water, recreation, aquatic life, wildlife, and agriculture. Short-term maximum or “acute” guidelines are set to protect against severe effects such as lethality or other equivalents to the most sensitive species and life stage over a defined short-term exposure period (BC MOE 2018). The requirement for applying long-term average guidelines is that five samples are collected at a station over a 30-day period.
British Columbia Working Water Quality Guidelines (BC WWQG; BC MOE 2017)	No application to surface water quality results	The BC WWQG were reviewed and determined not to be applicable for water quality parameters based on the sampling frequency selected (e.g., sampled parameters were presented as long-term averages within the guidelines, which do not apply to monitoring Program sampling frequency).
British Columbia Working Water Quality Guidelines (BC WWQG; BC MOE 2017)	Sediment quality results	The sediment quality results were compared to the BC WWQG because approved guidelines for sediment quality are not available. The BC WWQG for sediment quality parameters are applied using lower and upper surface water quality guidelines (SWQG). The Lower SWQG is based on “a concentration set to protect aquatic life from adverse effects of a toxic substance in most situations and is equivalent to the Canadian Council of Ministers of the Environment’s (CCME) Threshold Effect Level or Interim Sediment Quality Guidelines (TEL or ISQGs; CCME 2001a)”. The Upper SWQGs is based on “a concentration that if exceeded will likely cause severe effects on aquatic life (equivalent to CCME’s Probable Effect Level (PEL; CCME 2001a)”. As the guidelines are considered a working document, caution in applying the guidelines should be exercised. The sediment quality guidelines within the BC WWQG are based on levels of toxic substances found in the sediment where biological effects have been measured and are not based on cause-effect studies (BC MOE 2017).



Guidelines determined to be applicable to the analyzed parameters were compiled from the BC AWQG and BC WWQG and are presented in Tables 1 and 2. Guidelines for cadmium, copper, fluoride, lead, manganese, silver, and zinc are provided, where applicable, in Tables 3 to 11 as a referenced equation, which vary with hardness, pH, and temperature. Parameter-specific equations used to calculate the applicable guideline values are provided in the notes of the tables.

4.0 RESULTS

Results, both *in situ* and laboratory, were compared among the sampling periods and among stations (from upstream to downstream reaches). The objective of plotting the data was to start to identify differences and parameter concentrations that differ from guidelines.

Water quality results are presented in Tables 3 to 11 and Appendix B (laboratory reports), attached to this report, and include the following for each sampling location:

- Field parameter measurements and field observations;
- Laboratory analytical results for each sample submitted, including duplicate, trip blank, and field blank analysis; and
- Exceedances of the BC AWQG and BC WWQG are bolded and shaded in grey.

The GPS coordinates of each station are provided in Figures 2a and 2b. Photographs of the stations (Photos 1 to 17) are presented within the Photograph section of this report.

4.1 Williston and Dinosaur Reservoirs Water and Sediment Quality Results

Four reference stations were selected to monitor water flowing into the Site C reach from Dinosaur and Williston reservoirs.

Reference Station Sample IDs:

- Williston (W1) – Deep and Shallow; and
- Dinosaur (D1) – Deep and Shallow.

Sediment quality samples were collected for D1 and W1 within the near-shore littoral zones near the water sample locations to collect samples with a high fine to coarse material ratio. Particle size analysis of each sample determined that Dinosaur Reservoir and Williston Reservoir sediment were both classified as silt loam (Table 5; Appendix B).

Reservoir depth profiles for W1 and D1 are provided in Tables 3 and 4; reservoir sediment quality results for W1 and D1 are presented in Table 5. Surface water quality results for both W1 and D1 (Shallow and Deep samples) are presented monthly in Tables 6 to 11; all are located in the Appendix.

Throughout the sampling periods, field measured dissolved oxygen, electrical conductivity and specific electrical conductivity remained generally stable within both W1 and D1; dissolved oxygen levels decreased slightly throughout the sampling periods but remained within guidelines and supportive of aquatic life. Field measured water temperatures generally increased then decreased with the seasonal changes from May to October; surface temperatures exceeded BC AWQG in June, July and August at D1 and throughout the water column (to the measured depth of 5 m) in July and August at W1. Throughout the water column, temperatures generally decreased with depth in the summer months, however a distinct hypolimnion was not identified as there was no clear stratification observed within the top 5 m at any time. Within the Williston Reservoir, the thermocline would

likely have existed below a depth of 5 m during the months of July and August. Measurements collected in June, July and August were the most elevated temperatures recorded over the course of each sampling period (Tables 3 and 4). In the spring and fall months (May, September and October), the water column in both reservoirs was uniformly mixed with consistent temperatures existing throughout the upper 5 m of the reservoirs.

The pH values remained within guidelines throughout the water column measurements of both reservoirs over the course of each sampling period. Laboratory-analyzed pH is considered secondary to field-measured pH by a calibrated instrument due to the exceeded hold times (15 minutes) of all laboratory analyzed pH values. Hardness concentrations ranged from 86.7 mg/L to 94.0 mg/L for samples collected in May and October, which is considered moderately soft/hard to hard water (ESRD 2018; Tables 6 and 11).

Colour, TSS, TDS, and turbidity were moderate to low throughout the dataset and over each sampling period, except for D1, where colour, TSS and turbidity levels during the May and August sampling periods were elevated (Tables 6 to 11). The increase in May was likely from the operation of W.A.C Bennett Dam and Peace Canyon Dam and the management of water levels during spring runoff conditions; however, the increase in August is unknown. Secchi depths ranged from 0.75 m to 7.5 m below surface for D1 and 3.5 m to 7.5 m for W1 (Tables 3 and 4).

Since the BC AWQG for turbidity and TSS rely on daily sample collection over a 30-day period (for long-term average guideline) or the use of automated data collection over a 24-hour period (short-term maximum guideline), the individual samples collected in 2018 were not compared to guidelines.

Anions and nutrients analyzed within the lentic (reservoir) dataset did not exceed available guidelines. TOC concentrations were within normal range (1 mg/L to 30 mg/L) for natural waterbodies (BC MELP 1998). Boxplots showed that median TOC concentrations measured in the reservoirs during the Construction phase are generally highest in May but are stable throughout the sampling period (Figure 3e). In some instances, dissolved organic carbon (DOC) concentrations were found to exceed the TOC concentration, which was attributed to the use of polyethersulfone based filters and is discussed within Section 5.0 (Discussion) of this report (Tables 6 to 11).

Two nutrients were plotted – nitrogen and phosphorus (Figures 3c and 3d). Median concentrations of both nitrogen and phosphorus within the reservoirs were similar throughout all periods in the Construction phase. Median concentrations observed in May were slightly higher and had a greater range of values. Nitrogen and phosphorus concentrations in the Pre-Construction phase were, however, dissimilar. Median concentrations of nitrogen in the Pre-Construction phase were more variable across the periods and showed a wide range of values (greater distance between minimum and maximum concentrations) compared to the Construction phase. In contrast, Pre-Construction median concentrations of phosphorus were similar across the periods and were comparable to the Construction phase.

Chlorophyll *a* was included as a parameter for plotting since it is commonly used as an indicator of algae abundance and productivity in aquatic environments (Figure 3a). Median concentrations of Chlorophyll *a* within the reservoirs generally increased between May and October, though not dramatically. Chlorophyll *a* concentrations are commonly highest during the warm, sunny summer months, however, in the case of this dataset, September and October had the highest median concentrations.

Total and dissolved metals and metalloid analysis for water quality was conducted for May and October sampling periods only. No exceedances of guidelines were observed within the lentic dataset for metals or metalloid parameters, except for dissolved aluminum at D1 shallow and deep in May (Tables 6 and 11). Boxplots of iron in the reservoirs during the Construction phase show that median concentrations are highest in May – likely the result of spring freshet – then very low (less than 0.1 mg/L) in the fall (Figure 3b). Pre-Construction phase median concentrations were more stable, with a slight peak in August.

All samples analyzed for ultra-low-level detection of mercury and methylmercury resulted in concentrations either below or within an order of magnitude of detection limits (Tables 6 and 11).

Other than dissolved aluminum and temperature readings which occasionally exceeded the BC WQG, no other exceedances of the guidelines were observed within the datasets (Tables 6 to 11).

Sediment anions and nutrient levels were considered moderately low and close to detection limits, and pH was within a normal range. W1 exceeded the Lower SWQG guidelines for cadmium and nickel; D1 exceeded the Lower SWQG guidelines for arsenic, cadmium, and nickel. No metal concentrations within sediments collected from either reservoir exceeded the Upper SWQC (Table 5).

Other than the metals exceedances stated, no other exceedances of the BC WWQG were observed in 2018.

4.2 Peace River Water Quality Results: Site C Reservoir

The Mon-8 study area includes monthly monitoring from May to October at eight stations within the Site C Reach, defined as the portion of the Peace River that will be inundated by the Project and includes the Peace River from the Peace Canyon Dam downstream to the Site C Dam, and those sections of the Halfway and Moberly rivers that will be inundated following reservoir creation (approximately 10 km sections).

Site C Reservoir Station IDs:

- Peace Canyon (PC1);
- Upper Site C Reservoir (PR1);
- Middle Site C Reservoir (PR2);
- Halfway River Upstream (HU) and Downstream (HD);
- Lower Site C Reservoir (PR3); and
- Moberly River Upstream (MU) and Downstream (MD).

Following the 2016 field season, we determined that HU and MU would not be sampled until reservoir inundation due to access restrictions related to turbulent water conditions carrying large debris (i.e., safety hazard) or low water levels making the river impassable by boat. Following reservoir filling, HU and MU will be incorporated into the program again.

PC1 is considered the most upstream sample location and PR3 and MD (tributary) are considered the most downstream sample locations within the future Site C Reservoir. Samples were collected from designated stations relating to the sample names. Peace River samples were collected from mid-channel flow locations, isolating source water considered to be well mixed within the Peace River. Tributary river samples were collected upstream of the Peace River confluence to isolate mid-channel flow source prior to it mixing with the main Peace River channel.

All parameters analyzed were within the BC AWQG guidelines for the samples collected during 2018 except for intermittent exceedances above the guideline for total arsenic, total copper, total and dissolved iron and dissolved aluminum. During the June, July and August sampling periods, temperature readings were elevated above the BC AWQG for the tributaries as well as at PR2 in July. During the June sampling period, pH was elevated above the BC AWQG for PC 1 (Tables 6 to 11).

Intermittent samples analyzed throughout the May and October sampling periods exceeded the BC AWQG for total iron (Tables 6 and 11). Intermittent samples analyzed throughout the May sampling period exceeded the BC AWQG to dissolved iron (Table 6). Iron is a naturally occurring element due to the weathering of rocks and minerals but has also been associated with acidic mine water drainage, landfill leachates, sewage effluents and iron-related industries (Health Canada 1978).

All samples collected in May, except of PC1, exceeded the BC AWQG for dissolved aluminum (Table 6). Aluminum is a naturally occurring element due to erosion of watershed areas and is also used as a coagulant in drinking water treatment facilities (BC MOEAP 1988).

The HD and MD samples collected in May exceeded the BC AWQG for total copper (Table 6). Copper is a naturally occurring element due to the weathering of rocks and minerals (BC MOEAP 1987).

The HD and MD samples collected in May exceeded the BC AWQG for total arsenic (Table 6). Arsenic is a naturally occurring element entering surface waters from weathered rocks and soils. Smelting and refining are industry related sources of arsenic (CCME 2001b).

Field measurements of temperature from MD and HD in June through August indicated levels exceeding the BC AWQG (Tables 7 to 9). In addition, field measurement of temperature from PR2 in July indicated an exceedance of the BC AWQG (Table 8). Overall, the temperatures measured within tributaries were found to be higher than that of the Peace River, except for the October sampling period when temperatures within the tributaries were slightly lower relative to Peace River values.

The pH values remained within guidelines in 2018, except for an exceedance of 9.19 at PC1 during the June sampling period. Other than the one exceedance, the range of field measured pH values was 7.95 to 8.59 over the sampling periods. Laboratory-analyzed pH is considered secondary to field-measured pH by a calibrated instrument due to the exceeded hold times (15 minutes) of all laboratory-analyzed pH values (Tables 6 to 11).

TSS, TDS, and turbidity were consistent throughout the dataset and over each sample period, with elevated concentrations observed within the tributaries (HD and MD) as well as for all samples collected in May. These parameters were not compared against BC WQG, as short-term maximum guidelines were not provided in the guidelines (Tables 6 to 11).

Anions and nutrients analyzed within the dataset did not exceed the BC AWQG, however results for the tributary source waters were generally observed to be elevated relative to the Peace River samples. TOC concentrations were within normal range (1 mg/L to 30 mg/L) for natural waterbodies, except for the MD sample collected during the May sampling period, which was 45.5 mg/L (BC MELP 1998; Tables 6 to 11).

For both Tributaries Upstream and Peace River Upstream sites, median TOC concentrations were highest in May in both the Pre-Construction and Construction phases, likely the result of spring freshet (Figure 3e). Throughout the rest of the sampling periods, median TOC concentrations were reasonably consistent in both the Pre-Construction and Construction phases. However, the concentrations measured in the Peace River Upstream sites were much lower than those measured in the Tributaries.

DOC concentrations were occasionally found to exceed the TOC concentration, which was likely attributable to the use of polyethersulfone based filters and is discussed further within Section 5 of this report.

Median nitrogen and phosphorus concentrations were fairly consistent throughout all sampling periods in both the Pre-Construction and Construction phases for the Peace River Upstream sites (Figures 3c and 3d). For the Tributaries Upstream sites, median concentrations of nitrogen and phosphorus showed a generally decreasing trend through the periods (i.e., May to October) for both the Pre-Construction and Construction phases. Median



concentrations were highest during the spring freshet (May) and quickly decreased in subsequent sampling periods where they stabilized at very low concentrations.

For the Construction phase, median concentrations of nitrogen were slightly higher in the Tributary sites compared to the Peace River sites. Median concentrations of phosphorus, however, were approximately 8 times higher in the Peace River sites compared to the Tributary sites.

Pre-Construction phase median concentrations of Chlorophyll *a* were fairly consistent throughout all sampling periods in both Peace River and Tributary Upstream sites (Figure 3a). Construction phase sampling is more limited, with samples collected in only May and June. During this time, the median concentration increased from May to June at both Peace River and Tributary sites.

Hardness within the tributary source waters was generally higher than that of the Peace River; hardness varied between 83.8 mg/L to 216.0 mg/L for samples collected during the May and October sampling periods, which ranged from moderately soft/hard to hard to very hard water (ESRD 2018; Tables 6 and 11).

All samples analyzed for ultra-low-level detection of mercury and methylmercury resulted in concentrations either below or within an order of magnitude of detection limits (Tables 6 and 11).

Other than total arsenic, total copper, total and dissolved iron, dissolved aluminum, temperature and pH exceeding the BC AWQG, no other exceedances of the guidelines were observed within the datasets.

Median concentrations of iron in both the Peace River and Tributaries sites showed a generally decreasing trend for both the Pre-Construction and Construction phases from May to October (Figure 3b). The decreasing trend was more distinct during the Construction phase. For the data collected in May during the Construction phase, the median iron concentration exceeded the BC AWQG guidelines of 1 mg/L; subsequent periods were generally below the BC AWQG guideline.

Sediment quality samples were collected for all Site C Reservoir samples within the near-shore littoral zones near the water sample locations to collect samples with a high fine to moderately coarse material. Particle size analysis of each sample determined that sediment varied between silt loam, sandy loam and loamy sand soil textures (Table 5; Appendix B).

Sediment anions and nutrient levels were considered moderately low and close to detection limits, except for ammonium at PR3 which was slightly elevated. pH was within a normal range for all samples. The BC WWQG Lower SWQG were exceeded for arsenic (PC1, PR1, PR2, HD, PR3 and MD), cadmium (PR1, PR2 and PR3), iron (PC1 and HD) and nickel (PC1, PR1, PR2, HD, PR3 and MD). No metal concentrations within sediments collected from the Site C reach exceeded the Upper SWQC (Table 5).

Other than the metals exceedances stated, no other exceedances of the BC WWQG were observed within the datasets.

4.3 Peace River Water Quality Results: Downstream Reach

The Mon-9 study area includes monthly monitoring from May to October of nine stations within the Peace River from the Site C Dam downstream to the Many Islands area in Alberta, approximately 120 km.

Downstream Reach Station IDs:

- Peace at Pine (PD1);
- Pine River (PINE);

- Peace at Beatton (PD2);
- Beatton River (BEA);
- Peace at Kiskatinaw River (PD3);
- Kiskatinaw River (KR);
- Peace at Pouce Coupe (PD4);
- Pouce Coupe (POUCE); and
- Peace at Many Islands (PD5).

PD1 is considered the most upstream sample location and PD5 is considered the most downstream sample location within the downstream reach dataset. Samples were collected from designated stations relating to the sample names. Peace River samples were collected from mid-channel flow locations, isolating source water considered to be well mixed within the Peace River. Tributary river samples were collected upstream of the Peace River confluence to isolate mid-channel flow source prior to it mixing with the main Peace River channel.

All parameters analyzed met the BC AWQG for the samples collected in 2018 except for intermittent exceedances above the guideline for total and dissolved iron, total silver, total zinc and dissolved aluminum. Total arsenic, total copper and total iron exceeded the BC AWQG at all stations in May. During the June, July and August sampling periods, temperature readings were elevated above the BC AWQG for all stations, except for PD1 in June, PD1 and PD5 in July and PD1 and PD2 in August (Tables 7 to 9).

All samples collected in the May sampling period exceeded the BC AWQG for total iron, while only total iron at BEA and KR exceeded the BC AWQG during the October sampling period. Samples collected in May (PD1, PINE, PD2 and BEA) and in October (BEA and KR) also exceeded the BC AWQG for dissolved iron (Tables 6 and 11).

Median concentrations of iron in both the Peace River and Tributaries Downstream sites showed a generally decreasing trend from May to October for both the Pre-Construction and Construction phases (Figure 3b). Most median iron concentrations in both the Pre-Construction and Construction phases exceeded the BC AWQG guideline of 1 mg/L.

The PD1, PINE, PD2 and BEA samples collected in May and the BEA and KR samples collected in October exceeded the BC AWQG for dissolved aluminum (Tables 6 and 11).

All samples collected in May exceeded the BC AWQG for total copper (Table 6).

All samples collected in May, except PD1, PINE, PD2 and BEA, exceeded the BC AWQG for total zinc (Table 6). Zinc is a naturally occurring element; however, is also related to industrial and domestic emissions (Health Canada 1987).

All samples collected in May, except PD1, PINE, PD2 and PD3, exceeded the BC AWQG for total silver (Table 6). Silver naturally occurs in the environment in low concentrations except in and near mineral deposits. Extraction, manufacture, use and disposal are other related sources of silver (CCME 2015).

All samples collected in May, except PD1, exceeded the BC AWQG for total arsenic (Table 6).

Field measurements of temperature in June through August indicated levels exceeding the BC AWQG for all stations except for PD1 in June, PD1 and PD5 in July and PD1 and PD2 in August (Tables 7 to 9). Overall, the temperatures measured in the tributaries were generally found to be higher than that of the Peace River, except

for the September and October sampling periods when temperatures within the tributaries were generally slightly lower relative to the Peace River.

The pH values remained within guidelines throughout the dataset and sampling period. The range of field-measured pH values was 7.75 to 8.81 over the sampling period. Laboratory-analyzed pH is considered secondary to field-measured pH by a calibrated instrument due to the exceeded hold times (15 minutes) of all laboratory-analyzed pH values (Tables 6 to 11).

TSS, TDS, and turbidity were generally consistent throughout the dataset and over each sample period, with elevated concentrations generally observed within the tributaries (PINE, BEA, KR and POUCE) compared to the Peace River samples. Measurements and concentrations observed in May during higher spring flows were generally higher than other sampling periods in the program (Tables 6 to 11). These parameters were not compared against BC WQG, as short-term maximum guidelines were not provided in the guidelines.

Anions and nutrients analyzed within the dataset did not exceed the BC AWQG, however results for the tributary source waters were generally observed to be elevated relative to the Peace River samples. TOC concentrations were within normal range (1 mg/L to 30 mg/L) for natural waterbodies, except for the BEA, KR, POUCE and PD5 samples collected during the May sampling period and the KR and POUCE samples collected during the August sampling period (BC MELP 1998; Tables 6 to 11). DOC concentrations were occasionally found to exceed the TOC concentration, which was likely attributable to the use of polyethersulfone based filters and is discussed further within Section 5.0 of this report.

During the Construction phase, median TOC concentrations in the Peace River Downstream sites were highest in May (approximately 4 times higher) then quickly decreased and stabilized over the subsequent periods (i.e., June to October) (Figure 3e). At the Tributaries Downstream sites, the median TOC concentrations showed a similar pattern, though the May concentrations were only approximately twice as high as the other subsequent periods.

Median concentrations of nitrogen showed a decreasing trend through the periods for the Peace River Downstream sites in both the Pre-Construction and Construction phases (Figure 3c). The Tributaries Downstream sites had fairly consistent median concentrations of nitrogen during all periods of the Construction phase; whereas during the Pre-Construction phase, May concentrations were almost double the other periods, which were all similar.

At both the Peace River and Tributaries Downstream sites in both phases, median concentrations of phosphorus were highest during the spring freshet (May) and decreased in subsequent sampling periods where they stabilized at very low concentrations (Figure 3d).

Median Chlorophyll concentrations during the Pre-Construction phase were only available for Peace River Downstream sites (i.e., no Chlorophyll *a* data were collected at Tributaries Downstream sites in the Pre-Construction phase). For this phase, Chlorophyll *a* was relatively stable, with a slight increase in October (Figure 3a). During the Construction phase, Chlorophyll *a* was sampled only in May and June where it showed an increasing trend between the two months.

Hardness within the tributary source waters was generally lower than that of the Peace River during the May sampling period and generally higher than that of the Peace River during the October sampling period. Hardness varied between 57.6 mg/L to 364.0 mg/L for samples collected during the May and October sampling periods, which ranged from soft to moderately soft to very hard water (ESRD 2018; Tables 6 and 11).

All samples analyzed for ultra-low-level detection of mercury and methylmercury resulted in concentrations either below or within an order of magnitude of detection limits (Tables 6 and 11).

Other than intermittent exceedances above the BC AWQG for temperature, total and dissolved iron, total silver, total zinc and dissolved aluminum; regular exceedances above the BC AWQG of total arsenic in May; and all stations exceeding the BC AWQG for total copper and total iron in May, no other exceedances of the guidelines were observed within the datasets.

Sediment quality samples were collected for all downstream reach samples within the near-shore littoral zones near the water sample locations to collect samples with a high fine to moderately coarse material ratio. Particle size analysis of each sample determined that sediment varied between silt loam, loam, sandy loam, loamy sand and sand soil textures (Table 5; Appendix B).

Sediment anions and nutrient levels were considered moderately low and close to detection limits, except for ammonium at PD1 and PD3 which were slightly elevated. pH was within a normal range for all samples. All samples exceeded the BC WWQG Lower SWQG for arsenic and nickel; PD1, BEA and KR exceeded the BC WWQG for cadmium; and PINE, BEA and POUCE exceeded the BC WWQG for iron. All sediment samples collected from the Downstream Reach were within the BC WWQG Upper SWQG except for arsenic at BEA which slightly exceeded the guideline (Table 5).

Other than the metals exceedances stated, no other exceedances of the BC WWQG were observed within the datasets.

4.4 Quality Assurance and Quality Control

The quality assurance and quality control (QA/QC) programs for water and sediment quality sampling are implemented to assess and/or quantify field, laboratory and data reduction quality.

Laboratory QA/QC reports are required by environmental laboratories accredited by the Canadian Association of Environmental Analytical Laboratories (CAELA), such as ALS Environmental, and can be requested to be attached to the laboratory data or requested from the lab directly. Laboratory QA/QC data reviewed by the assessor is generally limited to percentage recovery of added surrogates. The reported detection limits (RDL) of the analytical methods are presented on the analytical reports and in Tables 12 to 14.

Field quality control includes procedures and documentation, and occasionally collection of quality assurance samples. Field quality assurance sampling programs are used to measure the precision and accuracy of the field sampling using blank and duplicate samples.

The field sampling and laboratory testing reproducibility of the sample-duplicate pairs is evaluated using the relative percentage difference (RPD) method, involving calculation of RPD as follows:

$$\text{RPD \%} = [\text{Sample} - \text{Duplicate}] / (X) * 100$$

where X is the average concentration of the sample and its duplicate.

The duplicate analysis is compared to the sample by evaluating the RPD, where the target RPD is less than a 20% difference for water and less than a 30% difference for sediment. RPD is calculated for results that are higher than five times the reported detection limit. Results of RPD analysis are presented in Tables 12 and 13. Approximately 3% of all water quality duplicates were found to generate an exceedance of 20% RPD analysis. Approximately 22% of all sediment quality duplicates were found to generate an exceedance of 30% RPD analysis. The water quality exceedances were attributed to the following parameters: colour, TSS, TDS, carbonate as CaCO₃, total ammonia (as N), total phosphorus and total manganese. The sediment quality exceedances were attributed to soil textures, antimony, arsenic, barium, calcium, copper, lead, magnesium, potassium, strontium, titanium and zinc. Overall, 3% exceedance of water quality parameters is within an



acceptable quality control range. The exceedance of 22% sediment quality parameters is higher; however, sediments tend to be heterogeneous due to differential factors such as deposition from the water column and upstream sources, therefore, there is a higher potential for variability within sediments than in water.

Trip or travel blanks are deionized water sealed in a bottle provided by the laboratory and are introduced for travelling with the samples for the duration of the sampling period. Elevations above the reported detection limit may indicate laboratory or transit introduced errors outside of the field methodology. Table 14 indicates that there were no elevations above reported detection limits for any parameters during all sampling periods.

Field blanks are deionized water filled into bottles using the same field methodology applied to the analyzed dataset. All bottles and water are provided by the laboratory and are introduced for evaluating the field methodology and potential for analytical interference using equipment or sampling practices. Elevations above the reported detection limit may indicate field level introduced errors. Table 14 indicates elevations above reported detection limits for TDS, turbidity, total zinc and dissolved tin in May; turbidity in June; turbidity in July; turbidity in August; turbidity and total phosphorus in September; and total manganese and dissolved ultra-low-level methylmercury in October.

The pH value reported for each field and trip blank were below the normal range of 6.5 to 9.0 and considered acidic. This is attributed to the acidity of the deionized water and not sampling and analytical methodologies. An ALS representative confirmed that the laboratory supplied deionized water typically has a low pH value. In addition, pH has a limited hold time of 15 minutes, therefore field measured pH and not laboratory analyzed pH is interpreted for data analysis of samples collected. Note that field measured pH data was not collected for field and trip blanks.

5.0 DISCUSSION

The objectives of Mon-8 and Mon-9 in 2018 were to contribute to the FAHMFP by characterizing the surface water and sediment conditions within the Peace River and its tributaries as it relates to the Project.

5.1 Management Hypotheses

Mon-8 and Mon-9 were developed to monitor water and sediment quality in the Site C Reservoir and Peace River to address the fisheries management questions listed in the FAHMFP (see Section 1.0).

The management questions and hypotheses outlined in Section 1.0 will require several years of data collection before the questions can be definitively addressed. This report is the third year of data collection for these two monitoring programs under the FAHMFP.

5.2 Discussion of Results

Similar to that reported in 2017, DOC concentrations in 2018 continued to occasionally be elevated above TOC concentrations. DOC concentrations of field blank samples collected during all sampling periods were reported to all be below detection in field-filtered deionized water provided by the lab, which indicates field methodologies are not introducing cross contamination between samples. In the 2017 report it was discussed that *“in 2016, one potential source of organic carbon was attributed to the field filtration equipment. ALS Environmental confirmed that this is a known contributor of organic carbon to analytical samples, and therefore, the concentrations reported are not considered to be an indicator of high concentrations of source water DOC”*. In 2017, SEES JV implemented flushing of the field equipment with a goal to reduce the incidence of false positives for DOC. In 2018, SEES JV continued with this methodology. Although this still has not fully resolved the concern of organic carbon impacts from field equipment, improvements continue to be seen 2018. The TOC concentrations are

considered stable and mostly within natural levels for a lotic/lentic system with elevated background turbidity conditions (BC MELP 1998).

Overall, water quality parameters were consistently below the guidelines. During the May sampling period, regular exceedances of total arsenic, total copper, total iron and dissolved aluminum and intermittent exceedances of total silver, total zinc and dissolved iron were observed. During the October sampling period, intermittent exceedances of total and dissolved iron and dissolved aluminum were observed. During the June, July and August sampling periods, regular exceedances of temperature were observed and during the June sampling period one exceedance of pH was observed. Sediment quality parameters were consistently below the guidelines except for regular exceedances of arsenic and nickel and intermittent exceedances of cadmium and iron. Source(s) of the exceeded parameters could not be conclusively determined. Many Peace River tributaries are large systems characterized by high, vertical banks composed of fine materials which are subject to erosion during high flow periods. Given the location and parameters involved, it is possible that the exceedances are the result of natural processes (i.e., regional geology and erosion) and process error (i.e., natural variability among years).

5.3 Boxplots

The data are temporally limited between Pre-Construction and Construction phases, and among periods. Only four years of Pre-Construction and three years of Construction data are available and the number of sample points within each period is also limited and inconsistent (e.g., October may have 12 Construction sample points while July has none). Plotting these data may start to reveal spatial and temporal trends, however with limited data, we cannot draw meaningful inference from the results until more data are collected. Although the Pre-Construction dataset cannot be augmented, as future sampling occurs, the Construction dataset will become more robust.

5.4 Quality Assurance and Quality Control

The QA/QC programs for water and sediment quality sampling are implemented to assess and/or quantify field, laboratory and data reduction quality.

All elevations of field blank parameters above the RDL are likely attributed to residual water left in the sample tubing between samples. Sample tubing is rinsed for a minimum of 10 minutes prior to sampling and other field equipment (e.g., grab sampler) is triple rinsed between samples. Infrequent elevations do not indicate major error, however do suggest that additional flushing time and/or rinsing between samples is advised.

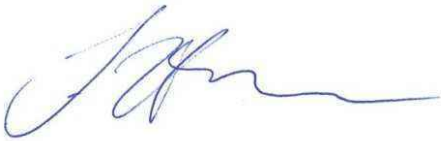
In general, the QA/QC program confirmed that most blank and duplicate parameter concentrations are within acceptable quality ranges, therefore the overall analytical program is considered to accurately characterize water and sediment quality conditions at the sample stations.



6.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Saulteau EBA Environmental Services Joint Venture



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TABLES

Table 1	Summary of Surface Water Quality Parameters Compared to BC Approved Water Quality Guidelines
Table 2	Summary of Sediment Quality Parameters Compared to BC Working Water Quality Guidelines
Table 3	Williston Reservoir Water Quality Depth Profile Summary
Table 4	Dinosaur Reservoir Water Quality Depth Profile Summary
Table 5	Summary of October Sediment Quality Results
Table 6	May 2018 Surface Water Quality Results Summary
Table 7	June 2018 Surface Water Quality Results Summary
Table 8	July 2018 Surface Water Quality Results Summary
Table 9	August 2018 Surface Water Quality Results Summary
Table 10	September 2018 Surface Water Quality Results Summary
Table 11	October 2018 Surface Water Quality Results Summary
Table 12	2018 Surface Water Quality Results Summary for Duplicate Analysis (May, June, July, August, September and October)
Table 13	October 2018 Sediment Quality Results Summary for Duplicate Analysis
Table 14	2018 Surface Water Quality Results Summary for Blank Analysis (May, June, July, August, September and October)
Table 15	Summary Statistics

Table 1: Summary of Surface Water Quality Parameters Compared to BC Approved Water Quality Guidelines

Parameters Represented within the BC Approved Water	Unit	Reported Detection Limit (RDL)	BC MOE 2018 (Approved Guidelines for freshwater aquatic life and short-term maximum)	Common Sources of Parameter
Physical Parameters and Field Measurements				
Temperature	°C	-	15	The temperature guideline is designed to protect aquatic life in fresh, estuarine and coastal marine waters from excessive temperature fluctuations that are influenced by anthropogenic activities during sensitive periods. Given the large variation in water temperatures throughout British Columbia due both to the geographical range of the province as well as the large differences in elevation, ambient temperatures are factored into the guidelines so that they adhere closely to the natural temperature regime to which sensitive organisms have adapted through evolutionary processes (BC MOE 2018). Deviation from the guideline value indicates variance of water temperatures outside of normal environmental conditions; natural variance outside of the normal range due to seasonal ambient temperature extremes may cause water temperatures to exceed guidelines and is reported accordingly.
Dissolved Oxygen (DO)	mg/L	-	Minimum 5 #1	Oxygen is the single most important component of surface water for self-purification processes and the maintenance of aquatic organisms which utilize aerobic respiration. The guideline value presented focuses on the effects of minimum oxygen levels on aquatic life. Dissolved oxygen is not a known concern for other water uses other than for some industries, where corrosion can be a concern (ESRD 2018).
Hardness as CaCO3	mg/L	0.5		The hardness of water is generally due to the presence of calcium and magnesium in the water; the main natural sources of hardness in water are sedimentary rocks and runoff from soils (Health Canada 1979a). The BC AWQG established for several water quality parameters, such as total copper, lead and zinc are hardness dependent. The toxicity of metals such as copper, lead and zinc can be reduced as hardness increases (BC MELP 1998). Water hardness varies from soft to hard water conditions based on the following scale: very soft water(0 - 30); soft to moderately soft (31 - 75 mg/L); moderately soft/hard to hard (76 - 180 mg/L); very hard (181 - 250 mg/L) (ESRD, 2014).
pH	pH Units	-	6.5-9.0	The pH of water is determined by the geology of the watershed and is influenced by the seasonal and daily variations in photosynthesis, respiration and decomposition (Sanderson et al, 2012). pH is an important water quality parameter as it affects the solubility and bioavailability of some nutrients and metals. For example, heavy metals tend to be more toxic in water with lower pH because they are more soluble (Michaud 1991 in Sanderson et al 2012, page 92). Laboratory analyzed pH is considered secondary to field measured pH by a calibrated instrument due to the exceeded hold times (15 minutes) of all laboratory analyzed pH values.
Anions and Nutrients				
Ammonia as N	mg/L	0.005	See narrative #2	Naturally occurring; released from agricultural or industrial wastes; added as part of chloramination for drinking water disinfection (Health Canada 2017)
Chloride	mg/L	0.5	600	Naturally occurring (seawater intrusion); dissolved salt deposits, highway salt, industrial effluents, oil well operations, sewage, irrigation drainage, refuse leachates (Health Canada 2017).
Fluoride	mg/L	0.02	See equation #3	Naturally occurring (rock and soil erosion); may be added drinking water sources to promote dental health and subsequently present within anthropogenic effluents discharged into surface waters (Health Canada 2017).
Nitrate (as N)	mg/L	0.005	32.8	Naturally occurring; leaching or runoff from agricultural fertilizer use, manure and domestic sewage; may be produced from excess ammonia or nitrification in the distribution system (Health Canada 2017).
Nitrite (as N)	mg/L	0.001	0.06-0.60 #4	Naturally occurring; leaching or runoff from agricultural fertilizer use, manure and domestic sewage; may be produced from excess ammonia or nitrification in the distribution system (Health Canada 2017).
Total Metals				
Arsenic	µg/L	0.0005	0.005	Arsenic is a natural component of the earth's crust and is widely distributed throughout the environment in the air, water and land (WHO 2016). It Arsenic occurs naturally as a result of weathering of rock and soil. Levels of arsenic in natural source waters ranges between 2 and 50 µg/L (CCME 2001b). Arsenic is highly toxic in its inorganic form and long-term exposure can cause considerable health issues in humans.
Cobalt	mg/L	0.0003	0.11	
Copper	mg/L	0.001	See equation #5	Copper is a natural constituent of most rock types, with igneous rock containing the highest concentrations, followed by sedimentary rocks such as shale, sandstone and limestone (BC MOEAP 1987b). Bertine and Goldberg (1971, in BC MOEAP 1987b, page 6) estimated that 40 to 67% of total copper inputs are the result of natural weathering. Copper is acutely toxic to most forms of aquatic life at relatively low concentrations but is generally found in freshwater at trace concentrations ranging from 1- to 10 µg/L (BC MELP 1998), but can be as high as 50 µg/L (CCREM 1987). The toxicity of copper is highly influenced by water hardness, increasing with decreased hardness. The BC AWQG for copper is hardness dependent (calculated as is calculated as 0.094(H)+2).
Iron	mg/L	0.03	1	Iron is a common element and is occurs naturally through weathering of sulphide ores and leaching of sandstones (CCREM 1987). Iron can be a significant constituent of soils, especially clays (Phippen et al 2008). Anthropogenic sources are often related to mining. It is a requirement for all lifeforms but can be toxic at high concentrations. The concentrations of iron in Canadian surface waters are generally below 10 mg/L (Health Canada 1978). The BC AWQG for total iron is 1 mg/L, the Health Canada aesthetic objective for iron in drinking water is ≤ 0.3 mg/L (Health Canada 1978).
Lead	mg/L	0.0005	See equation #6	Lead has been observed in natural waters ranging from trace levels up to 40 µg/L, in both the soluble and particulate forms (McNeely et al. 1979 in Sanderson et al 2012, page 174), and in regions with sulphide ores in the underlying geology, concentrations can reach 0.8 mg/L (BC MELP 1998). The toxicity of lead is dependent on the hardness, pH, alkalinity, and dissolved oxygen content of the water; toxicity increases as hardness decreases (CCREM 1987). The BC AWQG for total lead is hardness dependent (calculated as 3 µg/L at H=8 mg/L, or calculated as e ^{(1.273*ln(H)-1.460)} when H>8 mg/L).
Manganese	mg/L	0.0001	See equation #7	Naturally occurring (erosion and weathering of rocks and minerals; Health Canada 2017).
Molybdenum	mg/L	0.001	2	Molybdenum occurs in nature as a chemical combination with other elements (predominately in porphyry copper ore deposits of molybdenite mined from central BC). Drainage from molybdenum-bearing mineral deposits and molybdenum mines is the only known source of molybdenum discharged to surface waters in BC (BC MOE 2018).
Selenium	mg/L	0.00005	0.002	Selenium occurs naturally in sedimentary rocks, shales, coal and phosphate deposits and soils and generally occurs together with sulfides of metals such as copper, zinc and lead (US EPA 2016). Selenium is bioaccumulative and can be toxic to aquatic life. Surface waters in most areas contain less than 1.0 µg/L (Lakin and Davidson 1967 in CCREM 1987 page 412). Concentrations of selenium in central Canadian waters typically range from 0.1 to 4 µg/L (CCREM 1987).
Silver	mg/L	0.00002	0.0001 or 0.003 #9	Naturally occurring (erosion and weathering of rocks and soils; Health Canada 2017).
Zinc	mg/L	0.005	See equation #9	Although relatively non-toxic to terrestrial organisms, zinc can be both acutely and chronically toxic to aquatic organisms (MELP 1998). Several factors such as water hardness, salinity, temperature, and the presence of other contaminants influence zinc toxicity in aquatic environments (BC MOE 1999). Its toxicity decreases with increasing hardness, increases with increasing temperature, and increases with decreasing dissolved oxygen (BC MELP 1998). Natural concentrations range from 1 to 96 µg/L (0.001 to 0.0096 mg/L), but do not typically exceed 40 µg/L (0.04 mg/L) in river water (Environment Canada 1984 in Health Canada 1987, page 2). In certain waters, such as in mining areas or acidic waters, concentrations 10- to 1000 times greater can be found (CCREM 1987).
Dissolved Metals				
Aluminum (Filtered)	mg/L	0.005	0.1 #10	Aluminum is generally found in concentrations of less than 1000 µg/L (BC MELP 1998). The dissolved form of aluminum is more toxic than the particulate form, with the greatest toxicity occurring in waters with pH less than 6 (CCREM 1987). A large fraction of total aluminum may not be bioavailable so toxicity may be overestimated, especially in highly turbid water (BC MOEAP 1988).
Cadmium (Filtered)	mg/L	0.000005	See equation #11	Cadmium, which has been shown to bioaccumulate, is highly toxic in all its forms, though dissolved cadmium is more bioavailable. The toxicity of cadmium is highly influenced by water hardness; the toxicity increases with decreased water hardness (CCME 2014). Presence of other heavy metals like zinc and copper have has been shown to increase cadmium's toxicity (BC MELP 1998). Weathering of rock and forest fires are the most common natural pathways for cadmium to enter surface water therefore, cadmium may occur at higher concentrations naturally because of the underlying geology.
Iron (Filtered)	mg/L	0.03	0.35	Iron is a common element and is occurs naturally through weathering of sulphide ores and leaching of sandstones (CCREM 1987). Iron can be a significant constituent of soils, especially clays (Phippen et al 2008). Anthropogenic sources are often related to mining. It is a requirement for all lifeforms but can be toxic at high concentrations. The concentrations of iron in Canadian surface waters are generally below 10 mg/L (Health Canada 1978). The BC AWQG for total iron is 1 mg/L, the Health Canada aesthetic objective for iron in drinking water is ≤ 0.3 mg/L (Health Canada 1978).

NOTES:

- BC MOE 2018 British Columbia Ministry of Environment (BC MOE). 2018. British Columbia approved water quality guidelines: Aquatic life, wildlife & agriculture. Water Protection and Sustainability Branch. Victoria, British Columbia, Canada.
- H Hardness. Where hardness values exceed the range applied for guideline use, site specific assessment may be required.
- #1 Dissolved Oxygen guideline protects all life stages other than buried embryo/alevin, based on instantaneous measurement.
- #2 Guideline for ammonia nitrogen (NH₃) varies with pH and temperature, and is derived from Table 26D of the BC MOE, 2018 BCWQGs, ranging from 0.681 to 28.7 mg/L for pH 6.5-9.0 and temperature 0.0-20.0 degC.
- #3 Guideline for fluoride varies with H. Guideline is 0.4 mg/L when H <10 mg/L. Calculated in mg/L and based on equation: [-51.73 + 92.57*log(Hardness)]x0.01 when H =10-385 mg/L.
- #4 Guideline for nitrite varies with chloride concentrations.
- #5 Guideline for copper varies with H and is calculated in mg/L and based on equation: [0.094(H)+2]/1000, when H =13-400 mg/L.
- #6 Guideline for lead varies with H. Guideline is 0.003 mg/L when H<8 mg/L. Calculated in mg/L and based on equation: [e^{(1.273*ln(H)-1.460)}]/1000 when H=8-360 mg/L.
- #7 Guideline for manganese varies with H and is calculated in mg/L and based on equation: (0.01102*H)+0.54, when H =25-259 mg/L.
- #8 Guideline for silver varies with H. Guideline is 0.0001 mg/L when H<100 mg/L or 0.003 mg/L when H>100 mg/L.
- #9 Guideline for zinc varies with H. Guideline is 0.033 mg/L when H is <90 mg/L. Calculated in mg/L and based on equation: [33+0.75*(H-90)]/1000, when H=90-500 mg/L.
- #10 Guideline for aluminum varies with pH. Guideline is 0.1 mg/L if pH ≥ 6.5. Calculated in mg/L and based on equation: e^{(1.209-2.426(pH+0.289K))} where K=(pH)² and pH < 6.5.
- #11 Guideline for cadmium varies with H and is calculated in mg/L and based on equation: [e^{(1.037*ln(H)+5.274)}]/1000, when H=7-455 mg/L.

Table 2: Summary of Sediment Quality Parameters Compared to BC Working Water Quality Guidelines

Parameter	Unit	Reported Detection Limit (RDL)	BC MOE 2017 (mg/kg in dry weight) Lower SWQG	BC MOE 2017 (mg/kg in dry weight) Upper SWQG	Common Sources of Parameter
Metals (Soil)					
Arsenic	mg/kg	0.1	5.9 ^{#1}	17 ^{#2}	Arsenic is a natural component of the earth's crust and is widely distributed throughout the environment in the air, water and land (WHO 2016). It Arsenic occurs naturally as a result of weathering of rock and soil. Arsenic is highly toxic in its inorganic form and long-term exposure can cause considerable health issues in humans.
Cadmium	mg/kg	0.02	0.6 ^{#1}	3.5 ^{#2}	Cadmium, which has been shown to bioaccumulate, is highly toxic in all its forms, though dissolved cadmium is more bioavailable. Presence of other heavy metals like zinc and copper have has been shown to increase cadmium's toxicity (BC MELP 1998). Weathering of rock and forest fires are the most common natural pathways for cadmium to enter surface water therefore sediments; cadmium may occur at higher concentrations naturally because of the underlying geology.
Chromium	mg/kg	0.5	37.3 ^{#1}	90 ^{#2}	Leaching from topsoil and rocks is the most important natural source of chromium entry into bodies of water and underlying sediments (Agency for Toxic Disease and Substance Registry 2008). However, more than 70% of chromium in the environment comes from anthropogenic sources, such as tanneries, electroplating, non-ferrous foundries, wood treatment facilities, urban storm water runoff, and discharges from thermal generating stations (Health Canada 2015; BC MELP 1998). Chromium is generally present at low concentrations in Canadian surface waters (Health Canada 1979b).
Copper	mg/kg	0.5	35.7 ^{#1}	197 ^{#2}	Copper is a natural constituent of most rock types, with igneous rock containing the highest concentrations, followed by sedimentary rocks such as shale, sandstone and limestone (BC MOEAP 1987b). Bertine and Goldberg (1971, in BC MOEAP 1987b, page 6) estimated that 40 to 67% of total copper inputs are the result of natural weathering. Copper is acutely toxic to most forms of aquatic life at relatively low concentrations (BC MELP 1998).
Iron	mg/kg	50	21,200 (about 2%) ^{#3}	43,766 (about 4%) ^{#3}	Iron is a common element and is occurs naturally through weathering of sulphide ores and leaching of sandstones (CCREM 1987). Iron can be a significant constituent of soils, especially clays (Phippen et al 2008). Anthropogenic sources are often related to mining. It is a requirement for all lifeforms but can be toxic at high concentrations.
Lead	mg/kg	0.5	35 ^{#1}	91.3 ^{#2}	Lead has been observed in natural environments, occurring either naturally but is also present in older infrastructure (e.g. pipes, solder, brass fittings and lead service lines; Health Canada 2017).
Manganese	mg/kg	1	460 ^{#3}	1100 ^{#3}	Naturally occurring (erosion and weathering of rocks and minerals; Health Canada 2017).
Mercury	mg/kg	0.005	0.17 ^{#1}	0.486 ^{#2}	Mercury is found in the environment naturally from the weathering of rocks but atmospheric deposition is a major pathway to aquatic systems (Sanderson et al 2012).
Nickel	mg/kg	0.5	16 ^{#3}	75 ^{#3}	Nickel naturally occurs as a chemical combination with other elements (erosion and weathering of rocks and minerals), and is also widely used in metallurgical industry practices (BC MOE 2017).
Silver	mg/kg	0.1	0.5 ^{#4}	N/A ^{#4}	Naturally occurring (erosion and weathering of rocks and soils; Health Canada 2017).
Zinc	mg/kg	2	123 ^{#1}	315 ^{#2}	Although relatively non-toxic to terrestrial organisms, zinc can be both acutely and chronically toxic to aquatic organisms (BC MELP 1998). Several factors such as water hardness, salinity, temperature, and the presence of other contaminants influence zinc toxicity in aquatic environments (BC MOE 1999). Concentrations within areas affected by mining or acidic water, concentrations, increased concentrations are found (CCREM 1987).

NOTES:

BC MOE 2017	BC MOE. 2017. Working Water Quality Guidelines and Working Sediment Quality Guidelines for British Columbia. Water Protection and Sustainability Branch. British Columbia Ministry of Environment.
Lower SWQG	A concentration that will protect aquatic life from adverse effects of toxic substance in most situations (equivalent to CCME's Threshold Effect Level or Interim Sediment Quality Guidelines (TEL or ISQGs; CCME 2001))
Upper SWQG	A concentration that if exceeded will likely cause severe effects on aquatic life (equivalent to CCME's Probably Effect Level (PEL; CCME (2001)).
CCME 2001	Canadian Council of Ministers of the Environment [CCME]. 2001. Canadian sediment quality guidelines. Canadian Council of Ministers of the Environment, Winnipeg. Accessed on-line at http://ceqg-rcqe.come.ca/en/index.html#void
AET	Apparent Effects Threshold
BA	Background Approach
CoA	Co-Occurrence analysis
EqP	Equilibrium Partitioning
ISQG	Interim Sediment Quality Guideline
NSTPA	National Status and Trends Program Approach
PEL	Probable Effect Level
SLC	Screening Level Concentration
#1	Lower SWQG is based on ISQG
#2	Upper SWQG is based on PEL
#3	Effect levels based on SLC
#4	Based on Ontario sediment guideline

Table 3: Williston Reservoir Water Quality Depth Profile Summary

Field Parameter	Sample Depth	Secchi Depth	Total Depth	Temperature	Dissolved Oxygen	Specific Conductivity	Electrical Conductivity	Salinity	Total Dissolved Solids	pH	ORP	Turbidity
Units	m	m	m	°C	mg/L	SPCµS/cm	µS/cm	SAL-ppt	mg/L		mV	NTU
BC MOE 2018 (Approved Guidelines for freshwater aquatic life and short-term maximum)		-		15	Minimum 5 mg/L (All life stages other than buried embryo/alevin)	-	-	-	-	6.5-9.0	-	-
Sample Date	m	m	m	°C	mg/L	SPCµS/cm	µS/cm	SAL-ppt	mg/L		mV	NTU
11-May-18	0.2	6.50	137	2.7	12.15	187.5	107.9	0.09	121.8	8.04	171.3	0.09
	0.5			2.8	12.16	187.5	108.2	0.09	121.9	8.04	172.2	0.09
	1.0			2.8	12.16	187.5	108.1	0.09	121.9	8.04	172.2	0.90
	1.5			2.7	12.17	187.6	108.0	0.09	121.9	8.05	174.1	0.90
	2.0			2.8	12.15	187.6	107.8	0.09	122.0	8.07	173.7	0.90
	2.5			2.7	12.14	187.6	107.8	0.09	122.0	8.04	176.7	0.90
	3.0			2.8	12.14	187.6	108.0	0.09	122.0	8.02	178.3	1.00
	3.5			2.7	12.14	187.7	107.8	0.09	122.0	8.02	178.7	0.90
	4.0			2.8	12.14	187.6	108.1	0.09	121.9	8.02	179.8	0.90
	4.5			2.9	12.14	187.5	108.2	0.09	121.9	8.04	179.6	0.90
5.0	2.7	12.15	187.6	107.9	0.09	121.9	8.03	180.5	1.00			
18-Jun-18	0.2	4.00	194	11.8	11.24	186.5	138.5	0.09	121.0	7.94	114.0	1.70
	0.5			10.4	11.35	186.8	135.5	0.09	121.0	7.92	122.6	1.85
	1.0			10.3	11.41	186.5	133.1	0.09	121.0	7.93	125.9	1.89
	1.5			9.7	11.43	187.1	132.1	0.09	122.0	7.93	132.5	1.89
	2.0			9.5	11.46	186.8	131.5	0.09	121.0	7.97	134.3	1.92
	2.5			9.3	11.48	186.8	131.4	0.09	121.0	7.97	136.5	1.92
	3.0			9.1	11.46	187.2	130.8	0.09	122.0	7.96	140.2	1.92
	3.5			9.1	11.47	187.9	130.8	0.09	122.0	7.97	143.6	1.98
	4.0			9.1	11.47	187.9	130.8	0.09	122.0	7.96	145.7	1.91
	4.5			9.0	11.48	180.0	130.6	0.09	122.0	7.95	147.4	1.88
5.0	9.0	11.48	188.0	130.5	0.09	122.0	7.96	148.3	1.96			
17-Jul-18	0.2	3.50	30	17.4	9.48	180.4	154.2	0.09	117.0	8.33	230.0	3.39
	16.6			9.52	180.2	150.7	0.09	117.0	8.33	232.0	3.41	
	16.3			9.52	180.0	149.9	0.09	117.0	8.32	234.7	3.75	
	16.2			9.52	180.0	149.8	0.09	117.0	8.32	236.0	3.86	
	16.1			9.52	180.1	149.6	0.09	117.0	8.32	236.9	3.72	
	16.1			9.52	180.0	149.3	0.09	117.0	8.32	237.8	3.76	
	16.1			9.52	180.1	149.3	0.09	117.0	8.32	238.7	3.81	
	16.0			9.52	180.0	149.2	0.09	117.0	8.32	239.3	3.80	
	16.0			9.52	180.0	149.3	0.09	117.0	8.32	240.3	4.16	
	16.0			9.52	180.0	149.2	0.09	117.0	8.31	241.2	4.02	
31-Jul-18	0.2	4.50	57	19.4	9.23	172.7	154.0	0.08	112.0	8.38	225.2	3.87
	18.7			9.31	172.6	153.4	0.08	112.0	8.36	228.7	3.86	
	18.4			9.25	172.6	148.1	0.08	112.0	8.34	235.1	3.80	
	17.7			9.36	172.3	149.6	0.08	112.0	8.34	238.4	3.82	
	17.5			9.37	174.4	147.9	0.08	112.0	8.36	240.1	3.82	
	17.4			9.38	172.2	147.2	0.08	112.0	8.33	242.1	3.97	
	17.3			9.40	171.9	146.9	0.08	112.0	8.33	243.7	4.00	
	17.2			9.41	172.0	146.4	0.08	112.0	8.31	246.7	4.03	
	18.8			9.44	172.3	145.4	0.08	112.0	8.30	248.6	3.93	
	16.4			9.46	172.8	144.0	0.08	112.0	8.29	250.2	3.97	
11-Sep-18	0.2	-	70	16.2	9.42	173.0	143.7	0.08	112.0	8.27	252.1	4.01
	14.6			9.24	176.8	141.7	0.08	116.3	8.22	240.9	0.27	
	14.6			9.24	176.8	141.7	0.08	114.8	8.19	233.3	0.35	
	14.8			9.24	176.3	141.2	0.08	114.5	8.19	232.4	0.37	
	14.6			9.24	175.9	141.0	0.08	114.4	8.17	232.1	0.38	
	14.6			9.24	175.7	140.8	0.08	114.2	8.18	231.5	0.33	
	14.6			9.24	175.4	140.7	0.08	114.4	8.14	232.6	0.38	
	14.6			9.24	175.1	140.3	0.08	113.7	8.13	232.3	0.39	
	14.6			9.24	174.9	140.2	0.08	113.6	8.12	232.7	0.41	
	14.6			9.24	174.7	140.0	0.08	113.5	8.10	230.6	0.30	
19-Oct-18	0.2	7.50	82	14.6	9.22	174.4	139.8	0.08	113.4	8.11	229.9	0.37
	14.6			9.22	174.1	139.5	0.08	113.1	8.11	229.1	0.36	
	6.9			10.80	176.4	115.8	0.08	115.0	8.00	157.1	-1.56	
	6.9			10.81	177.1	115.8	0.08	115.0	8.00	157.1	-1.58	
	6.9			10.80	177.4	115.5	0.08	115.0	8.00	157.5	-1.56	
	6.9			10.80	177.0	116.0	0.08	115.0	8.00	157.7	-1.57	
	6.9			10.79	175.4	115.6	0.08	115.0	8.00	157.9	-1.54	
	6.9			10.79	177.3	116.3	0.08	115.0	7.99	158.1	-1.56	
	6.9			10.79	177.0	116.0	0.08	115.0	7.99	158.3	-1.58	
	6.9			10.79	176.1	115.8	0.08	115.0	7.99	158.6	-1.55	
6.9	10.79	176.2	115.9	0.08	115.0	7.98	159.0	-1.58				
6.9	10.78	177.5	115.6	0.08	115.0	7.98	159.3	-1.53				
6.9	10.78	177.2	116.0	0.08	115.0	7.97	159.9	-1.57				

NOTES:

BC MOE 2018 British Columbia Ministry of Environment (BC MOE). 2018. British Columbia approved water quality guidelines: Aquatic life, wildlife & agriculture. Water Protection and Sustainability Branch. Victoria, British Columbia, Canada.

- No applicable standard/guideline or analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- Bold** Bold and shaded indicates an exceedance of one of the applicable standards/guidelines.

Table 4: Dinosaur Reservoir Water Quality Depth Profile Summary

Field Parameter	Sample Depth	Secchi Depth	Total Depth	Temperature	Dissolved Oxygen	Specific Conductivity	Electrical Conductivity	Salinity	Total Dissolved Solids	pH	ORP	Turbidity
Units	m	m	m	°C	mg/L	SPCµS/cm	µS/cm	SAL-ppt	mg/L		mV	NTU
BC MOE 2018 (Approved Guidelines for freshwater aquatic life and short-term maximum)		-		15	Minimum 5 mg/L (All life stages other than buried embryo/alevin)	-	-	-	-	6.5-9.0	-	-
Sample Date	m	m	m	°C	mg/L	SPCµS/cm	µS/cm	SAL-ppt	mg/L		mV	NTU
11-May-18	0.2	0.75	140	3.6	12.38	171.7	101.5	0.08	111.6	7.97	124.9	26.3
	0.5			3.6	12.43	171.8	101.7	0.08	111.7	7.95	124.5	25.0
	1.0			3.6	12.46	171.8	101.6	0.08	111.6	7.93	133.5	24.7
	1.5			3.6	12.46	171.8	101.6	0.08	111.7	7.94	135.9	23.5
	2.0			3.6	12.49	172.1	101.6	0.08	111.9	7.93	140.0	24.9
	2.5			3.5	12.49	172.2	101.4	0.08	111.9	7.93	143.2	24.9
	3.0			3.4	12.50	172.1	101.3	0.08	111.9	7.93	145.3	25.9
	3.5			3.4	12.50	172.2	101.2	0.08	111.9	7.94	147.6	25.5
	4.0			3.5	12.49	172.1	101.4	0.08	111.9	7.94	149.7	25.8
	4.5			3.7	12.48	172.1	101.9	0.08	111.9	7.95	151.6	25.6
5.0	3.7	12.47	172.1	101.9	0.08	111.9	7.96	153.1	34.0			
18-Jun-18	0.2	5.00	42	18.8	10.36	191.6	169.0	0.09	125.0	8.10	178.3	1.49
	0.5			14.8	10.92	192.9	152.1	0.09	125.0	8.10	181.7	1.51
	1.0			13.0	11.32	189.7	145.7	0.09	123.0	8.10	182.2	1.54
	1.5			12.8	11.35	189.6	145.3	0.09	123.0	8.10	182.4	1.57
	2.0			12.4	11.49	189.6	143.8	0.09	123.0	8.11	182.6	1.56
	2.5			11.7	11.47	189.4	141.8	0.09	123.0	8.10	183.5	1.57
	3.0			11.6	11.52	189.4	141.1	0.09	123.0	8.11	183.4	1.59
	3.5			11.6	11.55	189.3	140.9	0.09	123.0	8.10	183.8	1.58
	4.0			10.9	11.63	189.2	137.4	0.09	123.0	8.10	184.7	1.56
	4.5			10.5	11.70	189.2	136.9	0.09	123.0	8.10	184.3	1.61
5.0	10.3	11.74	189.2	135.9	0.09	123.0	8.09	184.7	1.62			
17-Jul-18	0.2	5.00	23	16.7	10.03	184.2	155.4	0.09	120.0	8.30	184.8	1.91
	0.5			17.0	10.05	184.0	152.5	0.09	120.0	8.30	201.5	1.94
	1.0			16.0	10.13	184.4	151.2	0.09	120.0	8.31	205.7	2.06
	1.5			13.9	10.38	181.0	143.4	0.09	118.0	8.26	214.8	2.03
	2.0			13.7	10.40	181.7	142.8	0.09	118.0	8.25	219.0	2.05
	2.5			13.5	10.40	181.6	141.4	0.09	118.0	8.24	221.9	2.09
	3.0			13.3	10.46	181.3	141.6	0.09	118.0	8.24	224.3	2.09
	3.5			13.5	10.46	181.6	142.6	0.09	118.0	8.24	226.9	2.09
	4.0			12.8	10.51	181.3	141.2	0.09	118.0	8.23	230.4	2.15
	4.5			12.6	10.47	181.0	137.9	0.09	118.0	8.21	232.7	2.17
5.0	12.5	10.54	181.0	139.8	0.09	118.0	8.22	233.9	2.14			
31-Jul-18	0.2	0.75	38	20.3	9.50	179.0	163.3	0.08	116.0	8.22	250.9	17.52
	0.5			15.5	9.98	182.2	150.0	0.09	117.0	8.18	255.0	15.49
	1.0			12.9	10.32	183.5	140.9	0.09	120.0	8.14	202.2	10.32
	1.5			11.8	10.51	179.4	132.5	0.09	117.0	8.15	207.6	8.92
	2.0			11.2	10.57	179.6	131.1	0.09	117.0	8.15	211.5	9.14
	2.5			10.4	10.67	179.8	129.6	0.09	117.0	8.14	216.0	9.83
	3.0			10.3	10.67	179.8	129.2	0.09	117.0	8.14	219.7	10.12
	3.5			10.2	10.68	179.8	129.1	0.09	117.0	8.14	222.8	10.72
	4.0			10.2	10.68	180.0	129.0	0.09	117.0	8.15	225.6	10.06
	4.5			10.1	10.69	179.9	128.8	0.09	117.0	8.15	227.7	10.06
5.0	9.8	10.69	180.1	128.5	0.09	117.0	8.15	236.8	10.69			
11-Sep-18	0.2	3.50	35	11.6	10.30	180.0	134.0	0.09	117.1	8.03	164.0	1.15
	0.5			11.6	10.04	179.3	133.5	0.09	116.6	8.04	164.8	1.26
	1.0			11.6	10.03	179.0	133.2	0.09	116.4	8.04	187.7	1.14
	1.5			11.6	10.02	179.1	133.2	0.09	116.4	8.01	190.2	1.17
	2.0			11.6	10.02	179.9	133.1	0.09	116.3	8.03	189.8	1.17
	2.5			11.6	10.02	179.2	133.2	0.09	116.5	8.01	191.1	1.17
	3.0			11.6	10.01	178.8	133.0	0.08	116.2	8.01	191.1	1.17
	3.5			11.6	10.01	178.2	132.5	0.08	115.8	8.03	192.0	1.09
	4.0			11.6	10.01	178.0	132.3	0.08	115.7	8.03	192.4	1.10
	4.5			11.6	10.01	177.9	132.1	0.08	115.6	8.04	192.3	1.14
5.0	11.6	10.01	177.7	132.1	0.08	115.5	8.06	192.6	1.10			
19-Oct-18	0.2	7.50	29	7.1	10.90	177.0	116.1	0.08	115.0	8.06	162.8	-1.26
	0.5			7.1	10.89	176.7	116.3	0.08	115.0	8.07	163.0	-1.28
	1.0			7.1	10.89	176.8	115.2	0.08	115.0	8.07	163.2	-1.24
	1.5			7.1	10.89	176.3	116.0	0.08	115.0	8.07	163.7	-1.26
	2.0			7.1	10.88	176.7	116.2	0.08	115.0	8.07	163.9	-1.24
	2.5			7.1	10.88	176.6	116.4	0.08	115.0	8.07	164.2	-1.18
	3.0			7.0	10.87	176.4	115.9	0.08	114.0	8.07	164.4	-1.19
	3.5			7.0	10.87	175.9	115.7	0.08	115.0	8.07	164.7	-1.20
	4.0			7.0	10.87	177.0	115.6	0.08	114.0	8.07	164.9	-1.17
	4.5			7.0	10.86	177.3	116.8	0.08	115.0	8.07	165.2	-1.22
5.0	7.0	10.87	177.0	116.4	0.08	115.0	8.07	165.5	-1.18			

NOTES:

BC MOE 2018 British Columbia Ministry of Environment (BC MOE). 2018. British Columbia approved water quality guidelines: Aquatic life, wildlife & agriculture. Water Protection and Sustainability Branch. Victoria, British Columbia, Canada.

- No applicable standard/guideline or analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- Bold** Bold and shaded indicates an exceedance of one of the applicable standards/guidelines.

Table 9: August 2018 Surface Water Quality Results Summary

Parameter	Unit	Reported Detection Limit (RDL)	BC MOE 2018 (Approved Guidelines for freshwater aquatic life and short-term maximum)	Williston and Dinosaur Reservoirs				Future Site C Reservoir					Downstream of Site C Reservoir									
				Williston Shallow (W1-SHALLOW)	Williston Deep (W1-DEEP)	Dinosaur Reservoir Shallow (D1-SHALLOW)	Dinosaur Reservoir Deep (D1-DEEP)	Peace Canyon Dam (PC1)	Peace 1: Upper Site C Reservoir (PR1)	Peace 2: Middle Site C Reservoir (PR2)	Halfway River - Downstream (HD)	Peace 3: Lower Site C Reservoir (PR3)	Moberly River - Downstream (MD)	Peace 1: Peace at Pine (PD1)	Pine River (PINE)	Peace at Beaton (PD2)	Beaton River (BEA)	Peace at Kiskatinaw (PD3)	Kiskatinaw River (KR)	Peace at Pouce Coupe (PD4)	Pouce Coupe River (POUCE)	Peace at Many Islands (PD5)
Sample Date				7/31/2018	7/31/2018	7/31/2018	7/31/2018	7/31/2018	7/30/2018	7/30/2018	7/30/2018	8/2/2018	8/2/2018	8/2/2018	8/2/2018	8/1/2018	8/1/2018	8/1/2018	8/1/2018	8/1/2018	8/1/2018	8/1/2018
GPS - Northing (10 UTM)				6209610	6209610	6203491	6203491	6205050	6207857	6229426	6231488	6231374	6230146	6226276	6223596	6220293	6220613	6220751	6219559	6224982	6224275	6242006
GPS - Easting (10 UTM)				549540	549540	562028	562028	562934	566122	594889	596649	628028	628620	640247	641710	661946	663060	672509	676408	317950	318943	364653
Laboratory Identification Number				L2139662-1	L2139662-2	L2139662-3	L2139662-4	L2139662-6	L2138784-3	L2138784-2	L2138784-1	L2140599-2	L2140599-1	L2140599-3	L2140599-4	L2140393-1	L2140393-2	L2140393-3	L2140393-4	L2140393-5	L2140393-6	L2140393-7
Matrix				surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water
Field Measurements																						
Sample Depth	m	-		0.2	5.0	0.2	5.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total Depth	m	-		56.7	56.7	38.4	38.4	-	1.7	4.0	0.7	5.5	0.8	0.8	1.0	5.0	1.5	2.4	0.8	5.0	2.0	6.1
Temperature	°C	-	15	19.4	16.2	20.3	9.8	12.9	9.9	11.3	16.5	10.5	18.5	11.4	18.3	14.8	21.6	15.3	20.9	15.1	21.5	16.6
Dissolved Oxygen (DO)	mg/L	-	Minimum 5 ^{#1}	9.23	9.42	9.50	10.69	10.36	10.81	10.94	9.40	10.59	8.77	10.38	8.86	9.75	8.28	9.70	8.62	9.78	8.41	9.39
Specific Conductivity (SPC)	SPC _u /cm	-		172.7	173.0	179.0	180.1	184.2	180.3	186.3	377.6	189.6	200.1	197.1	290.7	230.5	242.4	229.8	294.7	226.9	322.4	241.4
Electrical Conductivity (EC)	SPC _u /cm	-		154.0	143.7	163.3	128.5	147.6	128.1	137.2	316.4	137.0	175.2	148.0	253.5	185.6	226.7	187.3	271.8	184.0	301.0	203.2
Salinity	parts per trillion	-		0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.18	0.09	0.09	0.09	0.14	0.11	0.11	0.11	0.14	0.11	0.15	0.11
pH	pH Units	-	6.5-9.0	8.38	8.27	8.27	8.15	8.21	8.18	8.25	8.47	8.21	8.29	8.27	8.43	8.39	8.28	8.38	8.55	8.35	8.20	8.33
Turbidity	nephelometric unit	-		3.9	4.0	17.5	10.7	20.4	8.9	12.6	48.2	21.2	127.9	32.1	39.7	43.2	52.8	39.0	478.7	51.4	1440.6	280.9
Physical Parameters																						
Colour	TCU	5		6.5	7.8	19.3	9.6	10	9.4	11.6	18.9	10.6	48.1	12.5	18.9	17.7	160	18.3	78.3	19.4	130	27.5
Electrical Conductivity (EC)	µS/cm	2		171	169	173	183	180	171	191	379	192	198	200	290	236	239	228	287	223	310	238
pH	pH Units	0.1	6.5-9.0	8.19	8.2	8.19	8.24	8.09	8.18	8.2	8.45	8.11	8.15	8.07	8.35	8.29	8.14	8.28	8.37	8.18	7.93	8.21
Total Suspended Solids (TSS)	mg/L	3		<3	<3	4.5	10.9	13.1	6	9.2	69.8	44.4	214	69.2	37.2	80.6	28.4	82.4	754	85.8	3480	347
Total Dissolved Solids (TDS)	mg/L	1		108	103	110	112	114	115	121	249	122	163	131	185	171	225	151	361	143	304	202
Turbidity	NTU	0.1		1.71	1.72	16.5	18.2	21.1	5.42	9.8	67.3	20.9	188	35.1	46.5	50.6	59.5	47.8	985	57.2	>4000	393
Anions and Nutrients																						
Alkalinity (Bicarbonate as CaCO ₃)	mg/L	1		77.5	78.5	81.1	85	87.3	84.1	87.9	164	92.2	109	94.2	144	111	84.1	109	160	102	117	110
Alkalinity (Carbonate as CaCO ₃)	mg/L	1		<1	<1	<1	<1	<1	<1	<1	9.2	<1	<1	<1	5	<1	<1	<1	4.8	<1	<1	<1
Alkalinity (Hydroxide) as CaCO ₃	mg/L	1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Alkalinity (total as CaCO ₃)	mg/L	1		77.5	78.5	81.1	85	87.3	84.1	87.9	173	92.2	109	94.2	149	111	84.1	109	164	102	117	110
Ammonia as N	mg/L	0.005	See narrative ^{#2}	<0.005	<0.005	<0.005	<0.005	<0.005	0.0062	<0.005	<0.005	<0.0073	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0493	0.006	0.0919	0.0165
Bromide	mg/L	0.05		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride	mg/L	0.5	600	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.71	<0.5	0.98	<0.5	1.24	<0.5	5.41	0.67
Fluoride	mg/L	0.02	See equation ^{#3}	0.036	0.034	0.045	0.038	0.04	0.039	0.041	0.098	0.038	0.07	0.044	0.074	0.062	0.11	0.06	0.096	0.058	0.169	0.071
Nitrate and Nitrite (as N)	mg/L	0.0051		0.0528	0.0577	0.0506	0.0704	0.0684	0.0613	0.0552	<0.0051	0.0611	0.0191	0.0582	0.0675	0.0579	<0.0051	0.0556	0.0218	0.054	0.192	0.0641
Nitrate (as N)	mg/L	0.005	32.8	0.0528	0.0577	0.0506	0.0686	0.0672	0.0613	0.0552	<0.0051	0.0611	0.0191	0.0582	0.0675	0.0579	<0.0051	0.0556	0.0187	0.054	0.183	0.0631
Nitrite (as N)	mg/L	0.001	0.06-0.60 ^{#4}	<0.001	<0.001	<0.001	0.0017	0.0012	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0031	<0.001	0.0098	0.001	
Total Kjeldahl Nitrogen (TKN)	mg/L	0.05		0.076	0.068	0.142	0.087	0.152	0.113	0.12	0.244	0.164	0.152	0.213	0.249	0.235	0.249	0.702	1.53	0.243	1.06	0.618
Nitrogen (Total)	mg/L	0.03		0.125	0.171	0.198	0.156	0.185	0.15	0.216	0.192	0.186	0.458	0.214	0.253	0.235	0.675	0.241	1.31	0.249	2.65	0.61
Orthophosphate (as P) (Filtered)	mg/L	0.001		<0.001	<0.001	0.0012	0.002	0.0021	0.0013	0.0016	0.0045	0.0017	0.0045	0.0021	0.0025	0.0027	0.0049	0.0027	0.0087	0.0029	0.0138	0.0063
Phosphorus (Total Dissolved)	mg/L	0.002		0.0052	0.0055	0.0237	0.0124	0.0322	0.01	0.0195	0.0948	0.0656	0.207	0.0974	0.0564	0.093	0.0793	0.116	0.584	0.112	2.04	0.376
Phosphorus	mg/L	0.002		<0.002	<0.002	0.0044	0.0041	0.0044	0.0021	0.0028	0.0057	0.0033	0.0106	0.004	0.0051	0.0048	0.0175	0.0049	0.0153	0.0058	0.0325	0.0094
Sulphate	mg/L	0.3		12.7	12.7	13.6	13.8	13.8	13.3	14	39.3	14.8	8.21	15.4	19.1	18.3	40.5	18.3	15.2	18.8	66.3	21.5
Silica	mg/L	0.5		3.98	3.61	4.4	4.25	4.24	4.13	4.25	3.98	4.3	3.69	4.27	3.85	3.82	6.06	4.07	4.78	3.94	5.88	3.9
Organic and Inorganic Carbon																						
Dissolved Organic Carbon (DOC) (Filtered)	mg/L	0.5		2.8	2.73	4.26	3.19	3.23	3.1	3.94	5.46	3.32	8.74	3.41	4.51	3.85	22.9	4.13	17.4	4.62	26.7	6.2
Total Organic Carbon (TOC)	mg/L	0.5		2.73	3.01	4.59	3.66	3.65	3.28	4	6.56	3.72	12	4.8	5.58	5.59	25.3	5.62	30.4	5.92	85.8	13.6

NOTES:

- BC MOE 2018 British Columbia Ministry of Environment (BC MOE). 2018. British Columbia approved water quality guidelines: Aquatic life, wildlife & agriculture. Water Protection and Sustainability Branch, Victoria, British Columbia, Canada.
- H Hardness. Where hardness values exceed the range applied for guideline use, site specific assessment may be required.
- #1 Dissolved Oxygen guideline protects all life stages other than buried embryo/alevin, based on instantaneous measurement.
- #2 Guideline for ammonia nitrogen (NH₃) varies with pH and temperature, and is derived from Table 26D of the BC MOE, 2017 BCWQGs, ranging from 0.681 to 28.7 mg/L for pH 6.5-9.0 and temperature 0.0-20.0 degC.
- #3 Guideline for fluoride varies with H. Guideline is 0.4 mg/L when H <10 mg/L. Calculated in mg/L and based on equation: [-51.73 + 92.57*log(Hardness)]x0.01 when H =10-385 mg/L.
- #4 Guideline for nitrite varies with chloride concentrations.
- #5 Guideline for copper varies with H and is calculated in mg/L and based on equation: [0.094(H)+2]/1000, when H =13-400 mg/L.
- #6 Guideline for lead varies with H. Guideline is 0.003 mg/L when H <8 mg/L. Calculated in mg/L and based on equation: [e^{(1.273*ln(H)-1.460)}]/1000 when H=8-360 mg/L.
- #7 Guideline for manganese varies with H and is calculated in mg/L and based on equation: (0.01102*H)+0.54, when H =25-259 mg/L.
- #8 Guideline for silver varies with H. Guideline is 0.0001 mg/L when H <100 mg/L or 0.003 mg/L when H >100 mg/L.
- #9 Guideline for zinc varies with H. Guideline is 0.033 mg/L when H is <90 mg/L. Calculated in mg/L and based on equation: [33+0.75*(H-90)]/1000, when H=90-500 mg/L.
- #10 Guideline for aluminum varies with pH. Guideline is 0.1 mg/L if pH ≥ 6.5. Calculated in mg/L and based on equation: e^{(1.209-2.426(pH)+0.286K)} where K=(pH)² and pH < 6.5.
- #11 Guideline for cadmium varies with H and is calculated in mg/L and based on equation: [e^{(0.031ln(H)-5.274)}]/1000, when H=7-455 mg/L.
- No applicable guideline or analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- Bold** Bold and shaded indicates an exceedance of the applied guideline.
- MPN Most Probable Number
- CFU Colony Forming Units

Table 10: September 2018 Surface Water Quality Results Summary

Parameter	Unit	Reported Detection Limit (RDL)	BC MOE 2018 (Approved Guidelines for freshwater aquatic life and short-term maximum)	Williston and Dinosaur Reservoirs				Future Site C Reservoir					Downstream of Site C Reservoir										
				Williston Shallow (W1-SHALLOW)	Williston Deep (W1-DEEP)	Dinosaur Reservoir Shallow (D1-SHALLOW)	Dinosaur Reservoir Deep (D1-DEEP)	Peace Canyon Dam (PC1)	Peace 1: Upper Site C Reservoir (PR1)	Peace 2: Middle Site C Reservoir (PR2)	Halfway River - Downstream (HD)	Peace 3: Lower Site C Reservoir (PR3)	Moberly River - Downstream (MD)	Peace 1: Peace at Pine (PD1)	Pine River (PINE)	Peace at Beaton (PD2)	Beaton River (BEA)	Peace at Kiskatinaw (PD3)	Kiskatinaw River (KR)	Peace at Pouce Coupe (PD4)	Pouce Coupe River (POUCE)	Peace at Many Islands (PD5)	
Sample Date				9/11/2018	9/11/2018	9/11/2018	9/11/2018	9/11/2018	9/13/2018	9/13/2018	9/13/2018	9/10/2018	9/10/2018	9/10/2018	9/10/2018	9/12/2018	9/12/2018	9/12/2018	9/12/2018	9/12/2018	9/12/2018	9/12/2018	9/12/2018
GPS - Northing (10 UTM)				6209610	6209610	6203491	6203491	6205050	6207857	6229426	6231488	6231374	6230146	6226276	6223596	6220293	6220613	6220751	6219559	6224982	6224275	6242006	
GPS - Easting (10 UTM)				549540	549540	562028	562028	562934	566122	594889	596649	628028	628620	640247	641710	661946	663060	672509	676408	317950	318943	364653	
Laboratory Identification Number				L2162370-1	L2162370-2	L2162370-3	L2162370-4	L2162370-6	L2163952-3	L2163952-2	L2163952-1	L2161498-2	L2161498-1	L2161498-3	L2161498-4	L2163509-1	L2163509-2	L2163509-3	L2163509-4	L2163509-5	L2163509-6	L2163509-7	
Matrix				surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water	surface water
Field Measurements																							
Sample Depth	m	-		0.2	5.0	0.2	5.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total Depth	m	-		70.0	70.0	35.0	35.0	0.5	2.9	10.6	3.3	1.6	1.0	1.8	0.7	4.2	1.0	3.8	0.9	5.7	0.5	5.0	
Temperature	°C	-	15	14.6	14.6	11.6	11.6	11.5	10.1	9.3	4.9	10.9	11.5	10.9	11.2	9.8	8.1	10.0	7.8	10.1	8.4	10.1	
Dissolved Oxygen (DO)	mg/L	-	Minimum 5 #1	9.24	9.22	10.30	10.01	10.23	10.56	10.72	12.30	10.63	10.34	10.66	10.39	10.80	11.24	10.75	11.69	10.70	12.05	10.79	
Specific Conductivity (SPC)	SPC _u /cm	-		176.8	174.1	180.0	177.7	183.3	176.3	185.0	429.1	211.4	262.2	213.6	348.5	221.8	372.3	204.9	512.0	209.1	969.0	224.0	
Electrical Conductivity (EC)	SPC _u /cm	-		141.7	139.5	134.0	132.1	136.0	126.0	129.6	264.6	154.3	194.6	155.9	256.5	157.5	253.1	146.4	343.7	149.8	662.0	160.0	
Salinity	parts per trillion	-		0.08	0.08	0.09	0.08	0.09	0.09	0.09	0.21	0.10	0.13	0.10	0.17	0.11	0.18	0.10	0.25	0.10	0.48	0.11	
pH	pH Units	-	6.5-9.0	8.22	8.11	8.03	8.06	8.01	8.02	8.21	8.37	8.15	8.11	8.09	8.16	8.21	8.06	8.17	8.46	8.21	8.43	8.29	
Turbidity	nephelometric unit	-		0.3	0.4	1.2	1.1	1.2	0.8	1.4	22.8	6.9	110.4	9.6	230.0	23.5	50.4	17.7	239.7	26.5	38.6	33.5	
Physical Parameters																							
Colour	TCU	5		5.8	6.6	6.2	8.1	6.1	6.2	6.7	10.9	5.8	24.9	6.1	7.4	7.1	106	9.2	13.8	<5	30.3	5.6	
Electrical Conductivity (EC)	µS/cm	2		173	175	181	181	189	181	184	432	214	268	217	348	199	374	214	504	215	991	222	
pH	pH Units	0.1	6.5-9.0	8.2	8.19	8.2	8.2	8.2	8.2	8.18	8.46	8.21	8.3	8.22	8.41	8.22	8.34	8.27	8.57	8.26	8.5	8.28	
Total Suspended Solids (TSS)	mg/L	3		<3	<3	<3	<3	<3	<3	<3	33	9.4	88.6	12.8	289	21.4	35.8	35.8	347	55.4	27.8	42.6	
Total Dissolved Solids (TDS)	mg/L	1		107	103	107	104	112	99.2	100	258	120	160	123	216	128	315	140	381	138	716	141	
Turbidity	NTU	0.1		0.48	0.49	1.08	1.07	1.11	0.57	1.07	22.2	7.25	126	9.18	235	13.3	72.6	23.3	280	27.8	47.3	36.7	
Anions and Nutrients																							
Alkalinity (Bicarbonate as CaCO ₃)	mg/L	1		81.8	81	83.1	83.3	86.4	84.5	84.3	181	97.9	136	98.5	163	93.1	127	98.1	227	99	195	104	
Alkalinity (Carbonate as CaCO ₃)	mg/L	1		<1	<1	<1	<1	<1	<1	<1	11	<1	<1	<1	7.8	<1	<1	<1	20.4	<1	15.6	<1	
Alkalinity (Hydroxide) as CaCO ₃	mg/L	1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Alkalinity (total as CaCO ₃)	mg/L	1		81.8	81	83.1	83.3	86.4	84.5	84.3	192	97.9	136	98.5	171	93.1	131	98.1	247	99	211	104	
Ammonia as N	mg/L	0.005	See narrative #2	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0079	0.0073	0.005	0.0103	<0.005	0.031	<0.005	0.03	<0.005	0.0371	0.0058		
Bromide	mg/L	0.05		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.25	<0.05	
Chloride	mg/L	0.5	600	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	0.52	<0.5	<0.5	1.27	<0.5	3.04	<0.5	1.75	<0.5	10.2	<0.5	<0.5	
Fluoride	mg/L	0.02	See equation #3	0.035	0.036	0.038	0.036	0.038	0.037	0.038	0.109	0.047	0.088	0.047	0.097	0.044	0.131	0.048	0.107	0.046	0.29	0.05	
Nitrate and Nitrite (as N)	mg/L	0.0051		0.0481	0.0483	0.0607	0.0607	0.0625	0.0635	0.0577	<0.0051	0.0557	<0.0051	0.0467	0.0663	0.057	0.0961	0.0581	0.118	0.056	0.202	0.0572	
Nitrate (as N)	mg/L	0.005	32.8	0.0453	0.0454	0.0595	0.0595	0.0625	0.0635	0.0577	<0.005	0.0541	<0.005	0.0467	0.0663	0.057	0.0922	0.0581	0.115	0.056	0.192	0.0572	
Nitrite (as N)	mg/L	0.001	0.06-0.60 #4	0.0027	0.0029	0.0012	0.0011	<0.001	<0.001	<0.001	0.0016	<0.001	<0.001	<0.001	<0.001	0.0039	<0.001	0.0024	<0.001	0.0105	<0.001	<0.001	
Total Kjeldahl Nitrogen (TKN)	mg/L	0.05		0.12	0.106	0.103	0.103	0.101	0.099	0.101	0.084	0.091	0.172	0.099	0.432	0.128	0.152	0.118	0.962	0.173	0.838	0.181	
Nitrogen (Total)	mg/L	0.03		0.147	0.146	0.146	0.148	0.145	0.147	0.143	0.137	0.136	0.291	0.143	0.34	0.18	0.746	0.173	0.541	0.177	1.01	0.202	
Orthophosphate (as P) (Filtered)	mg/L	0.001		<0.001	0.001	0.0012	<0.001	<0.001	0.0013	0.0013	0.0028	0.0013	0.0038	0.0013	0.0026	0.002	0.0071	0.0016	0.0039	0.002	0.002	0.0022	
Phosphorus (Total Dissolved)	mg/L	0.002		0.0022	<0.002	<0.002	<0.002	<0.002	0.0031	0.0034	0.0046	<0.002	0.0058	<0.002	0.0024	0.0026	0.0167	0.0023	0.0061	0.0027	0.0066	0.0033	
Phosphorus	mg/L	0.002		0.0035	0.0035	0.003	0.0034	0.0037	0.0036	0.0053	0.0418	0.0119	0.138	0.0167	0.314	0.0215	0.0656	0.0392	0.182	0.0456	0.0531	0.0449	
Sulphate	mg/L	0.3		12.7	12.7	13.7	13.7	14	13.4	13.6	54.3	19.3	16.5	19.9	34.2	15.8	64.2	17.1	47.1	17.1	321	18.8	
Silica	mg/L	0.5		4.31	4.11	4.26	4.52	4.62	4.41	4.19	3.8	4.35	3.38	4.16	3.09	4.28	4.21	4.09	4.86	4.35	1.18	4.02	
Organic and Inorganic Carbon																							
Dissolved Organic Carbon (DOC) (Filtered)	mg/L	0.5		2.91	2.91	2.68	2.88	2.82	2.59	2.77	3.53	3.03	6.95	3.01	3.32	2.8	19.5	2.87	7.84	3.21	15.6	3.12	
Total Organic Carbon (TOC)	mg/L	0.5		2.84	3	2.87	2.94	2.76	2.51	3.15	3.64	3.15	9.62	3.36	8.14	3.01	21.4	3.61	12.3	4.28	17.2	3.93	

NOTES:

- BC MOE 2018 British Columbia Ministry of Environment (BC MOE). 2018. British Columbia approved water quality guidelines: Aquatic life, wildlife & agriculture. Water Protection and Sustainability Branch, Victoria, British Columbia, Canada.
- H Hardness. Where hardness values exceed the range applied for guideline use, site specific assessment may be required.
- #1 Dissolved Oxygen guideline protects all life stages other than buried embryo/alevin, based on instantaneous measurement.
- #2 Guideline for ammonia nitrogen (NH₃) varies with pH and temperature, and is derived from Table 26D of the BC MOE, 2017 BCWQGs, ranging from 0.681 to 28.7 mg/L for pH 6.5-9.0 and temperature 0.0-20.0 degC.
- #3 Guideline for fluoride varies with H. Guideline is 0.4 mg/L when H <10 mg/L. Calculated in mg/L and based on equation: [-51.73 + 92.57*log(Hardness)]x0.01 when H =10-385 mg/L.
- #4 Guideline for nitrite varies with chloride concentrations.
- #5 Guideline for copper varies with H and is calculated in mg/L and based on equation: [0.094(H)+2]/1000, when H =13-400 mg/L.
- #6 Guideline for lead varies with H. Guideline is 0.003 mg/L when H<8 mg/L. Calculated in mg/L and based on equation: [e^{(1.273*ln(H)-1.460)}]/1000 when H=8-360 mg/L.
- #7 Guideline for manganese varies with H and is calculated in mg/L and based on equation: (0.01102*H)+0.54, when H =25-259 mg/L.
- #8 Guideline for silver varies with H. Guideline is 0.0001 mg/L when H<100 mg/L or 0.003 mg/L when H>100 mg/L.
- #9 Guideline for zinc varies with H. Guideline is 0.033 mg/L when H is <90 mg/L. Calculated in mg/L and based on equation: [33+0.75*(H-90)]/1000, when H=90-500 mg/L.
- #10 Guideline for aluminum varies with pH. Guideline is 0.1 mg/L if pH ≥ 6.5. Calculated in mg/L and based on equation: e^{(1.209-2.426(pH)+0.286K)} where K=(pH)² and pH < 6.5.
- #11 Guideline for cadmium varies with H and is calculated in mg/L and based on equation: [e^{(1.031*ln(H)-5.274)}]/1000, when H=7-455 mg/L.
- No applicable guideline or analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- Bold** Bold and shaded indicates an exceedance of the applied guideline.
- MPN Most Probable Number
- CFU Colony Forming Units

Table 12: May 2018 Surface Water Quality Results Summary for Duplicate Analysis

Parameter	Reported Detection Limit (RDL)	Unit	D1-SHALLOW	DUP1	RPD Analysis	PR2	DUP2	RPD Analysis
			5/11/2018	5/11/2018		5/9/2018	5/9/2018	
Laboratory Identification Number			L2093535-3	L2093535-5		L2092365-3	L2092365-4	
Physical Parameters								
Colour	5	Col. Unit	25.6	23.6	8.1	28	28.4	1.4
Electrical Conductivity (EC)	2	µS/cm	-	-		179	181	1.1
Hardness as CaCO ₃	0.5	mg/L	94	89.6	4.8	106	118	11
pH	0.1	pH Units	8.03	8.03	0.0	8.06	8.07	0.1
Total Suspended Solids (TSS)	3	mg/L	17.9	15.9	12	112	131	15.6
Total Dissolved Solids (TDS)	1	mg/L	102	137	29	97.4	123	23
Turbidity	0.1	NTU	29.9	30.7	2.6	129	134	3.8
Anions and Nutrients								
Bicarbonate as CaCO ₃	1	mg/L	81.6	81	0.7	81.8	80.7	1.4
Carbonate as CaCO ₃	1	mg/L	<1	<1		<1	<1	
Hydroxide as CaCO ₃	1	mg/L	<1	<1		<1	<1	
Total Alkalinity as CaCO ₃	1	mg/L	81.6	81	0.7	81.8	80.7	1.4
Ammonia, Total (as N)	0.005	mg/L	<0.005	0.0055		0.0125	0.009	33
Bromide	0.05	mg/L	<0.05	<0.05		<0.05	<0.05	
Chloride	0.5	mg/L	<0.5	<0.5		<0.5	<0.5	
Fluoride	0.02	mg/L	0.045	0.042		0.048	0.048	
Nitrate and Nitrite (as N)	0.0051	mg/L	0.0914	0.0935	2.3	0.104	0.105	1.0
Nitrate (as N)	0.005	mg/L	0.0914	0.0935	2.3	0.104	0.105	1.0
Nitrite (as N)	0.001	mg/L	<0.001	<0.001		<0.001	<0.001	
Total Kjeldahl Nitrogen	0.05	mg/L	0.204	0.196		0.406	0.39	4.0
Total Nitrogen	0.03	mg/L	0.253	0.274	8.0	0.36	0.341	5.4
Orthophosphate (as P)	0.001	mg/L	0.0025	0.0025		0.0033	0.0029	
Phosphorus (P)-Dissolved	0.002	mg/L	0.0062	0.0061		0.0065	0.0062	
Phosphorus (P)-Total	0.002	mg/L	0.0397	0.0403	1.5	0.165	0.156	5.6
Sulphate (SO ₄)	0.3	mg/L	13.6	13.6	0.0	15.4	15.5	0.6
Silica	0.5	mg/L	4.47	4.64	3.7	4.51	4.56	1.1
Anions Total		meq/L	1.92	1.91		1.97	1.94	
Cations Total		meq/L	1.91	1.82		2.71	2.98	
Ionic Balance		N/A	-0.5	-2.4		16	21.1	
Organic and Inorganic Carbon								
Dissolved Organic Carbon (DOC)	0.5	mg/L	4.34	5	14	7.24	7.77	7
Total Organic Carbon (TOC)	0.5	mg/L	4.87	5.54	13	8.06	7.8	3
Total Metals								
Aluminum	0.005	mg/L	0.654	0.677	3	2.56	2.48	3
Antimony	0.0005	mg/L	<0.0005	<0.0005		<0.0005	<0.0005	
Arsenic	0.0005	mg/L	0.00059	0.00059		0.00182	0.00184	
Barium	0.02	mg/L	0.072	0.071	1.4	0.115	0.109	5.4
Beryllium	0.001	mg/L	<0.0001	<0.0001		0.00013	0.00013	
Bismuth	0.2	mg/L	<0.2	<0.2		<0.2	<0.2	
Boron	0.1	mg/L	<0.1	<0.1		<0.1	<0.1	
Cadmium	0.000005	mg/L	0.0000379	0.000044	15	0.00024	0.000259	8
Calcium	0.1	mg/L	25.4	25.4	0	30.9	32.8	6
Chromium	0.001	mg/L	0.0017	0.0021		0.0047	0.0047	
Cobalt	0.0003	mg/L	0.00039	0.00039		0.00171	0.00175	2.3
Copper	0.001	mg/L	0.0024	0.0026		0.0061	0.0062	1.6
Iron	0.03	mg/L	0.967	0.998	3.2	4.08	4.08	0.0
Lead	0.0005	mg/L	<0.0005	0.00055		0.00219	0.00214	
Lithium	0.001	mg/L	0.0022	0.002		0.004	0.0044	
Magnesium	0.1	mg/L	6.18	6.16	0.3	8.41	8.64	3
Manganese	0.001	mg/L	0.0139	0.014	0.7	0.0645	0.0649	0.6
Mercury	0.000005 or 0.0000005	mg/L	0.00000448	0.00000449	0.2	0.0000116	0.0000115	0.9
Methyl mercury	0.00000002	mg/L	0.000000043	0.000000028		0.000000032	0.000000074	
Molybdenum	0.001	mg/L	<0.001	<0.001		<0.001	<0.001	
Nickel	0.001	mg/L	0.0023	0.0024		0.0074	0.0075	1.3
Phosphorus	0.3	mg/L	<0.3	<0.3		<0.3	<0.3	
Potassium	2	mg/L	<2	<2		<2	<2	
Selenium	0.00005	mg/L	0.000275	0.000281	2.2	0.00039	0.000404	3.5
Silicon	0.05	mg/L	3.18	3.11	2.2	6.29	6.05	3.9
Silver	0.00002	mg/L	<0.00002	<0.00002		0.000044	0.000041	
Sodium	2	mg/L	<2	<2		<2	<2	
Strontium	0.005	mg/L	0.106	0.107	0.9	0.109	0.108	0.9
Thallium	0.0002	mg/L	0.000018	0.000017		0.000082	0.000072	
Tin	0.0005	mg/L	<0.0005	<0.0005		<0.0005	<0.0005	
Titanium	0.01	mg/L	<0.01	<0.01		0.04	0.037	
Uranium	0.0002	mg/L	0.00048	0.00049		0.00068	0.00068	
Vanadium	0.0005	mg/L	0.00318	0.00327	2.8	0.0107	0.0105	
Zinc	0.005	mg/L	0.0059	0.0061		0.0219	0.0231	
Dissolved Metals								
Aluminum	0.005	mg/L	0.121	0.132	8.7	3.49	3.59	2.8
Antimony	0.0005	mg/L	<0.0005	<0.0005		<0.0005	<0.0005	
Arsenic	0.0005	mg/L	<0.0005	<0.0005		0.00121	0.00143	
Barium	0.02	mg/L	0.055	0.054		0.126	0.134	6.2
Beryllium	0.001	mg/L	<0.0001	<0.0001		0.00017	0.00017	
Bismuth	0.2	mg/L	<0.2	<0.2		<0.2	<0.2	
Boron	0.1	mg/L	<0.1	<0.1		<0.1	<0.1	
Cadmium	0.000005	mg/L	0.0000176	0.0000206		0.000216	0.000238	9.7
Calcium	0.1	mg/L	27.5	25.2	8.7	29.8	33.5	12
Chromium	0.001	mg/L	<0.001	<0.001		0.0051	0.0057	11.1
Cobalt	0.0003	mg/L	<0.0003	<0.0003		0.00126	0.00146	
Copper	0.001	mg/L	0.0011	0.0011		0.0045	0.005	
Iron	0.03	mg/L	0.273	0.29	6.0	2.67	3.13	15.9
Ferrous Iron	0.02	mg/L	-	-		-	-	
Lead	0.0005	mg/L	<0.0005	<0.0005		0.00157	0.0019	
Lithium	0.001	mg/L	0.0016	0.0014		0.0055	0.0058	5.3
Magnesium	0.0001	mg/L	6.16	6.49	5.2	7.72	8.3	7.2
Manganese	0.1	mg/L	0.00786	0.00814	3.5	0.0562	0.0649	14
Mercury	0.000005 or 0.0000005	mg/L	0.0000006	0.00000054	3.5	0.00000964	0.00000818	14
Methyl mercury	0.00000002	mg/L	0.000000026	0.00000002		0.000000052	0.00000006	
Molybdenum	0.001	mg/L	<0.001	<0.001		<0.001	<0.001	
Nickel	0.001	mg/L	0.0014	0.0014		0.0052	0.0062	18
Phosphorus	0.3	mg/L	<0.3	<0.3		<0.3	<0.3	
Potassium	2	mg/L	<2	<2		2.1	2.2	
Selenium	0.00005	mg/L	0.000173	0.000233		0.000321	0.000377	16
Silicon	0.05	mg/L	2.31	2.32	0.4	10	10.4	4
Silver	0.00002	mg/L	<0.00002	<0.00002		0.000029	0.000044	
Sodium	2	mg/L	<2	<2		<2	<2	
Strontium	0.005	mg/L	0.0994	0.0971	2.3	0.107	0.11	2.8
Thallium	0.0002	mg/L	<0.0002	<0.0002		<0.0002	<0.0002	
Tin	0.0005	mg/L	<0.0005	<0.0005		<0.0005	<0.0005	
Titanium	0.01	mg/L	<0.01	<0.01		<0.16	0.22	
Uranium	0.0002	mg/L	0.00043	0.00043		0.00064	0.00075	
Vanadium	0.0005	mg/L	0.00058	0.0006	3.4	0.0124	0.0125	0.8
Zinc	0.005	mg/L	<0.005	<0.005		0.0141	0.0158	

NOTES:

- Analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- RPD RPD is Relative Percentage Difference calculated as $RPD = \frac{C2 - C1}{(C1 + C2)/2}$ where C1, C2 = concentrations of parameters in 1st and 2nd sample respectively.
- RPDs have only been considered where a concentration is 5 times greater than the RDL
- BOLD** RPDs greater than 20% are shaded in grey and bolded
- MPN Most Probable Number

Table 12: June 2018 Surface Water Quality Results Summary for Duplicate Analysis

Parameter		Unit	HD	DUPLICATE 1	RPD Analysis	D1-DEEP	DUP 2	RPD Analysis
Sample Date	Reported Detection Limit (RDL)		6/19/2018	6/19/2018		6/18/2018	6/18/2018	
Laboratory Identification Number			L2115122-1	L2115122-4		L2115009-4	L2115009-5	
Physical Parameters								
Colour	5	Col. Unit	14.2	14.5	2	<5	<5	
Electrical Conductivity (EC)	2	µS/cm	394	389	1	183	184	1
pH	0.1	pH Units	8.48	8.46	0	8.1	8.09	0
Total Suspended Solids (TSS)	3	mg/L	95.2	68.4	33	<3	<3	
Total Dissolved Solids (TDS)	1	mg/L	218	219	0	101	94	7
Turbidity	0.1	NTU	59.8	64.8	8	1.02	0.93	9
Anions and Nutrients								
Bicarbonate as CaCO ₃	1	mg/L	157	157	0	86.2	85.5	1
Carbonate as CaCO ₃	1	mg/L	2.6	5.8	76	<1	<1	
Hydroxide as CaCO ₃	1	mg/L	<1	<1		<1	<1	
Total Alkalinity as CaCO ₃	1	mg/L	159	163	2	86.2	85.5	1
Ammonia, Total (as N)	0.005	mg/L	0.0061	0.0073		<0.005	0.0063	
Bromide	0.05	mg/L	<0.05	<0.05		<0.05	<0.05	
Chloride	0.5	mg/L	<0.5	<0.5		<0.5	<0.5	
Fluoride	0.02	mg/L	0.092	0.096		0.04	0.04	
Nitrate and Nitrite (as N)	0.0051	mg/L	<0.0051	<0.0051		0.0302	0.0307	2
Nitrate (as N)	0.005	mg/L	<0.005	<0.005		0.0302	0.0307	2
Nitrite (as N)	0.001	mg/L	<0.001	<0.001		<0.001	<0.001	
Total Kjeldahl Nitrogen	0.05	mg/L	0.233	0.235		0.081	0.13	
Total Nitrogen	0.03	mg/L	0.18	0.196	9	0.114	0.109	4
Orthophosphate (as P)	0.001	mg/L	0.0034	0.0036		0.0014	0.0016	
Phosphorus (P)-Dissolved	0.002	mg/L	0.0049	0.0055		<0.002	<0.002	
Phosphorus (P)-Total	0.002	mg/L	0.0981	0.0908	8	0.0039	0.0032	
Sulphate (SO ₄)	0.3	mg/L	43.4	43.5	0	15.2	15.2	0
Silica	0.5	mg/L	3.55	3.84	8	4.49	4.36	3
Organic and Inorganic Carbon								
Dissolved Organic Carbon (DOC)	0.5	mg/L	3.96	3.93	1	2.6	2.81	8
Total Organic Carbon (TOC)	0.5	mg/L	5.72	5.64	1	2.7	3.05	12

NOTES:

- Analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- RPD RPD is Relative Percentage Difference calculated as $RPD = \frac{C2 - C1}{[(C1 + C2) / 2]}$ where C1, C2 = concentrations of parameters in 1st and 2nd sample respectively. RPDs have only been considered where a concentration is 5 times greater than the RDL
- BOLD** RPDs greater than 20% are shaded in grey and bolded
- MPN Most Probable Number

Table 12: July 2018 Surface Water Quality Results Summary for Duplicate Analysis

Parameter	Reported Detection Limit (RDL)	Unit	PD2 7/19/2018	DUPLICATE 1 7/19/2018	RPD Analysis	PD2 7/19/2018	DUP-1A 7/19/2018	RPD Analysis	D1-SHALLOW 7/17/2018	DUPLICATE 2 7/17/2018	RPD Analysis
Laboratory Identification Number			L2133123-1	L2133123-8		L2133123-1	L2133123-9		L2131545-3	L2131545-5	
Physical Parameters											
Colour	5	Col. Unit	7.5	6.9	8	7.5	-		6.2	8.6	32
Electrical Conductivity (EC)	2	µS/cm	206	200	3	206	-		181	183	1
pH	0.1	pH Units	8.22	8.2	0	8.22	-		8.17	8.2	0
Total Suspended Solids (TSS)	3	mg/L	72.2	81.8	12	72.2	-		<3	<3	
Total Dissolved Solids (TDS)	1	mg/L	129	122	6	129	-		119	112	6
Turbidity	0.1	NTU	21.6	23.2	7	21.6	-		0.81	0.87	7
Anions and Nutrients											
Bicarbonate as CaCO ₃	1	mg/L	89.6	85.8	4	89.6	-		81.3	83.3	2
Carbonate as CaCO ₃	1	mg/L	<1	<1		<1	-		<1	<1	
Hydroxide as CaCO ₃	1	mg/L	<1	<1		<1	-		<1	<1	
Total Alkalinity as CaCO ₃	1	mg/L	89.6	85.8	4	89.6	-		81.3	83.3	2
Ammonia, Total (as N)	0.005	mg/L	<0.005	0.0055		<0.005	-		0.0074	<0.005	
Bromide	0.05	mg/L	<0.05	<0.05		<0.05	-		<0.05	<0.05	
Chloride	0.5	mg/L	<0.5	<0.5		<0.5	-		<0.5	<0.5	
Fluoride	0.02	mg/L	0.045	0.045		0.045	-		0.037	0.037	
Nitrate and Nitrite (as N)	0.0051	mg/L	0.0534	0.0535	0	0.0534	-		0.0494	0.0495	0
Nitrate (as N)	0.005	mg/L	0.0534	0.0535	0	0.0534	-		0.0494	0.0495	0
Nitrite (as N)	0.001	mg/L	<0.001	<0.001		<0.001	-		<0.001	<0.001	
Total Kjeldahl Nitrogen	0.05	mg/L	0.188	0.2		0.188	-		0.102	0.08	
Total Nitrogen	0.03	mg/L	0.174	0.181	4	0.174	-		0.138	0.131	
Orthophosphate (as P)	0.001	mg/L	0.0013	0.0012		0.0013	-		0.0017	0.0013	
Phosphorus (P)-Dissolved	0.002	mg/L	0.0031	0.0023		0.0031	-		<0.002	<0.002	
Phosphorus (P)-Total	0.002	mg/L	0.0696	0.0673	3	0.0696	-		0.0033	0.0039	
Sulphate (SO ₄)	0.3	mg/L	16.4	16.4	0	16.4	-		13.9	13.8	1
Silica	0.5	mg/L	3.99	4.11	3	3.99	-		4.21	4.03	4
Organic and Inorganic Carbon											
Dissolved Organic Carbon (DOC)	0.5	mg/L	3.04	3.26	7	3.04	2.82	7	2.78	3.02	8
Total Organic Carbon (TOC)	0.5	mg/L	3.11	3.46	11	3.11	-		2.85	2.82	1

NOTES:

- Analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- RPD RPD is Relative Percentage Difference calculated as $RPD = \frac{C2 - C1}{(C1 + C2)/2}$ where C1, C2 = concentrations of parameters in 1st and 2nd sample respectively. RPDs have only been considered where a concentration is 5 times greater than the RDL
- BOLD** RPDs greater than 30% are shaded in grey and bolded
- MPN Most Probable Number

Table 12: August 2018 Surface Water Quality Results Summary for Duplicate Analysis

Parameter		Unit	PD2	DUPLICATE 1	RPD Analysis	D1-SHALLOW	DUPLICATE 2	RPD Analysis
Sample Date	Reported Detection Limit (RDL)		8/1/2018	8/1/2018		7/31/2018	7/31/2018	
Laboratory Identification Number			L2140393-1	L2140393-8		L2139662-3	L2139662-5	
Physical Parameters								
Colour	5	Col. Unit	17.7	18.5	4	19.3	17	13
Electrical Conductivity (EC)	2	µS/cm	236	238	1	173	180	4
pH	0.1	pH Units	8.29	8.31	0	8.19	8.25	1
Total Suspended Solids (TSS)	3	mg/L	80.6	86.2	7	4.5	4.8	6
Total Dissolved Solids (TDS)	1	mg/L	171	161	6	110	112	2
Turbidity	0.1	NTU	50.6	47.5	6	16.5	16.4	1
Anions and Nutrients								
Bicarbonate as CaCO ₃	1	mg/L	111	109	2	81.1	83.5	3
Carbonate as CaCO ₃	1	mg/L	<1	2.6		<1	<1	
Hydroxide as CaCO ₃	1	mg/L	<1	<1		<1	<1	
Total Alkalinity as CaCO ₃	1	mg/L	111	112	1	81.1	83.5	3
Ammonia, Total (as N)	0.005	mg/L	<0.005	<0.005		<0.005	<0.005	
Bromide	0.05	mg/L	<0.05	<0.05		<0.05	<0.05	
Chloride	0.5	mg/L	<0.5	<0.5		<0.5	<0.5	
Fluoride	0.02	mg/L	0.062	0.061		0.045	0.045	
Nitrate and Nitrite (as N)	0.0051	mg/L	0.0579	0.0576	1	0.0506	0.0499	1
Nitrate (as N)	0.005	mg/L	0.0579	0.0576	1	0.0506	0.0499	1
Nitrite (as N)	0.001	mg/L	<0.001	<0.001		<0.001	<0.001	
Total Kjeldahl Nitrogen	0.05	mg/L	0.249	0.258		0.142	0.122	
Total Nitrogen	0.03	mg/L	0.235	0.253	7	0.198	0.192	3
Orthophosphate (as P)	0.001	mg/L	0.0027	0.0026	4	0.0012	0.0013	
Phosphorus (P)-Dissolved	0.002	mg/L	0.093	0.098	5	0.0237	0.02	17
Phosphorus (P)-Total	0.002	mg/L	0.0048	0.004		0.0044	0.0045	2
Sulphate (SO ₄)	0.3	mg/L	18.3	18.3	0	13.6	13.6	0
Silica	0.5	mg/L	3.82	3.99	4	4.4	4.39	0
Organic and Inorganic Carbon								
Dissolved Organic Carbon (DOC)	0.5	mg/L	3.85	4.13	7	4.26	4.09	4
Total Organic Carbon (TOC)	0.5	mg/L	5.59	5.31	5	4.59	4.59	0

NOTES:

- Analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- RPD RPD is Relative Percentage Difference calculated as $RPD = \frac{C2 - C1}{[(C1 + C2) / 2]}$ where C1, C2 = concentrations of parameters in 1st and 2nd sample respectively. RPDs have only been considered where a concentration is 5 times greater than the RDL
- BOLD** RPDs greater than 30% are shaded in grey and bolded
- MPN Most Probable Number

Table 12: September 2018 Surface Water Quality Results Summary for Duplicate Analysis

Parameter		Unit	PR2	DUPLICATE 1	RPD Analysis	D1-SHALLOW	DUP 2	RPD Analysis
Sample Date	Reported Detection Limit (RDL)		9/13/2018	9/13/2018		9/11/2018	9/11/2018	
Laboratory Identification Number			L2163952-2	L2163952-4		L2162370-5	L2162370-5	
Physical Parameters								
Colour	5	Col. Unit	6.7	6.2	8	6.2	7.2	15
Electrical Conductivity (EC)	2	µS/cm	184	184	0	181	182	1
pH	0.1	pH Units	8.18	8.21	0	8.2	8.21	0
Total Suspended Solids (TSS)	3	mg/L	<3	<3		<3	<3	
Total Dissolved Solids (TDS)	1	mg/L	100	100	0	107	104	3
Turbidity	0.1	NTU	1.07	1.14		1.08	1.21	11
Anions and Nutrients								
Bicarbonate as CaCO ₃	1	mg/L	84.3	84.3	0	83.1	83.6	1
Carbonate as CaCO ₃	1	mg/L	<1	<1		<1	<1	
Hydroxide as CaCO ₃	1	mg/L	<1	<1		<1	<1	
Total Alkalinity as CaCO ₃	1	mg/L	84.3	84.3	0	83.1	83.6	1
Ammonia, Total (as N)	0.005	mg/L	<0.005	<0.005		<0.005	<0.005	
Bromide	0.05	mg/L	<0.05	<0.05		<0.05	<0.05	
Chloride	0.5	mg/L	<0.5	<0.5		<0.5	<0.5	
Fluoride	0.02	mg/L	0.038	0.038		0.038	0.038	0
Nitrate and Nitrite (as N)	0.0051	mg/L	0.0577	0.0635	10	0.0607	0.0596	2
Nitrate (as N)	0.005	mg/L	0.0577	0.0635	10	0.0595	0.0585	2
Nitrite (as N)	0.001	mg/L	<0.001	<0.001		0.0012	0.0011	
Total Kjeldahl Nitrogen	0.05	mg/L	0.091	0.095		0.103	0.114	
Total Nitrogen	0.03	mg/L	0.143	0.147		0.146	0.155	
Orthophosphate (as P)	0.001	mg/L	0.0013	0.0013		0.0012	<0.001	
Phosphorus (P)-Dissolved	0.002	mg/L	0.0034	0.003		<0.002	<0.002	
Phosphorus (P)-Total	0.002	mg/L	0.0053	0.0038		0.003	0.0049	
Sulphate (SO ₄)	0.3	mg/L	13.6	13.6	0	13.7	13.7	0
Silica	0.5	mg/L	4.19	4.44	6	4.26	4.27	0
Organic and Inorganic Carbon								
Dissolved Organic Carbon (DOC)	0.5	mg/L	2.77	2.54	9	2.68	2.79	4
Total Organic Carbon (TOC)	0.5	mg/L	3.15	2.85	10	2.87	2.97	3

NOTES:

- Analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- RPD RPD is Relative Percentage Difference calculated as $RPD = \frac{|C2 - C1|}{[(C1 + C2)/2]}$ where C1, C2 = concentrations of parameters in 1st and 2nd sample respectively. RPDs have only been considered where a concentration is 5 times greater than the RDL
- BOLD** RPDs greater than 20% are shaded in grey and bolded
- MPN Most Probable Number

Table 12: October 2018 Surface Water Quality Results Summary for Duplicate Analysis

Parameter	Reported Detection Limit (RDL)	Unit	PD5	DUP1	RPD Analysis	D1-SHALLOW	DUP2	RPD Analysis
			10/18/2018	10/19/2018		10/19/2018	10/19/2018	
Laboratory Identification Number								
			L2183715-7	L2183715-8		L2184476-3	L2184476-5	
Physical Parameters								
Colour	5	Col. Unit	7.7	8.1	5.1	5.7	6.7	16.1
Electrical Conductivity (EC)	2	µS/cm	210	210	0.0	185	187	1.1
Hardness as CaCO ₃	0.5	mg/L	103	102	1.0	86.7	91	5
pH	0.1	pH Units	8.22	8.22	0.0	8.09	8.1	0.1
Total Suspended Solids (TSS)	3	mg/L	9.2	9.4		<3	<3	
Total Dissolved Solids (TDS)	1	mg/L	114	113	1	96.7	97	0
Turbidity	0.1	NTU	7.57	6.61	13.5	0.57	0.51	11.1
Anions and Nutrients								
Bicarbonate as CaCO ₃	1	mg/L	95	93.6	1.5	81.3	80.2	1.4
Carbonate as CaCO ₃	1	mg/L	<1	<1		<1	<1	
Hydroxide as CaCO ₃	1	mg/L	<1	<1		<1	<1	
Total Alkalinity as CaCO ₃	1	mg/L	95	93.6	1.5	81.3	80.2	1.4
Ammonia, Total (as N)	0.005	mg/L	<0.005	<0.005		<0.005	<0.005	
Bromide	0.05	mg/L	<0.05	<0.05		<0.05	<0.05	
Chloride	0.5	mg/L	<0.5	<0.5		<0.5	<0.5	
Fluoride	0.02	mg/L	0.044	0.045		0.038	0.038	
Nitrate and Nitrite (as N)	0.0051	mg/L	0.052	0.0517	0.6	0.0583	0.0596	2.2
Nitrate (as N)	0.005	mg/L	0.052	0.0517	0.6	0.0583	0.0596	2.2
Nitrite (as N)	0.001	mg/L	<0.001	<0.001		<0.001	<0.001	
Total Kjeldahl Nitrogen	0.05	mg/L	0.098	0.086		0.08	0.086	7.2
Total Nitrogen	0.03	mg/L	0.144	0.151		0.129	0.13	
Orthophosphate (as P)	0.001	mg/L	0.0023	0.0019		0.001	<0.001	
Phosphorus (P)-Dissolved	0.002	mg/L	0.0092	0.0021		0.0032	0.003	
Phosphorus (P)-Total	0.002	mg/L	0.0197	0.0151	26.4	0.0028	0.0042	
Sulphate (SO ₄)	0.3	mg/L	16.9	17	0.6	13.8	13.8	0.0
Silica	0.5	mg/L	4.21	4.03	4.4	4.46	4.46	0.0
Anions Total		meq/L	2.26	2.23		1.92	1.9	
Cations Total		meq/L	2.06	2.05		1.73	1.82	
Ionic Balance		N/A	-4.5	-4.3		-5.1	-2.1	
Organic and Inorganic Carbon								
Dissolved Organic Carbon (DOC)	0.5	mg/L	3.22	3.14	3	2.44	2.5	
Total Organic Carbon (TOC)	0.5	mg/L	3.24	3.17	2	2.65	2.44	
Total Metals								
Aluminum	0.005	mg/L	0.2	0.199	1	0.0188	0.0168	
Antimony	0.0005	mg/L	<0.0005	<0.0005		<0.0005	<0.0005	
Arsenic	0.0005	mg/L	<0.0005	<0.0005		<0.0005	<0.0005	
Barium	0.02	mg/L	0.048	0.049		0.031	0.031	
Beryllium	0.001	mg/L	<0.0001	<0.0001		<0.0001	<0.0001	
Bismuth	0.2	mg/L	<0.2	<0.2		<0.2	<0.2	
Boron	0.1	mg/L	<0.1	<0.1		<0.1	<0.1	
Cadmium	0.000005	mg/L	0.0000295	0.00003	2	0.0000149	0.0000139	
Calcium	0.1	mg/L	31.5	29.6	6	26.7	26.6	0
Chromium	0.001	mg/L	<0.001	<0.001		<0.001	<0.001	
Cobalt	0.0003	mg/L	<0.0003	<0.0003		<0.0003	<0.0003	
Copper	0.001	mg/L	<0.001	<0.001		<0.001	<0.001	
Iron	0.03	mg/L	0.304	0.296	2.7	<0.03	<0.03	
Lead	0.0005	mg/L	<0.0005	<0.0005		<0.0005	<0.0005	
Lithium	0.001	mg/L	0.002	0.002		0.0011	0.0011	0
Magnesium	0.1	mg/L	7.41	7.51	1.3	6.25	6.33	1
Manganese	0.0001	mg/L	0.00906	0.0074	20.2	0.00132	0.00132	0.0
Mercury	0.000005 or 0.0000005	mg/L	0.00000108	0.00000103		<0.0000005	<0.0000005	
Methylmercury	0.0000002	mg/L	<0.0000002	<0.0000002		<0.0000002	<0.0000002	
Molybdenum	0.001	mg/L	<0.001	<0.001		<0.001	<0.001	
Nickel	0.001	mg/L	0.0012	0.0013	8.0	<0.001	<0.001	
Phosphorus	0.3	mg/L	<0.3	<0.3		<0.3	<0.3	
Potassium	2	mg/L	<2	<2		<2	<2	
Selenium	0.00005	mg/L	0.000306	0.000321	4.8	0.000298	0.00027	9.9
Silicon	0.05	mg/L	2.21	2.22	0.5	2.09	2.07	1.0
Silver	0.00002	mg/L	<0.00002	<0.00002		<0.00002	<0.00002	
Sodium	2	mg/L	2	2		<2	<2	
Strontium	0.005	mg/L	0.117	0.117	0.0	0.104	0.105	1.0
Thallium	0.0002	mg/L	<0.00001	<0.00001		<0.00001	<0.00001	
Tin	0.0005	mg/L	<0.0005	<0.0005		<0.0005	<0.0005	
Titanium	0.01	mg/L	<0.01	<0.01		<0.01	<0.01	
Uranium	0.0002	mg/L	0.00045	0.00046		0.00043	0.00045	
Vanadium	0.0005	mg/L	0.00107	0.00111		<0.0005	<0.0005	
Zinc	0.005	mg/L	<0.005	<0.005		<0.005	<0.005	
Dissolved Metals								
Aluminum	0.005	mg/L	0.047	0.0404	15.1	<0.005	<0.005	
Antimony	0.0005	mg/L	<0.0005	<0.0005		<0.0005	<0.0005	
Arsenic	0.0005	mg/L	<0.0005	<0.0005		<0.0005	<0.0005	
Barium	0.02	mg/L	0.043	0.042		0.032	0.031	
Beryllium	0.001	mg/L	<0.0001	<0.0001		<0.0001	<0.0001	
Bismuth	0.2	mg/L	<0.2	<0.2		<0.2	<0.2	
Boron	0.1	mg/L	<0.1	<0.1		<0.1	<0.1	
Cadmium	0.000005	mg/L	0.000021	0.0000221		0.0000104	0.0000087	
Calcium	0.1	mg/L	29.2	28.9	1.0	25.7	25.9	1
Chromium	0.001	mg/L	<0.001	<0.001		<0.001	<0.001	
Cobalt	0.0003	mg/L	<0.0003	<0.0003		<0.0003	<0.0003	
Copper	0.001	mg/L	<0.001	<0.001		<0.001	<0.001	
Iron	0.03	mg/L	0.057	0.056		<0.03	<0.03	
Ferrous Iron (Filtered)		mg/L	0.02	-		-	-	
Lead	0.0005	mg/L	<0.0005	<0.0005		<0.0005	<0.0005	
Lithium	0.001	mg/L	0.0018	0.0018		0.001	0.001	
Magnesium	0.1	mg/L	7.25	7.26	0.1	5.46	6.37	15.4
Manganese	0.0001	mg/L	0.00252	0.00246	2.4	0.00042	0.00033	
Mercury	0.000005 or 0.0000005	mg/L	<0.0000005	0.00000050		<0.0000005	<0.0000005	
Methylmercury	0.0000002	mg/L	<0.0000002	<0.0000002		0.00000046	0.00000003	
Molybdenum	0.001	mg/L	<0.001	<0.001		<0.001	0.0012	
Nickel	0.001	mg/L	<0.001	<0.001		<0.001	<0.001	
Phosphorus	0.3	mg/L	<0.3	<0.3		<0.3	<0.3	
Potassium	2	mg/L	<2	<2		<2	<2	
Selenium	0.00005	mg/L	0.000319	0.000332	4.0	0.000225	0.000259	
Silicon	0.05	mg/L	1.79	1.82	1.7	1.88	1.98	5
Silver	0.00002	mg/L	<0.00002	<0.00002		<0.00002	<0.00002	
Sodium	2	mg/L	<2	<2		<2	<2	
Strontium	0.005	mg/L	0.115	0.113	1.8	0.102	0.104	1.9
Thallium	0.0002	mg/L	<0.0002	<0.0002		<0.0002	<0.0002	
Tin	0.0005	mg/L	<0.0005	<0.0005		<0.0005	<0.0005	
Titanium	0.01	mg/L	<0.01	<0.01		<0.01	<0.01	
Uranium	0.0002	mg/L	0.00047	0.00048		0.00047	0.00042	
Vanadium	0.0005	mg/L	<0.0005	<0.0005		<0.0005	<0.0005	
Zinc	0.005	mg/L	<0.005	<0.005		<0.005	<0.005	

NOTES:
 - Analysis was not conducted.
 < Concentration is less than the laboratory detection limit indicated.
 RPD RPD is Relative Percentage Difference calculated as $RPD = \frac{|C2 - C1|}{(C1 + C2)/2}$ where C1, C2 = concentrations of parameters in 1st and 2nd sample respectively.
 RPDs have only been considered where a concentration is 5 times greater than the RDL.
BOLD RPDs greater than 20% are shaded in grey and bolded
 MPN Most Probable Number

Table 13: October 2018 Sediment Quality Results Summary for Duplicate Analysis

Parameter	Reported Detection Limit (RDL)	Unit	PD5	DUP1	RPD Analysis	W1	DUP2	RPD Analysis
Sample Date			10/18/2018	10/18/2018		10/19/2018	10/19/2018	
Laboratory Identification Number			L2183717-7	L2183717-8		L2184475-1	L2184475-3	
Particle Size (Soil)								
% Sand (0.125mm - 0.063mm)	%	1	30.1	29.2	3.0	13.2	27.1	69.0
% Sand (0.25mm - 0.125mm)	%	1	<1	<1		5.1	<1	
% Sand (0.50mm - 0.25mm)	%	1	<1	<1		<1	<1	
% Clay (<4um)	%	1	7.4	8.1	9.0	10.1	2.7	115.6
% Gravel (>2mm)	%	1	<1	<1		<1	<1	
% Sand (1.00mm - 0.50mm)	%	1	<1	<1		<1	<1	
% Silt (0.0312mm - 0.004mm)	%	1	27.9	28.5	2.1	38.8	32.8	16.8
% Silt (0.063mm - 0.0312mm)	%	1	33.9	33.7	0.6	31.9	36.5	13.5
% Sand (2.00mm - 1.00mm)	%	1	<1	<1		<1	<1	
Carbon								
Total Organic Carbon (TOC)	%	0.05	0.793	0.834	5.0	1.73	1.39	21.8
Physical Tests (Soil)								
pH	pH Units	0.1	8.18	8.13	0.6	8.14	8.57	5.1
Anions and Nutrients (Soil)								
Nitrogen (Total)	%	0.02	0.065	0.07		0.12	0.03	
Plant Available Nutrients (Soil)								
Ammonium	mg/kg	1	2.7	2.4		1.6	<1	
Nitrate (as NO3-N)	mg/kg	2	<2	<2		<2	<2	
Nitrate and Nitrite (as N)	mg/kg	2	<2	<2		<2	<2	
Phosphate	mg/kg	2	2.1	<2		<2	<2	
Metals (Soil)								
Aluminum	mg/kg	50	7100	7040	0.8	7590	5650	29.3
Antimony	mg/kg	0.1	0.59	0.58	1.7	1.1	0.72	41.8
Arsenic	mg/kg	0.1	7.79	7.8	0.1	7.2	4.7	42.0
Barium	mg/kg	0.5	398	395	0.8	461	105	125.8
Beryllium	mg/kg	0.1	0.44	0.44		0.39	0.19	
Bismuth	mg/kg	0.2	<0.2	<0.2		<0.2	<0.2	
Boron - soluble	mg/kg	5	6.8	6.7		7.6	<5	
Cadmium	mg/kg	0.02	0.409	0.408	0.2	0.963	0.888	8.1
Calcium	mg/kg	50	11200	11400	1.8	37000	68300	59.4
Chromium	mg/kg	0.5	15	14.7	2.0	18.1	18.3	1.1
Cobalt	mg/kg	0.1	7.46	7.72	3.4	6.98	5.74	19.5
Copper	mg/kg	0.5	14.3	14.2	0.7	20.6	11.9	53.5
Iron	mg/kg	50	17600	18000	2.2	16400	14600	11.6
Lead	mg/kg	0.5	8.87	8.68	2.2	9.63	5.84	49.0
Lithium	mg/kg	2	9.9	10		9.2	7.6	
Magnesium	mg/kg	20	4810	4830	0.4	10700	19700	59.2
Manganese	mg/kg	1	251	252	0.4	312	314	0.6
Mercury	mg/kg	0.005	0.0521	0.0578	10.4	0.0519	0.0181	
Molybdenum	mg/kg	0.1	1.08	1.04	3.8	1.36	1.15	16.7
Nickel	mg/kg	0.5	22.3	22.6	1.3	23.8	18.6	24.5
Phosphorus	mg/kg	50	734	699	4.9	809	881	8.5
Potassium	mg/kg	100	1240	1190	4.1	1490	630	81.1
Selenium	mg/kg	0.2	0.41	0.52		0.53	0.2	
Silver	mg/kg	0.1	0.16	0.15		0.28	<0.1	
Sodium	mg/kg	50	77	81		109	93	
Strontium	mg/kg	0.5	45.5	43.3	5.0	84.8	126	39.1
Sulphur	mg/kg	1000	1000	1000		<1000	<1000	
Thallium	mg/kg	0.05	0.142	0.135		0.202	0.13	
Tin	mg/kg	2	<2	<2		<2	<2	
Titanium	mg/kg	1	65.9	63.7	3.4	96.7	338	111.0
Tungsten	mg/kg	0.5	<0.5	<0.5		<0.5	<0.5	
Uranium	mg/kg	0.05	1.04	0.973	6.7	0.778	0.853	9.2
Vanadium	mg/kg	0.2	29.1	28.8	1.0	41.1	38.6	6.3
Zinc	mg/kg	2	77	78.1	1.4	77.9	49.6	44.4
Zirconium	mg/kg	1	3.8	3.7	2.7	1.8	3.7	

NOTES:

- Analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- RPD RPD is Relative Percentage Difference calculated as $RPD = \frac{C2 - C1}{[(C1 + C2) / 2]}$ where C1, C2 = concentrations of parameters in 1st and 2nd sample respectively.
- RPDs have only been considered where a concentration is 5 times greater than the RDL
- BOLD** RPDs greater than 30% are shaded in grey and bolded

Table 14: May 2018 Surface Water Quality Results Summary for Blank Analysis

Parameter	Unit	Reported Detection Limit (RDL)	FIELD BLANK	TRIP BLANK
Sample Date			5/11/2018	5/11/2018
Laboratory Identification Number			L2093535-6	L2093535-7
Matrix			Deionized Water	Deionized Water
Physical Parameters				
Colour	TCU	5	<5	<5
Electrical Conductivity (EC)	µS/cm	2	-	-
Hardness as CaCO ₃	mg/L	0.5	<0.5	<0.5
pH	pH Units	0.1	5.49	5.37
Total Suspended Solids (TSS)	mg/L	3	<3	<3
Total Dissolved Solids (TDS)	mg/L	1	100	<1
Turbidity	NTU	0.1	0.18	<0.1
Anions and Nutrients				
Alkalinity (Bicarbonate as CaCO ₃)	mg/L	1	<1	<1
Alkalinity (Carbonate as CaCO ₃)	mg/L	1	<1	<1
Alkalinity (Hydroxide) as CaCO ₃	mg/L	1	<1	<1
Alkalinity (total as CaCO ₃)	mg/L	1	<1	<1
Ammonia as N	mg/L	0.005	<0.005	<0.005
Bromide	mg/L	0.05	<0.05	<0.05
Chloride	mg/L	0.5	<0.5	<0.5
Fluoride	mg/L	0.02	<0.02	<0.02
Nitrate and Nitrite (as N)	mg/L	0.0051	<0.0051	<0.0051
Nitrate (as NO ₃ -N)	mg/L	0.005	<0.005	<0.005
Nitrite (as NO ₂ -N)	mg/L	0.001	<0.001	<0.001
Total Kjeldahl Nitrogen (TKN)	mg/L	0.05	<0.05	<0.05
Nitrogen (Total)	mg/L	0.03	<0.03	<0.03
Orthophosphate (as P) (Filtered)	mg/L	0.001	<0.001	<0.001
Phosphorus (Filtered)	mg/L	0.002	<0.002	<0.002
Phosphorus	mg/L	0.002	<0.002	<0.002
Sulphate	mg/L	0.3	<0.3	<0.3
Silica	mg/L	0.5	<0.5	<0.5
Anions Total	meq/L		<0.1	<0.1
Cations Total	meq/L		<0.1	<0.1
Ionic Balance	N/A		0	0
Organic and Inorganic Carbon				
Dissolved Organic Carbon (DOC)	mg/L	0.5	<0.5	-
Total Organic Carbon (TOC)	mg/L	0.5	<0.5	<0.5
Total Metals				
Aluminum	mg/L	0.005	<0.005	<0.005
Antimony	mg/L	0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.0005	<0.0005	<0.0005
Barium	mg/L	0.02	<0.02	<0.02
Beryllium	mg/L	0.001	<0.0001	<0.0001
Bismuth	mg/L	0.2	<0.2	<0.2
Boron - soluble	mg/L	0.1	<0.1	<0.1
Cadmium	mg/L	0.000005	<0.000005	<0.000005
Calcium	mg/L	0.1	<0.1	<0.1
Chromium	mg/L	0.001	<0.001	<0.001
Cobalt	mg/L	0.0003	<0.0003	<0.0003
Copper	mg/L	0.001	<0.001	<0.001
Iron	mg/L	0.03	<0.03	<0.03
Lead	mg/L	0.0005	<0.0005	<0.0005
Lithium	mg/L	0.001	<0.001	<0.001
Magnesium	mg/L	0.1	<0.1	<0.1
Manganese	mg/L	0.0001	<0.0001	<0.0001
Mercury	mg/L	0.000005 or 0.0000005	<0.000005	<0.000005
Methyl mercury	mg/L	0.0000002	<0.0000002	<0.0000002
Molybdenum	mg/L	0.001	<0.001	<0.001
Nickel	mg/L	0.001	<0.001	<0.001
Phosphorus	mg/L	0.3	<0.3	<0.3
Potassium	mg/L	2	<2	<2
Selenium	mg/L	0.00005	<0.00005	<0.00005
Silicon	mg/L	0.05	<0.1	<0.1
Silver	mg/L	0.00002	<0.00002	<0.00002
Sodium	mg/L	2	<2	<2
Strontium	mg/L	0.005	<0.005	<0.005
Thallium	mg/L	0.0002	<0.00001	<0.00001
Tin	mg/L	0.0005	<0.0005	<0.0005
Titanium	mg/L	0.01	<0.01	<0.01
Uranium	mg/L	0.0002	<0.0002	<0.0002
Vanadium	mg/L	0.0005	<0.0005	<0.0005
Zinc	mg/L	0.005	0.0055	<0.005
Dissolved Metals				
Aluminum (Filtered)	mg/L	0.005	<0.005	-
Antimony (Filtered)	mg/L	0.0005	<0.0005	-
Arsenic (Filtered)	mg/L	0.0005	<0.0005	-
Barium (Filtered)	mg/L	0.02	<0.02	-
Beryllium (Filtered)	mg/L	0.001	<0.0001	-
Bismuth (Filtered)	mg/L	0.2	<0.2	-
Boron - soluble (Filtered)	mg/L	0.1	<0.1	-
Cadmium (Filtered)	mg/L	0.000005	<0.000005	-
Calcium (Filtered)	mg/L	0.1	<0.1	-
Chromium (Filtered)	mg/L	0.001	<0.001	-
Cobalt (Filtered)	mg/L	0.0003	<0.0003	-
Copper (Filtered)	mg/L	0.001	<0.001	-
Iron (Filtered)	mg/L	0.03	<0.03	-
Ferrous Iron (Filtered)	mg/L	0.02	-	-
Lead (Filtered)	mg/L	0.0005	<0.0005	-
Lithium (Filtered)	mg/L	0.001	<0.001	-
Magnesium (Filtered)	mg/L	0.1	<0.1	-
Manganese (Filtered)	mg/L	0.0001	<0.0001	-
Mercury (Filtered)	mg/L	0.000005 or 0.0000005	<0.000005	-
Methyl mercury (Filtered)	mg/L	0.0000002	<0.0000002	-
Molybdenum (Filtered)	mg/L	0.001	<0.001	-
Nickel (Filtered)	mg/L	0.001	<0.001	-
Phosphorus (filtered) (Filtered)	mg/L	0.3	<0.3	-
Potassium (Filtered)	mg/L	2	<2	-
Selenium (Filtered)	mg/L	0.00005	<0.00005	-
Silicon (Filtered)	mg/L	0.05	<0.05	-
Silver (Filtered)	mg/L	0.00002	<0.00002	-
Sodium (Filtered)	mg/L	2	<2	-
Strontium (Filtered)	mg/L	0.005	<0.005	-
Thallium (Filtered)	mg/L	0.0002	<0.0002	-
Tin (Filtered)	mg/L	0.0005	0.00068	-
Titanium (Filtered)	mg/L	0.01	<0.01	-
Uranium (Filtered)	mg/L	0.0002	<0.0002	-
Vanadium (Filtered)	mg/L	0.0005	<0.0005	-
Zinc (Filtered)	mg/L	0.005	<0.005	-

NOTES:

- No applicable guideline or analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- Bold** Bold and underlined indicates an exceedance of the RDL.
- RDL Reported Detection Limit

Table 14: June 2018 Surface Water Quality Results Summary for Blank Analysis

Parameter	Unit	Reported Detection Limit (RDL)	FIELD BLANK-SW	TRAVEL BLANK
Sample Date			6/23/2018	
Laboratory Identification Number			L2117855-2	L2117855-1
Matrix			Deionized Water	Deionized Water
Physical Parameters				
Colour	TCU	5	<5	<5
Electrical Conductivity (EC)	µS/cm	2	<2	<2
pH	pH Units	0.1	<u>5.89</u>	<u>5.38</u>
Total Suspended Solids (TSS)	mg/L	3	<3	<3
Total Dissolved Solids (TDS)	mg/L	1	<1	-
Turbidity	NTU	0.1	0.18	<0.1
Anions and Nutrients				
Alkalinity (Bicarbonate as CaCO3)	mg/L	1	<1	<1
Alkalinity (Carbonate as CaCO3)	mg/L	1	<1	<1
Alkalinity (Hydroxide) as CaCO3	mg/L	1	<1	<1
Alkalinity (total as CaCO3)	mg/L	1	<1	<1
Ammonia as N	mg/L	0.005	<0.005	<0.005
Bromide	mg/L	0.05	<0.05	<0.05
Chloride	mg/L	0.5	<0.5	<0.5
Fluoride	mg/L	0.02	<0.02	<0.02
Nitrate and Nitrite (as N)	mg/L	0.0051	<0.0051	<0.0051
Nitrate (as NO3-N)	mg/L	0.005	<0.005	<0.005
Nitrite (as NO2-N)	mg/L	0.001	<0.001	<0.001
Total Kjeldahl Nitrogen (TKN)	mg/L	0.05	<0.05	<0.05
Nitrogen (Total)	mg/L	0.03	<0.03	<0.03
Orthophosphate (as P) (Filtered)	mg/L	0.001	<0.001	<0.001
Phosphorus (Filtered)	mg/L	0.002	<0.002	<0.002
Phosphorus	mg/L	0.002	<0.002	<0.002
Sulphate	mg/L	0.3	<0.3	<0.3
Silica			<0.5	<0.5
Organic and Inorganic Carbon				
Dissolved Organic Carbon (DOC)	mg/L	0.5	<0.5	-
Total Organic Carbon (TOC)	mg/L	0.5	<0.5	<0.5

NOTES:

- No applicable guideline or analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- Bold and underlined indicates an exceedance of the RDL.
- RDL Reported Detection Limit

Table 14: July 2018 Surface Water Quality Results Summary for Blank Analysis

Parameter	Unit	Reported Detection Limit (RDL)	FIELD BLANK	FIELD 1A	TRIP BLANK
Sample Date					
Laboratory Identification Number			L2133123-11	L2133123-12	L2133123-10
Matrix			Deionized Water	Deionized Water	Deionized Water
Physical Parameters					
Colour	TCU	5	<5	-	<5
Electrical Conductivity (EC)	µS/cm	2	<2	-	<2
pH	pH Units	0.1	<u>5.67</u>	-	<u>5.47</u>
Total Suspended Solids (TSS)	mg/L	3	<3	-	<3
Total Dissolved Solids (TDS)	mg/L	1	<10	-	<10
Turbidity	NTU	0.1	<u>0.17</u>	-	<0.1
Anions and Nutrients					
Alkalinity (Bicarbonate as CaCO ₃)	mg/L	1	<1	-	<1
Alkalinity (Carbonate as CaCO ₃)	mg/L	1	<1	-	<1
Alkalinity (Hydroxide) as CaCO ₃	mg/L	1	<1	-	<1
Alkalinity (total as CaCO ₃)	mg/L	1	<1	-	<1
Ammonia as N	mg/L	0.005	<0.005	-	<0.005
Bromide	mg/L	0.05	<0.05	-	<0.05
Chloride	mg/L	0.5	<0.5	-	<0.5
Fluoride	mg/L	0.02	<0.02	-	<0.02
Nitrate and Nitrite (as N)	mg/L	0.0051	<0.0051	-	<0.0051
Nitrate (as NO ₃ -N)	mg/L	0.005	<0.005	-	<0.005
Nitrite (as NO ₂ -N)	mg/L	0.001	<0.001	-	<0.001
Total Kjeldahl Nitrogen (TKN)	mg/L	0.05	<0.05	-	<0.05
Nitrogen (Total)	mg/L	0.03	<0.03	-	<0.03
Orthophosphate (as P) (Filtered)	mg/L	0.001	<0.001	-	<0.001
Phosphorus (Filtered)	mg/L	0.002	<0.002	-	<0.002
Phosphorus	mg/L	0.002	<0.002	-	<0.002
Sulphate	mg/L	0.3	<0.3	-	<0.3
Silica			<0.5	-	<0.5
Organic and Inorganic Carbon					
Dissolved Organic Carbon (DOC)	mg/L	0.5	<0.5	<0.5	-
Total Organic Carbon (TOC)	mg/L	0.5	<0.5	-	<0.5

NOTES:

- No applicable guideline or analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- Bold** Bold and underlined indicates an exceedance of the RDL.
- RDL Reported Detection Limit

Table 14: August 2018 Surface Water Quality Results Summary for Blank Analysis

Parameter	Unit	Reported Detection Limit (RDL)	FIELD BLANK	TRIP BLANK
Sample Date			8/1/2018	
Laboratory Identification Number			L2140393-9	L2140599-5
Matrix			Deionized Water	Deionized Water
Physical Parameters				
Colour	TCU	5	<5	<5
Electrical Conductivity (EC)	µS/cm	2	<2	<2
pH	pH Units	0.1	5.54	5.65
Total Suspended Solids (TSS)	mg/L	3	<3	<3
Total Dissolved Solids (TDS)	mg/L	1	<10	<10
Turbidity	NTU	0.1	0.16	<0.1
Anions and Nutrients				
Alkalinity (Bicarbonate as CaCO3)	mg/L	1	<1	<1
Alkalinity (Carbonate as CaCO3)	mg/L	1	<1	<1
Alkalinity (Hydroxide) as CaCO3	mg/L	1	<1	<1
Alkalinity (total as CaCO3)	mg/L	1	<1	<1
Ammonia as N	mg/L	0.005	<0.005	<0.005
Bromide	mg/L	0.05	<0.05	<0.05
Chloride	mg/L	0.5	<0.5	<0.5
Fluoride	mg/L	0.02	<0.02	<0.02
Nitrate and Nitrite (as N)	mg/L	0.0051	<0.0051	<0.0051
Nitrate (as NO3-N)	mg/L	0.005	<0.005	<0.005
Nitrite (as NO2-N)	mg/L	0.001	<0.001	<0.001
Total Kjeldahl Nitrogen (TKN)	mg/L	0.05	<0.05	<0.05
Nitrogen (Total)	mg/L	0.03	<0.03	<0.03
Orthophosphate (as P) (Filtered)	mg/L	0.001	<0.001	<0.001
Phosphorus (Filtered)	mg/L	0.002	<0.002	<0.002
Phosphorus	mg/L	0.002	<0.002	<0.002
Sulphate	mg/L	0.3	<0.3	<0.3
Silica			<0.5	<0.5
Organic and Inorganic Carbon				
Dissolved Organic Carbon (DOC)	mg/L	0.5	<0.5	-
Total Organic Carbon (TOC)	mg/L	0.5	<0.5	<0.5

NOTES:

- No applicable guideline or analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- Bold** Bold and underlined indicates an exceedance of the RDL.
- RDL Reported Detection Limit

Table 14: September 2018 Surface Water Quality Results Summary for Blank Analysis

Parameter	Unit	Reported Detection Limit (RDL)	FIELD BLANK	TRAVEL BLANK
Sample Date			9/13/2018	9/13/2018
Laboratory Identification Number			L2163952-5	L2163952-6
Matrix			Deionized Water	Deionized Water
Physical Parameters				
Colour	TCU	5	<5	<5
Electrical Conductivity (EC)	µS/cm	2	<2	<2
pH	pH Units	0.1	5.41	5.34
Total Suspended Solids (TSS)	mg/L	3	<3	<3
Total Dissolved Solids (TDS)	mg/L	1	<1	<1
Turbidity	NTU	0.1	0.17	<0.1
Anions and Nutrients				
Alkalinity (Bicarbonate as CaCO3)	mg/L	1	<1	<1
Alkalinity (Carbonate as CaCO3)	mg/L	1	<1	<1
Alkalinity (Hydroxide) as CaCO3	mg/L	1	<1	<1
Alkalinity (total as CaCO3)	mg/L	1	<1	<1
Ammonia as N	mg/L	0.005	<0.005	<0.005
Bromide	mg/L	0.05	<0.05	<0.05
Chloride	mg/L	0.5	<0.5	<0.5
Fluoride	mg/L	0.02	<0.02	<0.02
Nitrate and Nitrite (as N)	mg/L	0.0051	<0.0051	<0.0051
Nitrate (as NO3-N)	mg/L	0.005	<0.005	<0.005
Nitrite (as NO2-N)	mg/L	0.001	<0.001	<0.001
Total Kjeldahl Nitrogen (TKN)	mg/L	0.05	<0.05	<0.05
Nitrogen (Total)	mg/L	0.03	<0.03	<0.03
Orthophosphate (as P) (Filtered)	mg/L	0.001	<0.001	<0.001
Phosphorus (Filtered)	mg/L	0.002	<0.002	<0.002
Phosphorus	mg/L	0.002	0.0068	<0.002
Sulphate	mg/L	0.3	<0.3	<0.3
Silica			<0.5	<0.5
Organic and Inorganic Carbon				
Dissolved Organic Carbon (DOC)	mg/L	0.5	<0.5	-
Total Organic Carbon (TOC)	mg/L	0.5	<0.5	<0.5

NOTES:

- No applicable guideline or analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- Bold** Bold and underlined indicates an exceedance of the RDL.
- RDL Reported Detection Limit

Table 14: October 2018 Surface Water Quality Results Summary for Blank Analysis

Parameter	Unit	Reported Detection Limit (RDL)	FIELD BLANK	TRIP BLANK
Sample Date			10/20/2018	10/20/2018
Laboratory Identification Number			L2184609-3	L2184609-4
Matrix			Deionized Water	Deionized Water
Physical Parameters				
Colour	TCU	5	<5	<5
Electrical Conductivity (EC)	µS/cm	2	<2	<2
Hardness as CaCO3	mg/L	0.5	<0.5	<0.5
pH	pH Units	0.1	5.44	5.4
Total Suspended Solids (TSS)	mg/L	3	<3	<3
Total Dissolved Solids (TDS)	mg/L	1	<1	<1
Turbidity	NTU	0.1	<0.1	<0.1
Anions and Nutrients				
Alkalinity (Bicarbonate as CaCO3)	mg/L	1	<1	<1
Alkalinity (Carbonate as CaCO3)	mg/L	1	<1	<1
Alkalinity (Hydroxide) as CaCO3	mg/L	1	<1	<1
Alkalinity (total as CaCO3)	mg/L	1	<1	<1
Ammonia as N	mg/L	0.005	<0.005	<0.005
Bromide	mg/L	0.05	<0.05	<0.05
Chloride	mg/L	0.5	<0.5	<0.5
Fluoride	mg/L	0.02	<0.02	<0.02
Nitrate and Nitrite (as N)	mg/L	0.0051	<0.0051	<0.0051
Nitrate (as NO3-N)	mg/L	0.005	<0.005	<0.005
Nitrite (as NO2-N)	mg/L	0.001	<0.001	<0.001
Total Kjeldahl Nitrogen (TKN)	mg/L	0.05	<0.05	<0.05
Nitrogen (Total)	mg/L	0.03	<0.03	<0.03
Orthophosphate (as P) (Filtered)	mg/L	0.001	<0.001	<0.001
Phosphorus (Filtered)	mg/L	0.002	<0.002	<0.002
Phosphorus	mg/L	0.002	<0.002	<0.002
Sulphate	mg/L	0.3	<0.3	<0.3
Silica	mg/L	0.5	<0.5	<0.5
Anions Total	meq/L		<0.1	<0.1
Cations Total	meq/L		<0.1	<0.1
Ionic Balance	N/A		0	0
Organic and Inorganic Carbon				
Dissolved Organic Carbon (DOC)	mg/L	0.5	<0.5	-
Total Organic Carbon (TOC)	mg/L	0.5	<0.5	<0.5
Total Metals				
Aluminum	mg/L	0.005	<0.005	<0.005
Antimony	mg/L	0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.0005	<0.0005	<0.0005
Barium	mg/L	0.02	<0.02	<0.02
Beryllium	mg/L	0.001	<0.0001	<0.0001
Bismuth	mg/L	0.2	<0.2	<0.2
Boron - soluble	mg/L	0.1	<0.1	<0.1
Cadmium	mg/L	0.000005	<0.000005	<0.000005
Calcium	mg/L	0.1	<0.1	<0.1
Chromium	mg/L	0.001	<0.001	<0.001
Cobalt	mg/L	0.0003	<0.0003	<0.0003
Copper	mg/L	0.001	<0.001	<0.001
Iron	mg/L	0.03	<0.03	<0.03
Lead	mg/L	0.0005	<0.0005	<0.0005
Lithium	mg/L	0.001	<0.001	<0.001
Magnesium	mg/L	0.1	<0.1	<0.1
Manganese	mg/L	0.0001	0.00011	<0.0001
Mercury	mg/L	0.000005 or 0.0000005	<0.000005	<0.000005
Methyl mercury	mg/L	0.0000002	<0.0000002	<0.0000002
Molybdenum	mg/L	0.001	<0.001	<0.001
Nickel	mg/L	0.001	<0.001	<0.001
Phosphorus	mg/L	0.3	<0.3	<0.3
Potassium	mg/L	2	<2	<2
Selenium	mg/L	0.00005	<0.00005	<0.00005
Silicon	mg/L	0.05	<0.1	<0.1
Silver	mg/L	0.00002	<0.00002	<0.00002
Sodium	mg/L	2	<2	<2
Strontium	mg/L	0.005	<0.005	<0.005
Thallium	mg/L	0.0002	<0.00001	<0.00001
Tin	mg/L	0.0005	<0.0005	<0.0005
Titanium	mg/L	0.01	<0.01	<0.01
Uranium	mg/L	0.0002	<0.0002	<0.0002
Vanadium	mg/L	0.0005	<0.0005	<0.0005
Zinc	mg/L	0.005	<0.005	<0.005
Dissolved Metals				
Aluminum (Filtered)	mg/L	0.005	<0.005	-
Antimony (Filtered)	mg/L	0.0005	<0.0005	-
Arsenic (Filtered)	mg/L	0.0005	<0.0005	-
Barium (Filtered)	mg/L	0.02	<0.02	-
Beryllium (Filtered)	mg/L	0.001	<0.0001	-
Bismuth (Filtered)	mg/L	0.2	<0.2	-
Boron - soluble (Filtered)	mg/L	0.1	<0.1	-
Cadmium (Filtered)	mg/L	0.000005	<0.000005	-
Calcium (Filtered)	mg/L	0.1	<0.1	-
Chromium (Filtered)	mg/L	0.001	<0.001	-
Cobalt (Filtered)	mg/L	0.0003	<0.0003	-
Copper (Filtered)	mg/L	0.001	<0.001	-
Iron (Filtered)	mg/L	0.03	<0.03	-
Ferrous Iron (Filtered)	mg/L	0.02	-	-
Lead (Filtered)	mg/L	0.0005	<0.0005	-
Lithium (Filtered)	mg/L	0.001	<0.001	-
Magnesium (Filtered)	mg/L	0.1	<0.1	-
Manganese (Filtered)	mg/L	0.0001	<0.0001	-
Mercury (Filtered)	mg/L	0.000005 or 0.0000005	<0.000005	-
Methyl mercury (Filtered)	mg/L	0.0000002	0.00000071	-
Molybdenum (Filtered)	mg/L	0.001	<0.001	-
Nickel (Filtered)	mg/L	0.001	<0.001	-
Phosphorus (filtered) (Filtered)	mg/L	0.3	<0.3	-
Potassium (Filtered)	mg/L	2	<2	-
Selenium (Filtered)	mg/L	0.00005	<0.00005	-
Silicon (Filtered)	mg/L	0.05	<0.05	-
Silver (Filtered)	mg/L	0.00002	<0.00002	-
Sodium (Filtered)	mg/L	2	<2	-
Strontium (Filtered)	mg/L	0.005	<0.005	-
Thallium (Filtered)	mg/L	0.0002	<0.0002	-
Tin (Filtered)	mg/L	0.0005	<0.0005	-
Titanium (Filtered)	mg/L	0.01	<0.01	-
Uranium (Filtered)	mg/L	0.0002	<0.0002	-
Vanadium (Filtered)	mg/L	0.0005	<0.0005	-
Zinc (Filtered)	mg/L	0.005	<0.005	-

NOTES:

- No applicable guideline or analysis was not conducted.
- < Concentration is less than the laboratory detection limit indicated.
- Bold** Bold and underlined indicates an exceedance of the RDL.
- RDL Reported Detection Limit

Table 15: Summary Statistics

	Peace River Upstream Preconstruction	Peace River Upstream Construction	Peace River Downstream Preconstruction	Peace River Downstream Construction	Tributaries Upstream Preconstruction	Tributaries Upstream Construction	Tributaries Downstream Preconstruction	Tributaries Downstream Construction	Reservoirs Preconstruction	Reservoirs Construction
NITROGEN										
Mean	0.23	0.17	0.35	0.27	0.64	0.43	1.03	0.77	0.17	0.15
Standard Error	0.03	0.01	0.05	0.03	0.16	0.11	0.23	0.07	0.02	0.00
Median	0.18	0.14	0.25	0.17	0.29	0.24	0.76	0.68	0.17	0.14
Mode	0.05	0.14	0.05	0.21	#N/A	#N/A	0.05	1.02	0.05	0.14
Standard Deviation	0.22	0.12	0.29	0.27	0.82	0.66	1.03	0.60	0.10	0.03
Sample Variance	0.05	0.01	0.08	0.07	0.68	0.44	1.07	0.36	0.01	0.00
Kurtosis	30.24	26.48	7.43	7.59	5.03	11.65	2.60	3.52	1.15	3.87
Skewness	4.84	4.89	2.36	2.86	2.28	3.38	1.52	1.65	1.02	1.91
Range	1.62	0.85	1.50	1.30	3.39	3.17	4.00	2.81	0.39	0.16
Minimum	0.05	0.08	0.05	0.12	0.05	0.07	0.05	0.08	0.05	0.11
Maximum	1.67	0.93	1.55	1.42	3.44	3.24	4.05	2.89	0.44	0.27
Sum	13.85	12.43	13.47	23.21	17.87	15.07	20.62	53.47	3.51	9.83
Count	60	72	39	86	28	35	20	69	21	66
PHOSPHORUS										
Mean	0.05	1.33	0.12	0.15	0.21	0.22	0.22	0.29	0.01	0.01
Standard Error	0.02	0.28	0.04	0.03	0.05	0.08	0.08	0.06	0.00	0.00
Median	0.01	0.02	0.06	0.04	0.12	0.05	0.07	0.09	0.01	0.00
Mode	0.01	0.00	#N/A	0.13	#N/A	#N/A	#N/A	#N/A	#N/A	0.00
Standard Deviation	0.13	2.38	0.23	0.30	0.23	0.49	0.29	0.48	0.00	0.01
Sample Variance	0.02	5.65	0.05	0.09	0.05	0.24	0.08	0.23	0.00	0.00
Kurtosis	36.56	15.40	20.42	8.42	0.00	9.83	4.91	5.33	0.56	16.26
Skewness	5.85	3.24	4.32	2.92	1.18	3.16	2.12	2.42	0.92	3.93
Range	0.85	15.10	1.16	1.59	0.64	2.26	1.00	2.13	0.01	0.04
Minimum	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.00
Maximum	0.85	15.10	1.17	1.59	0.65	2.27	1.01	2.13	0.01	0.04
Sum	2.08	95.67	3.03	12.93	3.91	7.67	2.59	20.02	0.11	0.38
Count	44	72	26	86	19	35	12	69	13	66
TOTAL ORGANIC CARBON										
Mean	3.36	2.63	3.76	6.71	10.14	9.78	-	22.29	-	3.01
Standard Error	0.32	0.50	0.55	0.73	6.07	1.81	-	2.05	-	0.07
Median	3.02	2.75	3.17	4.17	4.62	6.56	-	19.30	-	2.86
Mode	2.65	2.73	#N/A	3.89	#N/A	6.56	-	#N/A	-	2.70
Standard Deviation	1.66	4.23	1.64	6.73	13.58	10.72	-	17.00	-	0.61
Sample Variance	2.77	17.91	2.69	45.28	184.49	114.89	-	288.87	-	0.37
Kurtosis	20.48	47.60	5.01	6.22	4.78	6.14	-	1.49	-	6.49
Skewness	4.33	6.30	2.19	2.61	2.17	2.59	-	1.04	-	2.54
Range	8.77	34.70	5.19	30.45	32.35	43.93	-	84.13	-	3.01
Minimum	2.43	0.00	2.56	2.65	1.95	1.57	-	1.67	-	2.37
Maximum	11.20	34.70	7.75	33.10	34.30	45.50	-	85.80	-	5.38
Sum	90.82	189.07	33.85	576.67	50.70	342.29	-	1538.15	-	210.64
Count	27	72	9	86	5	35	-	69	-	70
IRON										
Mean	1.00	1.33	2.70	6.26	7.44	6.35	9.46	13.19	0.11	0.19
Standard Error	0.51	0.64	0.81	1.45	2.92	2.30	5.05	3.11	0.03	0.07
Median	0.16	0.14	0.77	1.16	1.81	1.46	3.32	3.77	0.08	0.04
Mode	0.07	0.06	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	0.08	0.03
Standard Deviation	3.28	4.03	3.95	8.95	12.05	10.53	15.95	17.59	0.09	0.38
Sample Variance	10.76	16.25	15.60	80.02	145.17	110.92	254.53	309.42	0.01	0.14
Kurtosis	36.63	26.49	6.14	0.33	3.93	3.26	7.52	0.92	9.64	2.62
Skewness	5.91	4.91	2.35	1.36	2.19	2.07	2.68	1.47	3.04	2.08
Range	21.07	23.87	16.56	28.18	38.20	36.87	52.50	57.33	0.33	1.18
Minimum	0.03	0.03	0.04	0.12	0.20	0.13	0.20	0.07	0.05	0.03
Maximum	21.10	23.90	16.60	28.30	38.40	37.00	52.70	57.40	0.37	1.21
Sum	41.93	53.04	64.90	237.70	126.45	133.35	94.62	421.98	1.19	5.06
Count	42	40	24	38	17	21	10	32	11	26
CHLOROPHYLL A										
Mean	0.78	1.00	0.87	1.51	0.37	3.17	-	4.31	-	0.92
Standard Error	0.05	0.26	0.09	0.17	0.11	0.75	-	1.07	-	0.06
Median	0.79	0.83	0.76	1.45	0.41	3.17	-	5.19	-	0.80
Mode	0.83	#N/A	#N/A	#N/A	#N/A	#N/A	-	#N/A	-	0.74
Standard Deviation	0.28	0.52	0.28	0.34	0.24	1.07	-	2.15	-	0.47
Sample Variance	0.08	0.27	0.08	0.12	0.06	1.14	-	4.62	-	0.22
Kurtosis	0.42	0.87	1.04	2.08	-2.84	#DIV/0!	-	3.43	-	-0.15
Skewness	0.24	1.28	1.15	1.04	-0.22	#DIV/0!	-	-1.84	-	0.52
Range	1.15	1.11	0.86	0.82	0.51	1.51	-	4.61	-	2.14
Minimum	0.24	0.61	0.58	1.16	0.09	2.41	-	1.13	-	0.11
Maximum	1.39	1.72	1.44	1.98	0.61	3.92	-	5.74	-	2.25
Sum	21.08	3.99	7.80	6.03	1.85	6.33	-	17.24	-	62.85
Count	27	4	9	4	5	2	-	4	-	68

PHOTOS

Photos 1 to 17





Photo 1: W1 Sampling Location, September 11, 2018



Photo 2: D1 Sampling Location, September 11, 2018



Photo 3: PC1 Sampling Location, September 11, 2018



Photo 4: PR1 Sampling Location, September 13, 2018



Photo 5: PR2 Sampling Location, September 13, 2018



Photo 6: HD Sampling Location, September 13, 2018



Photo 7: PR3 Sampling Location, September 10, 2018



Photo 8: MD Sampling Location, September 10, 2018



Photo 9: PD1 Sampling Location, September 10, 2018



Photo 10: Pine River Sampling Location, September 10, 2018



Photo 11: PD2 Sampling Location, September 12, 2018



Photo 12: Beaton River Sampling Location, September 12, 2018



Photo 13: PD3 Sampling Location, September 12, 2018



Photo 14: Kiskatinaw River Sampling Location, September 12, 2018



Photo 15: PD4 Sampling Location, September 12, 2018



Photo 16: Pouce Coupe Sampling Location, September 12, 2018

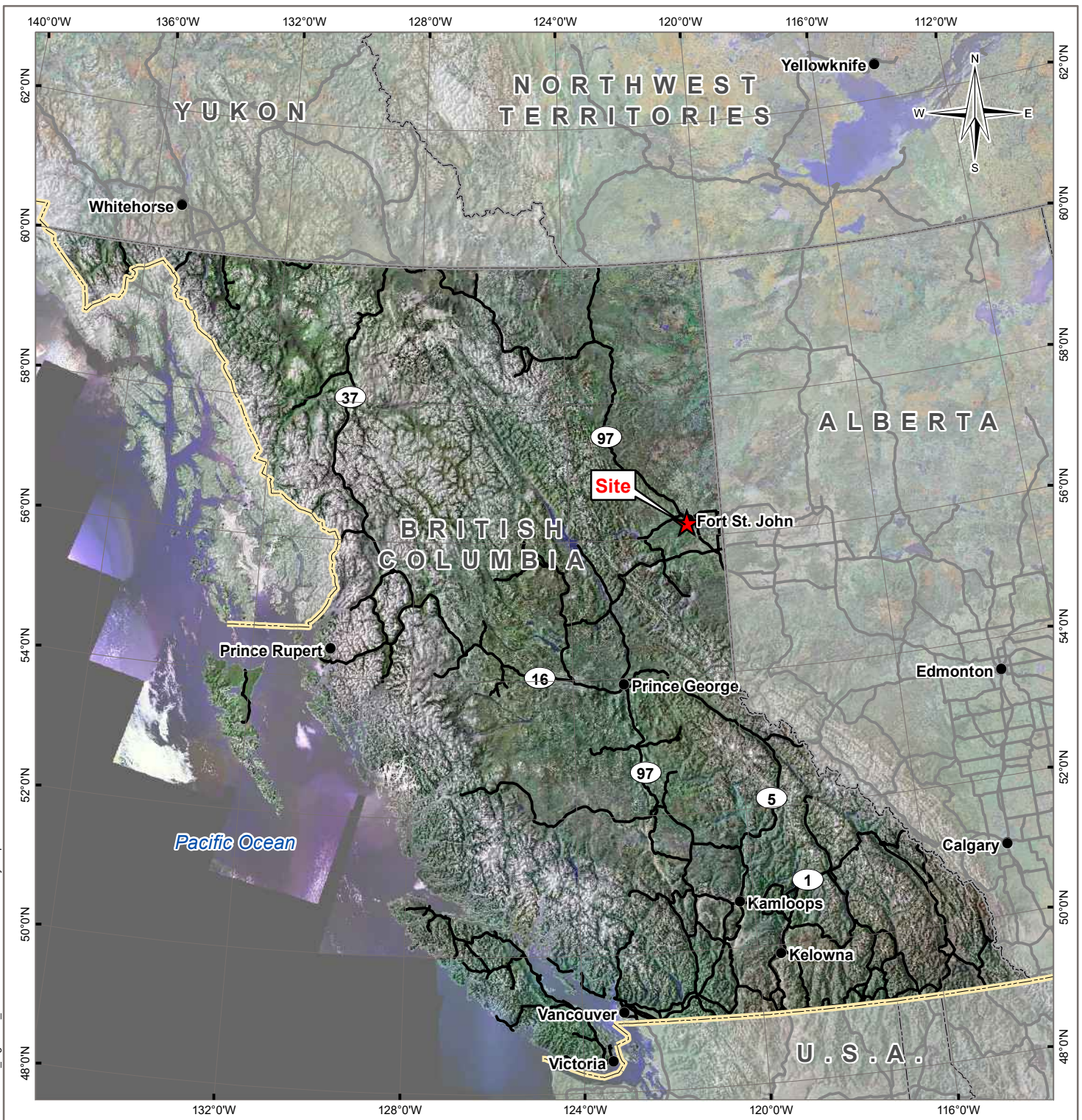


Photo 17: PD5 Sampling Location, September 12, 2018

FIGURES

Figure 1	Site Location
Figure 2a	Water Quality Monitoring Station Location Plan
Figure 2b	Water Quality Monitoring Station Location Plan
Figure 3a	Descriptive Analysis of Chlorophyll a
Figure 3b	Descriptive Analysis of Iron
Figure 3c	Descriptive Analysis of Nitrogen
Figure 3d	Descriptive Analysis of Phosphorus
Figure 3e	Descriptive Analysis of TOC

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LEGEND

- ★ Site Location
- Populated Place
- Major Road
- ▭ Provincial / Territorial / State Boundary
- International Border

NOTES
Base data source:
ESRI Data & Maps

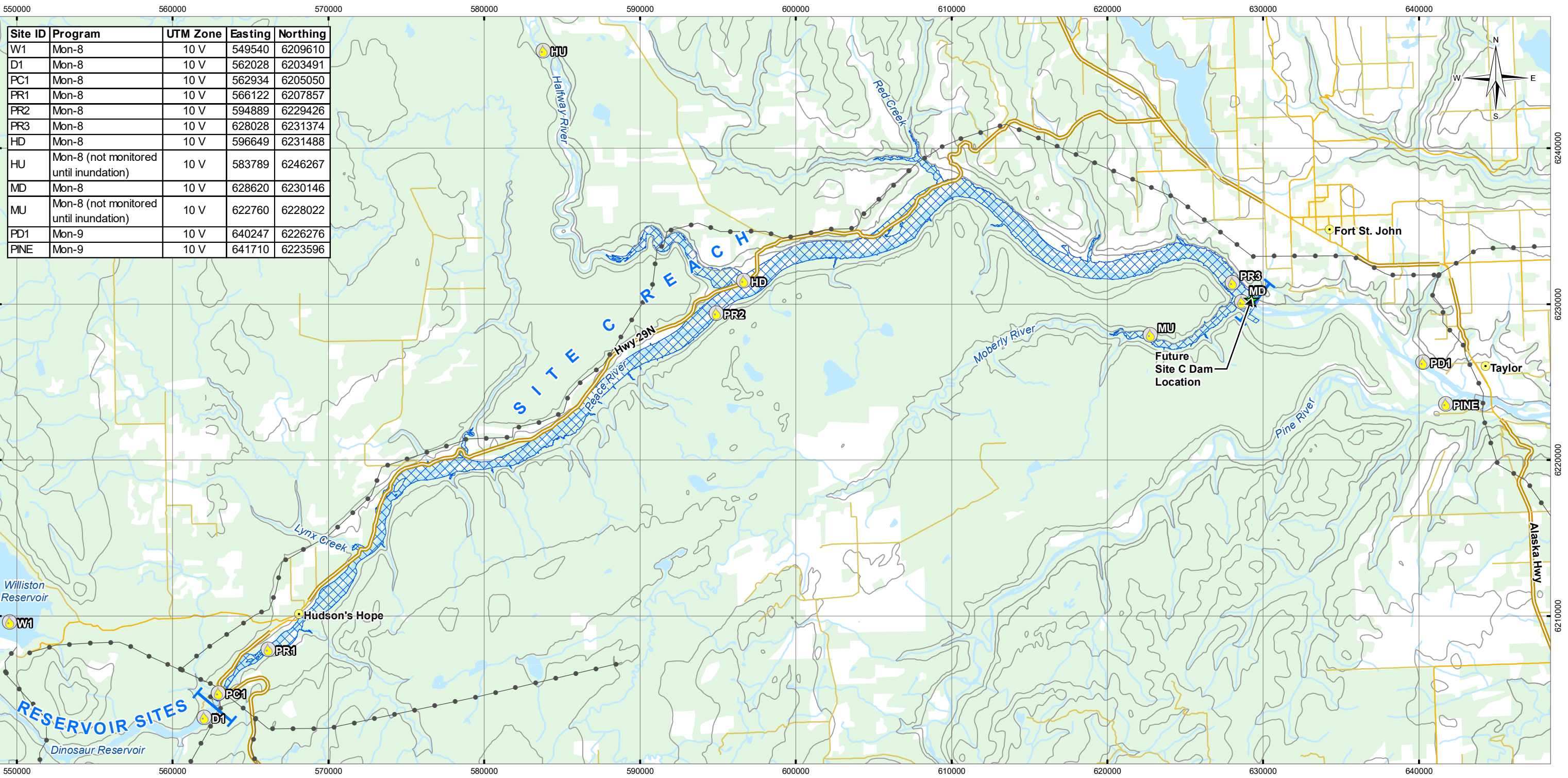
STATUS
ISSUED FOR USE

**PEACE RIVER AND SITE C RESERVOIR
WATER AND SEDIMENT QUALITY
MONITORING PROGRAMS**

Site Location

PROJECTION BC Albers		DATUM NAD83		CLIENT 	
Scale: 1:9,000,000 					
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OFFICE TL-VANC		DWN RG	CKD SL	APVD LH	REV 0
DATE March 6, 2019		PROJECT NO. ENW.VENW03060-02			
					Figure 1





Site ID	Program	UTM Zone	Easting	Northing
W1	Mon-8	10 V	549540	6209610
D1	Mon-8	10 V	562028	6203491
PC1	Mon-8	10 V	562934	6205050
PR1	Mon-8	10 V	566122	6207857
PR2	Mon-8	10 V	594889	6229426
PR3	Mon-8	10 V	628028	6231374
HD	Mon-8	10 V	596649	6231488
HU	Mon-8 (not monitored until inundation)	10 V	583789	6246267
MD	Mon-8	10 V	628620	6230146
MU	Mon-8 (not monitored until inundation)	10 V	622760	6228022
PD1	Mon-9	10 V	640247	6226276
PINE	Mon-9	10 V	641710	6223596

LEGEND

- Surface Water Monitoring Station / Sediment Sample Location
- Reach Break
- Future Site C Dam Location
- Proposed Site C Reservoir
- Power Line
- Highway
- Main Road
- Local Road
- Contour (100 m)
- Watercourse
- Waterbody
- Residential Area
- Wooded Area
- BC-Alberta Border

NOTES
Base data source:
CanVec 1:250K

**PEACE RIVER AND SITE C RESERVOIR
WATER AND SEDIMENT QUALITY
MONITORING PROGRAMS**

**Water Quality Monitoring
Station Location Plan**

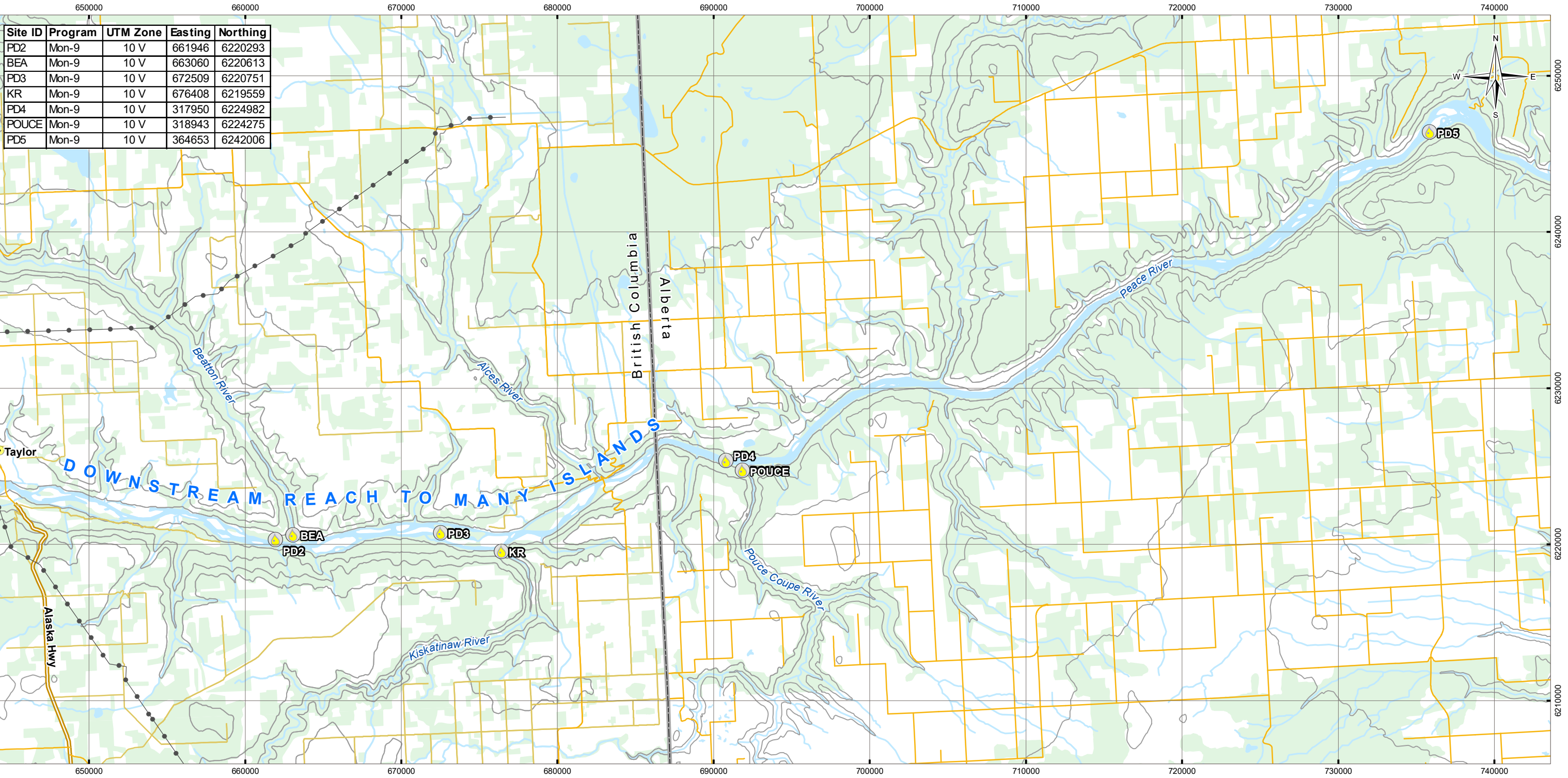
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OFFICE TI-VANC	DWN SL/RG	CKD SL	APVD DM	REV 0
DATE March 6, 2019	PROJECT NO. ENW.VENW03060-02			



Figure 2a

STATUS
ISSUED FOR USE

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Site ID	Program	UTM Zone	Easting	Northing
PD2	Mon-9	10 V	661946	6220293
BEA	Mon-9	10 V	663060	6220613
PD3	Mon-9	10 V	672509	6220751
KR	Mon-9	10 V	676408	6219559
PD4	Mon-9	10 V	317950	6224982
POUCE	Mon-9	10 V	318943	6224275
PD5	Mon-9	10 V	364653	6242006

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Surface Water Monitoring Station / Sediment Sample Location	Contour (100 m)
Power Line	Watercourse
Highway	Waterbody
Main Road	Residential Area
Local Road	Wooded Area
	BC-Alberta Border

NOTES
Base data source:
CanVec 1:250K

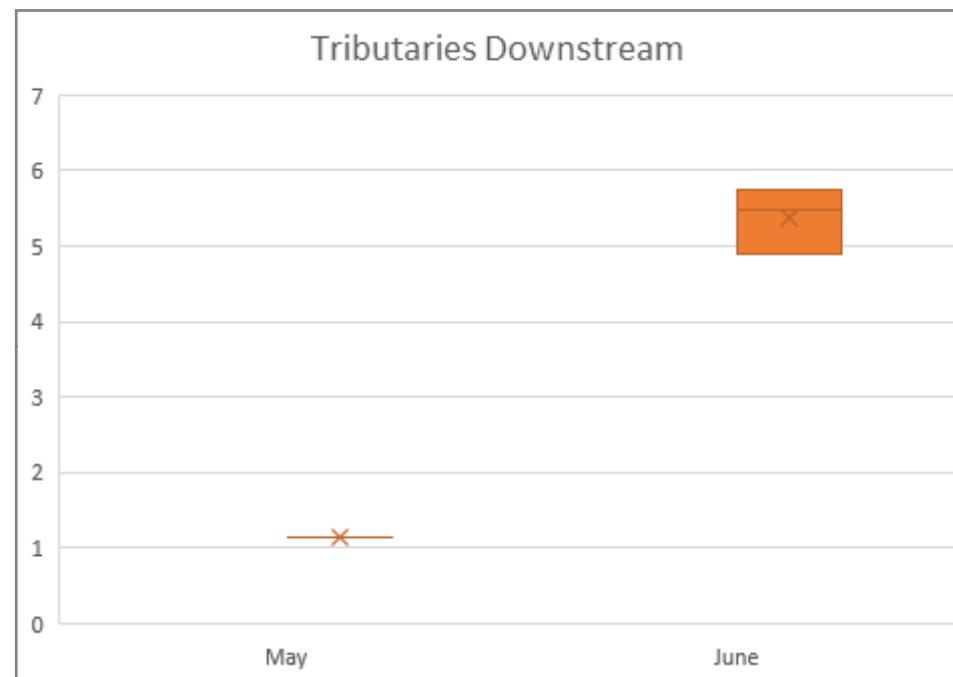
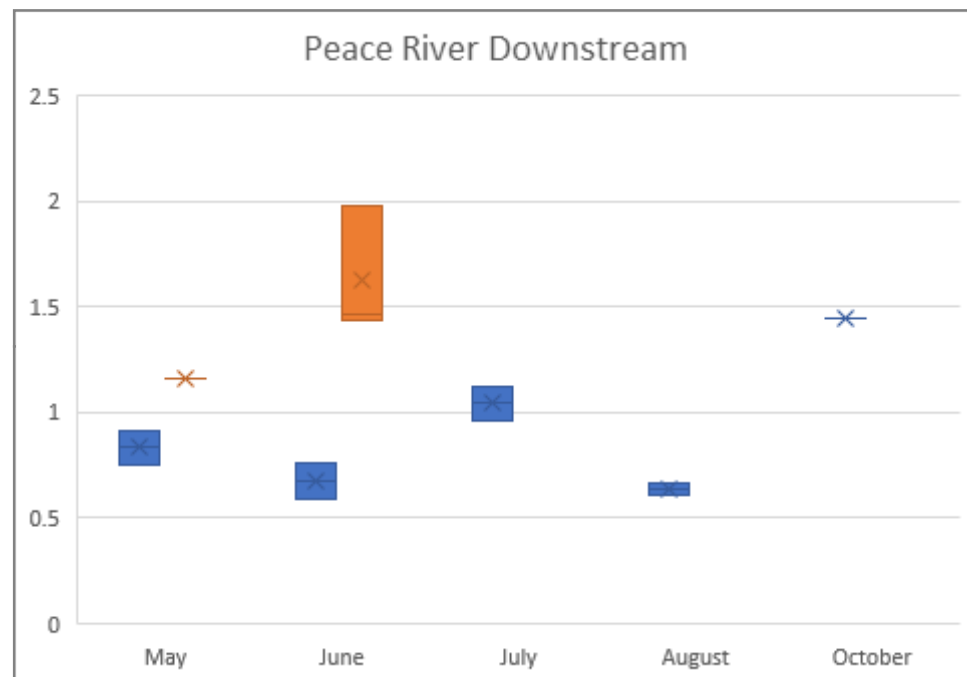
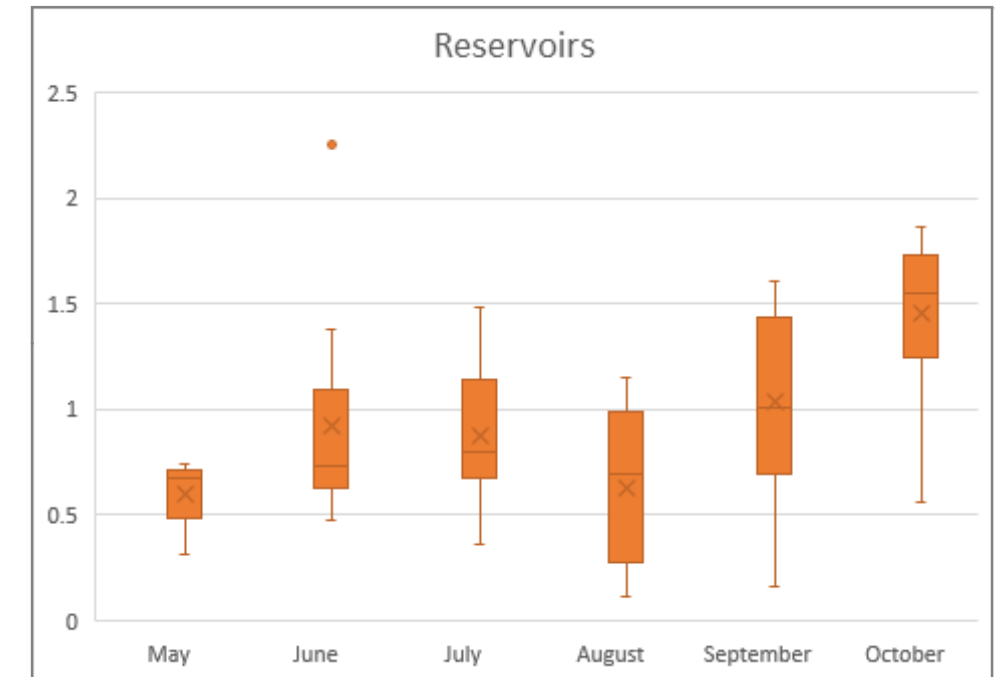
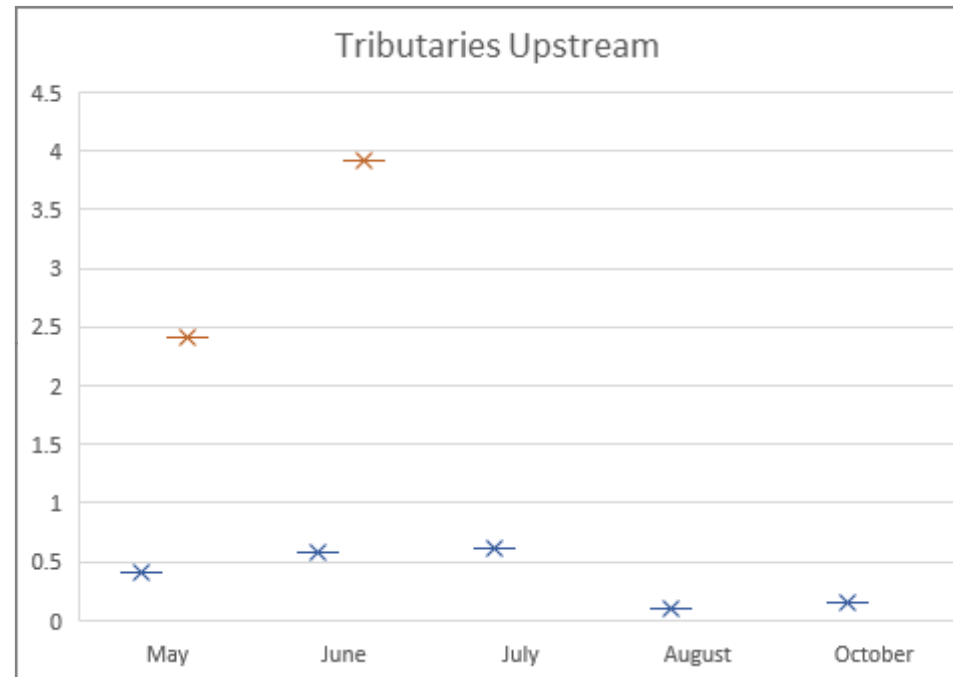
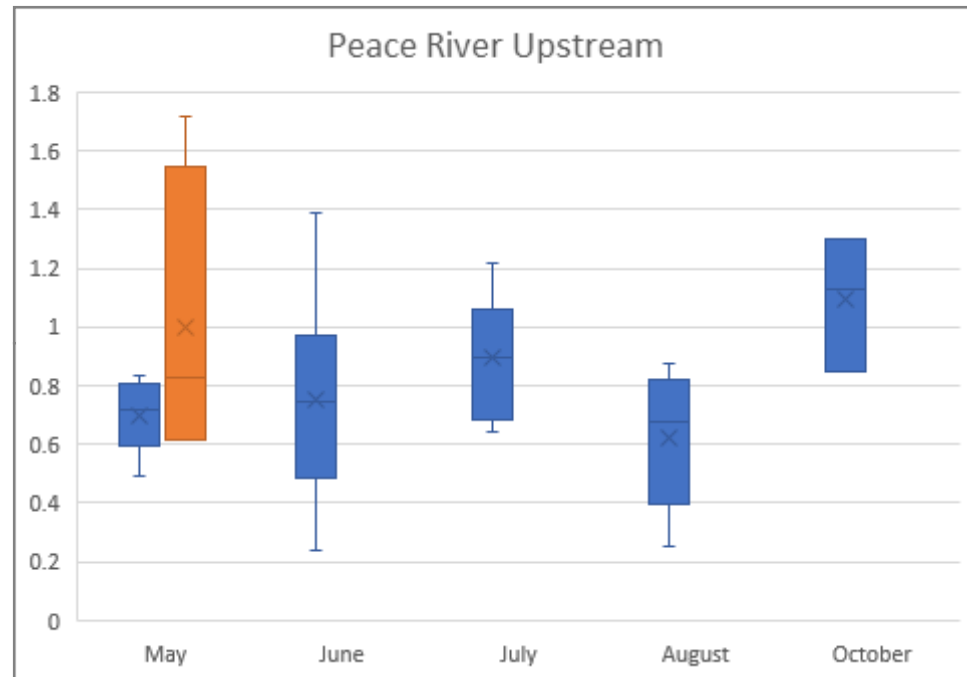
**PEACE RIVER AND SITE C RESERVOIR
WATER AND SEDIMENT QUALITY
MONITORING PROGRAMS**

**Water Quality Monitoring
Station Location Plan**

PROJECTION UTM Zone 10	DATUM NAD83	CLIENT
Scale: 1:250,000		
FILE NO. VENW03060-02_Figure02b_WQMon.mxd		
OFFICE TI-VANC		
DATE March 6, 2019	PROJECT NO. ENW.VENW03060-02	Figure 2b

STATUS
ISSUED FOR USE

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LEGEND

- Pre-Construction
- Construction

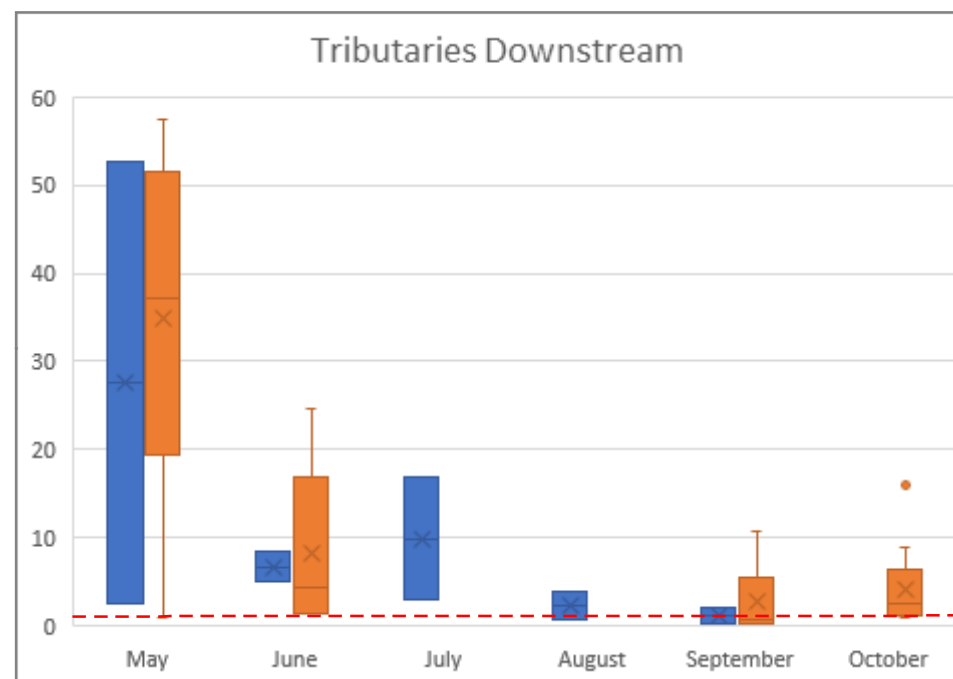
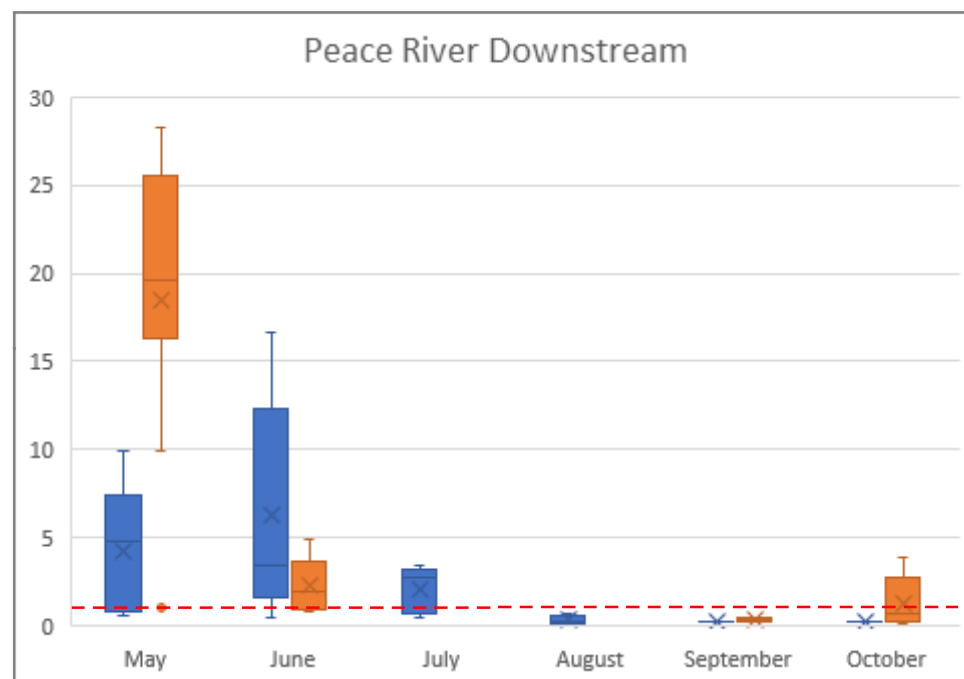
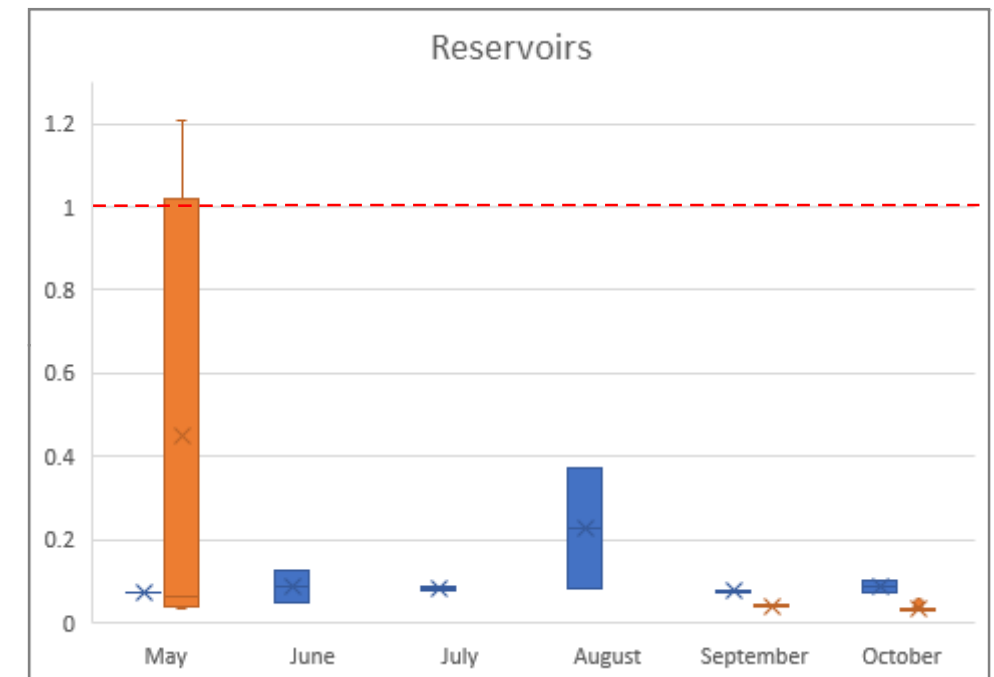
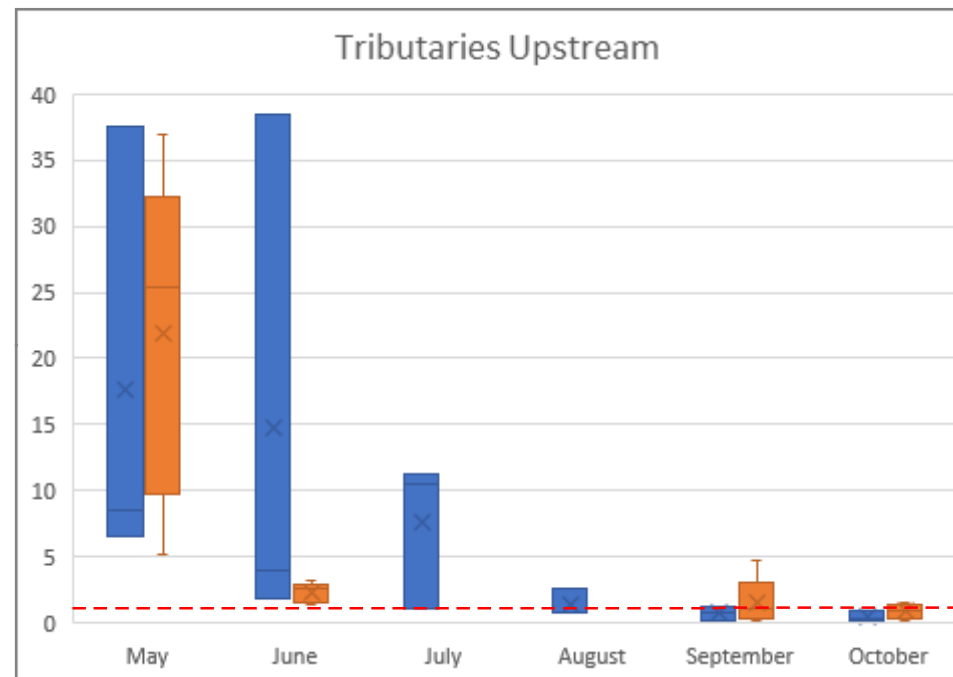
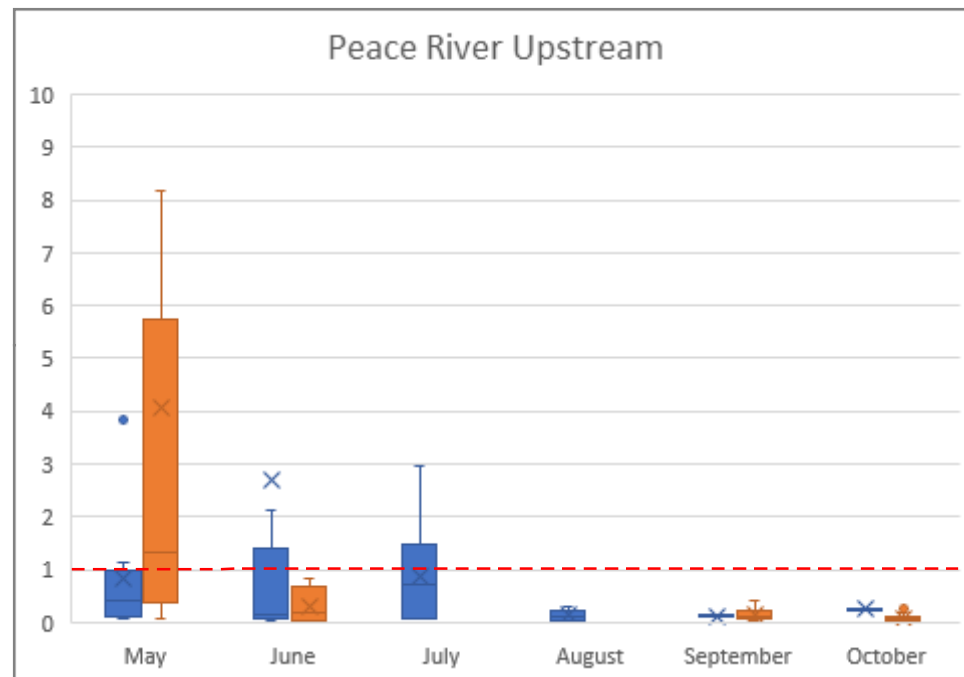
PEACE RIVER AND SITE C RESERVOIR WATER AND SEDIMENT QUALITY MONITORING PROGRAMS

Descriptive Analysis of Chlorophyll A

PROJECTION N/A	DATUM N/A	CLIENT BChydro
NOTES 1. Y-axis is mg/L 2. Scale of y-axis varies in each panel		
FILE NO. VENW03060-02_Figure03a_ChlorophyllA.mxd		
OFFICE Tl-VANC	DWN SL	CKD LH
DATE March 6, 2019	APVD SW	REV 0
PROJECT NO. ENW.VENW03060-02		TETRA TECH
Figure 3a		

STATUS
ISSUED FOR USE

Q:\Vancouver\GIS\ENVIRONMENTAL\VENW\ENW03060-02\Maps\VENW03060-02_Figure03b_Iron.mxd modified 3/6/2019 by stephanie.leusink



LEGEND

- Pre-Construction
- Construction
- BC AWQG Guideline Limit for Total Iron (1 mg/L)

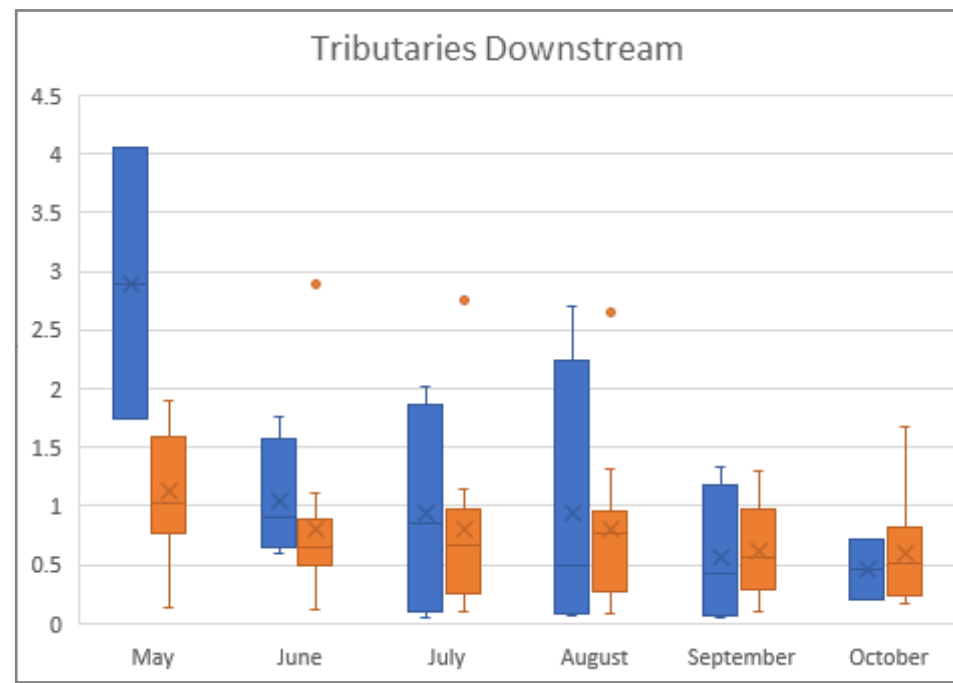
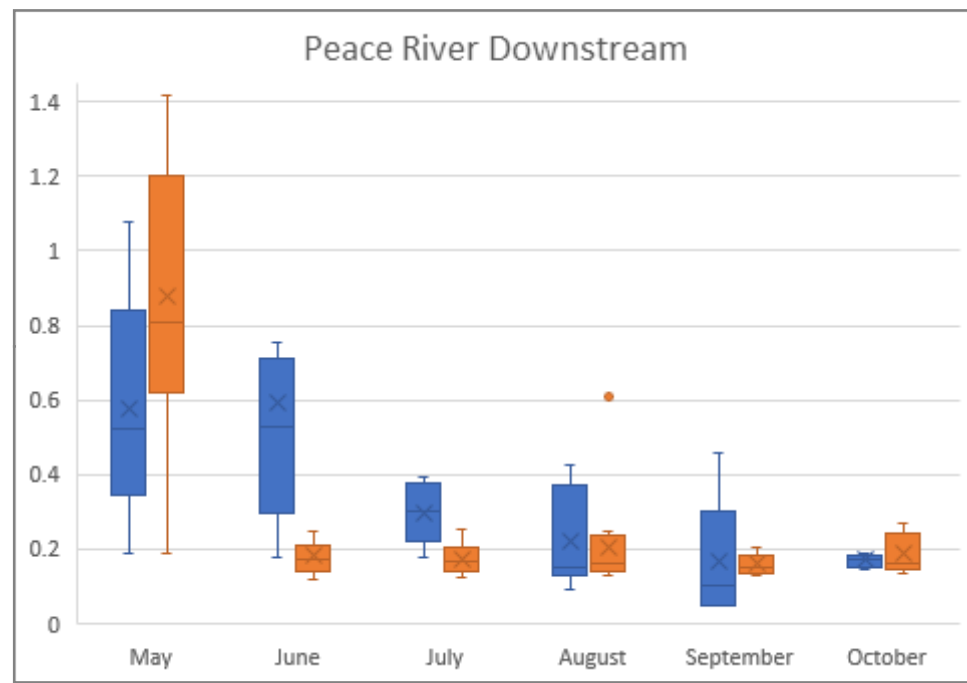
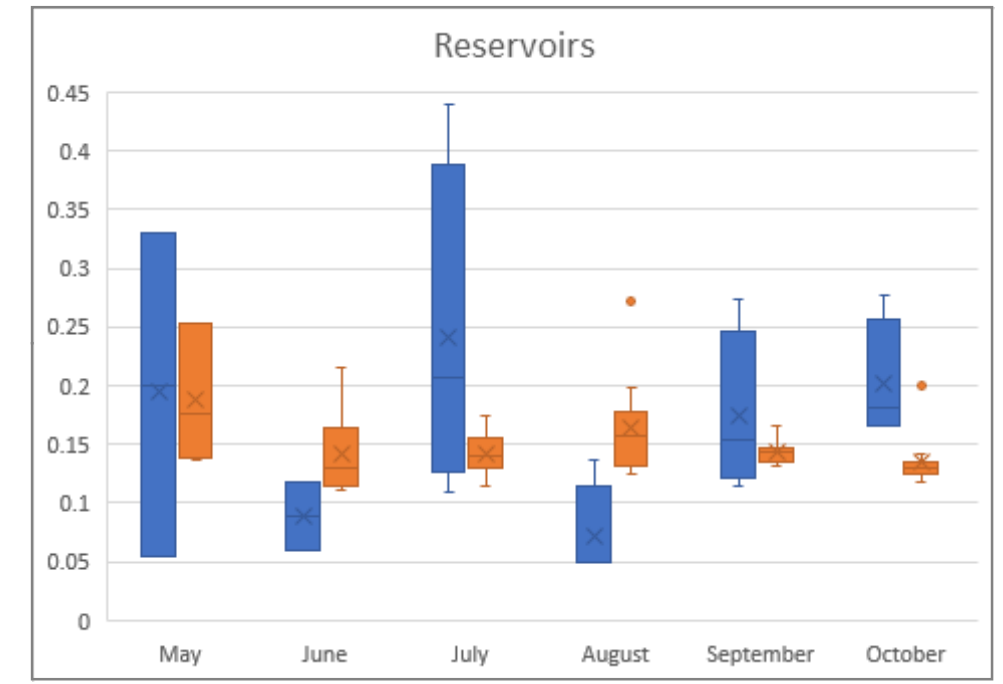
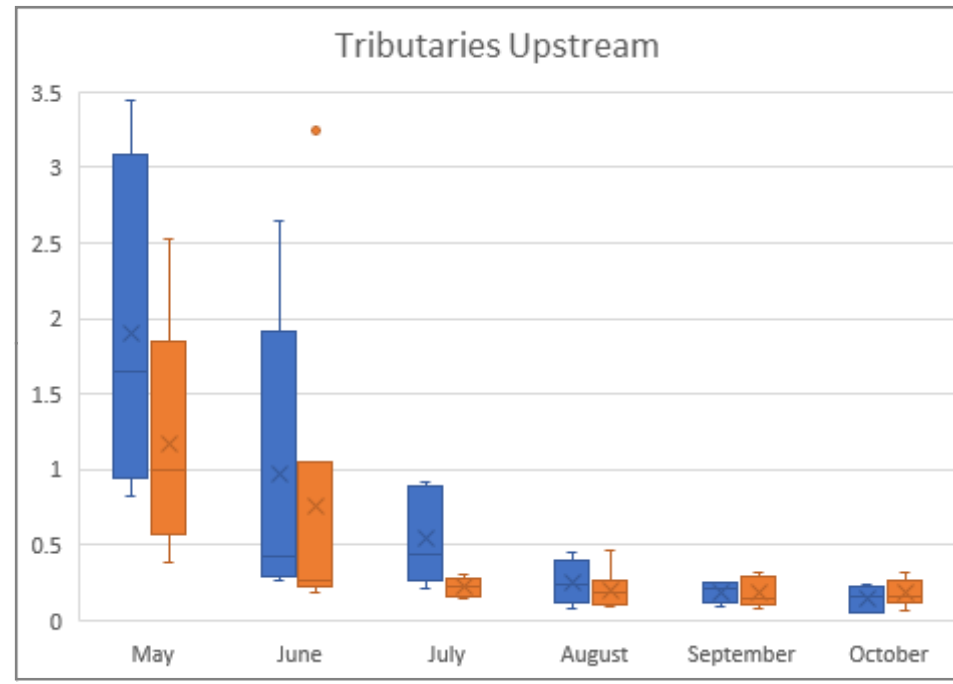
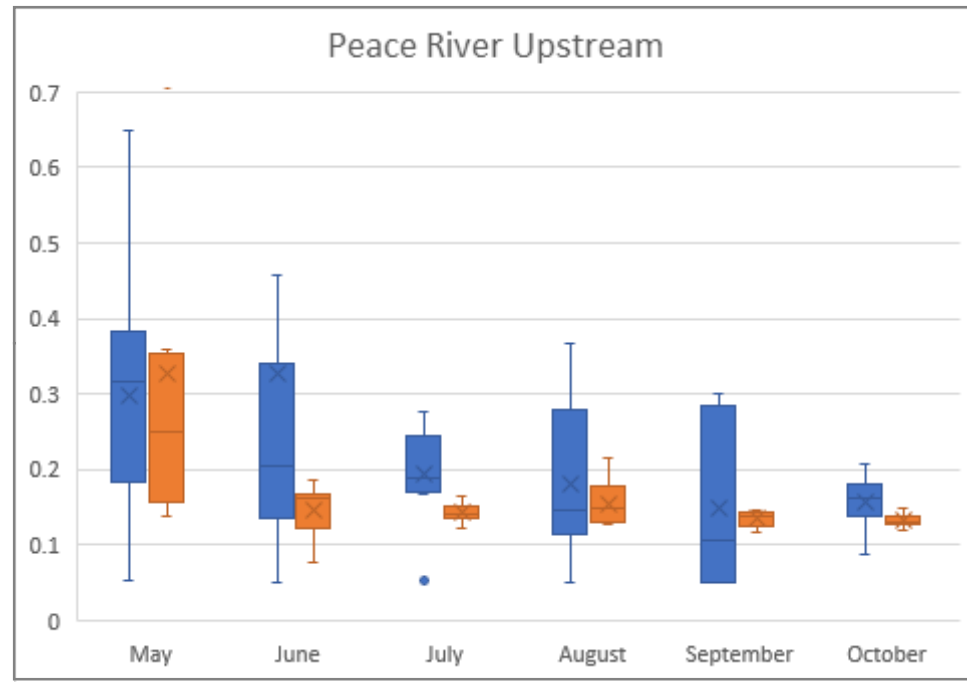
PEACE RIVER AND SITE C RESERVOIR WATER AND SEDIMENT QUALITY MONITORING PROGRAMS

Descriptive Analysis of Iron

PROJECTION N/A		DATUM N/A		CLIENT 	
NOTES 1. Y-axis is mg/L 2. Scale of y-axis varies in each panel 3. BC AWQG for total iron = 1 mg/L					
FILE NO. VENW03060-02_Figure03b_Iron.mxd					
OFFICE Tl-VANC	DWN SL	CKD LH	APVD SW	REV 0	 Figure 3b
DATE March 6, 2019	PROJECT NO. ENW.VENW03060-02				

STATUS
ISSUED FOR USE

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LEGEND

- Pre-Construction
- Construction

PEACE RIVER AND SITE C RESERVOIR WATER AND SEDIMENT QUALITY MONITORING PROGRAMS

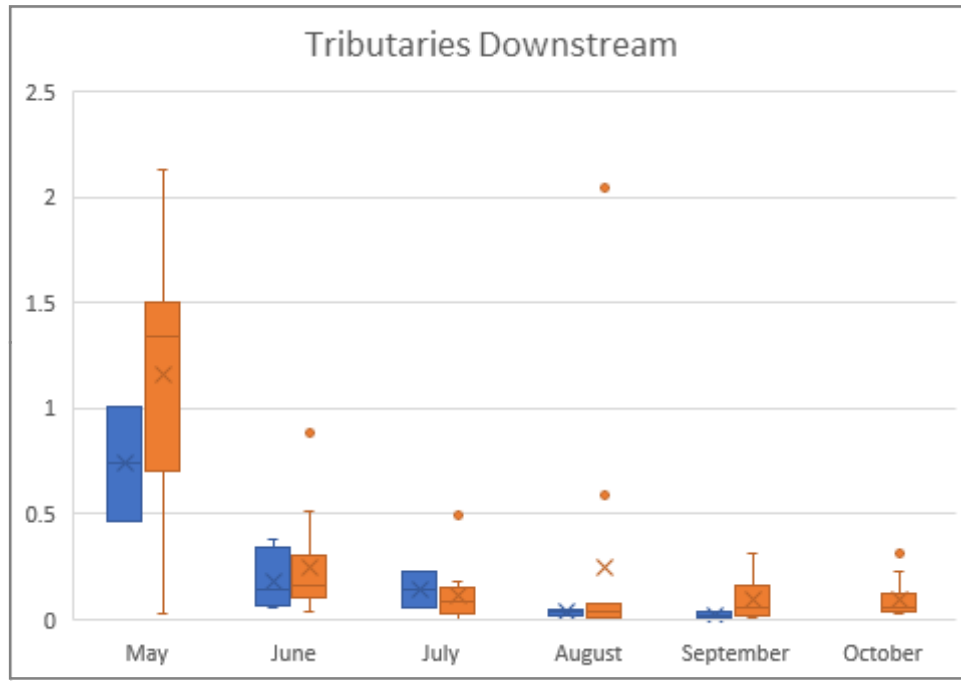
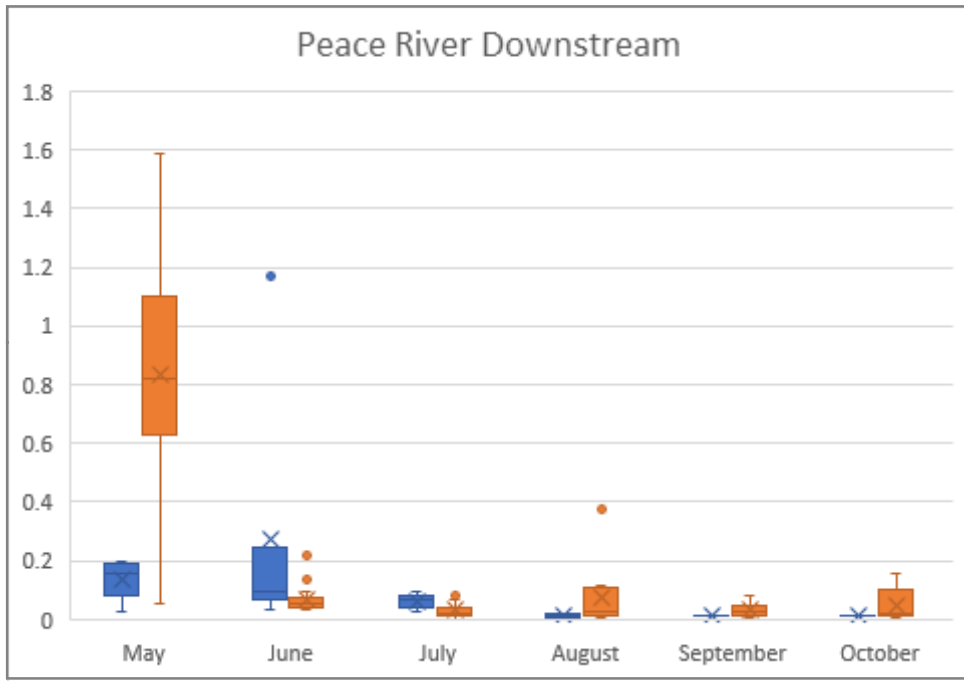
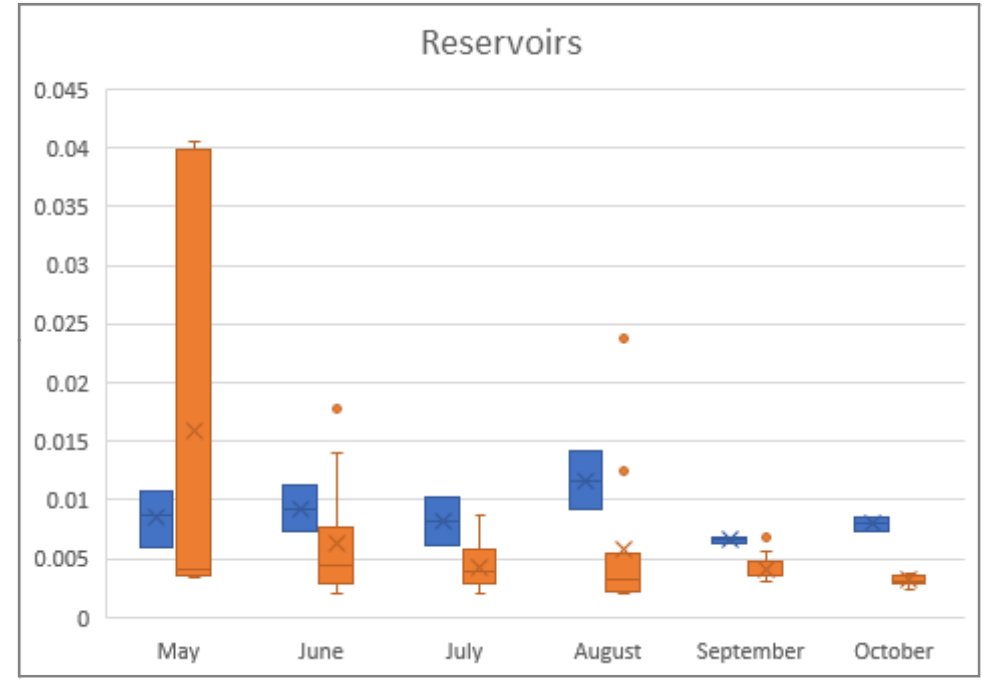
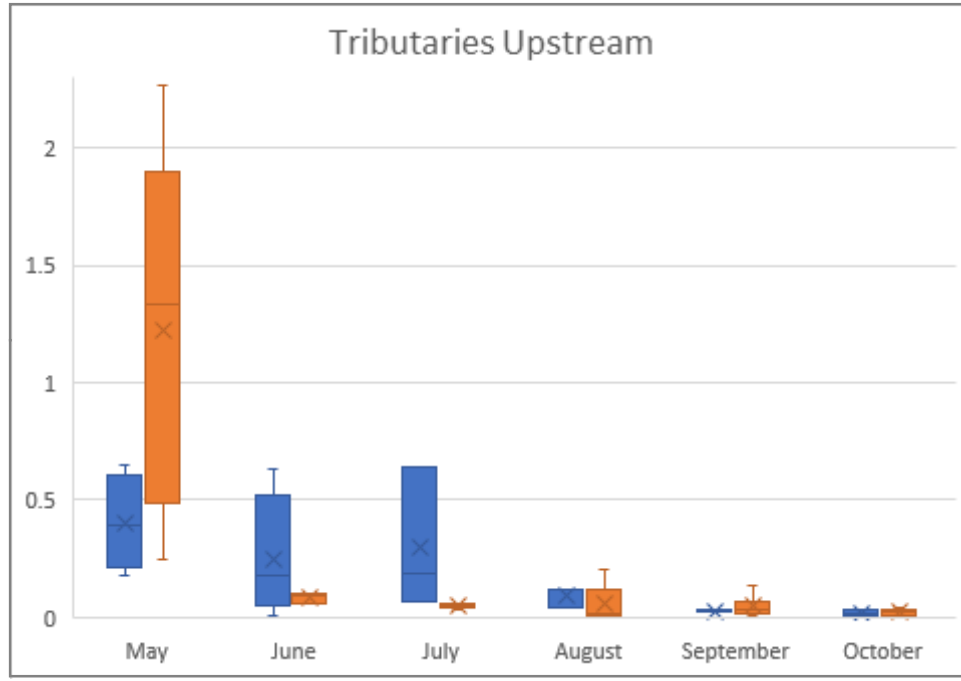
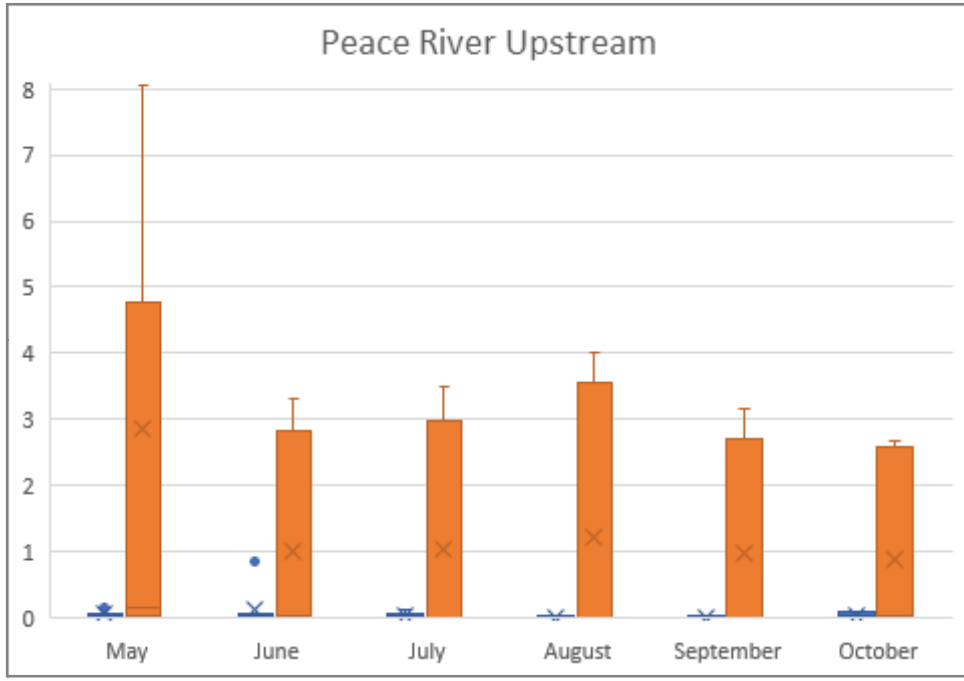
Descriptive Analysis of Nitrogen

PROJECTION N/A	DATUM N/A	CLIENT BChydro
NOTES 1. Y-axis is mg/L 2. Scale of y-axis varies in each panel		TETRA TECH
FILE NO. VENW03060-02_Figure03c_Nitrogen.mxd		
OFFICE Tl-VANC	DWN SL	CKD LH
APVD SW	REV 0	
DATE March 6, 2019	PROJECT NO. ENW.VENW03060-02	

Figure 3c

STATUS
ISSUED FOR USE

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LEGEND

- Pre-Construction
- Construction

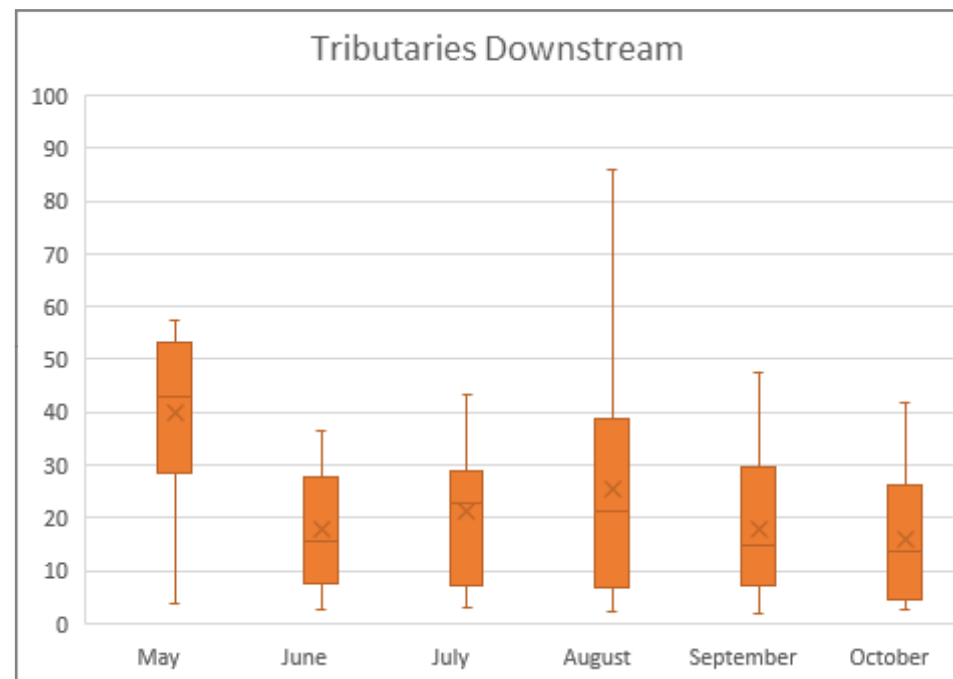
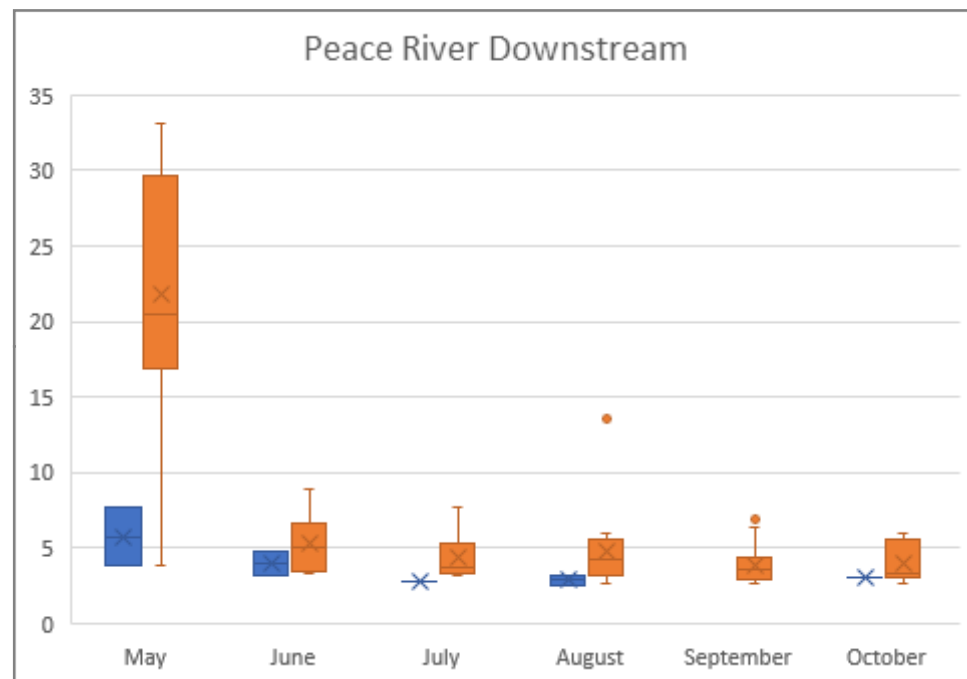
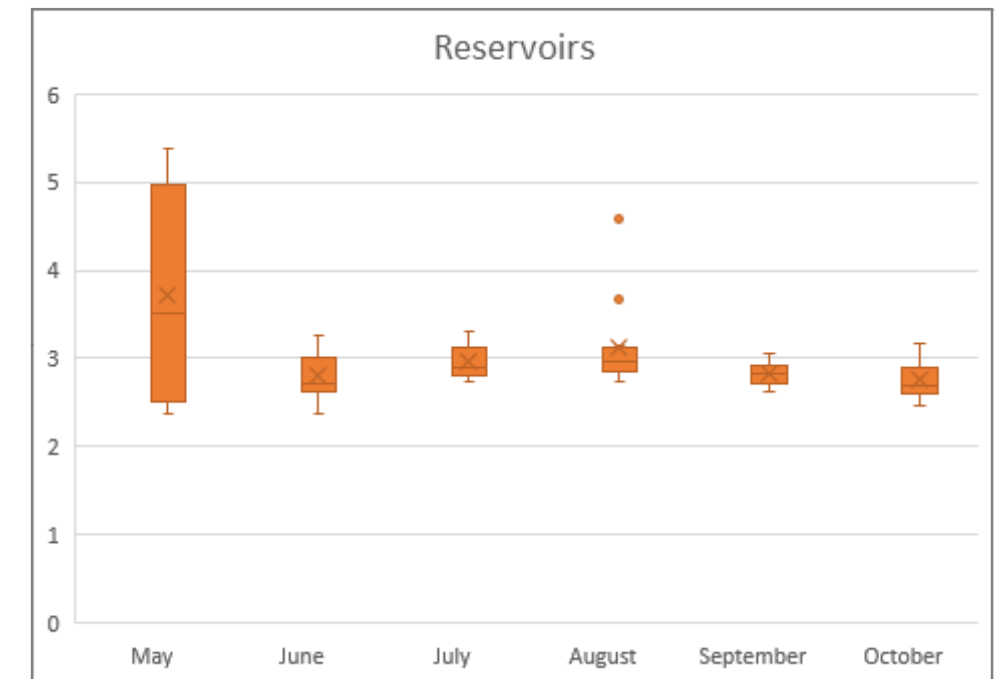
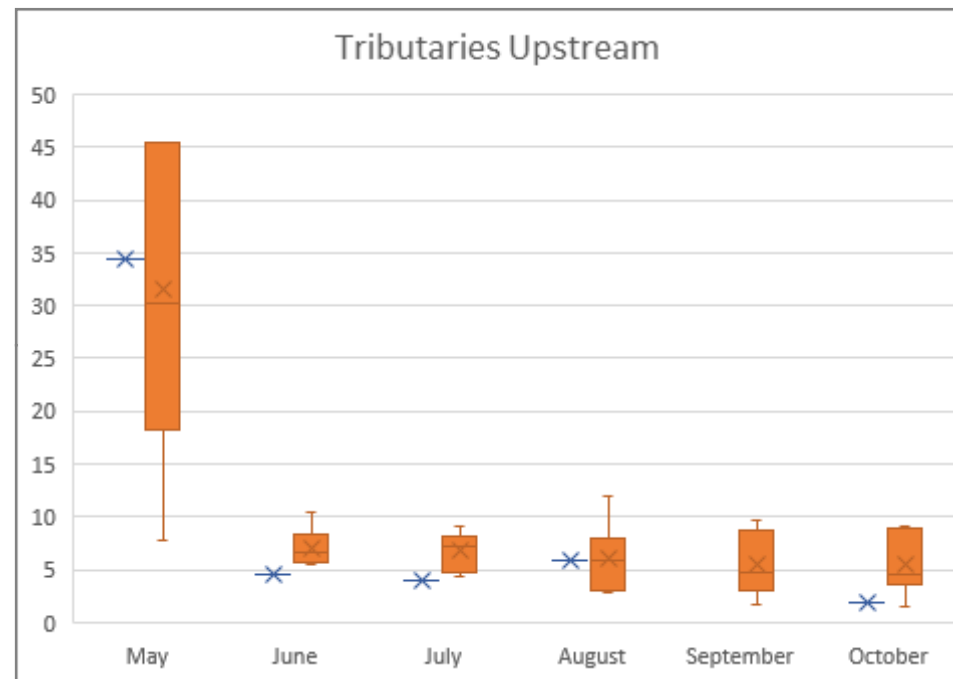
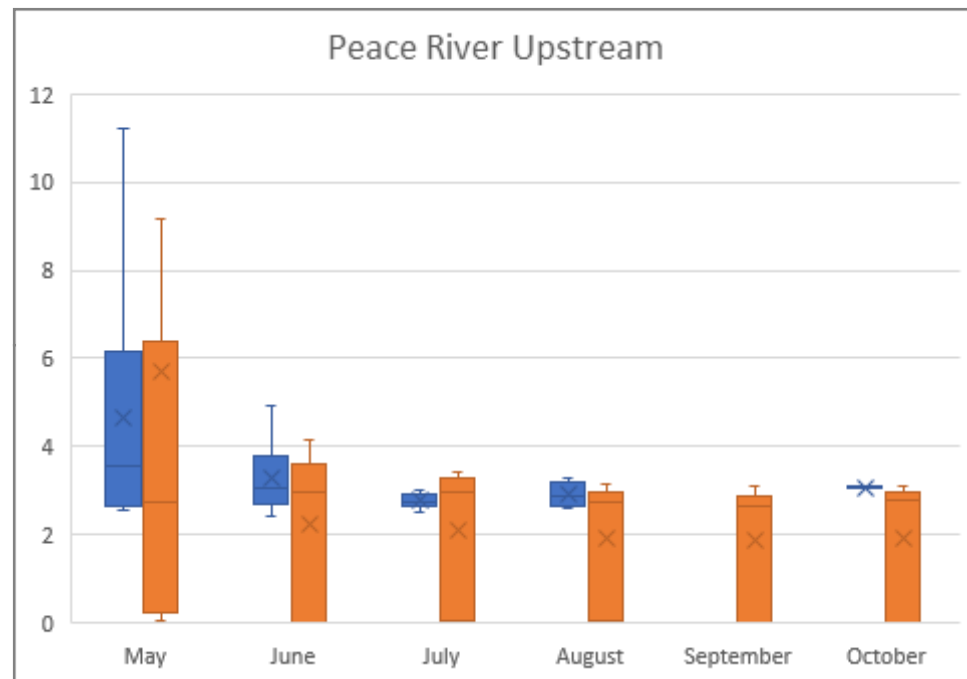
PEACE RIVER AND SITE C RESERVOIR WATER AND SEDIMENT QUALITY MONITORING PROGRAMS

Descriptive Analysis of Phosphorus

PROJECTION N/A	DATUM N/A	CLIENT BChydro
NOTES 1. Y-axis is mg/L 2. Scale of y-axis varies in each panel		
FILE NO. VENW03060-02_Figure03d_Phosphorus.mxd		
OFFICE Tl-VANC	DWN SL	CKD LH
DATE March 6, 2019	APVD SW	REV 0
PROJECT NO. ENW.VENW03060-02		TETRA TECH
Figure 3d		

STATUS
ISSUED FOR USE

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LEGEND

- Pre-Construction
- Construction

PEACE RIVER AND SITE C RESERVOIR WATER AND SEDIMENT QUALITY MONITORING PROGRAMS

Descriptive Analysis of TOC

PROJECTION N/A		DATUM N/A		CLIENT BChydro	
NOTES 1. Y-axis is mg/L 2. Scale of y-axis varies in each panel					
FILE NO. VENW03060-02_Figure03e_TOC.mxd					
OFFICE Tl-VANC	DWN SL	CKD LH	APVD SW	REV 0	TETRA TECH
DATE March 6, 2019	PROJECT NO. ENW.VENW03060-02				
					Figure 3e

STATUS
ISSUED FOR USE

APPENDIX A

LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

NATURAL SCIENCES

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

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Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by persons other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary investigation and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL ISSUES

The ability to rely upon and generalize from environmental baseline data is dependent on data collection activities occurring within biologically relevant survey windows.

It is incumbent upon the Client and any Authorized Party, to be knowledgeable of the level of risk that has been incorporated into the project design or scope, in consideration of the level of the environmental baseline information that was reasonably acquired to facilitate completion of the scope.

1.8 NOTIFICATION OF AUTHORITIES

TETRA TECH professionals are bound by their ethical commitments to act within the bounds of all pertinent regulations. In certain instances, observations by TETRA TECH of regulatory contravention may require that regulatory agencies and other persons be informed. The client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.

APPENDIX B

LABORATORY REPORTS





Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 12-MAY-18
Report Date: 01-JUN-18 18:39 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2093535
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060-02.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L2093535-1	L2093535-2	L2093535-3	L2093535-4	L2093535-5										
	Water	11-MAY-18	11:30	WILLISTON SHALLOW (W1-SHALLOW)	Water	11-MAY-18	12:00	WILLISTON DEEP (W1-DEEP)	Water	11-MAY-18	15:00	WILLISTON SHALLOW (D1-SHALLOW)	Water	11-MAY-18	15:30	WILLISTON DEEP (D1-DEEP)	Water	11-MAY-18	DUPLICATE 1 (DUP 1)
Grouping	Analyte																		
FILTER																			
Plant Pigments	Chlorophyll a (ug/L)	0.722	0.706	0.742	0.682	0.709													

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2093535-6 Water 11-MAY-18 FIELD BLANK				
Grouping	Analyte				
FILTER					
Plant Pigments	Chlorophyll a (ug/L)	<0.010			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L2093535-1	L2093535-2	L2093535-3	L2093535-4	L2093535-5
					Water	Water	Water	Water	Water
		11-MAY-18	11:30		11-MAY-18	11-MAY-18	11-MAY-18	11-MAY-18	11-MAY-18
					11:30	12:00	15:00	15:30	
					WILLISTON SHALLOW (W1-SHALLOW)	WILLISTON DEEP (W1-DEEP)	WILLISTON SHALLOW (D1-SHALLOW)	WILLISTON DEEP (D1-DEEP)	DUPLICATE 1 (DUP 1)
Grouping	Analyte								
WATER									
Physical Tests	Colour, True (CU)	5.5	5.5	25.6	23.1	23.6			
	Conductivity (umhos/cm)	187	186	172	171	169			
	Hardness (as CaCO3) (mg/L)	93.2	91.7	94.0	86.8	89.6			
	pH (pH units)	8.04	8.01	8.03	8.00	8.03			
	Total Suspended Solids (mg/L)	<3.0	<3.0	17.9	17.3	15.9			
	TDS (Calculated) (mg/L)	103	103	102	98.2	100			
	Turbidity (NTU)	1.27	1.20	29.9	29.6	30.7			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	85.5	86.5	81.6	79.9	81.0			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)	85.5	86.5	81.6	79.9	81.0			
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	0.0055			
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050			
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50			
	Fluoride (F) (mg/L)	0.035	0.036	0.045	0.043	0.042			
	Nitrate and Nitrite (as N) (mg/L)	0.0605	0.0605	0.0914	0.0915	0.0935			
	Nitrate (as N) (mg/L)	0.0605	0.0605	0.0914	0.0915	0.0935			
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	0.090	0.080	0.204	0.220	0.196			
	Total Nitrogen (mg/L)	0.202	0.149	0.253	0.252	0.274			
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	0.0025	0.0025	0.0025			
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	0.0062	0.0057	0.0061			
	Phosphorus (P)-Total (mg/L)	0.0037	0.0042	0.0397	0.0405	0.0403			
	Silicate (as SiO2) (mg/L)	4.78	4.60	4.47	4.37	4.64			
	Sulfate (SO4) (mg/L)	15.5	15.5	13.6	13.6	13.6			
	Anion Sum (meq/L)	2.04	2.06	1.92	1.89	1.91			
	Cation Sum (meq/L)	1.86	1.83	1.91	1.77	1.82			
	Cation - Anion Balance (%)	-4.5	-5.7	-0.5	-3.3	-2.4			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.36	2.30	4.34	4.62	5.00			
	Total Organic Carbon (mg/L)	2.43	2.37	4.87	5.12	5.54			
Total Metals	Aluminum (Al)-Total (mg/L)	0.0228	0.0256	0.654	0.678	0.677			
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050			
	Arsenic (As)-Total (mg/L)	<0.00050	<0.00050	0.00059	0.00062	0.00059			
	Barium (Ba)-Total (mg/L)	0.033	0.033	0.072	0.072	0.071			
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010			
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2093535-6	L2093535-7	L2093535-8
		Description	Water	Water	Water
		Sampled Date	11-MAY-18	11-MAY-18	11-MAY-18
		Sampled Time			20:00
		Client ID	FIELD BLANK	TRAVEL BLANK	PEACE CANYON DAM (PC1)
Grouping	Analyte				
WATER					
Physical Tests	Colour, True (CU)	<5.0	<5.0	21.1	
	Conductivity (umhos/cm)	<1.0	<1.0	175	
	Hardness (as CaCO3) (mg/L)	<0.50	<0.50 ^{HTC}	92.5	
	pH (pH units)	5.49	5.37	8.00	
	Total Suspended Solids (mg/L)	<3.0	<3.0	16.1	
	TDS (Calculated) (mg/L)	<1.0	<1.0	101	
	Turbidity (NTU)	0.18 ^{RRV}	<0.10	27.7	
	Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<1.0	<1.0	81.9
Alkalinity, Carbonate (as CaCO3) (mg/L)		<1.0	<1.0	<1.0	
Alkalinity, Hydroxide (as CaCO3) (mg/L)		<1.0	<1.0	<1.0	
Alkalinity, Total (as CaCO3) (mg/L)		<1.0	<1.0	81.9	
Ammonia, Total (as N) (mg/L)		<0.0050	<0.0050	<0.0050	
Bromide (Br) (mg/L)		<0.050	<0.050	<0.050	
Chloride (Cl) (mg/L)		<0.50	<0.50	<0.50	
Fluoride (F) (mg/L)		<0.020	<0.020	0.042	
Nitrate and Nitrite (as N) (mg/L)		<0.0051	<0.0051	0.0921	
Nitrate (as N) (mg/L)		<0.0050	<0.0050	0.0921	
Nitrite (as N) (mg/L)		<0.0010	<0.0010	<0.0010	
Total Kjeldahl Nitrogen (mg/L)		<0.050	<0.050	0.186	
Total Nitrogen (mg/L)		<0.030	<0.030	0.248	
Orthophosphate-Dissolved (as P) (mg/L)		<0.0010 ^{HTD}	<0.0010	0.0020	
Phosphorus (P)-Total Dissolved (mg/L)		<0.0020	<0.0020	0.0050	
Phosphorus (P)-Total (mg/L)		<0.0020	<0.0020	0.0378	
Silicate (as SiO2) (mg/L)		<0.50	<0.50	4.39	
Sulfate (SO4) (mg/L)		<0.30	<0.30	14.0	
Anion Sum (meq/L)		<0.10	<0.10	1.94	
Cation Sum (meq/L)		<0.10	<0.10	1.86	
Cation - Anion Balance (%)		0.0	0.0	-1.9	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	<0.50		4.25	
	Total Organic Carbon (mg/L)	<0.50	<0.50 ^{SP}	4.83	
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0050	<0.0050	0.531	
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Arsenic (As)-Total (mg/L)	<0.00050	<0.00050	0.00055	
	Barium (Ba)-Total (mg/L)	<0.020	<0.020	0.067	
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2093535-1	L2093535-2	L2093535-3	L2093535-4	L2093535-5
		Description	Water	Water	Water	Water	Water
		Sampled Date	11-MAY-18	11-MAY-18	11-MAY-18	11-MAY-18	11-MAY-18
		Sampled Time	11:30	12:00	15:00	15:30	
		Client ID	WILLISTON SHALLOW (W1-SHALLOW)	WILLISTON DEEP (W1-DEEP)	WILLISTON SHALLOW (D1-SHALLOW)	WILLISTON DEEP (D1-DEEP)	DUPLICATE 1 (DUP 1)
Grouping	Analyte						
WATER							
Total Metals	Boron (B)-Total (mg/L)		<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)		0.0000112	0.0000138	0.0000379	0.0000388	0.0000440
	Calcium (Ca)-Total (mg/L)		27.3	26.9	25.4	25.3	25.4
	Chromium (Cr)-Total (mg/L)		<0.0010	<0.0010	0.0017	0.0017	0.0021
	Cobalt (Co)-Total (mg/L)		<0.00030	<0.00030	0.00039	0.00040	0.00039
	Copper (Cu)-Total (mg/L)		<0.0010	<0.0010	0.0024	0.0017	0.0026
	Iron (Fe)-Total (mg/L)		0.040	0.037	0.967	1.01	0.998
	Lead (Pb)-Total (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050	0.00055
	Lithium (Li)-Total (mg/L)		0.0010	0.0010	0.0022	0.0021	0.0020
	Magnesium (Mg)-Total (mg/L)		6.12	6.25	6.18	6.11	6.16
	Manganese (Mn)-Total (mg/L)		0.00301	0.00300	0.0139	0.0143	0.0140
	Mercury (Hg)-Total (ug/L)		0.00056	0.00051	0.00448	0.00446	0.00449
	Molybdenum (Mo)-Total (mg/L)		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Nickel (Ni)-Total (mg/L)		<0.0010	<0.0010	0.0023	0.0023	0.0024
	Phosphorus (P)-Total (mg/L)		<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)		<2.0	<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Total (mg/L)		0.000290	0.000243	0.000275	0.000275	0.000281
	Silicon (Si)-Total (mg/L)		2.25	2.24	3.18	3.12	3.11
	Silver (Ag)-Total (mg/L)		<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Total (mg/L)		<2.0	<2.0	<2.0	<2.0	<2.0
	Strontium (Sr)-Total (mg/L)		0.118	0.119	0.106	0.105	0.107
	Thallium (Tl)-Total (mg/L)		<0.000010	<0.000010	0.000018	0.000019	0.000017
	Tin (Sn)-Total (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)		<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)		0.00052	0.00052	0.00048	0.00049	0.00049
	Vanadium (V)-Total (mg/L)		<0.0010 ^{DLB}	<0.0010 ^{DLB}	0.00318	0.00329	0.00327
	Zinc (Zn)-Total (mg/L)		<0.0050	<0.0050	0.0059	0.0053	0.0061
Dissolved Metals	Dissolved MeHg Filtration Location		FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Mercury Filtration Location		LAB	LAB	LAB	LAB	LAB
	Dissolved Metals Filtration Location		FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)		0.0136	0.0083	0.121	0.144	0.132
	Antimony (Sb)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Barium (Ba)-Dissolved (mg/L)		0.031	0.030	0.055	0.054	0.054
	Beryllium (Be)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)		<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)		<0.10	<0.10	<0.10	<0.10	<0.10

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2093535-6	L2093535-7	L2093535-8
		Description	Water	Water	Water
		Sampled Date	11-MAY-18	11-MAY-18	11-MAY-18
		Sampled Time			20:00
		Client ID	FIELD BLANK	TRAVEL BLANK	PEACE CANYON DAM (PC1)
Grouping	Analyte				
WATER					
Total Metals	Boron (B)-Total (mg/L)		<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)		<0.0000050	<0.0000050	0.0000400
	Calcium (Ca)-Total (mg/L)		<0.10	<0.10	26.2
	Chromium (Cr)-Total (mg/L)		<0.0010	<0.0010	0.0019
	Cobalt (Co)-Total (mg/L)		<0.00030	<0.00030	0.00034
	Copper (Cu)-Total (mg/L)		<0.0010	<0.0010	0.0017
	Iron (Fe)-Total (mg/L)		<0.030	<0.030	0.810
	Lead (Pb)-Total (mg/L)		<0.00050	<0.00050	<0.00050
	Lithium (Li)-Total (mg/L)		<0.0010	<0.0010	0.0019
	Magnesium (Mg)-Total (mg/L)		<0.10	<0.10	6.35
	Manganese (Mn)-Total (mg/L)		<0.00010	<0.00010	0.0130
	Mercury (Hg)-Total (ug/L)		<0.00050	<0.00050	0.00420
	Molybdenum (Mo)-Total (mg/L)		<0.0010	<0.0010	<0.0010
	Nickel (Ni)-Total (mg/L)		<0.0010	<0.0010	0.0022
	Phosphorus (P)-Total (mg/L)		<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)		<2.0	<2.0	<2.0
	Selenium (Se)-Total (mg/L)		<0.000050	<0.000050	0.000269
	Silicon (Si)-Total (mg/L)		<0.10	<0.10	3.00
	Silver (Ag)-Total (mg/L)		<0.000020	<0.000020	<0.000020
	Sodium (Na)-Total (mg/L)		<2.0	<2.0	<2.0
	Strontium (Sr)-Total (mg/L)		<0.0050	<0.0050	0.111
	Thallium (Tl)-Total (mg/L)		<0.000010	<0.000010	0.000014
	Tin (Sn)-Total (mg/L)		<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)		<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)		<0.00020	<0.00020	0.00050
	Vanadium (V)-Total (mg/L)		<0.00050	<0.00050	0.00275
	Zinc (Zn)-Total (mg/L)		0.0055	<0.0050	0.0082
Dissolved Metals	Dissolved MeHg Filtration Location		FIELD		FIELD
	Dissolved Mercury Filtration Location		LAB		LAB
	Dissolved Metals Filtration Location		FIELD		FIELD
	Aluminum (Al)-Dissolved (mg/L)		<0.0050		0.0735
	Antimony (Sb)-Dissolved (mg/L)		<0.00050		<0.00050
	Arsenic (As)-Dissolved (mg/L)		<0.00050		<0.00050
	Barium (Ba)-Dissolved (mg/L)		<0.020 ^{RRV}		0.051
	Beryllium (Be)-Dissolved (mg/L)		<0.00010		<0.00010
	Bismuth (Bi)-Dissolved (mg/L)		<0.20		<0.20
	Boron (B)-Dissolved (mg/L)		<0.10		<0.10

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L2093535-1	L2093535-2	L2093535-3	L2093535-4	L2093535-5
					Water	Water	Water	Water	Water
		11-MAY-18	11:30		11-MAY-18	11-MAY-18	11-MAY-18	11-MAY-18	11-MAY-18
					WILLISTON SHALLOW (W1-SHALLOW)	WILLISTON DEEP (W1-DEEP)	WILLISTON SHALLOW (D1-SHALLOW)	WILLISTON DEEP (D1-DEEP)	DUPLICATE 1 (DUP 1)
Grouping	Analyte								
WATER									
Dissolved Metals	Cadmium (Cd)-Dissolved (mg/L)	0.0000068	0.0000079	0.0000176	0.0000266	0.0000206			
	Calcium (Ca)-Dissolved (mg/L)	26.8	26.3	27.5	24.4	25.2			
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010			
	Cobalt (Co)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030			
	Copper (Cu)-Dissolved (mg/L)	<0.0010	<0.0010	0.0011	0.0012	0.0011			
	Iron (Fe)-Dissolved (mg/L)	<0.030	<0.030	0.273	0.330	0.290			
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050			
	Lithium (Li)-Dissolved (mg/L)	<0.0010	0.0011	0.0016	0.0015	0.0014			
	Magnesium (Mg)-Dissolved (mg/L)	6.36	6.34	6.16	6.31	6.49			
	Manganese (Mn)-Dissolved (mg/L)	0.00223	0.00165	0.00786	0.00888	0.00814			
	Mercury (Hg)-Dissolved (ug/L)	<0.00050	<0.00050	0.00060	0.00063	0.00054			
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010			
	Nickel (Ni)-Dissolved (mg/L)	<0.0010	<0.0010	0.0014	0.0015	0.0014			
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30			
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0			
	Selenium (Se)-Dissolved (mg/L)	0.000224	0.000265	0.000173	0.000223	0.000233			
	Silicon (Si)-Dissolved (mg/L)	2.20	2.22	2.31	2.41	2.32			
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020			
	Sodium (Na)-Dissolved (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0			
	Strontium (Sr)-Dissolved (mg/L)	0.104	0.103	0.0994	0.0962	0.0971			
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020			
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050			
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010			
	Uranium (U)-Dissolved (mg/L)	0.00046	0.00047	0.00043	0.00043	0.00043			
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	0.00058	0.00066	0.00060			
	Zinc (Zn)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050			
Speciated Metals	Methylmercury (as MeHg)-Dissolved (ug/L)	<0.000020	<0.000020	0.000026	0.000030	0.000024			
	Methylmercury (as MeHg)-Total (ug/L)	<0.000020	<0.000020	0.000043	0.000031	0.000028			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2093535-6 Water 11-MAY-18 FIELD BLANK	L2093535-7 Water 11-MAY-18 TRAVEL BLANK	L2093535-8 Water 11-MAY-18 20:00 PEACE CANYON DAM (PC1)		
Grouping	Analyte					
WATER						
Dissolved Metals	Cadmium (Cd)-Dissolved (mg/L)	<0.000050		0.0000143		
	Calcium (Ca)-Dissolved (mg/L)	<0.10		26.3		
	Chromium (Cr)-Dissolved (mg/L)	<0.0010		<0.0010		
	Cobalt (Co)-Dissolved (mg/L)	<0.00030		<0.00030		
	Copper (Cu)-Dissolved (mg/L)	<0.0010		0.0015		
	Iron (Fe)-Dissolved (mg/L)	<0.030		0.133		
	Lead (Pb)-Dissolved (mg/L)	<0.00050		<0.00050		
	Lithium (Li)-Dissolved (mg/L)	<0.0010		0.0014		
	Magnesium (Mg)-Dissolved (mg/L)	<0.10		6.51		
	Manganese (Mn)-Dissolved (mg/L)	<0.00010		0.00607		
	Mercury (Hg)-Dissolved (ug/L)	<0.00050		0.00063		
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0010		<0.0010		
	Nickel (Ni)-Dissolved (mg/L)	<0.0010		0.0013		
	Phosphorus (P)-Dissolved (mg/L)	<0.30		<0.30		
	Potassium (K)-Dissolved (mg/L)	<2.0		<2.0		
	Selenium (Se)-Dissolved (mg/L)	<0.000050		0.000328		
	Silicon (Si)-Dissolved (mg/L)	<0.050		2.26		
	Silver (Ag)-Dissolved (mg/L)	<0.000020		<0.000020		
	Sodium (Na)-Dissolved (mg/L)	<2.0		<2.0		
	Strontium (Sr)-Dissolved (mg/L)	<0.0050		0.0988		
	Thallium (Tl)-Dissolved (mg/L)	<0.00020		<0.00020		
	Tin (Sn)-Dissolved (mg/L)	0.00068 ^{RRV}		<0.00050		
	Titanium (Ti)-Dissolved (mg/L)	<0.010		<0.010		
	Uranium (U)-Dissolved (mg/L)	<0.00020		0.00047		
	Vanadium (V)-Dissolved (mg/L)	<0.00050		<0.00050		
	Zinc (Zn)-Dissolved (mg/L)	<0.0050		<0.0050		
Speciated Metals	Methylmercury (as MeHg)-Dissolved (ug/L)	<0.000020		0.000024		
	Methylmercury (as MeHg)-Total (ug/L)	<0.000020	<0.000020	0.000026		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Arsenic (As)-Total	MB-LOR	L2093535-1, -2, -3, -4, -5, -6, -7, -8
Method Blank	Chromium (Cr)-Total	MB-LOR	L2093535-1, -2, -3, -4, -5, -6, -7, -8
Method Blank	Manganese (Mn)-Total	MB-LOR	L2093535-3, -4, -5, -6, -7, -8
Method Blank	Vanadium (V)-Total	MB-LOR	L2093535-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Dissolved Organic Carbon	MS-B	L2093535-1, -2, -3, -4, -5, -6, -8
Matrix Spike	Total Organic Carbon	MS-B	L2093535-1, -3, -4, -5, -6, -7, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2093535-1, -2, -3, -4, -5, -6, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2093535-6
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2093535-1, -2, -3, -4, -5, -6, -8
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2093535-6
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2093535-1, -2, -3, -4, -5, -6, -8
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2093535-6
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2093535-6
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2093535-1, -2, -3, -4, -5, -6, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2093535-6
Matrix Spike	Uranium (U)-Dissolved	MS-B	L2093535-6
Matrix Spike	Calcium (Ca)-Total	MS-B	L2093535-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2093535-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Manganese (Mn)-Total	MS-B	L2093535-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Potassium (K)-Total	MS-B	L2093535-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Total	MS-B	L2093535-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Total	MS-B	L2093535-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Total Nitrogen	MS-B	L2093535-1, -2, -3, -4, -5, -7, -8
Matrix Spike	Total Nitrogen	MS-B	L2093535-1, -2, -3, -4, -5, -7, -8
Matrix Spike	Phosphorus (P)-Total	MS-B	L2093535-1, -2, -3, -4, -5, -6, -7, -8

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis
SP	Sample was Preserved at the laboratory

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-CO3-CALC-WP	Water	Alkalinity, Carbonate (as CaCO ₃)	CALCULATION
		The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by carbonate is calculated and reported as mg/L CaCO ₃ .	
ALK-HCO3-CALC-WP	Water	Alkalinity, Bicarbonate (as CaCO ₃)	CALCULATION
		The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by bicarbonate is calculated and reported as mg/L CaCO ₃ .	
ALK-OH-CALC-WP	Water	Alkalinity, Hydroxide (as CaCO ₃)	CALCULATION
		The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by hydroxide is calculated and reported as mg/L CaCO ₃ .	
ALK-TITR-WP	Water	Alkalinity, Total (as CaCO ₃)	APHA 2320B
		The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. Total alkalinity is determined by titration with a strong standard mineral acid to the successive HCO ₃ ⁻ and H ₂ CO ₃ endpoints indicated electrometrically.	

Reference Information

ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0
This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.			
Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
EC-WP	Water	Conductivity	APHA 2510B
Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO ₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
HG-D-U-CVAF-VA	Water	Diss. Mercury in Water by CVAFS (Ultra)	APHA 3030 B / EPA 1631 REV. E
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure may involve preliminary sample treatment by filtration (APHA 3030B) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.			
HG-T-U-CVAF-VA	Water	Total Mercury in Water by CVAFS (Ultra)	EPA 1631 REV. E
This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.			
IONBALANCE-VA	Water	Ion Balance Calculation	APHA 1030E
Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.			
Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:			
Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]			
MEHG-D-GCAF-VA	Water	Diss. Methylmercury in Water by GCAFS	EPA 1630
This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".			

Reference Information

MEHG-T-GCAF-VA	Water	Total Methylmercury in Water by GCAFS	EPA 1630
This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Weston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.			
Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.			
P-TD-COL-VA	Water	Total Dissolved P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.			
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.			
Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.			
PH-WP	Water	pH	APHA 4500H
The pH of a sample is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode.			
PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.			
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.			
Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.			
SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.
This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
TDS-CALC-VA	Water	TDS (Calculated)	APHA 1030E (20TH EDITION)
This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".			
The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.			

Reference Information

TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.
This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.			
TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC
This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.			
TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity
This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



ALS Environmental

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L2093535-COFC

COFC Number: 14

Page 1 of 1

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<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</td> <td colspan="3">Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources.</td> <td colspan="13">Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/></td> </tr> <tr> <td colspan="2">Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</td> <td colspan="3">All dissolved samples filtered + preserved</td> <td colspan="13">Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/></td> </tr> <tr> <td colspan="2">SHIPMENT RELEASE (client use)</td> <td colspan="3">INITIAL SHIPMENT RECEPTION (lab use only)</td> <td colspan="13">Cooling Initiated <input type="checkbox"/></td> </tr> <tr> <td colspan="2">Released by: [Signature]</td> <td colspan="3">Date: May 12 Time: 10:57</td> <td colspan="13">INITIAL COOLER TEMPERATURES °C: 5.9°C</td> </tr> <tr> <td colspan="2">Date: May 12 Time: 10:57</td> <td colspan="3">Received by: Dawn</td> <td colspan="13">FINAL COOLER TEMPERATURES °C: -0.6, 2.8</td> </tr> <tr> <td colspan="2">Date: May 12 Time: 10:57</td> <td colspan="3">Date: May 12/18 Time: 11:00 AM</td> <td colspan="13">FINAL SHIPMENT RECEPTION (lab use only)</td> </tr> <tr> <td colspan="2">Date: May 12 Time: 10:57</td> <td colspan="3">Received by: CW</td> <td colspan="13">Received by: CW Date: May 13 Time: 11:00</td> </tr> </tbody> </table>																	P	F/P	P	F/P	P	F/P	P	F/P	P	F/P		F		ALS Quote #: Q53931	Job #: VENW03060 -02.002	PO / AFE:	LSD:	ALS Lab Work Order # (lab use only): L2093535	ALS Contact: Brent Mack	Sampler:	Alk-Species: Antions by IC, NO2+NO2Calc	Color-True, EC, pH, TSS, TDS-Calc	Turbidity, Silicate, Ortho PO4, Ion Balance	TOC, TN, TP, TDP, TKN, NH3	DOC	Total Metals (CCME+ICP+Hardness)	Dissolved Metals (CCME+ICP+Hardness)	Total Hg (ultra low detection limit)	Dissolved Hg (ultra low detection limit)	Total MeHg (ultra low detection limit)	Dissolved MeHg (ultra low detection limit)	chlorophyll a (field filtered 250 mL)	Number of Containers	Approver ID:	Cost Center:	GL Account:	Routing Code:	Activity Code:	Location:	ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	R	R	R	R	R	R	R	R	R	R	R	R	R	R	1	Williston Shallow (W1 - Shallow)	May 11	11:30	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	10	2	Williston Deep (W1 - Deep)	2018	12:00	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	10	3	Dinosaur Shallow (D1 - Shallow)	2018	15:00	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	10	4	Dinosaur Deep (D1 - Deep)	↓	15:30	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	10	5	Duplicate 1 (DUP 1)	↓	-	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	10	6	Field Blank	↓	-	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	10	7	TRAVEL BLANK	↓	-	water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	6	8	Peace Canyon Dam (PCI)	↓	20:00	water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	9	Drinking Water (DW) Samples ¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)			SAMPLE CONDITION AS RECEIVED (lab use only)													Are samples taken from a Regulated DW System? 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Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources.			Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																																																																																																																																																																																																																																																																																																										
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		All dissolved samples filtered + preserved			Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																																																																																																																																																																																																																																																																																																										
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Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 10-MAY-18
Report Date: 04-JUN-18 11:28 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2092365
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2092365-1	L2092365-2	L2092365-3	L2092365-4
		Description	Water	Water	Water	Water
		Sampled Date	09-MAY-18	09-MAY-18	09-MAY-18	09-MAY-18
		Sampled Time				
		Client ID	HD	PR1	PR2	DUP2
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	97.4	18.2	28.0	28.4	
	Conductivity (uS/cm)	208	177	179	181	
	Hardness (as CaCO3) (mg/L)	141	83.8	106	118	
	pH (pH)	7.98	8.06	8.06	8.07	
	Total Suspended Solids (mg/L)	608	18.0	112	131	
	TDS (Calculated) (mg/L)	177	97.4	119	123	
	Turbidity (NTU)	523	26.9	129	134	
	Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	86.5	78.4	81.8	80.7
Alkalinity, Carbonate (as CaCO3) (mg/L)		<1.0	<1.0	<1.0	<1.0	
Alkalinity, Hydroxide (as CaCO3) (mg/L)		<1.0	<1.0	<1.0	<1.0	
Alkalinity, Total (as CaCO3) (mg/L)		86.5	78.4	81.8	80.7	
Ammonia, Total (as N) (mg/L)		0.0057 ^{PEHT}	0.0061	0.0125	0.0090	
Bromide (Br) (mg/L)		<0.050	<0.050	<0.050	<0.050	
Chloride (Cl) (mg/L)		<0.50	<0.50	<0.50	<0.50	
Fluoride (F) (mg/L)		0.088	0.042	0.048	0.048	
Nitrate and Nitrite (as N) (mg/L)		0.0795	0.0956	0.104	0.105	
Nitrate (as N) (mg/L)		0.0795	0.0956	0.104	0.105	
Nitrite (as N) (mg/L)		<0.0010	<0.0010	<0.0010	<0.0010	
Total Kjeldahl Nitrogen (mg/L)		1.70 ^{PEHT}	0.175	0.406	0.390	
Total Nitrogen (mg/L)		0.76 ^{RRV}	0.242	0.360	0.341	
Orthophosphate-Dissolved (as P) (mg/L)		0.0078	0.0012	0.0033	0.0029	
Phosphorus (P)-Total Dissolved (mg/L)		0.0225	0.0039	0.0065	0.0062	
Phosphorus (P)-Total (mg/L)		0.727	0.0353	0.165	0.156	
Silicate (as SiO2) (mg/L)		4.15	4.41	4.51	4.56	
Sulfate (SO4) (mg/L)		26.7	14.8	15.4	15.5	
Anion Sum (meq/L)		2.29	1.88	1.97	1.94	
Cation Sum (meq/L)		4.22	1.76	2.71	2.98	
Cation - Anion Balance (%)	29.6	-3.3	16.0	21.1		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	18.3	4.61	7.24	7.77	
	Total Organic Carbon (mg/L)	28.8	4.56	8.06	7.80	
Total Metals	Aluminum (Al)-Total (mg/L)	7.20	0.594	2.56	2.48	
	Antimony (Sb)-Total (mg/L)	0.00054	<0.00050	<0.00050	<0.00050	
	Arsenic (As)-Total (mg/L)	0.00622	0.00056	0.00182	0.00184	
	Barium (Ba)-Total (mg/L)	0.355	0.064	0.115	0.109	
	Beryllium (Be)-Total (mg/L)	0.00051	<0.00010	0.00013	0.00013	
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	<0.20	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2092365-1 Water 09-MAY-18 HD	L2092365-2 Water 09-MAY-18 PR1	L2092365-3 Water 09-MAY-18 PR2	L2092365-4 Water 09-MAY-18 DUP2
Grouping	Analyte				
WATER					
Total Metals	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)	0.000875	0.0000411	0.000240	0.000259
	Calcium (Ca)-Total (mg/L)	44.5	26.0	30.9	32.8
	Chromium (Cr)-Total (mg/L)	0.0138	0.0012	0.0047	0.0047
	Cobalt (Co)-Total (mg/L)	0.00635	0.00035	0.00171	0.00175
	Copper (Cu)-Total (mg/L)	0.0197	0.0020	0.0061	0.0062
	Iron (Fe)-Total (mg/L)	14.3	0.880	4.08	4.08
	Lead (Pb)-Total (mg/L)	0.00819	<0.00050	0.00219	0.00214
	Lithium (Li)-Total (mg/L)	0.0125	0.0018	0.0040	0.0044
	Magnesium (Mg)-Total (mg/L)	13.8	6.65	8.41	8.64
	Manganese (Mn)-Total (mg/L)	0.195	0.0138	0.0645	0.0649
	Mercury (Hg)-Total (ug/L)	0.0466	0.00396	0.0116	0.0115
	Molybdenum (Mo)-Total (mg/L)	0.0023	<0.0010	<0.0010	<0.0010
	Nickel (Ni)-Total (mg/L)	0.0262	0.0021	0.0074	0.0075
	Phosphorus (P)-Total (mg/L)	0.66	<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)	3.0	<2.0	<2.0	<2.0
	Selenium (Se)-Total (mg/L)	0.00137	0.000306	0.000390	0.000404
	Silicon (Si)-Total (mg/L)	12.9	3.17	6.29	6.05
	Silver (Ag)-Total (mg/L)	0.000186	<0.000020	0.000044	0.000041
	Sodium (Na)-Total (mg/L)	3.0	<2.0	<2.0	<2.0
	Strontium (Sr)-Total (mg/L)	0.167	0.101	0.109	0.108
	Thallium (Tl)-Total (mg/L)	0.000251	0.000017	0.000082	0.000072
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)	0.041	<0.010	0.040	0.037
	Uranium (U)-Total (mg/L)	0.00129	0.00053	0.00068	0.00068
	Vanadium (V)-Total (mg/L)	0.0324	0.00265	0.0107	0.0105
	Zinc (Zn)-Total (mg/L)	0.0837	0.0059	0.0219	0.0231
Dissolved Metals	Dissolved MeHg Filtration Location	FIELD	FIELD	FIELD	FIELD
	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	8.30	0.636	3.49 ^{DTC}	3.59 ^{DTC}
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)	0.00235	<0.00050	0.00121	0.00143
	Barium (Ba)-Dissolved (mg/L)	0.253	0.056	0.126	0.134
	Beryllium (Be)-Dissolved (mg/L)	0.00033	<0.00010	0.00017	0.00017
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10	<0.10

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2092365-1 Water 09-MAY-18 HD	L2092365-2 Water 09-MAY-18 PR1	L2092365-3 Water 09-MAY-18 PR2	L2092365-4 Water 09-MAY-18 DUP2	
Grouping	Analyte				
WATER					
Dissolved Metals	Cadmium (Cd)-Dissolved (mg/L)	0.000412	0.0000247	0.000216	0.000238
	Calcium (Ca)-Dissolved (mg/L)	39.1	23.4	29.8	33.5
	Chromium (Cr)-Dissolved (mg/L)	0.0122	0.0012	0.0051	0.0057
	Cobalt (Co)-Dissolved (mg/L)	0.00260	<0.00030	0.00126	0.00146
	Copper (Cu)-Dissolved (mg/L)	0.0085	0.0012	0.0045	0.0050
	Iron (Fe)-Dissolved (mg/L)	5.06	0.329	2.67	3.13
	Lead (Pb)-Dissolved (mg/L)	0.00341	<0.00050	0.00157	0.00190
	Lithium (Li)-Dissolved (mg/L)	0.0123	0.0020	0.0055	0.0058
	Magnesium (Mg)-Dissolved (mg/L)	10.5	6.17	7.72	8.30
	Manganese (Mn)-Dissolved (mg/L)	0.0967	0.00923	0.0562	0.0649
	Mercury (Hg)-Dissolved (ug/L)	0.0191	0.00320	0.00964	0.00818
	Molybdenum (Mo)-Dissolved (mg/L)	0.0016	<0.0010	<0.0010	<0.0010
	Nickel (Ni)-Dissolved (mg/L)	0.0114	0.0014	0.0052	0.0062
	Phosphorus (P)-Dissolved (mg/L)	0.33	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	3.3	<2.0	2.1	2.2
	Selenium (Se)-Dissolved (mg/L)	0.000816	0.000254	0.000321	0.000377
	Silicon (Si)-Dissolved (mg/L)	22.3 ^{DTMF}	3.52	10.0 ^{DTC}	10.4 ^{DTC}
	Silver (Ag)-Dissolved (mg/L)	0.000066	<0.000020	0.000029	0.000044
	Sodium (Na)-Dissolved (mg/L)	2.8	<2.0	<2.0	<2.0
	Strontium (Sr)-Dissolved (mg/L)	0.143	0.0932	0.107	0.110
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Dissolved (mg/L)	0.36 ^{DLM}	<0.17 ^{DLM}	<0.16 ^{DLM}	0.22 ^{DLM}
	Uranium (U)-Dissolved (mg/L)	0.00098	0.00044	0.00064	0.00075
	Vanadium (V)-Dissolved (mg/L)	0.0310	0.00217	0.0124	0.0125
	Zinc (Zn)-Dissolved (mg/L)	0.0302	<0.0050	0.0141	0.0158
Speciated Metals	Methylmercury (as MeHg)-Dissolved (ug/L)	<0.000020	<0.000020	0.000052	0.000055
	Methylmercury (as MeHg)-Total (ug/L)	0.000082	<0.000020	0.000032	0.000074

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Alkalinity, Total (as CaCO3)	B	L2092365-1, -2, -3, -4
Method Blank	Total Nitrogen	B	L2092365-2, -3, -4
Matrix Spike	Total Organic Carbon	MS-B	L2092365-1, -2, -3, -4
Matrix Spike	Aluminum (Al)-Total	MS-B	L2092365-1, -2, -3, -4
Matrix Spike	Barium (Ba)-Total	MS-B	L2092365-1, -2, -3, -4
Matrix Spike	Calcium (Ca)-Total	MS-B	L2092365-1, -2, -3, -4
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2092365-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Total	MS-B	L2092365-1, -2, -3, -4
Matrix Spike	Total Nitrogen	MS-B	L2092365-2, -3, -4
Matrix Spike	Total Nitrogen	MS-B	L2092365-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
DTC	Dissolved concentration exceeds total. Results were confirmed by re-analysis.
DTMF	Dissolved concentration exceeds total for field-filtered metals sample. Metallic contaminants may have been introduced to dissolved sample during field filtration.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
PEHT	Parameter Exceeded Recommended Holding Time Prior to Analysis
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-U-CVAF-VA Water Diss. Mercury in Water by CVAFS (Ultra) APHA 3030 B / EPA 1631 REV. E

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure may involve preliminary sample treatment by filtration (APHA 3030B) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.

HG-T-U-CVAF-VA Water Total Mercury in Water by CVAFS (Ultra) EPA 1631 REV. E

This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.

IONBALANCE-VA Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MEHG-D-GCAF-VA Water Diss. Methylmercury in Water by GCAFS EPA 1630

This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".

MEHG-T-GCAF-VA Water Total Methylmercury in Water by GCAFS EPA 1630

This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

N-T-COL-VA Water Total Nitrogen in water by Colour APHA4500-P(J)/NEMI9171/USGS03-4174

This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Reference Information

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter. Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-CALC-VA Water TDS (Calculated) APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses". The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

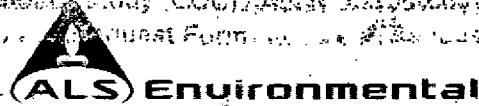
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



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Canada Toll Free: 1-800-668-9878



L2092365-COFC

COC Number: 14444444444444444444
 Request Form Page 1 of 1

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																																																																																																																																																																																
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		Email 1 or Fax: danielle.macdonald@tetratech.com			Specify Date Required for E2, E or P:																																																																																																																																																																																
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	Peace at Pine (PD1)			Water	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																																																																				
	Pine River (Pine)			Water	R	R	R	R	R	R	R	R	R	R	R	R	R																																																																																																																																																																				
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Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources.			Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																																																																																																
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Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 11-MAY-18
Report Date: 04-JUN-18 14:10 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2093204
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060-02.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2093204-1 Water 10-MAY-18 15:57 MOBERLY RIVER- DOWNSTREAM (MD)	L2093204-2 Water 10-MAY-18 15:09 LOWER SITE C RESERVOIR (PR3)	L2093204-3 Water 10-MAY-18 16:44 PEACE AT PINE (PD1)	L2093204-4 Water 10-MAY-18 17:06 PINE RIVER (PINE)	L2093204-5 Water 10-MAY-18 18:38 BEATTON RIVER (BEA)
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	38.5	50.8	52.6	34.8	164
	Conductivity (uS/cm)				196 ^{HTD}	114 ^{HTD}
	Conductivity (umhos/cm)	197	203	195		
	Hardness (as CaCO3) (mg/L)	128	116	127	118	57.6
	pH (pH)	7.99	7.98	8.02	8.06	7.37
	Total Suspended Solids (mg/L)	1500	314	316	697	1410
	TDS (Calculated) (mg/L)	182	140	152	139	137
	Turbidity (NTU)	989	241	307	491	1170
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	109	95.8	106	108 ^{HTD}	32.7 ^{HTD}
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	109	95.8	106	108	32.7
	Ammonia, Total (as N) (mg/L)	0.0483	0.0216	0.0217	0.0241	0.0621
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50	0.51
	Fluoride (F) (mg/L)	0.072	0.063	0.064	0.058	0.063
	Nitrate and Nitrite (as N) (mg/L)	0.130	0.0931	0.0981	0.141	0.0216
	Nitrate (as N) (mg/L)	0.130	0.0931	0.0981	0.141	0.0216
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	3.03 ^{PEHT}	0.879	1.05	1.41	3.07 ^{PEHT}
	Total Nitrogen (mg/L)	2.53	0.71	0.81	0.80	1.42
	Orthophosphate-Dissolved (as P) (mg/L)	0.0066	0.0064	0.0057 ^{RRV}	0.0043 ^{RRV}	0.0050 ^{RRV}
	Phosphorus (P)-Total Dissolved (mg/L)	0.0120	0.0142	0.0149	0.0097	0.0259
	Phosphorus (P)-Total (mg/L)	1.52	0.360	0.483	0.861	1.34
	Silicate (as SiO2) (mg/L)	3.72	4.37	4.26	2.99	4.45
	Sulfate (SO4) (mg/L)	9.85	20.8	19.7	9.33	20.8
	Anion Sum (meq/L)	2.40	2.36	2.54	2.37	1.11
	Cation Sum (meq/L)	3.70	2.61	2.91	2.47	2.34
Cation - Anion Balance (%)	21.2	5.1	6.9	2.1	35.9	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	8.97 ^{HTP}	9.81 ^{HTP}	9.64 ^{HTP}	6.96 ^{HTP}	27.2 ^{HTP}
	Total Organic Carbon (mg/L)	45.5	15.1	16.9	20.1	57.4
Total Metals	Aluminum (Al)-Total (mg/L)	11.5	4.21	5.14	7.36	12.9
	Antimony (Sb)-Total (mg/L)	0.00058	<0.00050	<0.00050	0.00055	0.00055
	Arsenic (As)-Total (mg/L)	0.00936	0.00346	0.00430	0.00649	0.0128
	Barium (Ba)-Total (mg/L)	0.697	0.217	0.278	0.394	0.607
	Beryllium (Be)-Total (mg/L)	0.00080	0.00029	0.00033	0.00054	0.00097

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2093204-6 Water 10-MAY-18 18:09 PEACE RIVER ABOVE BEATTON (PD2)			
Grouping	Analyte				
WATER					
Physical Tests	Colour, True (CU)	41.0			
	Conductivity (uS/cm)	199			
	Conductivity (umhos/cm)				
	Hardness (as CaCO3) (mg/L)	111			
	pH (pH)	7.99			
	Total Suspended Solids (mg/L)	593			
	TDS (Calculated) (mg/L)	139			
	Turbidity (NTU)	480			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	107			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)	107			
	Ammonia, Total (as N) (mg/L)	0.0281			
	Bromide (Br) (mg/L)	<0.050			
	Chloride (Cl) (mg/L)	<0.50			
	Fluoride (F) (mg/L)	0.060			
	Nitrate and Nitrite (as N) (mg/L)	0.130			
	Nitrate (as N) (mg/L)	0.129			
	Nitrite (as N) (mg/L)	0.0010			
	Total Kjeldahl Nitrogen (mg/L)	1.44 ^{PEHT}			
	Total Nitrogen (mg/L)	1.20			
	Orthophosphate-Dissolved (as P) (mg/L)	0.0041 ^{RRV}			
	Phosphorus (P)-Total Dissolved (mg/L)	0.0106			
	Phosphorus (P)-Total (mg/L)	1.10			
	Silicate (as SiO2) (mg/L)	3.47			
	Sulfate (SO4) (mg/L)	12.1			
	Anion Sum (meq/L)	2.39			
	Cation Sum (meq/L)	2.41			
	Cation - Anion Balance (%)	0.4			
	Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	7.98 ^{HTP}		
Total Organic Carbon (mg/L)		20.5			
Total Metals	Aluminum (Al)-Total (mg/L)	7.15			
	Antimony (Sb)-Total (mg/L)	<0.00060 ^{DLB}			
	Arsenic (As)-Total (mg/L)	0.00631			
	Barium (Ba)-Total (mg/L)	0.382			
	Beryllium (Be)-Total (mg/L)	0.00053			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2093204-1 Water 10-MAY-18 15:57 MOBERLY RIVER- DOWNSTREAM (MD)	L2093204-2 Water 10-MAY-18 15:09 LOWER SITE C RESERVOIR (PR3)	L2093204-3 Water 10-MAY-18 16:44 PEACE AT PINE (PD1)	L2093204-4 Water 10-MAY-18 17:06 PINE RIVER (PINE)	L2093204-5 Water 10-MAY-18 18:38 BEATTON RIVER (BEA)
Grouping	Analyte					
WATER						
Total Metals	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)	0.00108	0.000461	0.000555	0.000705	0.000975
	Calcium (Ca)-Total (mg/L)	61.9	42.8	44.3	57.1	21.6
	Chromium (Cr)-Total (mg/L)	0.0212	0.0081	0.0099	0.0135	0.0248
	Cobalt (Co)-Total (mg/L)	0.0126	0.00351	0.00455	0.00737	0.0146
	Copper (Cu)-Total (mg/L)	0.0326	0.0109	0.0133	0.0181	0.0403
	Iron (Fe)-Total (mg/L)	27.6	8.19	9.94	19.1	31.4
	Lead (Pb)-Total (mg/L)	0.0140	0.00423	0.00530	0.00969	0.0161
	Lithium (Li)-Total (mg/L)	0.0192	0.0081	0.0092	0.0147	0.0222
	Magnesium (Mg)-Total (mg/L)	18.6	11.0	11.7	14.2	8.68
	Manganese (Mn)-Total (mg/L)	0.522	0.118	0.158	0.299	0.430
	Mercury (Hg)-Total (mg/L)	<0.00010 ^{DLM}	<0.00010 ^{DLM}	<0.00010 ^{DLM}	<0.00010 ^{DLM}	0.00010
	Mercury (Hg)-Total (ug/L)	0.0572	0.0251	0.0248	0.0370	0.0920
	Molybdenum (Mo)-Total (mg/L)	0.0011	0.0017	0.0016	0.0013	0.0011
	Nickel (Ni)-Total (mg/L)	0.0417	0.0142	0.0172	0.0254	0.0493
	Phosphorus (P)-Total (mg/L)	1.38	0.35	0.44	0.79	1.11
	Potassium (K)-Total (mg/L)	3.6	2.0	2.3	2.5	4.5
	Selenium (Se)-Total (mg/L)	0.000999	0.000790	0.000766	0.000966	0.00121
	Silicon (Si)-Total (mg/L)	18.4	8.54	9.15	11.6	18.7
	Silver (Ag)-Total (mg/L)	0.000280	0.000100	0.000129	0.000187	0.000341
	Sodium (Na)-Total (mg/L)	2.2	2.5	2.4	<2.0	4.6
	Strontium (Sr)-Total (mg/L)	0.159	0.158	0.154	0.150	0.105
	Thallium (Tl)-Total (mg/L)	0.000264	0.000141	0.000164	0.000223	0.000310
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)	0.062	0.040	0.045	0.029	0.041
	Uranium (U)-Total (mg/L)	0.00135	0.00083	0.00086	0.00097	0.00171
	Vanadium (V)-Total (mg/L)	0.0422	0.0189	0.0223	0.0294	0.0458
	Zinc (Zn)-Total (mg/L)	0.127	0.0445	0.0553	0.0879	0.159
Dissolved Metals	Dissolved MeHg Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Mercury Filtration Location	LAB	LAB	LAB	LAB	LAB
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	7.10	0.817	1.25	0.485	5.50
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)	0.00222	0.00111	0.00123	0.00064	0.00237
	Barium (Ba)-Dissolved (mg/L)	0.257	0.109	0.145	0.096	0.205
	Beryllium (Be)-Dissolved (mg/L)	0.00029	0.00012	0.00013	<0.00010	0.00033

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2093204-6			
		Water			
		10-MAY-18			
		18:09			
		PEACE RIVER ABOVE BEATTON (PD2)			
Grouping	Analyte				
WATER					
Total Metals	Bismuth (Bi)-Total (mg/L)	<0.20			
	Boron (B)-Total (mg/L)	<0.10			
	Cadmium (Cd)-Total (mg/L)	0.000734			
	Calcium (Ca)-Total (mg/L)	55.8			
	Chromium (Cr)-Total (mg/L)	0.0131			
	Cobalt (Co)-Total (mg/L)	0.00725			
	Copper (Cu)-Total (mg/L)	0.0182			
	Iron (Fe)-Total (mg/L)	18.3			
	Lead (Pb)-Total (mg/L)	0.00904			
	Lithium (Li)-Total (mg/L)	0.0136			
	Magnesium (Mg)-Total (mg/L)	14.3			
	Manganese (Mn)-Total (mg/L)	0.298			
	Mercury (Hg)-Total (mg/L)	<0.00010 ^{DLM}			
	Mercury (Hg)-Total (ug/L)	0.0350			
	Molybdenum (Mo)-Total (mg/L)	0.0013			
	Nickel (Ni)-Total (mg/L)	0.0251			
	Phosphorus (P)-Total (mg/L)	0.87			
	Potassium (K)-Total (mg/L)	2.6			
	Selenium (Se)-Total (mg/L)	0.000920			
	Silicon (Si)-Total (mg/L)	12.3			
	Silver (Ag)-Total (mg/L)	0.000176			
	Sodium (Na)-Total (mg/L)	<2.0			
	Strontium (Sr)-Total (mg/L)	0.156			
	Thallium (Tl)-Total (mg/L)	0.000208			
	Tin (Sn)-Total (mg/L)	<0.00050			
	Titanium (Ti)-Total (mg/L)	0.033			
	Uranium (U)-Total (mg/L)	0.00106			
	Vanadium (V)-Total (mg/L)	0.0290			
	Zinc (Zn)-Total (mg/L)	0.0853			
Dissolved Metals	Dissolved MeHg Filtration Location	FIELD			
	Dissolved Mercury Filtration Location	LAB			
	Dissolved Metals Filtration Location	FIELD			
	Aluminum (Al)-Dissolved (mg/L)	1.17			
	Antimony (Sb)-Dissolved (mg/L)	<0.00050			
	Arsenic (As)-Dissolved (mg/L)	0.00074			
	Barium (Ba)-Dissolved (mg/L)	0.100			
	Beryllium (Be)-Dissolved (mg/L)	<0.00010			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L2093204-1	L2093204-2	L2093204-3	L2093204-4	L2093204-5
					Water	Water	Water	Water	Water
		10-MAY-18	15:57		10-MAY-18	10-MAY-18	10-MAY-18	10-MAY-18	10-MAY-18
					15:57	15:09	16:44	17:06	18:38
					MOBERLY RIVER-DOWNSTREAM (MD)	LOWER SITE C RESERVOIR (PR3)	PEACE AT PINE (PD1)	PINE RIVER (PINE)	BEATTON RIVER (BEA)
Grouping	Analyte								
WATER									
Dissolved Metals	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Dissolved (mg/L)	0.000262	0.000187	0.000290	0.0000914	0.000287			
	Calcium (Ca)-Dissolved (mg/L)	35.7	33.1	36.0	34.2	15.8			
	Chromium (Cr)-Dissolved (mg/L)	0.0103	0.0049	0.0027	0.0011	0.0081			
	Cobalt (Co)-Dissolved (mg/L)	0.00259	0.00114	0.00191	0.00080	0.00344			
	Copper (Cu)-Dissolved (mg/L)	0.0081	0.0042	0.0062	0.0026	0.0112			
	Iron (Fe)-Dissolved (mg/L)	4.83	2.13	2.59	1.23	6.09			
	Lead (Pb)-Dissolved (mg/L)	0.00367	0.00150	0.00223	0.00090	0.00456			
	Lithium (Li)-Dissolved (mg/L)	0.0090	0.0055	0.0045	0.0036	0.0101			
	Magnesium (Mg)-Dissolved (mg/L)	9.48	8.04	8.98	7.84	4.38			
	Manganese (Mn)-Dissolved (mg/L)	0.121	0.0456	0.0743	0.0350	0.131			
	Mercury (Hg)-Dissolved (mg/L)	0.0000139	0.0000147	0.0000154	<0.0000050	0.0000143			
	Mercury (Hg)-Dissolved (ug/L)	0.00106	0.00100	0.00104	0.00156	0.00203			
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0010	0.0010	<0.0010	<0.0010	<0.0010			
	Nickel (Ni)-Dissolved (mg/L)	0.0102	0.0056	0.0079	0.0035	0.0135			
	Phosphorus (P)-Dissolved (mg/L)	0.31	<0.30	<0.30	<0.30	0.31			
	Potassium (K)-Dissolved (mg/L)	3.1	<2.0	<2.0	<2.0	3.0			
	Selenium (Se)-Dissolved (mg/L)	0.000302	0.000503	0.000444	0.000372	0.000339			
	Silicon (Si)-Dissolved (mg/L)	19.8	8.99	3.62	1.91	15.2			
	Silver (Ag)-Dissolved (mg/L)	0.000080	0.000033	0.000028	<0.000020	0.000047			
	Sodium (Na)-Dissolved (mg/L)	<2.0	2.1	2.2	<2.0	3.8			
	Strontium (Sr)-Dissolved (mg/L)	0.0904	0.117	0.127	0.101	0.0607			
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020			
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050			
	Titanium (Ti)-Dissolved (mg/L)	0.259 ^{DTMF}	0.123 ^{DTMF}	0.014	<0.010	0.214 ^{DTMF}			
	Uranium (U)-Dissolved (mg/L)	0.00069	0.00071	0.00067	0.00032	0.00084			
	Vanadium (V)-Dissolved (mg/L)	0.0236	0.00355	0.00488	0.00159	0.0175			
	Zinc (Zn)-Dissolved (mg/L)	0.0236	0.0124	0.0180	0.0068	0.0300			
Speciated Metals	Methylmercury (as MeHg)-Dissolved (ug/L)	0.000111	<0.00010 ^{DLIS}	<0.00010 ^{DLIS}	<0.00010 ^{DLIS}	0.00024			
	Methylmercury (as MeHg)-Total (ug/L)	0.00029	<0.00010 ^{DLIS}	<0.00010 ^{DLIS}	<0.00010 ^{DLIS}	0.00041			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2093204-6			
		Water	10-MAY-18	18:09	PEACE RIVER ABOVE BEATTON (PD2)
Grouping	Analyte				
WATER					
Dissolved Metals	Bismuth (Bi)-Dissolved (mg/L)	<0.20			
	Boron (B)-Dissolved (mg/L)	<0.10			
	Cadmium (Cd)-Dissolved (mg/L)	0.000111			
	Calcium (Ca)-Dissolved (mg/L)	32.1			
	Chromium (Cr)-Dissolved (mg/L)	0.0021			
	Cobalt (Co)-Dissolved (mg/L)	0.00085			
	Copper (Cu)-Dissolved (mg/L)	0.0030			
	Iron (Fe)-Dissolved (mg/L)	1.28			
	Lead (Pb)-Dissolved (mg/L)	0.00117			
	Lithium (Li)-Dissolved (mg/L)	0.0043			
	Magnesium (Mg)-Dissolved (mg/L)	7.37			
	Manganese (Mn)-Dissolved (mg/L)	0.0418			
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050			
	Mercury (Hg)-Dissolved (ug/L)	0.00179			
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0010			
	Nickel (Ni)-Dissolved (mg/L)	0.0037			
	Phosphorus (P)-Dissolved (mg/L)	<0.30			
	Potassium (K)-Dissolved (mg/L)	<2.0			
	Selenium (Se)-Dissolved (mg/L)	0.000416			
	Silicon (Si)-Dissolved (mg/L)	3.92			
	Silver (Ag)-Dissolved (mg/L)	<0.000020			
	Sodium (Na)-Dissolved (mg/L)	<2.0			
	Strontium (Sr)-Dissolved (mg/L)	0.0939			
	Thallium (Tl)-Dissolved (mg/L)	<0.00020			
	Tin (Sn)-Dissolved (mg/L)	<0.00050			
	Titanium (Ti)-Dissolved (mg/L)	<0.039 ^{DLM}			
	Uranium (U)-Dissolved (mg/L)	0.00044			
	Vanadium (V)-Dissolved (mg/L)	0.00440			
	Zinc (Zn)-Dissolved (mg/L)	0.0078			
Speciated Metals	Methylmercury (as MeHg)-Dissolved (ug/L)	<0.00010 ^{DLS}			
	Methylmercury (as MeHg)-Total (ug/L)	0.00017			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Manganese (Mn)-Dissolved	MB-LOR	L2093204-1, -2, -5, -6
Method Blank	Antimony (Sb)-Total	MB-LOR	L2093204-1, -2, -3, -4, -5, -6
Matrix Spike	Dissolved Organic Carbon	MS-B	L2093204-3, -4, -5, -6
Matrix Spike	Dissolved Organic Carbon	MS-B	L2093204-1, -2
Matrix Spike	Total Organic Carbon	MS-B	L2093204-3, -4, -6
Matrix Spike	Total Organic Carbon	MS-B	L2093204-2
Matrix Spike	Total Organic Carbon	MS-B	L2093204-1
Matrix Spike	Total Organic Carbon	MS-B	L2093204-5
Matrix Spike	Total Organic Carbon	MS-B	L2093204-5
Matrix Spike	Aluminum (Al)-Dissolved	MS-B	L2093204-1, -2, -5, -6
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2093204-1, -2, -5, -6
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2093204-1, -2, -5, -6
Matrix Spike	Iron (Fe)-Dissolved	MS-B	L2093204-1, -2, -5, -6
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2093204-1, -2, -5, -6
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2093204-1, -2, -5, -6
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L2093204-1, -2, -5, -6
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2093204-1, -2, -5, -6
Matrix Spike	Titanium (Ti)-Dissolved	MS-B	L2093204-1, -2, -5, -6
Matrix Spike	Aluminum (Al)-Total	MS-B	L2093204-1, -2, -3, -4, -5, -6
Matrix Spike	Barium (Ba)-Total	MS-B	L2093204-1, -2, -3, -4, -5, -6
Matrix Spike	Calcium (Ca)-Total	MS-B	L2093204-1, -2, -3, -4, -5, -6
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2093204-1, -2, -3, -4, -5, -6
Matrix Spike	Manganese (Mn)-Total	MS-B	L2093204-1, -2, -3, -4, -5, -6
Matrix Spike	Sodium (Na)-Total	MS-B	L2093204-1, -2, -3, -4, -5, -6
Matrix Spike	Strontium (Sr)-Total	MS-B	L2093204-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLB	Detection Limit Raised. Analyte detected at comparable level in Method Blank.
DLIS	Detection Limit Adjusted: Insufficient Sample
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
DTMF	Dissolved concentration exceeds total for field-filtered metals sample. Metallic contaminants may have been introduced to dissolved sample during field filtration.
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
HTP	Sample preparation or preservation hold time was exceeded.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
PEHT	Parameter Exceeded Recommended Holding Time Prior to Analysis
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-CO3-CALC-WP	Water	Alkalinity, Carbonate (as CaCO ₃)	CALCULATION
		The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by carbonate is calculated and reported as mg/L CaCO ₃ .	
ALK-HCO3-CALC-WP	Water	Alkalinity, Bicarbonate (as CaCO ₃)	CALCULATION
		The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by bicarbonate is calculated and reported as mg/L CaCO ₃ .	
ALK-OH-CALC-WP	Water	Alkalinity, Hydroxide (as CaCO ₃)	CALCULATION
		The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. The fraction of alkalinity contributed by hydroxide is calculated and reported as mg/L CaCO ₃ .	

Reference Information

ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ALK-TITR-WP	Water	Alkalinity, Total (as CaCO ₃)	APHA 2320B
The Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. Total alkalinity is determined by titration with a strong standard mineral acid to the successive HCO ₃ ⁻ and H ₂ CO ₃ endpoints indicated electrometrically.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
EC-WP	Water	Conductivity	APHA 2510B
Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO ₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)
Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			
HG-D-U-CVAF-VA	Water	Diss. Mercury in Water by CVAFS (Ultra)	APHA 3030 B / EPA 1631 REV. E
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure may involve preliminary sample treatment by filtration (APHA 3030B) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.			
HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)
Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			
HG-T-U-CVAF-VA	Water	Total Mercury in Water by CVAFS (Ultra)	EPA 1631 REV. E

Reference Information

This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.

IONBALANCE-VA Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

$$\text{Ion Balance (\%)} = \frac{[\text{Cation Sum} - \text{Anion Sum}]}{[\text{Cation Sum} + \text{Anion Sum}]}$$

MEHG-D-GCAF-VA Water Diss. Methylmercury in Water by GCAFS EPA 1630

This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".

MEHG-T-GCAF-VA Water Total Methylmercury in Water by GCAFS EPA 1630

This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

N-T-COL-VA Water Total Nitrogen in water by Colour APHA4500-P(J)/NEMI9171/USGS03-4174

This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

Reference Information

It is recommended that this analysis be conducted in the field.

PH-WP	Water	pH	APHA 4500H
The pH of a sample is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode.			
PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.			
Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.			
SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.
This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
TDS-CALC-VA	Water	TDS (Calculated)	APHA 1030E (20TH EDITION)
This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses". The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.			
TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.
This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.			
TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC
This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.			
TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity
This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878



L2093204-COFC

COC Number: 14 -

Page 1 of 1

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																													
Company:	Tetratech	Select Report Format:	<input checked="" type="checkbox"/> PDF	<input checked="" type="checkbox"/> EXCEL	<input checked="" type="checkbox"/> EDD (DIGITAL)	R	<input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																											
Contact:	Danielle MacDonald	Quality Control (QC) Report with Report	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P	<input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT																											
Address:	14940-123 Ave NW Edmonton, AB T5V 1B4	<input type="checkbox"/> Criteria on Report - provide details below if box checked				E	<input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																											
Phone:	780-886-3055	Select Distribution:	<input checked="" type="checkbox"/> EMAIL	<input type="checkbox"/> MAIL	<input type="checkbox"/> FAX	E2	<input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																											
		Email 1 or Fax:	danielle.macdonald@tetratech.com			Specify Date Required for E2, E or P:																												
		Email 2:	molly.brewis@bcny.com			Analysis Request																												
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																													
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select invoice Distribution:																																
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																																
Company:		Email 1 or Fax:																																
Contact:		Email 2:																																
Project Information		Oil and Gas Required Fields (client use)																																
ALS Quote #:	Q53931	Approver ID:	Cost Center:																															
Job #:	VENW03060-02.002	GL Account:	Routing Code:																															
PO / AFE:		Activity Code:																																
LSD:		Location:																																
ALS Lab Work Order # (lab use only)		ALS Contact:	Brent Mack	Sampler:																														
L 2093204				Danielle MacDonald																														
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alk-Species	Amions	by	IC ₂	NO ₂	NO ₃	Color-True	EC	pH	TSS	TDS-Calc	Turbidity	Silicate	Ortho PO ₄	Ion Balance	TOC	TN	TP	TDP	TKN	NH ₃	DOC	Total Metals (CCME+ICP+Hardness)	Dissolved Metals (CCME+ICP+Hardness)	Total Hg (ultra low detection limit)	Dissolved Hg (ultra low detection limit)	Total Methg (ultra low detection limit)	Dissolved MeHg (ultra low detection limit)	Number of Containers	
	Moberly River - Downstream (MD)	MAY 10	15:57	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	9
	Lower Site C Reservoir (PR3)	2018	15:09	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	9
	Peace at Pine (PD1)		16:44	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	9
	Pine River (Pine)		17:06	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	9
	BEATON RIVER (BEA)		18:38	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	9
	PEACE ABOVE BEATON (PD2)		18:09	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	9
		* WATER QUALITY VERY TURBID; FILTERS EXCEEDED FREQUENTLY EXCEEDED CAPACITY AND WERE REPLACED. SEDIMENT NOTED IN MD + PR3 SAMPLES WHICH MAY NEED TO BE EXTRACTED SEPARATELY FROM ROUTINE BOTTLE																																
Drinking Water (DW) Samples ¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)			SAMPLE CONDITION AS RECEIVED (lab use only)																													
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources.			Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																													
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		ALL SAMP DISSOLVED SAMPLES FILTERED + PRESERVED			Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																													
					Cooling Initiated <input type="checkbox"/>																													
					INITIAL COOLER TEMPERATURES °C: 7 °C FINAL COOLER TEMPERATURES °C: 7 5																													
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)																													
Released by: [Signature]		Date: MAY 10 20:30 2018 Time: 20:30			Received by: [Signature] Date: MAY 11 18 Time: 9:04A																													
					Received by: JC Date: 5/12/18 Time: 12:15 pm																													

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM 0226-021 Form 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

C



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 09-MAY-18
Report Date: 23-MAY-18 15:01 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2091502
Project P.O. #: NOT SUBMITTED
Job Reference: VENW003060-02.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2091502-1 WATER 08-MAY-18 PEACE AT KISKATINAW (PD3)	L2091502-2 WATER 08-MAY-18 KISKATINAW RIVER (KR)	L2091502-3 WATER 08-MAY-18 PEACE AT POUCE COUPE (PD4)	L2091502-4 WATER 08-MAY-18 POUCE COUPE (POUCE)	L2091502-5 WATER 08-MAY-18 PEACE AT MANY ISLANDS (PD5)	
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	52.2	69.5	68.9	101	67.2
	Conductivity (uS/cm)	190	181	184	208	187
	Hardness (as CaCO3) (mg/L)	104	90.7	91.6	90.4	94.0
	pH (pH)	8.13	8.04	8.00	7.90	8.02
	Total Suspended Solids (mg/L)	1030	2580	942	1590	1350
	TDS (Calculated) (mg/L)	139	165	141	171	148
	Turbidity (NTU)	787	>4000 ^{TMV}	916	2610	1200
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	105	117	99.9	71.7	106
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	105	117	99.9	71.7	106
	Ammonia, Total (as N) (mg/L)	0.0264	0.0911	0.0330	0.150	0.0419
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	1.53	<0.50
	Fluoride (F) (mg/L)	0.072	0.074	0.073	0.099	0.076
	Nitrate and Nitrite (as N) (mg/L)	0.158	0.0582	0.125	0.0779	0.130
	Nitrate (as N) (mg/L)	0.157	0.0568	0.125	0.0748	0.129
	Nitrite (as N) (mg/L)	0.0014	0.0014	<0.0010	0.0031	0.0012
	Total Kjeldahl Nitrogen (mg/L)	1.18	1.91	1.39	2.22	1.50
	Total Nitrogen (mg/L)	1.06	1.43	1.42	1.90	1.25
	Orthophosphate-Dissolved (as P) (mg/L)	0.0059	0.0060	0.0059	0.0105	0.0071
	Phosphorus (P)-Total Dissolved (mg/L)	0.0129	0.0165	0.0155	0.0308	0.0155
	Phosphorus (P)-Total (mg/L)	0.870	2.13	0.953	1.44	1.20
	Silicate (as SiO2) (mg/L)	3.65	3.96	3.88	4.34	3.94
	Sulfate (SO4) (mg/L)	13.0	7.23	15.2	34.4	15.6
	Anion Sum (meq/L)	2.38	2.49	2.33	2.20	2.45
	Cation Sum (meq/L)	2.09	1.95	1.94	2.16	2.00
	Cation - Anion Balance (%)	-6.5	-12.1	-9.0	-0.9	-10.1
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	9.40 ^{HTP}	14.7 ^{HTP}	12.5 ^{HTP}	20.7 ^{HTP}	12.6 ^{HTP}
	Total Organic Carbon (mg/L)	24.9	51.8	29.6	49.6	32.2
Total Metals	Aluminum (Al)-Total (mg/L)	8.97	25.3	11.2	23.3	12.1
	Antimony (Sb)-Total (mg/L)	0.00054	0.00063	0.00058	<0.00050	0.00057
	Arsenic (As)-Total (mg/L)	0.00775	0.0167	0.00977	0.0241	0.0104
	Barium (Ba)-Total (mg/L)	0.458	1.09	0.534	0.823	0.553
	Beryllium (Be)-Total (mg/L)	0.00063	0.00175	0.00078	0.00159	0.00082
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2091502-1	L2091502-2	L2091502-3	L2091502-4	L2091502-5
		Description	WATER	WATER	WATER	WATER	WATER
		Sampled Date	08-MAY-18	08-MAY-18	08-MAY-18	08-MAY-18	08-MAY-18
		Sampled Time					
		Client ID	PEACE AT KISKATINAW (PD3)	KISKATINAW RIVER (KR)	PEACE AT POUCE COUPE (PD4)	POUCE COUPE (POUCE)	PEACE AT MANY ISLANDS (PD5)
Grouping	Analyte						
WATER							
Total Metals	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)	0.000862	0.00214	0.00104	0.000917	0.00102	0.00102
	Calcium (Ca)-Total (mg/L)	50.6	115	51.4	48.5	49.8	49.8
	Chromium (Cr)-Total (mg/L)	0.0170	0.0429	0.0204	0.0398	0.0221	0.0221
	Cobalt (Co)-Total (mg/L)	0.00889	0.0255	0.0114	0.0241	0.0120	0.0120
	Copper (Cu)-Total (mg/L)	0.0229	0.0644	0.0292	0.0608	0.0320	0.0320
	Iron (Fe)-Total (mg/L)	20.9	57.4	25.5	55.0	28.3	28.3
	Lead (Pb)-Total (mg/L)	0.0110	0.0297	0.0137	0.0280	0.0142	0.0142
	Lithium (Li)-Total (mg/L)	0.0170	0.0386	0.0197	0.0414	0.0214	0.0214
	Magnesium (Mg)-Total (mg/L)	14.2	31.5	14.8	17.5	15.0	15.0
	Manganese (Mn)-Total (mg/L)	0.339	0.996	0.424	0.671	0.435	0.435
	Mercury (Hg)-Total (ug/L)	0.0470	0.122	0.0630	0.123	0.0710	0.0710
	Molybdenum (Mo)-Total (mg/L)	0.0014	0.0012	0.0016	0.0014	0.0014	0.0014
	Nickel (Ni)-Total (mg/L)	0.0305	0.0841	0.0387	0.0733	0.0410	0.0410
	Phosphorus (P)-Total (mg/L)	0.92	2.17	1.04	1.65	1.01	1.01
	Potassium (K)-Total (mg/L)	3.2	5.8	3.7	7.4	3.9	3.9
	Selenium (Se)-Total (mg/L)	0.00104	0.00124	0.00121	0.00155	0.00111	0.00111
	Silicon (Si)-Total (mg/L)	14.7	36.2	17.8	37.1	19.3	19.3
	Silver (Ag)-Total (mg/L)	0.000217	0.000575	0.000298	0.000404	0.000295	0.000295
	Sodium (Na)-Total (mg/L)	2.1	3.5	2.6	6.2	2.8	2.8
	Strontium (Sr)-Total (mg/L)	0.160	0.270	0.151	0.212	0.164	0.164
	Thallium (Tl)-Total (mg/L)	0.000241	0.000578	0.000312	0.000435	0.000315	0.000315
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)	0.046	0.063	0.052	0.062	0.053	0.053
	Uranium (U)-Total (mg/L)	0.00126	0.00263	0.00153	0.00291	0.00152	0.00152
	Vanadium (V)-Total (mg/L)	0.0356	0.0804	0.0423	0.0721	0.0437	0.0437
	Zinc (Zn)-Total (mg/L)	0.103	0.274	0.131	0.232	0.139	0.139
Dissolved Metals	Dissolved MeHg Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Mercury Filtration Location	LAB	LAB	LAB	LAB	LAB	LAB
	Dissolved Metals Filtration Location	LAB	LAB	LAB	LAB	LAB	LAB
	Aluminum (Al)-Dissolved (mg/L)	0.0251	0.0179	0.0261	0.0251	0.0283	0.0283
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)	<0.00050	0.00053	<0.00050	0.00095	<0.00050	<0.00050
	Barium (Ba)-Dissolved (mg/L)	0.069	0.074	0.060	0.045	0.063	0.063
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2091502-1 WATER 08-MAY-18 PEACE AT KISKATINAW (PD3)	L2091502-2 WATER 08-MAY-18 KISKATINAW RIVER (KR)	L2091502-3 WATER 08-MAY-18 PEACE AT POUCE COUPE (PD4)	L2091502-4 WATER 08-MAY-18 POUCE COUPE (POUCE)	L2091502-5 WATER 08-MAY-18 PEACE AT MANY ISLANDS (PD5)	
Grouping	Analyte					
WATER						
Dissolved Metals	Cadmium (Cd)-Dissolved (mg/L)	0.0000289	0.0000237	0.0000381	0.0000200	0.0000319
	Calcium (Ca)-Dissolved (mg/L)	30.1	26.1	26.6	26.5	27.4
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cobalt (Co)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Copper (Cu)-Dissolved (mg/L)	0.0022	0.0049	0.0030	0.0058	0.0034
	Iron (Fe)-Dissolved (mg/L)	0.117	0.164	0.137	0.301	0.185
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Lithium (Li)-Dissolved (mg/L)	0.0031	0.0015	0.0030	0.0033	0.0030
	Magnesium (Mg)-Dissolved (mg/L)	6.98	6.16	6.10	5.88	6.19
	Manganese (Mn)-Dissolved (mg/L)	0.00372	0.00421	0.00328	0.00394	0.00318
	Mercury (Hg)-Dissolved (ug/L)	0.00101	0.00102	0.00155	0.00146	0.00126
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Nickel (Ni)-Dissolved (mg/L)	0.0020	0.0022	0.0025	0.0037	0.0025
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0	<2.0	3.3	<2.0
	Selenium (Se)-Dissolved (mg/L)	0.000388	0.000363	0.000411	0.000435	0.000514
	Silicon (Si)-Dissolved (mg/L)	1.70	1.93	1.83	2.15	1.82
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Dissolved (mg/L)	<2.0	2.8	2.2	5.6	2.4
	Strontium (Sr)-Dissolved (mg/L)	0.0946	0.0949	0.0844	0.105	0.0876
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.00040	0.00054	0.00043	0.00062	0.00047
	Vanadium (V)-Dissolved (mg/L)	<0.00050	0.00059	<0.00050	0.00083	0.00053
	Zinc (Zn)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Speciated Metals	Methylmercury (as MeHg)-Dissolved (ug/L)	0.000063	<0.00010 ^{DLIS}	0.000025	<0.000020	0.000031
	Methylmercury (as MeHg)-Total (ug/L)	0.000145	<0.00010 ^{DLIS}	<0.000020	<0.000020	<0.000020

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Total Nitrogen	B	L2091502-1, -2, -3, -4, -5
Method Blank	Manganese (Mn)-Total	MB-LOR	L2091502-1, -2, -3, -4, -5
Matrix Spike	Dissolved Organic Carbon	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Dissolved Organic Carbon	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Total Organic Carbon	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Barium (Ba)-Total	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Calcium (Ca)-Total	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Total	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Sodium (Na)-Total	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Total	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Uranium (U)-Total	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Total Nitrogen	MS-B	L2091502-1, -2, -3, -4, -5
Matrix Spike	Nitrate (as N)	MS-B	L2091502-1, -2, -3, -4, -5

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
DLIS	Detection Limit Adjusted: Insufficient Sample
HTP	Sample preparation or preservation hold time was exceeded.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
TMV	Turbidity exceeded upper limit of the nephelometric method. Minimum value reported.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.			
Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			

Reference Information

EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO ₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
HG-D-U-CVAF-VA	Water	Diss. Mercury in Water by CVAFS (Ultra)	APHA 3030 B / EPA 1631 REV. E
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure may involve preliminary sample treatment by filtration (APHA 3030B) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.			
HG-T-U-CVAF-VA	Water	Total Mercury in Water by CVAFS (Ultra)	EPA 1631 REV. E
This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.			
IONBALANCE-VA	Water	Ion Balance Calculation	APHA 1030E
Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.			
Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:			
Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]			
MEHG-D-GCAF-VA	Water	Diss. Methylmercury in Water by GCAFS	EPA 1630
This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".			
MEHG-T-GCAF-VA	Water	Total Methylmercury in Water by GCAFS	EPA 1630
This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-CALC-VA Water TDS (Calculated) APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".

The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
----------------------------	---------------------

VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA
----	---

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



ALS Environmental

Canada Toll Free: 1 800 668 9878

L2091502-COFC

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Report To		Report Format / Distribution				Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)													
Company: Tetrattech		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)				R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)													
Contact: Danielle MacDonald		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT													
Address: 14940-123 Ave NW Edmonton, AB T5V 1B4		<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked				E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT													
Phone: 780-886-3055		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX				E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge													
		Email 1 or Fax danielle.macdonald@tetrattech.com				Specify Date Required for E2,E or P:													
		Email 2				Analysis Request													
Invoice To		Invoice Distribution				Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below													
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																	
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax ebaaccountspayable@tetrattech.com																	
Company:		Email 2 danielle.macdonald@tetrattech.com																	
Contact:																			
Project Information		Oil and Gas Required Fields (client use)																	
ALS Quote #: Q53931		Approver ID:		Cost Center:															
Job #: VENW003060-02,002		GL Account:		Routing Code:															
PO / AFE:		Activity Code:																	
LSD:		Location:																	
ALS Lab Work Order # (lab use only)		ALS Contact: Brent Mack		Sampler:															
L2091502																			
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alk-Species/Anions by IC, NO2+NO2Calc	Color-True, EC, pH, TSS, TDS-Calc	Turbidity, Silicate, Ortho PO4, Ion Balance	TOC, TN, TP, TDP, TKN, NH3	DOC	Total Metals (CCME+ICP+Hardness)	Dissolved Metals (CCME+ICP+Hardness)	Total Hg (ultra low detection limit)	Dissolved Hg (ultra low detection limit)	Total MeHg (ultra low detection limit)	Dissolved MeHg (ultra low detection limit)	Number of Containers	
	Peace at Beaton (PD2) <i>PD2 to be sampled on May 9</i>			<i>May 8</i>		Water	R	R	R	R	R	R	R	R	R	R	R	9	
	Beaton River (Beaton) <i>BEA</i>			<i>not incl</i>		Water	R	R	R	R	R	R	R	R	R	R	R	9	
	Peace at Kiskatinaw (PD3)			<i>2018</i>		Water	R	R	R	R	R	R	R	R	R	R	R	9	
	Kiskatinaw River (KR)					Water	R	R	R	R	R	R	R	R	R	R	R	9	
	Peace at Pouce Coupe (PD4)					Water	R	R	R	R	R	R	R	R	R	R	R	9	
	Pouce Coupe (Pouce)					Water	R	R	R	R	R	R	R	R	R	R	R	9	
	Peace at Many Islands (PD5)					Water	R	R	R	R	R	R	R	R	R	R	R	9	
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)				SAMPLE CONDITION AS RECEIVED (lab use only)													
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life. samples were taken from surface water				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>													
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No						Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>													
						Cooling Initiated <input type="checkbox"/>													
						INITIAL COOLER TEMPERATURES °C													
						5°C													
						FINAL COOLER TEMPERATURES °C													
						5													
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)													
Released by: <i>[Signature]</i>		Date: May 8/2018		Time: 9:00 AM		Received by: <i>[Signature]</i>		Date: May 8/2018		Time: 9:00 AM		Received by: <i>[Signature]</i>		Date: 5/10		Time: 12:30 PM			



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 19-JUN-18
Report Date: 10-JUL-18 10:27 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2115009
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060 - 02.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2115009-1	L2115009-2	L2115009-3	L2115009-4	L2115009-5
		Description	Water	Water	Water	Water	Water
		Sampled Date	18-JUN-18	18-JUN-18	18-JUN-18	18-JUN-18	18-JUN-18
		Sampled Time	14:15	14:45	17:50	17:35	
		Client ID	W1 - SHALLOW	W1 - DEEP	D1 - SHALLOW	D1 - DEEP	DUP 2
Grouping	Analyte						
FILTER							
Plant Pigments	Chlorophyll a (ug/L)	0.609	1.38	1.04	2.25	0.158	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2115009-1	L2115009-2	L2115009-3	L2115009-4	L2115009-5
		Description	Water	Water	Water	Water	Water
		Sampled Date	18-JUN-18	18-JUN-18	18-JUN-18	18-JUN-18	18-JUN-18
		Sampled Time	14:15	14:45	17:50	17:35	
		Client ID	W1 - SHALLOW	W1 - DEEP	D1 - SHALLOW	D1 - DEEP	DUP 2
Grouping	Analyte						
WATER							
Physical Tests	Colour, True (CU)	<5.0	<5.0	5.4	<5.0	<5.0	
	Conductivity (uS/cm)	187	187	185	183	184	
	pH (pH)	8.15	8.07	8.06	8.10	8.09	
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0	<3.0	
	Total Dissolved Solids (mg/L)	120	116	104	89	94	
	Turbidity (NTU)	0.86	1.25	1.04	1.02	0.93	
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	81.6	86.0	85.7	86.2	85.5	
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	
	Alkalinity, Total (as CaCO3) (mg/L)	81.6	86.0	85.7	86.2	85.5	
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	0.0096	<0.0050	0.0063	
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050	
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50	
	Fluoride (F) (mg/L)	0.038	0.039	0.041	0.040	0.040	
	Nitrate and Nitrite (as N) (mg/L)	0.0453	0.0452	0.0300	0.0302	0.0307	
	Nitrate (as N) (mg/L)	0.0453	0.0452	0.0300	0.0302	0.0307	
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	
	Total Kjeldahl Nitrogen (mg/L)	0.078	0.061	0.104	0.081	0.130	
	Total Nitrogen (mg/L)	0.121	0.111	0.114	0.114	0.109	
	Orthophosphate-Dissolved (as P) (mg/L)	0.0015	0.0011	0.0017	0.0014	0.0016	
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	
	Phosphorus (P)-Total (mg/L)	0.0027	0.0029	0.0049	0.0039	0.0032	
	Silicate (as SiO2) (mg/L)	4.29	4.50	4.26	4.49	4.36	
Sulfate (SO4) (mg/L)	15.0	15.3	15.2	15.2	15.2		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.93	2.44	2.97	2.60	2.81	
	Total Organic Carbon (mg/L)	2.59	2.49	2.71	2.70	3.05	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Dissolved Organic Carbon	MS-B	L2115009-1, -2, -3, -4
Matrix Spike	Dissolved Organic Carbon	MS-B	L2115009-1, -2, -3, -4
Matrix Spike	Dissolved Organic Carbon	MS-B	L2115009-1, -2, -3, -4
Matrix Spike	Total Organic Carbon	MS-B	L2115009-1, -2, -3, -4
Matrix Spike	Total Organic Carbon	MS-B	L2115009-1, -2, -3, -4
Matrix Spike	Total Organic Carbon	MS-B	L2115009-1, -2, -3, -4
Matrix Spike	Total Nitrogen	MS-B	L2115009-1, -2, -3, -4, -5
Matrix Spike	Total Nitrogen	MS-B	L2115009-1, -2, -3, -4, -5
Matrix Spike	Phosphorus (P)-Total	MS-B	L2115009-1, -2, -3, -4, -5

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0
This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

Reference Information

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
----------------------------	---------------------

Reference Information

VA

ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

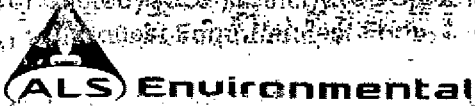
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



www.alsglobal.com

Canada Toll Free: 1 800 668 9878



L2115009-COFC

Report To Company: Tetratech Contact: Danielle MacDonald Address: 14940-123 Ave NW Edmonton, AB T5V 1B4 Phone: 780-886-3055		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: danielle.macdonald@tetratech.com Email 2:		Rush Turnaround Time (TAT) is not available for all tests R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P:																																																																																																																																																																																							
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Project Information ALS Quote #: Q53931 Job #: VENW03060 - 02,002 PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: _____ Cost Center: _____ GL Account: _____ Routing Code: _____ Activity Code: _____ Location: _____		<table border="1"> <thead> <tr> <th></th> <th>P</th> <th>F/P</th> <th>P</th> <th>F/P</th> <th>P</th> <th>F/P</th> <th>P</th> <th>F/P</th> <th>P</th> <th>F/P</th> <th>F</th> <th></th> </tr> </thead> <tbody> <tr> <td>Alk-Species/Anions by IC, NO2+NO3/Calc</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Color-True, EC, pH, TSS, TDS-Calc</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Turbidity, Silicate, Ortho PO4, Ion Balance</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>TOC, TN, TP, TDP, TKN, NH3</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>DOC</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Total Metals (CCME+ICP+Hardness)</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Dissolved Metals (CCME+ICP+Hardness)</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Total Hg (ultra low detection limit)</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Dissolved Hg (ultra low detection limit)</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Total MeHg (ultra low detection limit)</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Dissolved MeHg (ultra low detection limit)</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Chlorophyll a (field filtered 250 mL)</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Number of Containers</td> </tr> </tbody> </table>			P	F/P	P	F/P	P	F/P	P	F/P	P	F/P	F		Alk-Species/Anions by IC, NO2+NO3/Calc													Color-True, EC, pH, TSS, TDS-Calc													Turbidity, Silicate, Ortho PO4, Ion Balance													TOC, TN, TP, TDP, TKN, NH3													DOC													Total Metals (CCME+ICP+Hardness)													Dissolved Metals (CCME+ICP+Hardness)													Total Hg (ultra low detection limit)													Dissolved Hg (ultra low detection limit)													Total MeHg (ultra low detection limit)													Dissolved MeHg (ultra low detection limit)													Chlorophyll a (field filtered 250 mL)																									Number of Containers
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Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client use) Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources. <i>Chlorophyll filtered through 0.2 µm filter 200 mL sample</i>		SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: 9 FINAL COOLER TEMPERATURES °C: 5																																																																																																																																																																																							
SHIPMENT RELEASE (client use) Released by: <i>[Signature]</i> Date: June 18/18 Time: 20:59		INITIAL SHIPMENT RECEPTION (lab use only) Received by: <i>Gloft</i> Date: June 19/18 Time: 9:15		FINAL SHIPMENT RECEPTION (lab use only) Received by: <i>HA</i> Date: 6/20 Time: 12:26p																																																																																																																																																																																							



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 23-JUN-18
Report Date: 10-JUL-18 16:14 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2117855
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060-02.002
C of C Numbers:
Legal Site Desc:

Comments:

Brent Mack, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID L2117855-2 Description water Sampled Date 23-JUN-18 Sampled Time 16:30 Client ID FIELD BLANK-SW				
Grouping		Analyte				
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	<0.010				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2117855-1 water TRAVEL BLANK	L2117855-2 water 23-JUN-18 16:30 FIELD BLANK-SW	L2117855-3 water 23-JUN-18 15:45 PC-1		
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	<5.0	<5.0	7.0		
	Conductivity (uS/cm)	<2.0	<2.0	205		
	Hardness (as CaCO ₃) (mg/L)	<0.50 ^{HTC}	<0.50			
	pH (pH)	5.38	5.89	7.70		
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0		
	Total Dissolved Solids (mg/L)			121		
	TDS (Calculated) (mg/L)	<1.0	<1.0			
	Turbidity (NTU)	<0.10	0.18	0.84		
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO ₃) (mg/L)	<1.0	<1.0	96.0		
	Alkalinity, Carbonate (as CaCO ₃) (mg/L)	<1.0	<1.0	<1.0		
	Alkalinity, Hydroxide (as CaCO ₃) (mg/L)	<1.0	<1.0	<1.0		
	Alkalinity, Total (as CaCO ₃) (mg/L)	<1.0	<1.0	96.0		
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050		
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050		
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50		
	Fluoride (F) (mg/L)	<0.020	<0.020	0.042		
	Nitrate and Nitrite (as N) (mg/L)	<0.0051	<0.0051	0.0439		
	Nitrate (as N) (mg/L)	<0.0050	<0.0050	0.0439		
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010		
	Total Kjeldahl Nitrogen (mg/L)	<0.050	<0.050	0.093		
	Total Nitrogen (mg/L)	<0.030	<0.030	0.116		
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	0.0023		
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	0.0030		
	Phosphorus (P)-Total (mg/L)	<0.0020	<0.0020	0.0031		
	Silicate (as SiO ₂) (mg/L)	<0.50	<0.50	4.42		
	Sulfate (SO ₄) (mg/L)	<0.30	<0.30	15.1		
	Anion Sum (meq/L)	<0.10	<0.10			
	Cation Sum (meq/L)	<0.10	<0.10			
	Cation - Anion Balance (%)	0.0	0.0			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)		<0.50	2.66		
	Total Organic Carbon (mg/L)	<0.50	<0.50	2.66		
Bacteriological Tests	E. coli (MPN/100mL)	<1	<1			
	HPC (CFU/1mL)	<1	<1			
	Coliform Bacteria - Total (MPN/100mL)	<1	<1			
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0050	<0.0050			
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2117855-1 water TRAVEL BLANK	L2117855-2 water 23-JUN-18 16:30 FIELD BLANK-SW	L2117855-3 water 23-JUN-18 15:45 PC-1		
Grouping	Analyte					
WATER						
Total Metals	Arsenic (As)-Total (mg/L)	<0.00050	<0.00050			
	Barium (Ba)-Total (mg/L)	<0.020	<0.020			
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010			
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20			
	Boron (B)-Total (mg/L)	<0.10	<0.10			
	Cadmium (Cd)-Total (mg/L)	<0.0000050	<0.0000050			
	Calcium (Ca)-Total (mg/L)	<0.10	0.11 ^{RRV}			
	Chromium (Cr)-Total (mg/L)	<0.0010	<0.0010			
	Cobalt (Co)-Total (mg/L)	<0.00030	<0.00030			
	Copper (Cu)-Total (mg/L)	<0.0010	<0.0010			
	Iron (Fe)-Total (mg/L)	<0.030	<0.030			
	Lead (Pb)-Total (mg/L)	<0.00050	<0.00050			
	Lithium (Li)-Total (mg/L)	<0.0010	<0.0010			
	Magnesium (Mg)-Total (mg/L)	<0.10	<0.10			
	Manganese (Mn)-Total (mg/L)	<0.00010	0.00022 ^{RRV}			
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050			
	Molybdenum (Mo)-Total (mg/L)	<0.0010	<0.0010			
	Nickel (Ni)-Total (mg/L)	<0.0010	<0.0010			
	Phosphorus (P)-Total (mg/L)	<0.30	<0.30			
	Potassium (K)-Total (mg/L)	<2.0	<2.0			
	Selenium (Se)-Total (mg/L)	<0.000050	<0.000050			
	Silicon (Si)-Total (mg/L)	<0.10	<0.10			
	Silver (Ag)-Total (mg/L)	<0.000020	<0.000020			
	Sodium (Na)-Total (mg/L)	<2.0	<2.0			
	Strontium (Sr)-Total (mg/L)	<0.0050	<0.0050			
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010			
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050			
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010			
	Uranium (U)-Total (mg/L)	<0.00020	<0.00020			
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050			
	Zinc (Zn)-Total (mg/L)	<0.0050	<0.0050			
Dissolved Metals	Dissolved Fe2 Filtration Location		FIELD			
	Dissolved Mercury Filtration Location		FIELD			
	Dissolved Metals Filtration Location		FIELD			
	Aluminum (Al)-Dissolved (mg/L)		<0.0050			
	Antimony (Sb)-Dissolved (mg/L)		<0.00050			
	Arsenic (As)-Dissolved (mg/L)		<0.00050			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2117855-1 water TRAVEL BLANK	L2117855-2 water 23-JUN-18 16:30 FIELD BLANK-SW	L2117855-3 water 23-JUN-18 15:45 PC-1		
Grouping	Analyte				
WATER					
Dissolved Metals	Barium (Ba)-Dissolved (mg/L)		<0.020		
	Beryllium (Be)-Dissolved (mg/L)		<0.00010		
	Bismuth (Bi)-Dissolved (mg/L)		<0.20		
	Boron (B)-Dissolved (mg/L)		<0.10		
	Cadmium (Cd)-Dissolved (mg/L)		<0.0000050		
	Calcium (Ca)-Dissolved (mg/L)		<0.10		
	Chromium (Cr)-Dissolved (mg/L)		<0.0010		
	Cobalt (Co)-Dissolved (mg/L)		<0.00030		
	Copper (Cu)-Dissolved (mg/L)		<0.0010		
	Iron (Fe)-Dissolved (mg/L)		<0.030		
	Ferrous Iron, Dissolved (mg/L)		<0.020		
	Lead (Pb)-Dissolved (mg/L)		<0.00050		
	Lithium (Li)-Dissolved (mg/L)		<0.0010		
	Magnesium (Mg)-Dissolved (mg/L)		<0.10		
	Manganese (Mn)-Dissolved (mg/L)		<0.00010		
	Mercury (Hg)-Dissolved (mg/L)		<0.0000050		
	Molybdenum (Mo)-Dissolved (mg/L)		<0.0010		
	Nickel (Ni)-Dissolved (mg/L)		<0.0010		
	Phosphorus (P)-Dissolved (mg/L)		<0.30		
	Potassium (K)-Dissolved (mg/L)		<2.0		
	Selenium (Se)-Dissolved (mg/L)		<0.0000050		
	Silicon (Si)-Dissolved (mg/L)		<0.050		
	Silver (Ag)-Dissolved (mg/L)		<0.000020		
	Sodium (Na)-Dissolved (mg/L)		<2.0		
	Strontium (Sr)-Dissolved (mg/L)		<0.0050		
	Thallium (Tl)-Dissolved (mg/L)		<0.00020		
	Tin (Sn)-Dissolved (mg/L)		<0.00050		
	Titanium (Ti)-Dissolved (mg/L)		<0.010		
	Uranium (U)-Dissolved (mg/L)		<0.00020		
	Vanadium (V)-Dissolved (mg/L)		<0.00050		
	Zinc (Zn)-Dissolved (mg/L)		<0.0050		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Copper (Cu)-Dissolved	MB-LOR	L2117855-2
Method Blank	Antimony (Sb)-Total	MB-LOR	L2117855-2
Matrix Spike	Total Nitrogen	MS-B	L2117855-1, -2, -3
Matrix Spike	Phosphorus (P)-Total	MS-B	L2117855-1, -2, -3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0
This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
ECOLI-COLI-BCDW-VA	Water	E.coli by Colilert	APHA METHOD 9223
This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
FE2-D-COL-VA	Water	Diss. Ferrous Iron in Water by Colour	APHA 3500-Fe B/James Ball et al (1999)
This analysis is carried out using procedures adapted from APHA 3500-Fe B and "A New Method for the Direct Determination of Dissolved Iron			

Reference Information

Concentration in Acid Mine Waters" published by James W. Ball et al (1999). The procedure involves preliminary sample filtration, and ferrous iron is determined using the "FerroZine" colourimetric method.

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO ₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)
Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			
HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)
Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			
HPC-PP-ENV-VA	Water	HPC by pour plate	APHA METHOD 9215
This analysis is carried out using procedures adapted from APHA Method 9215 "Heterotropic Plate Count". Heterotropic plate count (standard plate count or total plate count) is determined by culturing and colony counting using the pour plate method with a 48 hour incubation period. The test measures colonies formed by heterotropic bacteria.			
HPC-PP-HLTH-VA	Water	HPC by pour plate	APHA METHOD 9215
This analysis is carried out using procedures adapted from APHA Method 9215 "Heterotropic Plate Count". Heterotropic plate count (standard plate count or total plate count) is determined by culturing and colony counting using the pour plate method with a 48 hour incubation period. The test measures colonies formed by heterotropic bacteria.			
IONBALANCE-VA	Water	Ion Balance Calculation	APHA 1030E
Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.			
Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:			
Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.			
Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.			
P-TD-COL-VA	Water	Total Dissolved P in Water by Colour	APHA 4500-P Phosphorous

Reference Information

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter. Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TCOLI-COLI-BCDW-VA Water Total coliform by Colilert APHA METHOD 9223

This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is quantified by a statistical estimation of bacteria density (most probable number).

TDS-CALC-VA Water TDS (Calculated) APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".

The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



ALS Environmental

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L2117855-COFC

Request Form (Rev. 01/13)

Page 1 of 1

Report To			Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																																																																																																																																		
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			Email 2 danielle.macdonald@tetrtech.com																																																																																																																																					
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Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Please use criteria: Health Canada Guidelines for Drinking Water, samples were taken from pre-treatment groundwater sources (domestic use) and BC water quality Guidelines for freshwater aquatic source: Peace River (Surface water)																																																																																																																																					
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REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION. WHITE - LABORATORY COPY - YELLOW - CLIENT COPY. Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy. 1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 19-JUN-18
Report Date: 11-JUL-18 13:09 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2115122
Project P.O. #: NOT SUBMITTED
Job Reference: ENW.VENW03058-02A.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2115122-1 Water 19-JUN-18 13:45 HALFWAY RIVER - DOWNSTREAM - (HD)	L2115122-2 Water 19-JUN-18 13:00 MIDDLE SITE C RESERVOIR (PR2)	L2115122-3 Water 19-JUN-18 11:40 UPPER SITE C RESERVOIR (PR1)	L2115122-4 Water 19-JUN-18 DUPLICATE 1	
Grouping	Analyte				
WATER					
Physical Tests	Colour, True (CU)	14.2	6.9	8.1	14.5
	Conductivity (uS/cm)	394	210	198	389
	Hardness (as CaCO3) (mg/L)	202	100	96.1	202
	pH (pH)	8.48	8.29	8.19	8.46
	Total Suspended Solids (mg/L)	95.2	11.8	4.0	68.4
	TDS (Calculated) (mg/L)	218	110	104	219
	Turbidity (NTU)	59.8	4.96	0.86	64.8
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	157	91.1	86.3	157
	Alkalinity, Carbonate (as CaCO3) (mg/L)	2.6	<1.0	<1.0	5.8
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	159	91.1	86.3	163
	Ammonia, Total (as N) (mg/L)	0.0061	<0.0050	<0.0050	0.0073
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50
	Fluoride (F) (mg/L)	0.092	0.043	0.038	0.096
	Nitrate and Nitrite (as N) (mg/L)	<0.0051	0.0301	0.0450	<0.0051
	Nitrate (as N) (mg/L)	<0.0050	0.0301	0.0450	<0.0050
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.233	0.097	0.079	0.235
	Total Nitrogen (mg/L)	0.180	0.078	0.085	0.196
	Orthophosphate-Dissolved (as P) (mg/L)	0.0034	0.0017	0.0013	0.0036
	Phosphorus (P)-Total Dissolved (mg/L)	0.0049	<0.0020	<0.0020	0.0055
	Phosphorus (P)-Total (mg/L)	0.0981	0.0117	0.0041	0.0908
	Silicate (as SiO2) (mg/L)	3.55	4.39	4.36	3.84
	Sulfate (SO4) (mg/L)	43.4	16.4	15.1	43.5
	Anion Sum (meq/L)	4.09	2.17	2.04	4.16
	Cation Sum (meq/L)	4.15	2.00	1.92	4.13
	Cation - Anion Balance (%)	0.7	-4.1	-3.1	-0.3
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	3.96	2.80	2.59	3.93
	Total Organic Carbon (mg/L)	5.72	3.06	2.86	5.64
Bacteriological Tests	E. coli (MPN/100mL)	21	66	<1	22
	HPC (CFU/1mL)	130 ^{PEHR}	91 ^{PEHR}	10 ^{PEHR}	190 ^{PEHR}
	Coliform Bacteria - Total (MPN/100mL)	145	201	4	165
Total Metals	Aluminum (Al)-Total (mg/L)	1.53	0.104	0.0216	1.56
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Total (mg/L)	0.00121	<0.00050	<0.00050	0.00124

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2115122-1	L2115122-2	L2115122-3	L2115122-4
		Description	Water	Water	Water	Water
		Sampled Date	19-JUN-18	19-JUN-18	19-JUN-18	19-JUN-18
		Sampled Time	13:45	13:00	11:40	
		Client ID	HALFWAY RIVER - DOWNSTREAM (HD)	MIDDLE SITE C RESERVOIR (PR2)	UPPER SITE C RESERVOIR (PR1)	DUPLICATE 1
Grouping	Analyte					
WATER						
Total Metals	Barium (Ba)-Total (mg/L)		0.149	0.041	0.034	0.129
	Beryllium (Be)-Total (mg/L)		0.00010	<0.00010	<0.00010	0.00011
	Bismuth (Bi)-Total (mg/L)		<0.20	<0.20	<0.20	<0.20
	Boron (B)-Total (mg/L)		<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)		0.000178	0.0000288	0.0000158	0.000167
	Calcium (Ca)-Total (mg/L)		57.9	29.3	27.7	56.8
	Chromium (Cr)-Total (mg/L)		0.0028	<0.0010	<0.0010	0.0027
	Cobalt (Co)-Total (mg/L)		0.00116	<0.00030	<0.00030	0.00113
	Copper (Cu)-Total (mg/L)		0.0036	<0.0010	<0.0010	0.0036
	Iron (Fe)-Total (mg/L)		2.53	0.171	0.034	2.47
	Lead (Pb)-Total (mg/L)		0.00143	<0.00050	<0.00050	0.00137
	Lithium (Li)-Total (mg/L)		0.0067	0.0017	0.0013	0.0071
	Magnesium (Mg)-Total (mg/L)		16.4	7.03	6.70	16.4
	Manganese (Mn)-Total (mg/L)		0.0442	0.00673	0.00266	0.0420
	Mercury (Hg)-Total (mg/L)		0.0000058	<0.0000050	<0.0000050	0.0000054
	Molybdenum (Mo)-Total (mg/L)		0.0035	<0.0010	<0.0010	0.0036
	Nickel (Ni)-Total (mg/L)		0.0051	<0.0010	<0.0010	0.0050
	Phosphorus (P)-Total (mg/L)		<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)		<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Total (mg/L)		0.00155	0.000298	0.000278	0.00150
	Silicon (Si)-Total (mg/L)		4.24	2.28	2.27	4.24
	Silver (Ag)-Total (mg/L)		0.000034	<0.000020	<0.000020	0.000029
	Sodium (Na)-Total (mg/L)		2.3	<2.0	<2.0	2.3
	Strontium (Sr)-Total (mg/L)		0.274	0.112	0.104	0.269
	Thallium (Tl)-Total (mg/L)		0.000063	<0.000010	<0.000010	0.000062
	Tin (Sn)-Total (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)		0.021	<0.010	<0.010	0.020
	Uranium (U)-Total (mg/L)		0.00092	0.00052	0.00049	0.00092
	Vanadium (V)-Total (mg/L)		0.00728	0.00074	<0.00050	0.00759
	Zinc (Zn)-Total (mg/L)		0.0154	<0.0050	<0.0050	0.0150
Dissolved Metals	Dissolved Fe2 Filtration Location		FIELD	FIELD	FIELD	FIELD
	Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location		FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)		0.0151	<0.0050	<0.0050	0.0139
	Antimony (Sb)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
	Barium (Ba)-Dissolved (mg/L)		0.084	0.039	0.034	0.086

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2115122-1 Water 19-JUN-18 13:45 HALFWAY RIVER - DOWNSTREAM - (HD)	L2115122-2 Water 19-JUN-18 13:00 MIDDLE SITE C RESERVOIR (PR2)	L2115122-3 Water 19-JUN-18 11:40 UPPER SITE C RESERVOIR (PR1)	L2115122-4 Water 19-JUN-18 DUPLICATE 1	
Grouping	Analyte				
WATER					
Dissolved Metals	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Dissolved (mg/L)	0.0000180	0.0000084	0.0000069	0.0000159
	Calcium (Ca)-Dissolved (mg/L)	55.0	28.5	27.8	54.2
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Cobalt (Co)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030
	Copper (Cu)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Iron (Fe)-Dissolved (mg/L)	<0.030	<0.030	<0.030	<0.030
	Ferrous Iron, Dissolved (mg/L)	<0.020	<0.020	<0.020	<0.020
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Lithium (Li)-Dissolved (mg/L)	0.0061	0.0016	0.0013	0.0056
	Magnesium (Mg)-Dissolved (mg/L)	15.7	7.02	6.48	16.1
	Manganese (Mn)-Dissolved (mg/L)	0.00356	0.00169	0.00075	0.00353
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.0034	<0.0010	<0.0010	0.0034
	Nickel (Ni)-Dissolved (mg/L)	0.0014	<0.0010	<0.0010	0.0015
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Dissolved (mg/L)	0.00132	0.000291	0.000246	0.00142
	Silicon (Si)-Dissolved (mg/L)	1.70	2.02	2.05	1.66
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Dissolved (mg/L)	2.4	<2.0	<2.0	2.4
	Strontium (Sr)-Dissolved (mg/L)	0.278	0.112	0.109	0.274
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.00081	0.00050	0.00048	0.00081
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Dissolved Organic Carbon	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Total Organic Carbon	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Boron (B)-Dissolved	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Potassium (K)-Dissolved	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Calcium (Ca)-Total	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Copper (Cu)-Total	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Sodium (Na)-Total	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Total	MS-B	L2115122-1, -2, -3, -4
Matrix Spike	Total Nitrogen	MS-B	L2115122-2, -3
Matrix Spike	Total Nitrogen	MS-B	L2115122-1, -4
Matrix Spike	Silicate (as SiO ₂)	MS-B	L2115122-1, -2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
PEHR	Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering a sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.			
Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			

Reference Information

ECOLI-COLI-ENV-VA	Water	E.coli by Colilert	APHA METHOD 9223
<p>This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.</p>			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
FE2-D-COL-VA	Water	Diss. Ferrous Iron in Water by Colour	APHA 3500-Fe B/James Ball et al (1999)
<p>This analysis is carried out using procedures adapted from APHA 3500-Fe B and "A New Method for the Direct Determination of Dissolved Iron Concentration in Acid Mine Waters" published by James W. Ball et al (1999). The procedure involves preliminary sample filtration, and ferrous iron is determined using the "FerroZine" colourimetric method.</p>			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
<p>Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.</p>			
HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)
<p>Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.</p>			
HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)
<p>Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.</p>			
HPC-PP-ENV-VA	Water	HPC by pour plate	APHA METHOD 9215
<p>This analysis is carried out using procedures adapted from APHA Method 9215 "Heterotropic Plate Count". Heterotropic plate count (standard plate count or total plate count) is determined by culturing and colony counting using the pour plate method with a 48 hour incubation period. The test measures colonies formed by heterotropic bacteria.</p>			
IONBALANCE-VA	Water	Ion Balance Calculation	APHA 1030E
<p>Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.</p>			
<p>Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:</p>			
$\text{Ion Balance (\%)} = \frac{[\text{Cation Sum} - \text{Anion Sum}]}{[\text{Cation Sum} + \text{Anion Sum}]}$			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
<p>Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.</p>			
<p>Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.</p>			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
<p>Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.</p>			
<p>Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.</p>			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
<p>This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.</p>			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
<p>This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.</p>			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus

Reference Information

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.
 Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.
 Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.
 Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TCOLI-COLI-ENV-VA Water Total coliform by Colilert APHA METHOD 9223

This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is quantified by a statistical estimation of bacteria density (most probable number).

TDS-CALC-VA Water TDS (Calculated) APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".
 The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.
 Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																															
Company: Tetrattech		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																															
Contact: Danielle MacDonald		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-3 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT																															
Address: 14940-123 Ave NW Edmonton, AB T5V 1B4		<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																															
Phone: 780-886-3055		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																															
		Email 1 or Fax: danielle.macdonald@tetrattech.com			Specify Date Required for E2, E or P:																															
		Email 2: molly.brewis@bchydro.com			Analysis Request																															
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																															
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																																		
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: ebaaccounts@tetrattech.com																																		
Company:		Email 2: danielle.macdonald@tetrattech.com																																		
Contact:																																				
Project Information		Oil and Gas Required Fields (client use)																																		
ALS Quote #: Q53931		Approver ID:																																		
Job #: VENW03058 ENW, VENW03058-02		Account:																																		
PO / AFE: .002		Activity Code:																																		
LSD:		Location: M. Brewis																																		
ALS Lab Work Order # (lab use only): L2115122		ALS Contact: Brent Mack																																		
		Sampler: D. Macdonald R. Payette																																		
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alk-Species	Ammonia	Calc	Color-True	EC	pH	TSS	TDS-Calc	Turbidity	Silicate	Ortho PO4	Ion Balance	TOC	TN	TP	TDP	TKN	NH3	DOC	Total Metals (CCME+ICP+Hardness) & Hg	Dissolved Metals (CCME+ICP+Hardness)/H	Total Hg (ultra low detection limit)	Dissolved Hg (ultra low detection limit)	Total Met-Hg (ultra low detection limit)	Dissolved Me-Hg (ultra low detection limit)	Total Coliform	E. coli	HPC	Ferrous Iron	Number of Containers		
	Halfway River - Downstream (HD)	June	1345	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	9
	Middle Site C Reservoir (PR2)	19	1300	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	9
	Peace Canyon (PG4)			Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	1
	Upper Site C Reservoir (PR1)	2018	11:40	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	9
	Duplicate 2 (DUPI)	↓	—	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	9
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client use)			SAMPLE CONDITION AS RECEIVED (lab use only)																															
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources.			Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																															
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																															
					Cooling Initiated <input type="checkbox"/>																															
					INITIAL COOLER TEMPERATURES °C: 15 FINAL COOLER TEMPERATURES °C: 5																															
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)																															
Released by: [Signature] Date: June 19/18 Time: [Blank]		Received by: Geoff Date: June 19/18 Time: 15:30			Received by: [Signature] Date: 6/20 Time: 12:26P																															

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 21-JUN-18
Report Date: 09-JUL-18 13:56 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2116982
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060-02.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L2116982-1	L2116982-2	L2116982-3	L2116982-4	
					L2116982-1 WATER 21-JUN-18 15:10 MOBERLY RIVER - DOWNSTREAM (MD)	L2116982-2 WATER 21-JUN-18 15:30 LOWER SITE C RESERVOIR (PR3)	L2116982-3 WATER 21-JUN-18 16:10 PEACE AT PINE (PD1)	L2116982-4 WATER 21-JUN-18 16:40 PINE RIVER (PINE)	
Grouping	Analyte								
WATER									
Physical Tests	Colour, True (CU)	28.9	8.1	9.1	6.3				
	Conductivity (uS/cm)	215	233	225	209				
	Hardness (as CaCO3) (mg/L)	120	123	119	111				
	pH (pH)	8.21	8.29	8.26	8.28				
	Total Suspended Solids (mg/L)	37.9	23.9	44.1	42.5				
	TDS (Calculated) (mg/L)	126	131	125	116				
	Turbidity (NTU)	38.7	15.7	24.1	30.3				
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	107	105	99.6	105				
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0				
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0				
	Alkalinity, Total (as CaCO3) (mg/L)	107	105	99.6	105				
	Ammonia, Total (as N) (mg/L)	0.0098	<0.0050	0.0061	<0.0050				
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050				
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50				
	Fluoride (F) (mg/L)	0.082	0.054	0.052	0.051				
	Nitrate and Nitrite (as N) (mg/L)	0.0127	0.0340	0.0367	0.0314				
	Nitrate (as N) (mg/L)	0.0127	0.0340	0.0367	0.0314				
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010				
	Total Kjeldahl Nitrogen (mg/L)	0.296	0.114	0.182	0.120				
	Total Nitrogen (mg/L)	0.248	0.165	0.139	0.110				
	Orthophosphate-Dissolved (as P) (mg/L)	0.0024	0.0010	0.0012	0.0012				
	Phosphorus (P)-Total Dissolved (mg/L)	0.0066	0.0025	0.0027	0.0021				
	Phosphorus (P)-Total (mg/L)	0.0575	0.0312	0.0533	0.0471				
	Silicate (as SiO2) (mg/L)	3.53	4.39	4.21	2.08				
	Sulfate (SO4) (mg/L)	9.38	21.0	19.7	10.7				
	Anion Sum (meq/L)	2.33	2.54	2.41	2.32				
	Cation Sum (meq/L)	2.50	2.45	2.38	2.22				
	Cation - Anion Balance (%)	3.5	-1.8	-0.6	-2.0				
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	6.97	2.56	2.90	1.89				
	Total Organic Carbon (mg/L)	7.72	3.30	3.36	2.70				
Bacteriological Tests	E. coli (MPN/100mL)	37	91	138	24				
	HPC (CFU/1mL)	210 ^{PEHR}	84 ^{PEHR}	120 ^{PEHR}	66 ^{PEHR}				
	Coliform Bacteria - Total (MPN/100mL)	629	219	411	101				
Total Metals	Aluminum (Al)-Total (mg/L)	0.817	0.399	0.686	0.787				
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050				
	Arsenic (As)-Total (mg/L)	0.00077	<0.00050	0.00067	0.00060				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2116982-1	L2116982-2	L2116982-3	L2116982-4
		Description	WATER	WATER	WATER	WATER
		Sampled Date	21-JUN-18	21-JUN-18	21-JUN-18	21-JUN-18
		Sampled Time	15:10	15:30	16:10	16:40
		Client ID	MOBERLY RIVER - DOWNSTREAM (MD)	LOWER SITE C RESERVOIR (PR3)	PEACE AT PINE (PD1)	PINE RIVER (PINE)
Grouping	Analyte					
WATER						
Total Metals	Barium (Ba)-Total (mg/L)		0.156	0.056	0.073	0.089
	Beryllium (Be)-Total (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)		<0.20	<0.20	<0.20	<0.20
	Boron (B)-Total (mg/L)		<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)		0.0000642	0.0000579	0.0000919	0.0000543
	Calcium (Ca)-Total (mg/L)		30.1	33.5	33.6	30.8
	Chromium (Cr)-Total (mg/L)		0.0015	<0.0010	0.0013	0.0013
	Cobalt (Co)-Total (mg/L)		0.00057	<0.00030	0.00054	0.00051
	Copper (Cu)-Total (mg/L)		0.0027	0.0014	0.0020	0.0016
	Iron (Fe)-Total (mg/L)		1.40	0.623	1.13	1.25
	Lead (Pb)-Total (mg/L)		0.00078	<0.00050	0.00064	0.00073
	Lithium (Li)-Total (mg/L)		0.0043	0.0027	0.0029	0.0043
	Magnesium (Mg)-Total (mg/L)		7.96	8.22	8.23	7.24
	Manganese (Mn)-Total (mg/L)		0.0300	0.0155	0.0285	0.0217
	Mercury (Hg)-Total (mg/L)		0.0000070	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)		<0.0010	0.0013	0.0012	<0.0010
	Nickel (Ni)-Total (mg/L)		0.0033	0.0018	0.0025	0.0020
	Phosphorus (P)-Total (mg/L)		<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)		<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Total (mg/L)		0.000255	0.000499	0.000435	0.000360
	Silicon (Si)-Total (mg/L)		2.91	2.69	3.08	2.03
	Silver (Ag)-Total (mg/L)		<0.000020	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Total (mg/L)		<2.0	<2.0	<2.0	<2.0
	Strontium (Sr)-Total (mg/L)		0.0769	0.140	0.134	0.0939
	Thallium (Tl)-Total (mg/L)		0.000027	0.000017	0.000027	0.000027
	Tin (Sn)-Total (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)		<0.010	<0.010	0.012	<0.010
	Uranium (U)-Total (mg/L)		0.00028	0.00059	0.00061	0.00028
	Vanadium (V)-Total (mg/L)		0.00337	0.00205	0.00327	0.00305
	Zinc (Zn)-Total (mg/L)		0.0068	<0.0050	0.0067	0.0098
Dissolved Metals	Dissolved Fe2 Filtration Location		FIELD	FIELD	FIELD	FIELD
	Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location		FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)		0.0080	<0.0050	<0.0050	0.0090
	Antimony (Sb)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
	Barium (Ba)-Dissolved (mg/L)		0.141	0.047	0.048	0.069

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2116982-1 WATER 21-JUN-18 15:10 MOBERLY RIVER - DOWNSTREAM (MD)	L2116982-2 WATER 21-JUN-18 15:30 LOWER SITE C RESERVOIR (PR3)	L2116982-3 WATER 21-JUN-18 16:10 PEACE AT PINE (PD1)	L2116982-4 WATER 21-JUN-18 16:40 PINE RIVER (PINE)	
Grouping	Analyte				
WATER					
Dissolved Metals	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Dissolved (mg/L)	0.0000135	0.0000107	0.0000105	0.0000095
	Calcium (Ca)-Dissolved (mg/L)	33.3	34.7	33.7	31.7
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Cobalt (Co)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030
	Copper (Cu)-Dissolved (mg/L)	0.0014	<0.0010	<0.0010	<0.0010
	Iron (Fe)-Dissolved (mg/L)	<0.030	<0.030	<0.030	<0.030
	Ferrous Iron, Dissolved (mg/L)	<0.020	<0.020	<0.020	<0.020
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Lithium (Li)-Dissolved (mg/L)	0.0037	0.0024	0.0023	0.0035
	Magnesium (Mg)-Dissolved (mg/L)	8.96	8.77	8.48	7.78
	Manganese (Mn)-Dissolved (mg/L)	0.00485	0.00196	0.00316	0.00175
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	0.0000065	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0010	0.0013	0.0011	<0.0010
	Nickel (Ni)-Dissolved (mg/L)	0.0015	<0.0010	0.0012	<0.0010
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Dissolved (mg/L)	0.000200	0.000455	0.000418	0.000320
	Silicon (Si)-Dissolved (mg/L)	1.69	1.98	2.01	0.963
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Dissolved (mg/L)	2.3	<2.0	<2.0	<2.0
	Strontium (Sr)-Dissolved (mg/L)	0.0791	0.141	0.136	0.0953
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.00023	0.00056	0.00050	0.00023
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0064	<0.0050	<0.0050	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Samples Listed:

Sample Number	Client Sample ID	Qualifier	Description
L2116982-2	LOWER SITE C RESERVOIR	WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type	Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike		Dissolved Organic Carbon	MS-B	L2116982-1, -2, -4
Matrix Spike		Dissolved Organic Carbon	MS-B	L2116982-3
Matrix Spike		Dissolved Organic Carbon	MS-B	L2116982-3
Matrix Spike		Total Organic Carbon	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Aluminum (Al)-Dissolved	MS-B	L2116982-1, -2
Matrix Spike		Antimony (Sb)-Dissolved	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Arsenic (As)-Dissolved	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Barium (Ba)-Dissolved	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Barium (Ba)-Dissolved	MS-B	L2116982-1, -2
Matrix Spike		Cadmium (Cd)-Dissolved	MS-B	L2116982-1, -2
Matrix Spike		Calcium (Ca)-Dissolved	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Calcium (Ca)-Dissolved	MS-B	L2116982-1, -2
Matrix Spike		Copper (Cu)-Dissolved	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Copper (Cu)-Dissolved	MS-B	L2116982-1, -2
Matrix Spike		Magnesium (Mg)-Dissolved	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Magnesium (Mg)-Dissolved	MS-B	L2116982-1, -2
Matrix Spike		Manganese (Mn)-Dissolved	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Manganese (Mn)-Dissolved	MS-B	L2116982-1, -2
Matrix Spike		Molybdenum (Mo)-Dissolved	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Nickel (Ni)-Dissolved	MS-B	L2116982-1, -2
Matrix Spike		Potassium (K)-Dissolved	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Sodium (Na)-Dissolved	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Strontium (Sr)-Dissolved	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Strontium (Sr)-Dissolved	MS-B	L2116982-1, -2
Matrix Spike		Zinc (Zn)-Dissolved	MS-B	L2116982-1, -2
Matrix Spike		Calcium (Ca)-Total	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Magnesium (Mg)-Total	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Manganese (Mn)-Total	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Sodium (Na)-Total	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Strontium (Sr)-Total	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Total Nitrogen	MS-B	L2116982-1, -2, -3, -4
Matrix Spike		Total Nitrogen	MS-B	L2116982-1, -2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
PEHR	Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

Reference Information

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.			
Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
ECOLI-COLI-ENV-VA	Water	E.coli by Colilert	APHA METHOD 9223
This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
FE2-D-COL-VA	Water	Diss. Ferrous Iron in Water by Colour	APHA 3500-Fe B/James Ball et al (1999)
This analysis is carried out using procedures adapted from APHA 3500-Fe B and "A New Method for the Direct Determination of Dissolved Iron Concentration in Acid Mine Waters" published by James W. Ball et al (1999). The procedure involves preliminary sample filtration, and ferrous iron is determined using the "FerroZine" colourimetric method.			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO ₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)
Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			
HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)
Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			
HPC-PP-ENV-VA	Water	HPC by pour plate	APHA METHOD 9215
This analysis is carried out using procedures adapted from APHA Method 9215 "Heterotropic Plate Count". Heterotropic plate count (standard plate count or total plate count) is determined by culturing and colony counting using the pour plate method with a 48 hour incubation period. The test measures colonies formed by heterotropic bacteria.			
IONBALANCE-VA	Water	Ion Balance Calculation	APHA 1030E
Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.			
Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:			
Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			

Reference Information

MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.			
Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.			
P-TD-COL-VA	Water	Total Dissolved P in Water by Colour	APHA 4500-P Phosphorous
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.			
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.			
Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.			
PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value
This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode			
It is recommended that this analysis be conducted in the field.			
PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.			
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.			
Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.			
SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.
This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
TCOLI-COLI-ENV-VA	Water	Total coliform by Colilert	APHA METHOD 9223
This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is quantified by a statistical estimation of bacteria density (most probable number).			
TDS-CALC-VA	Water	TDS (Calculated)	APHA 1030E (20TH EDITION)
This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".			
The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.			
TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.
This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl			

Reference Information

Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																																																																																																																																																																																																																																																												
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ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alk-Species	Color-True	Turbidity, Silicate	TOC, TN, TP, TDP, TKN, NH3	DOC	Total Metals (CCME+ICP+Hardness) & Hg	Dissolved Metals (CCME+ICP+Hardness)/H	Total Hg (ultra low detection limit)	Dissolved Hg (ultra low detection limit)	Total MeHg (ultra low detection limit)	Dissolved MeHg (ultra low detection limit)	Total Coliform, E. coli, HPC	Ferrous Iron	Number of Containers																																																																																																																																																																																																																																															
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	Lower Site C Reservoir (PR3)	21	15:30	Water	R	R	R	R	R	R	R					R	R	7																																																																																																																																																																																																																																															
	Peace at Pine (PD1)	2018	16:10	Water	R	R	R	R	R	R	R					R	R	9																																																																																																																																																																																																																																															
	Pine River (Pine)	↓	16:40	Water	R	R	R	R	R	R	R					R	R	8																																																																																																																																																																																																																																															
	* Notes → Pine Hg vial is not filtered or preserved (to be used for dissolved and total samples) → PR3 → Hg total + dissolved to be taken from Routine or metals bottles																																																																																																																																																																																																																																																																
Drinking Water (DW) Samples (client use)					Special Instructions / Specify Criteria to add on report (client Use)																																																																																																																																																																																																																																																												
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources.																																																																																																																																																																																																																																																												
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Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 21-JUN-18
Report Date: 12-JUL-18 11:54 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2116460
Project P.O. #: NOT SUBMITTED
Job Reference: VENW003060-02.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2116460-1 Water 20-JUN-18 11:40 PEACE AT BEATTON (PD2)	L2116460-2 Water 20-JUN-18 11:10 BEATTON RIVER (BEATTON)	L2116460-3 Water 20-JUN-18 12:40 PEACE AT KISKATINAW (PD3)	L2116460-4 Water 20-JUN-18 13:20 KISKATINAW RIVER (KR)	L2116460-5 Water 20-JUN-18 14:05 PEACE AT POUCE COUPE (PD4)	
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	10.2	153	9.3	29.7	13.1
	Conductivity (uS/cm)	235	160	230	406	232
	pH (pH)	8.27	7.80	8.27	8.55	8.26
	Total Suspended Solids (mg/L)	26.3	51.1	28.7	66.9	50.9
	Total Dissolved Solids (mg/L)	149	173	143	305	159
	Turbidity (NTU)	20.6	71.3	20.0	132	29.3
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	109	43.2	108	192	109
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	14.4	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	109	43.2	108	207	109
	Ammonia, Total (as N) (mg/L)	<0.0050	0.0317	<0.0050	0.0133	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	<0.50	0.74	<0.50	0.87	<0.50
	Fluoride (F) (mg/L)	0.059	0.083	0.058	0.101	0.059
	Nitrate and Nitrite (as N) (mg/L)	0.0300	0.0219	0.0210	0.0300	0.0270
	Nitrate (as N) (mg/L)	0.0300	0.0115	0.0210	0.0300	0.0270
	Nitrite (as N) (mg/L)	<0.0010	0.0104	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.147	0.733	0.137	0.572	0.218
	Total Nitrogen (mg/L)	0.127	0.68	0.117	0.59	0.174
	Orthophosphate-Dissolved (as P) (mg/L)	0.0015	0.0091	0.0013	0.0018	0.0015
	Phosphorus (P)-Total Dissolved (mg/L)	0.0023	0.0215	<0.0020	0.0060	0.0033
	Phosphorus (P)-Total (mg/L)	0.0390	0.111	0.0393	0.117	0.0579
	Silicate (as SiO2) (mg/L)	3.35	5.09	2.95	4.90	3.17
Sulfate (SO4) (mg/L)	19.2	32.6	17.4	23.2	18.3	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.71	26.0	3.00	11.2	3.50
	Total Organic Carbon (mg/L)	3.39	28.1	3.50	13.5	4.15

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID					
L2116460-6	Water	20-JUN-18	15:10	POUCE COUPE (POUCE)	L2116460-7	Water	20-JUN-18	16:35	PEACE AT MANY ISLANDS
Grouping	Analyte								
WATER									
Physical Tests	Colour, True (CU)	72.4	17.5						
	Conductivity (uS/cm)	558	231						
	pH (pH)	8.30	8.28						
	Total Suspended Solids (mg/L)	46.5	43.7						
	Total Dissolved Solids (mg/L)	429	162						
	Turbidity (NTU)	77.2	30.1						
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	136	107						
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0						
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0						
	Alkalinity, Total (as CaCO3) (mg/L)	136	107						
	Ammonia, Total (as N) (mg/L)	0.0146	<0.0050						
	Bromide (Br) (mg/L)	<0.050	<0.050						
	Chloride (Cl) (mg/L)	11.7	<0.50						
	Fluoride (F) (mg/L)	0.171	0.062						
	Nitrate and Nitrite (as N) (mg/L)	<0.0051	0.0297						
	Nitrate (as N) (mg/L)	<0.0050	0.0297						
	Nitrite (as N) (mg/L)	<0.0010	<0.0010						
	Total Kjeldahl Nitrogen (mg/L)	1.07	0.200						
	Total Nitrogen (mg/L)	0.82	0.166						
	Orthophosphate-Dissolved (as P) (mg/L)	0.0024	0.0017						
	Phosphorus (P)-Total Dissolved (mg/L)	0.0139	0.0044						
	Phosphorus (P)-Total (mg/L)	0.102	0.0609						
	Silicate (as SiO2) (mg/L)	1.67	3.34						
Sulfate (SO4) (mg/L)	139	20.1							
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	24.4	4.40						
	Total Organic Carbon (mg/L)	25.9	5.48						

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Dissolved Organic Carbon	MS-B	L2116460-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Total Organic Carbon	MS-B	L2116460-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Total Nitrogen	MS-B	L2116460-1, -2, -3, -7
Matrix Spike	Total Nitrogen	MS-B	L2116460-1, -2, -3, -7
Matrix Spike	Total Nitrogen	MS-B	L2116460-5
Matrix Spike	Phosphorus (P)-Total	MS-B	L2116460-1, -2, -3, -4, -5, -6, -7

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEM19171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



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Report To		Report Format / Distribution				Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																									
Company: Tetratech		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)				R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																									
Contact: Danielle MacDonald		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm). 50% surcharge - contact ALS to confirm TAT																									
Address: 14940-123 Ave NW Edmonton, AB T5V 1B4		<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked				E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																									
Phone: 780-886-3055		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX				E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																									
		Email 1 or Fax danielle.macdonald@tetratech.com				Specify Date Required for E2, E or P:																									
		Email 2				Analysis Request																									
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Invoice Distribution				Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																									
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX				P	F/P	P	F/P	P	F/P	P	F/P	P	F/P	P	F/P														
Company:		Email 1 or Fax ebaaccountspayable@tetratech.com				Alk-Species/Anions by IC, NO2+NO3/Calc	Color-True, EC, pH, TSS, TDS-Calc	Turbidity, Silicate, Ortho PO4, Ion Balance	TOC, TN, TP, TDP, TKN, NH3	DOC	Total Metals (CCME+ICP+Hardness)	Dissolved Metals (CCME+ICP+Hardness)	Total Hg (ultra low detection limit)	Dissolved Hg (ultra low detection limit)	Total MeHg (ultra low detection limit)	Dissolved MeHg (ultra low detection limit)			Number of Containers												
Contact:		Email 2 danielle.macdonald@tetratech.com																													
Project Information		Oil and Gas Required Fields (client use)																													
ALS Quote #: Q53931		Approver ID:		Cost Center:																											
Job #: VENW003060 - 02.002		GL Account:		Routing Code:																											
PO / AFE:		Activity Code:																													
LSD:		Location:																													
ALS Lab Work Order # (lab use only) L2116460		ALS Contact: Brent Mack		Sampler: D. MacDonald R. Pagnelle																											
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)															Sample Type											
	Peace at Beatton (PD2)			June	11:40															Water	R	R	R	R	R						3
	Beatton River (Beatton)			20	11:10															Water	R	R	R	R	R						3
	Peace at Kiskatinaw (PD3)			2018	12:40															Water	R	R	R	R	R						3
	Kiskatinaw River (KR)				13:20	Water	R	R	R	R	R						3														
	Peace at Pouce Coupe (PD4)				1405	Water	R	R	R	R	R						3														
	Pouce Coupe (Pouce)				1510	Water	R	R	R	R	R						3														
	Peace at Many Islands (PD5)				1635	Water	R	R	R	R	R						3														
Drinking Water (DW) Samples ¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)						SAMPLE CONDITION AS RECEIVED (lab use only)																							
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life. samples were taken from surface water						Frozen <input type="checkbox"/>		SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>		Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/>		Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>		Cooling Initiated <input type="checkbox"/>															
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No								INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C		Received by:		Date:		Time:		Received by:		Date:		Time:									
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)						FINAL SHIPMENT RECEPTION (lab use only)																							
Released by: Danielle MacDonald		Date: 2000 June 20/18		Time: 9:00am		Received by: Shy bin		Date: June 21/18		Time: 9:00am		Received by: HJ		Date: 6/22		Time: 12:15															

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 18-JUL-18
Report Date: 30-JUL-18 17:24 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2131545
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060 - 02.002
C of C Numbers: 14-
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2131545-1	L2131545-2	L2131545-3	L2131545-4	L2131545-5
		Description	Water	Water	Water	Water	Water
		Sampled Date	17-JUL-18	17-JUL-18	17-JUL-18	17-JUL-18	17-JUL-18
		Sampled Time	11:15	11:40	16:15	17:00	
		Client ID	WILLISTON SHALLOW (W1-SHALLOW)	WILLISTON DEEP (W1-DEEP)	DINOSAUR SHALLOW (D1-SHALLOW)	DINOSAUR DEEP(D1-DEEP)	DUPLICATE 2 (DUP 2)
Grouping	Analyte						
FILTER							
Plant Pigments	Chlorophyll a (ug/L)	1.09	1.48	0.804	0.769	0.903	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2131545-1 Water 17-JUL-18 11:15 WILLISTON SHALLOW (W1- SHALLOW)	L2131545-2 Water 17-JUL-18 11:40 WILLISTON DEEP (W1-DEEP)	L2131545-3 Water 17-JUL-18 16:15 DINOSAUR SHALLOW (D1- SHALLOW)	L2131545-4 Water 17-JUL-18 17:00 DINOSAUR DEEP(D1-DEEP)	L2131545-5 Water DUPLICATE 2 (DUP 2)
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	5.7	6.0	6.2	6.0	8.6
	Conductivity (uS/cm)	179	179	181	180	183
	pH (pH)	8.23	8.18	8.17	8.17	8.20
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0	<3.0
	Total Dissolved Solids (mg/L)	116	115	119	115	112
	Turbidity (NTU)	2.45	2.54	0.81	0.84	0.87
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	81.8	80.8	81.3	79.4	83.3
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	81.8	80.8	81.3	79.4	83.3
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	0.0074	0.0058	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Fluoride (F) (mg/L)	0.035	0.035	0.037	0.035	0.037
	Nitrate and Nitrite (as N) (mg/L)	0.0527	0.0524	0.0494	0.0610	0.0495
	Nitrate (as N) (mg/L)	0.0527	0.0524	0.0494	0.0610	0.0495
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.115	0.089	0.102	0.077	0.080
	Total Nitrogen (mg/L)	0.157	0.152	0.138	0.146	0.131
	Orthophosphate-Dissolved (as P) (mg/L)	0.0015	0.0012	0.0017	0.0012	0.0013
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Phosphorus (P)-Total (mg/L)	0.0059	0.0060	0.0033	0.0044	0.0039
	Silicate (as SiO2) (mg/L)	4.11	4.02	4.21	4.15	4.03
Sulfate (SO4) (mg/L)	13.5	13.4	13.9	13.5	13.8	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.90	2.82	2.78	3.09	3.02
	Total Organic Carbon (mg/L)	2.91	2.85	2.85	3.31	2.82

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	Sample ID	Description	Sampled Date	Sampled Time	Client ID
		L2131545-6	Water	17-JUL-18	18:30	PEACE CANYON (PC1)
WATER						
Physical Tests	Colour, True (CU)			7.2		
	Conductivity (uS/cm)			179		
	pH (pH)			8.16		
	Total Suspended Solids (mg/L)			<3.0		
	Total Dissolved Solids (mg/L)			115		
	Turbidity (NTU)			1.01		
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)			81.3		
	Alkalinity, Carbonate (as CaCO3) (mg/L)			<1.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)			<1.0		
	Alkalinity, Total (as CaCO3) (mg/L)			81.3		
	Ammonia, Total (as N) (mg/L)			0.0091		
	Bromide (Br) (mg/L)			<0.050		
	Chloride (Cl) (mg/L)			<0.50		
	Fluoride (F) (mg/L)			0.035		
	Nitrate and Nitrite (as N) (mg/L)			0.0615		
	Nitrate (as N) (mg/L)			0.0615		
	Nitrite (as N) (mg/L)			<0.0010		
	Total Kjeldahl Nitrogen (mg/L)			0.100		
	Total Nitrogen (mg/L)			0.132		
	Orthophosphate-Dissolved (as P) (mg/L)			<0.0010		
	Phosphorus (P)-Total Dissolved (mg/L)			<0.0020		
	Phosphorus (P)-Total (mg/L)			0.0025		
	Silicate (as SiO2) (mg/L)			3.95		
	Sulfate (SO4) (mg/L)			13.6		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)			3.54		
	Total Organic Carbon (mg/L)			3.03		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Alkalinity, Total (as CaCO ₃)	B	L2131545-2, -3, -4, -6
Matrix Spike	Total Nitrogen	MS-B	L2131545-1, -2, -3, -4, -5, -6
Matrix Spike	Silicate (as SiO ₂)	MS-B	L2131545-1, -2, -3, -4, -5, -6
Matrix Spike	Sulfate (SO ₄)	MS-B	L2131545-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0
This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.			
Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEM19171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



L2131545-COFC

Report To		Report Format / Distribution				Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																													
Company: Tetrtech		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)				R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																													
Contact: Danielle MacDonald		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				Specify Date Required for E2, E or P:																													
Address: 14940-123 Ave NW Edmonton, AB T5V 1B4		<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked																																	
Phone: 780-886-3055		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																																	
Email 1 or Fax: danielle.macdonald@tetrtech.com		Email 2				Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																													
Invoice To: Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																																	
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																																	
Company:		Email 1 or Fax: ebaaccounts@tetrtech.com																																	
Contact:		Email 2: danielle.macdonald@tetrtech.com																																	
Project Information		Oil and Gas Required Fields (client use)																																	
ALS Quote #: Q53931		Approver ID:		Cost Center:																															
Job #: VENW03060 - 02.002		GL Account:		Routing Code:																															
PO / AFE:		Activity Code:																																	
LSD:		Location:																																	
ALS Lab Work Order # (lab use only)		ALS Contact: Brent Mack		Sampler:																															
L2131545																																			
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	Alk-Species	Calc	IC	NO2	NO3	Ca	Color-True	EC	pH	TSS	TDS	Calc	Turbidity	Silicate	Ortho PO4	Ion Balance	TOC	TP	TDP	TKN	NH3	DOC	Total Metals (CCME+ICP+Hardness)	Dissolved Metals (CCME+ICP+Hardness)	Total Hg (ultra low detection limit)	Dissolved Hg (ultra low detection limit)	Total MeHg (ultra low detection limit)	Dissolved MeHg (ultra low detection limit)	chlorophyll a (field filtered 250 mL)	Number of Containers	
	Williston Shallow (W1 - Shallow)	July 17	11:15	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R								R	4
	Williston Deep (W1 - Deep)		11:40	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R								R	4
	Dinosaur Shallow (D1 - Shallow)	2018	16:15	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R								R	4
	Dinosaur Deep (D1 - Deep)		17:00	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R								R	4
	Duplicate 1 (DUP 1) Duplicate 2 (DUP 2)			Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R								R	4
	Peace Canyon (PE1)		1830	water	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R								R	3
Drinking Water (DW) Samples¹ (client use)					Special Instructions / Specify Criteria to add on report (client Use)					SAMPLE CONDITION AS RECEIVED (lab use only)																									
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources.					Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																									
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No										Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																									
										Cooling Initiated <input type="checkbox"/>																									
										INITIAL COOLER TEMPERATURES °C: 5°C																									
										FINAL COOLER TEMPERATURES °C: 4 7																									
SHIPMENT RELEASE (client use)					INITIAL SHIPMENT RECEPTION (lab use only)					FINAL SHIPMENT RECEPTION (lab use only)																									
Released by: [Signature]		Date:		Time:		Received by: Shubin		Date: July 18, 2018		Time: 9:00 AM		Received by: JC		Date: July 19, 2018		Time: 11 AM																			



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 17-JUL-18
Report Date: 27-JUL-18 15:06 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2130358
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060-02.002
C of C Numbers: 14-
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2130358-1	L2130358-2	L2130358-3		
		Description	Water	Water	Water		
		Sampled Date	16-JUL-18	16-JUL-18	16-JUL-18		
		Sampled Time	16:53	16:15	16:35		
		Client ID	HALFWAY RIVER-DOWNSTREAM (HD)	MIDDLE SITE C RESERVOIR (PR2)	UPPER SITE C RESERVOIR (PR1)		
Grouping	Analyte						
WATER							
Physical Tests	Colour, True (CU)	12.6	8.1	5.9			
	Conductivity (uS/cm)	413	192	183			
	pH (pH)	8.47	8.12	8.09			
	Total Suspended Solids (mg/L)	27.4	15.4	5.4			
	Total Dissolved Solids (mg/L)	285	119	122			
	Turbidity (NTU)	30.8	7.92	1.55			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	167	86.9	82.5			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	10.6	<1.0	<1.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)	177	86.9	82.5			
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	0.0067			
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050			
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50			
	Fluoride (F) (mg/L)	0.104	0.039	0.036			
	Nitrate and Nitrite (as N) (mg/L)	<0.0051	0.0364	0.0593			
	Nitrate (as N) (mg/L)	<0.0050	0.0364	0.0593			
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	0.190	0.135	0.105			
	Total Nitrogen (mg/L)	0.150	0.157	0.147			
	Orthophosphate-Dissolved (as P) (mg/L)	0.0025	0.0017	0.0017			
	Phosphorus (P)-Total Dissolved (mg/L)	0.0045	0.0028	<0.0020			
	Phosphorus (P)-Total (mg/L)	0.0522	0.0221	0.0058			
	Silicate (as SiO2) (mg/L)	4.00	4.48	4.17			
Sulfate (SO4) (mg/L)	50.7	14.6	13.3				
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	4.00	3.25	2.80			
	Total Organic Carbon (mg/L)	4.79	3.49	2.85			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Dissolved Organic Carbon	MS-B	L2130358-1, -2
Matrix Spike	Total Organic Carbon	MS-B	L2130358-3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Weston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			

Reference Information

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
----------------------------	---------------------

VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA
----	---

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

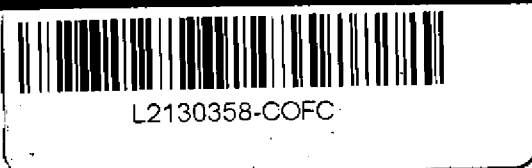
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



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Report To		Report Format / Distribution				Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																	
Company: Tetratech		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)				R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																	
Contact: Danielle MacDonald		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT																	
Address: 14940-123 Ave NW Edmonton, AB T5V 1B4		<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked				E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																	
Phone: 780-866-3055		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX				E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																	
		Email 1 or Fax: danielle.macdonald@tetratech.com				Specify Date Required for E2,E or P:																	
		Email 2:				Analysis Request																	
Invoice To		Invoice Distribution				Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																	
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																					
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: ebaaccountspayable@tetratech.com																					
Company:		Email 2: danielle.macdonald@tetratech.com																					
Contact:																							
Project Information		Oil and Gas Required Fields (client use)																					
ALS Quote #: Q53931		Approver ID:		Cost Center:																			
Job #: VENW03060 -02.002		GL Account:		Routing Code:																			
PO / AFE:		Activity Code:																					
LSD:		Location:																					
ALS Lab Work Order # (lab use only) L2130358		ALS Contact: Brent Mack		Sampler:																			
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alk-Species	Antons	IC, ND2+	NO2Calc	Color-True	EC, pH, TSS, TDS-Calc	Turbidity, Silicate	Ortho PO4, Ion Balance	TOC, TN, TP, TDP, TKN, NH3	DOC	Total Metals (CCME+ICP+Hardness) & Hg	Dissolved Metals (CCME+ICP+Hardness)/Hg	Total Hg (ultra low detection limit)	Dissolved Hg (ultra low detection limit)	Total MeHg (ultra low detection limit)	Dissolved MeHg (ultra low detection limit)	Total Coliform, E. coli, HPC	Ferrous Iron	Number of Containers
	Halfway River - Downstream (HD)	July 16	1653	Water	R	R	R	R	R	R													3
	Middle Site C Reservoir (PR2)	2018	1615	Water	R	R	R	R	R	R													3
	Peace Canyon (PCT)			Water	R	R	R	R	R	R													
	Upper Site C Reservoir (PR1)	↓	1435	Water	R	R	R	R	R	R													3
	Duplicate 2 (DUP-2)			Water	R	R	R	R	R	R													
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)				SAMPLE CONDITION AS RECEIVED (lab use only)																	
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources.				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																	
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No						Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																	
						Cooling Initiated <input type="checkbox"/>																	
						INITIAL COOLER TEMPERATURES °C					FINAL COOLER TEMPERATURES °C												
						11°C					2												
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)																	
Released by: <i>[Signature]</i>		Date: 15 July 2018		Time: 18:18		Received by: <i>[Signature]</i>		Date: July 17 2018		Time: 9:00 AM		Received by: <i>[Signature]</i>		Date: 17 JUL 2018		Time: 11:10 AM							

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

ALS-FM-0376e-v08 Form04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 18-JUL-18
Report Date: 30-JUL-18 11:02 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2131720
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060 - 02.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2131720-1 Water 18-JUL-18 10:40 MOBERLY RIVER - DOWNSTREAM - (MD)	L2131720-2 Water 18-JUL-18 10:10 LOWER SITE C RESERVOIR (PR3)	L2131720-3 Water 18-JUL-18 11:00 PEACE AT PINE (PD1)	L2131720-4 Water 18-JUL-18 11:30 PINE RVER (PINE)
Grouping	Analyte				
WATER					
Physical Tests	Colour, True (CU)	23.1	8.3	7.5	7.2
	Conductivity (uS/cm)	232	192	202	262
	pH (pH)	8.29	8.19	8.09	8.36
	Total Suspended Solids (mg/L)	39.0	22.0	46.6	12.0
	Total Dissolved Solids (mg/L)	154	114	126	154
	Turbidity (NTU)	36.5	7.67	12.6	11.8
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	117	87.2	90.0	126
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	3.6
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	117	87.2	90.0	129
	Ammonia, Total (as N) (mg/L)	0.0060	<0.0050	0.0250	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	0.53	<0.50	<0.50	0.68
	Fluoride (F) (mg/L)	0.080	0.040	0.044	0.064
	Nitrate and Nitrite (as N) (mg/L)	0.0144	0.0546	0.0516	0.0180
	Nitrate (as N) (mg/L)	0.0144	0.0546	0.0516	0.0180
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.261	0.165	0.117	0.093
	Total Nitrogen (mg/L)	0.246	0.152	0.183	0.114
	Orthophosphate-Dissolved (as P) (mg/L)	0.0027	0.0015	0.0025	0.0021
	Phosphorus (P)-Total Dissolved (mg/L)	0.0049	0.0021	0.0024	<0.0020
	Phosphorus (P)-Total (mg/L)	0.0500	0.0242	0.0022	0.0176
	Silicate (as SiO2) (mg/L)	3.23	4.02	4.16	2.49
Sulfate (SO4) (mg/L)	10.5	15.4	16.9	17.0	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	6.94	3.19	2.93	2.91
	Total Organic Carbon (mg/L)	7.57	3.09	3.17	2.93

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Alkalinity, Total (as CaCO ₃)	B	L2131720-1
Matrix Spike	Total Nitrogen	MS-B	L2131720-1, -2, -3, -4
Matrix Spike	Silicate (as SiO ₂)	MS-B	L2131720-1, -2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.			
Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

Reference Information

P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
<p>This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample. Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.</p> <p>Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.</p>			
P-TD-COL-VA	Water	Total Dissolved P in Water by Colour	APHA 4500-P Phosphorus
<p>This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter. Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.</p> <p>Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.</p>			
PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value
<p>This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode</p> <p>It is recommended that this analysis be conducted in the field.</p>			
PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus
<p>This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.</p> <p>Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.</p>			
SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.
<p>This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.</p>			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC
<p>This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.</p>			
TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.
<p>This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.</p>			
TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC
<p>This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.</p>			
TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity
<p>This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.</p>			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



L2131720-COFC

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	Peace at Pine (PD1)			2018	11:00	Water														3																																																																																																																																																																																																																																		
	Pine River (Pine)			↓	11:30	Water														3																																																																																																																																																																																																																																		
Drinking Water (DW) Samples¹ (client use)				Special Instructions / Specify Criteria to add on report (client Use)				SAMPLE CONDITION AS RECEIVED (lab use only)																																																																																																																																																																																																																																														
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources. <i>Please send email if turnaround is anticipated to be delayed for distribution. Thanks</i>				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																																																																																																																																																														
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No								Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																																																																																																																																																														
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SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)																																																																																																																																																																																																																																														
Released by: <i>[Signature]</i>	Date: July 18/18	Time: 13:40	Received by: <i>[Signature]</i>	Date: July 18/18	Time: 12:00pm	Received by: <i>[Signature]</i>	Date: JUL 19 2018	Time: 11 AM																																																																																																																																																																																																																																														

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

ALS-FM-0225a-109 Form 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 20-JUL-18
Report Date: 02-AUG-18 11:50 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2133123
Project P.O. #: NOT SUBMITTED
Job Reference: VENW003060-02.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2133123-11 Water FIELD BLANK				
Grouping	Analyte				
FILTER					
Plant Pigments	Chlorophyll a (ug/L)	<0.010			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2133123-1 Water 19-JUL-18 11:45 PEACE AT BEATTON (PD2)	L2133123-2 Water 19-JUL-18 12:55 BEATTON RIVER (BEATTON)	L2133123-3 Water 19-JUL-18 13:30 PEACE AT KISKATINAW (PD3)	L2133123-4 Water 19-JUL-18 13:50 KISKATINAW RIVER (KR)	L2133123-5 Water 19-JUL-18 15:15 PEACE AT POUCE COUPE (PD4)	
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	7.5	193	9.8	40.3	13.5
	Conductivity (uS/cm)	206	182	211	384	210
	pH (pH)	8.22	7.90	8.25	8.58	8.22
	Total Suspended Solids (mg/L)	72.2	29.0	75.8	45.0	93.0
	Total Dissolved Solids (mg/L)	129	170	136	276	133
	Turbidity (NTU)	21.6	48.9	21.6	108	25.7
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	89.6	55.4	93.3	175	93.0
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	15.6	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	89.6	55.4	93.3	191	93.0
	Ammonia, Total (as N) (mg/L)	<0.0050	0.0081	<0.0050	0.0119	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	<0.50	0.57	<0.50	0.77	<0.50
	Fluoride (F) (mg/L)	0.045	0.085	0.048	0.095	0.049
	Nitrate and Nitrite (as N) (mg/L)	0.0534	<0.0051	0.0494	0.0064	0.0472
	Nitrate (as N) (mg/L)	0.0534	<0.0050	0.0494	0.0064	0.0472
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.188	0.720	0.194	0.638	0.223
	Total Nitrogen (mg/L)	0.174	0.648	0.204	0.534	0.214
	Orthophosphate-Dissolved (as P) (mg/L)	0.0013	0.0052	0.0013	0.0017	0.0013
	Phosphorus (P)-Total Dissolved (mg/L)	0.0031	0.0170	0.0032	0.0069	0.0036
	Phosphorus (P)-Total (mg/L)	0.0696	0.0705	0.0836	0.0900	0.0920
	Silicate (as SiO2) (mg/L)	3.99	5.54	3.74	4.82	4.06
Sulfate (SO4) (mg/L)	16.4	31.7	16.6	17.7	17.0	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	3.04	27.2	3.27	12.7	4.00
	Total Organic Carbon (mg/L)	3.11	27.8	3.88	14.9	4.62

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2133123-6 Water 19-JUL-18 16:00 POUCE COUPE (POUCE)	L2133123-7 Water 19-JUL-18 17:00 PEACE AT MANY ISLANDS (PD5)	L2133123-8 Water DUPLICATE 1 (DUP 1)	L2133123-9 Water DUP-1A	L2133123-10 Water TRIP BLANK
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	58.5	11.9	6.9		<5.0
	Conductivity (uS/cm)	612	223	200		<2.0
	pH (pH)	8.48	8.27	8.20		5.47
	Total Suspended Solids (mg/L)	33.8	83.4	81.8		<3.0
	Total Dissolved Solids (mg/L)	424	139	122		<10
	Turbidity (NTU)	53.5	23.8	23.2		<0.10
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	158	99.5	85.8		<1.0
	Alkalinity, Carbonate (as CaCO3) (mg/L)	8.4	<1.0	<1.0		<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0		<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	167	99.5	85.8		<1.0
	Ammonia, Total (as N) (mg/L)	0.0159	<0.0050	0.0055		<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050		<0.050
	Chloride (Cl) (mg/L)	10.0	<0.50	<0.50		<0.50
	Fluoride (F) (mg/L)	0.189	0.053	0.045		<0.020
	Nitrate and Nitrite (as N) (mg/L)	<0.0051	0.0371	0.0535		<0.0051
	Nitrate (as N) (mg/L)	<0.0050	0.0371	0.0535		<0.0050
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010		<0.0010
	Total Kjeldahl Nitrogen (mg/L)	1.07	0.121	0.200		<0.050
	Total Nitrogen (mg/L)	0.977	0.140	0.181		<0.030
	Orthophosphate-Dissolved (as P) (mg/L)	0.0016	0.0010	0.0012		<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	0.0128	0.0034	0.0023		<0.0020
	Phosphorus (P)-Total (mg/L)	0.0780	0.0068	0.0673		<0.0020
	Silicate (as SiO2) (mg/L)	0.96	3.78	4.11		<0.50
Sulfate (SO4) (mg/L)	134	18.8	16.4		<0.30	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	21.0	3.73	3.26	2.82	
	Total Organic Carbon (mg/L)	24.1	3.65	3.46		<0.50 ^{HTP}

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2133123-11 Water FIELD BLANK	L2133123-12 Water FIELD 1A		
Grouping	Analyte				
WATER					
Physical Tests	Colour, True (CU)	<5.0			
	Conductivity (uS/cm)	<2.0			
	pH (pH)	5.67			
	Total Suspended Solids (mg/L)	<3.0			
	Total Dissolved Solids (mg/L)	<10			
	Turbidity (NTU)	0.17 ^{RRV}			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<1.0			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)	<1.0			
	Ammonia, Total (as N) (mg/L)	<0.0050			
	Bromide (Br) (mg/L)	<0.050			
	Chloride (Cl) (mg/L)	<0.50			
	Fluoride (F) (mg/L)	<0.020			
	Nitrate and Nitrite (as N) (mg/L)	<0.0051			
	Nitrate (as N) (mg/L)	<0.0050			
	Nitrite (as N) (mg/L)	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	<0.050			
	Total Nitrogen (mg/L)	<0.030			
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010			
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020			
	Phosphorus (P)-Total (mg/L)	<0.0020			
	Silicate (as SiO2) (mg/L)	<0.50			
	Sulfate (SO4) (mg/L)	<0.30			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	<0.50	<0.50		
	Total Organic Carbon (mg/L)	<0.50			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Total Nitrogen	B	L2133123-1, -10, -11, -3, -8
Matrix Spike	Dissolved Organic Carbon	MS-B	L2133123-1
Matrix Spike	Phosphorus (P)-Total	MS-B	L2133123-1, -10, -11, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Silicate (as SiO ₂)	MS-B	L2133123-1, -10, -2, -3, -4, -5, -6, -7, -8

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
HTP	Sample preparation or preservation hold time was exceeded.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0
This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.			
Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Weston et			

Reference Information

al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Reference Information

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Report To			Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)															
Company: Tetrtech			Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge															
Contact: Danielle MacDonald			Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No																		
Address: 14940-123 Ave NW Edmonton, AB T5V 1B4			<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked																		
Phone: 780-886-3055			Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																		
			Email 1 or Fax: danielle.macdonald@tetrtech.com			Specify Date Required for E2,E or P:															
			Email 2:																		
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below															
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																		
Company:			Email 1 or Fax: ebaaccounts payable@tetrtech.com																		
Contact:			Email 2: danielle.macdonald@tetrtech.com																		
Project Information			Oil and Gas Required Fields (client use)																		
ALS Quote #: Q53931			Approver ID:																		
Job #: VENW003060 - 02,002			GL Account:																		
PO / AFE:			Routing Code:																		
LSD:			Activity Code:																		
			Location:																		
ALS Lab Work Order # (lab use only) L2133123			ALS Contact: Brent Mack			Sampler: Danielle MacDonald															
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alk-Species	Color-True	EC, pH, TSS, TDS-Calc	Turbidity, Silicate	Ortho PO4, Ion Balance	TOC, TN, TP, TDP, TKN, NH3	DOC	Total Metals (CCME+CP+Hardness)	Dissolved Metals (CCME+CP+Hardness)	Total Hg (ultra low detection limit)	Dissolved Hg (ultra low detection limit)	Total MerHg (ultra low detection limit)	Dissolved MerHg (ultra low detection limit)	Chlorophylla	Number of Containers	
	Peace at Beaton (PD2)		July	1145	Water	R	R	R	R	R	R										3
	Beaton River (Beaton)		198	1255	Water	R	R	R	R	R	R										3
	Peace at Kiskatinaw (PD3)		2018	1330	Water	R	R	R	R	R	R										3
	Kiskatinaw River (KR)			1340	Water	R	R	R	R	R	R										3
	Peace at Pouce Coupe (PD4)			1515	Water	R	R	R	R	R	R										3
	Pouce Coupe (Pouce)			1600	Water	R	R	R	R	R	R										3
	Peace at Many Islands (PD5)			1700	Water	R	R	R	R	R	R										3
	Duplicate 7 (DUPE)					R	R	R	R	R	R										3
	DUPE - DUPE IA					R	R	R	R	R	R										3
	TRIP BLANK					R	R	R	R	R	R										2
	FIELD BLANK					R	R	R	R	R	R										4
	FIELD IA					R	R	R	R	R	R								R		1
Drinking Water (DW) Samples (client use)			Special Instructions / Specify Criteria to add on report (client use)			SAMPLE CONDITION AS RECEIVED (lab use only)															
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater, aquatic life. samples were taken from surface water.			Frozen <input type="checkbox"/>					SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>					Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>					
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Field IA + DUPE IA analyze for DOC only			Cooling Initiated <input type="checkbox"/>					INITIAL COOLER TEMPERATURES °C: 50C					FINAL COOLER TEMPERATURES °C					
SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)															
Released by: [Signature] Date: July 19/18 Time: 20:30			Received by: [Signature] Date: July 20/18 Time: 9:05 AM			Received by:					Date:										
REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION																					
WHITE - LABORATORY COPY										YELLOW - CLIENT COPY											



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 01-AUG-18
Report Date: 13-AUG-18 11:46 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2139662
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060-02.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
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ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2139662-1	L2139662-2	L2139662-3	L2139662-4	L2139662-5
		Description	Water	Water	Water	Water	Water
		Sampled Date	31-JUL-18	31-JUL-18	31-JUL-18	31-JUL-18	31-JUL-18
		Sampled Time	13:30	14:30	17:30	18:30	
		Client ID	WILLISTON SHALLOW (W1-SHALLOW)	WILLISTON DEEP (W1 - DEEP)	DINOSAUR SHALLOW (D1 - SHALLOW)	DINOSAUR DEEP (D1 - DEEP)	DUPLICATE 2 (DUP 2)
Grouping	Analyte						
FILTER							
Plant Pigments	Chlorophyll a (ug/L)	1.15	0.286	0.872	1.03	0.799	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2139662-1 Water 31-JUL-18 13:30 WILLISTON SHALLOW (W1- SHALLOW)	L2139662-2 Water 31-JUL-18 14:30 WILLISTON DEEP (W1 - DEEP)	L2139662-3 Water 31-JUL-18 17:30 DINOSAUR SHALLOW (D1 - SHALLOW)	L2139662-4 Water 31-JUL-18 18:30 DINOSAUR DEEP (D1 - DEEP)	L2139662-5 Water DUPLICATE 2 (DUP 2)
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	6.5	7.8	19.3	9.6	17.0
	Conductivity (uS/cm)	171	169	173	183	180
	pH (pH)	8.19	8.20	8.19	8.24	8.25
	Total Suspended Solids (mg/L)	<3.0	<3.0	4.5	10.9	4.8
	Total Dissolved Solids (mg/L)	108	103	110	112	112
	Turbidity (NTU)	1.71	1.72	16.5	18.2	16.4
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	77.5	78.5	81.1	85.0	83.5
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	77.5	78.5	81.1	85.0	83.5
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Fluoride (F) (mg/L)	0.036	0.034	0.045	0.038	0.045
	Nitrate and Nitrite (as N) (mg/L)	0.0528	0.0577	0.0506	0.0704	0.0499
	Nitrate (as N) (mg/L)	0.0528	0.0577	0.0506	0.0686	0.0499
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	0.0017	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.076	0.068	0.142	0.087	0.122
	Total Nitrogen (mg/L)	0.125	0.171	0.198	0.156	0.192
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	0.0012	0.0020	0.0013
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020	<0.0020	0.0044	0.0041	0.0045
	Phosphorus (P)-Total (mg/L)	0.0052	0.0055	0.0237	0.0124	0.0200
	Silicate (as SiO2) (mg/L)	3.98	3.81	4.40	4.25	4.39
	Sulfate (SO4) (mg/L)	12.7	12.7	13.6	13.8	13.6
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.80	2.73	4.26	3.19	4.09
	Total Organic Carbon (mg/L)	2.73	3.01	4.59	3.66	4.59

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	Sample ID	Description	Sampled Date	Sampled Time	Client ID
		L2139662-6	Water	31-JUL-18	20:00	PEACE CANYON (PC1)
WATER						
Physical Tests	Colour, True (CU)		10.0			
	Conductivity (uS/cm)		180			
	pH (pH)		8.09			
	Total Suspended Solids (mg/L)		13.1			
	Total Dissolved Solids (mg/L)		114			
	Turbidity (NTU)		21.1			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)		87.3			
	Alkalinity, Carbonate (as CaCO3) (mg/L)		<1.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)		<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)		87.3			
	Ammonia, Total (as N) (mg/L)		0.0073			
	Bromide (Br) (mg/L)		<0.050			
	Chloride (Cl) (mg/L)		<0.50			
	Fluoride (F) (mg/L)		0.040			
	Nitrate and Nitrite (as N) (mg/L)		0.0684			
	Nitrate (as N) (mg/L)		0.0672			
	Nitrite (as N) (mg/L)		0.0012			
	Total Kjeldahl Nitrogen (mg/L)		0.152			
	Total Nitrogen (mg/L)		0.185			
	Orthophosphate-Dissolved (as P) (mg/L)		0.0021			
	Phosphorus (P)-Total Dissolved (mg/L)		0.0044			
	Phosphorus (P)-Total (mg/L)		0.0322			
	Silicate (as SiO2) (mg/L)		4.24			
	Sulfate (SO4) (mg/L)		13.8			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)		3.23			
	Total Organic Carbon (mg/L)		3.65			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Dissolved Organic Carbon	MS-B	L2139662-1, -2, -3, -4, -5, -6
Matrix Spike	Dissolved Organic Carbon	MS-B	L2139662-1, -2, -3, -4, -5, -6
Matrix Spike	Total Organic Carbon	MS-B	L2139662-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0
This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.			
Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
----------------------------	---------------------

VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA
----	---

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



ALS Environmental

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Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L2139662-COFC

COC Number: 14

Page 1 of 1

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																
Company: Tetratech		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																
Contact: Danielle MacDonald		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT																
Address: 14940-123 Ave NW Edmonton, AB T5V 1B4		<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																
Phone: 780-886-3055		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																
		Email 1 or Fax: danielle.macdonald@tetratech.com			Specify Date Required for E2, E or P:																
		Email 2			Analysis Request																
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																			
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: ebaaccounts@tetratech.com																			
Company:		Email 2: danielle.macdonald@tetratech.com																			
Contact:																					
Project Information					Oil and Gas Required Fields (client use)																
ALS Quote #: Q53931		Approver ID:			Cost Center:																
Job #: VENW03060-02.002		GL Account:			Routing Code:																
PO / AFE:		Activity Code:																			
LSD:		Location:																			
ALS Lab Work Order # (lab use only) L2139662		ALS Contact: Brent Mack			Sampler: D. MacDonald																
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alk-Species	Color-True	Turbidity	TOC, TN, TP, TDP, TKN, NH3	DOC	Total Metals (CCME+ICP+Hardness)	Dissolved Metals (CGME+ICP+Hardness)	Total Hg (ultra low detection limit)	Dissolved Hg (ultra low detection limit)	Total MeHg (ultra low detection limit)	Dissolved MeHg (ultra low detection limit)	chlorophyll a (field filtered 250 mL)	Number of Containers		
	Williston Shallow (W1 - Shallow)			July	13:30	Water	R	R	R	R	R								R	4	
	Williston Deep (W1 - Deep)			31	14:30	Water	R	R	R	R	R								R	4	
	Dinosaur Shallow (D1 - Shallow)			31	17:30	Water	R	R	R	R	R								R	4	
	Dinosaur Deep (D1 - Deep)			2018	18:30	Water	R	R	R	R	R								R	4	
	Duplicate (DUP)					Water	R	R	R	R	R								R	4	
	Peace Canyon (PCI)				20:00	Water	R	R	R	R	R									3	
Drinking Water (DW) Samples¹ (client use)				Special Instructions / Specify Criteria to add on report (client use)				SAMPLE CONDITION AS RECEIVED (lab use only)													
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources.				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>													
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No								Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>													
								Cooling Initiated <input type="checkbox"/>													
								INITIAL COOLER TEMPERATURES °C						FINAL COOLER TEMPERATURES °C							
								2°C						3 4							
SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)													
Released by: [Signature]		Date: July 31/18		Time: 10:30		Received by: [Signature]		Date: Aug 01/18		Time: 9:00 AM		Received by: JC				Date: 8/2/18		Time: 10:10 AM			



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 30-JUL-18
Report Date: 13-AUG-18 11:45 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2138784
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060-02.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2138784-1 Water 30-JUL-18 14:48 HALFWAY RIVER - DOWNSTREAM - (HD)	L2138784-2 Water 30-JUL-18 14:21 MIDDLE SITE C RESERVOIR (PR2)	L2138784-3 Water 30-JUL-18 12:48 UPPER SITE C RESERVOIR (PR1)		
Grouping	Analyte				
WATER					
Physical Tests	Colour, True (CU)	18.9	11.6	9.4	
	Conductivity (uS/cm)	379	191	184	
	pH (pH)	8.45	8.20	8.18	
	Total Suspended Solids (mg/L)	69.8	9.2	6.0	
	Total Dissolved Solids (mg/L)	249	121	115	
	Turbidity (NTU)	67.3	9.80	5.42	
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	164	87.9	84.1	
	Alkalinity, Carbonate (as CaCO3) (mg/L)	9.2	<1.0	<1.0	
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	
	Alkalinity, Total (as CaCO3) (mg/L)	173	87.9	84.1	
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	0.0062	
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	
	Fluoride (F) (mg/L)	0.098	0.041	0.039	
	Nitrate and Nitrite (as N) (mg/L)	<0.0051	0.0552	0.0613	
	Nitrate (as N) (mg/L)	<0.0050	0.0552	0.0613	
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	
	Total Kjeldahl Nitrogen (mg/L)	0.244 ^{RRV}	0.120	0.113	
	Total Nitrogen (mg/L)	0.192 ^{RRV}	0.216	0.150	
	Orthophosphate-Dissolved (as P) (mg/L)	0.0045	0.0016	0.0013	
	Phosphorus (P)-Total Dissolved (mg/L)	0.0057	0.0028	0.0021	
	Phosphorus (P)-Total (mg/L)	0.0948	0.0195	0.0100	
	Silicate (as SiO2) (mg/L)	3.98	4.25	4.13	
	Sulfate (SO4) (mg/L)	39.3	14.0	13.3	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	5.46	3.94	3.10	
	Total Organic Carbon (mg/L)	6.56	4.00	3.28	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Dissolved Organic Carbon	MS-B	L2138784-1, -2
Matrix Spike	Dissolved Organic Carbon	MS-B	L2138784-3
Matrix Spike	Total Organic Carbon	MS-B	L2138784-1, -2
Matrix Spike	Total Organic Carbon	MS-B	L2138784-3
Matrix Spike	Fluoride (F)	MS-B	L2138784-1, -2, -3
Matrix Spike	Total Nitrogen	MS-B	L2138784-1, -2, -3
Matrix Spike	Sulfate (SO4)	MS-B	L2138784-1, -2, -3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

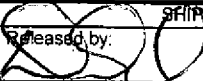

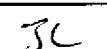
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																
Company: Tetrattech		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																
Contact: Danielle MacDonald		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT																
Address: 14940-123 Ave NW		<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																
Edmonton, AB T5V 1B4		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																
Phone: 780-886-3055		Email 1 or Fax: danielle.macdonald@tetrattech.com			Specify Date Required for E2, E or P:																
		Email 2:			Analysis Request																
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																			
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: ebaaccounts@tetrattech.com																			
Company:		Email 2: danielle.macdonald@tetrattech.com																			
Contact:																					
Project Information		Oil and Gas Required Fields (client use)																			
ALS Quote #: Q53931		Approver ID:																			
Job #: VENW03060 - 02.002		GL Account:																			
PO / AFE:		Activity Code:																			
LSD:		Location:																			
ALS Lab Work Order # (lab use only) L2138784		ALS Contact: Brent Mack		Sampler: D MacDonald																	
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alk-Species/Anions by IC, NO2+NO3/Calc	Color-True, EC, pH, TSS, TDS-Calc	Turbidity, Silicate, Ortho PO4, Ion Balance	TOC, TN, TP, YDP, TKN, NH3	DOC	Total Metals (Cd, Cu, Fe, Pb, Hg, Mn, Ni, Zn)	Dissolved Metals (As, Ba, Be, Bi, Br, Ca, Cd, Co, Cr, Cs, K, Li, Mg, Mn, Mo, Ni, Pb, Se, Sr, Tl, U, V, Zn)	Total Hg (ultra-low detection limit)	Dissolved Hg (ultra-low detection limit)	Total Hg (ultra-low detection limit)	Dissolved Hg (ultra-low detection limit)	Total Coliform, E. coli, HPC	Ferrous Iron	Number of Containers	
	Halfway River - Downstream (HD)			July 30 2018	14:48	Water	R	R	R	R	R										3
	Middle Site C Reservoir (PR2)			July 30 2018	14:21	Water	R	R	R	R	R										3
	Lower Canyon (PR1)					Water	R	R	R	R	R										
	Upper Site C Reservoir (PR1)			July 30 2018	12:48	Water	R	R	R	R	R										3
	Upper Site C Reservoir (PR2)					Water	R	R	R	R	R										
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)																			
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources.																			
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No																					
SHIPMENT RELEASE (client use)		SAMPLE CONDITION AS RECEIVED (lab use only)																			
Released by: 		Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																			
Date: July 30/18		Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																			
Time: 16:30		Cooling Initiated <input type="checkbox"/>																			
		INITIAL COOLER TEMPERATURES °C: 8																			
		FINAL COOLER TEMPERATURES °C: 6, 3																			
INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																			
Received by: 		Received by: 																			
Date: July 30/18		Date: AUG - 1 2018																			
Time: 16:30		Time: 12:10 pm																			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326-v09 From 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 02-AUG-18
Report Date: 13-AUG-18 15:12 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2140599
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060-02.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2140599-1 WATER 02-AUG-18 09:39 MOBERLY RIVER - DOWNSTREAM - (MD)	L2140599-2 WATER 02-AUG-18 09:15 LOWER SITE C RESERVOIR (PR3)	L2140599-3 WATER 02-AUG-18 10:12 PEACE AT PINE (PD1)	L2140599-4 WATER 02-AUG-18 10:47 PINE RIVER (PINE)	L2140599-5 WATER TRIP	
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	48.1	10.6	12.5	18.9	<5.0
	Conductivity (uS/cm)	198	192	200	290	<2.0
	pH (pH)	8.15	8.11	8.07	8.35	5.65
	Total Suspended Solids (mg/L)	214	44.4	69.2	37.2	<3.0
	Total Dissolved Solids (mg/L)	163	122	131	185	<10
	Turbidity (NTU)	188	20.9	35.1	46.5	<0.10
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	109	92.2	94.2	144	<1.0
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	5.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	109	92.2	94.2	149	<1.0
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	0.71	<0.50
	Fluoride (F) (mg/L)	0.070	0.038	0.044	0.074	<0.020
	Nitrate and Nitrite (as N) (mg/L)	0.0191	0.0611	0.0582	0.0675	<0.0051
	Nitrate (as N) (mg/L)	0.0191	0.0611	0.0582	0.0675	<0.0050
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.558	0.164	0.213	0.205	<0.050
	Total Nitrogen (mg/L)	0.458	0.186	0.214	0.253	<0.030
	Orthophosphate-Dissolved (as P) (mg/L)	0.0045	0.0017	0.0021	0.0025	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	0.0106	0.0033	0.0040	0.0051	<0.0020
	Phosphorus (P)-Total (mg/L)	0.207	0.0656	0.0974	0.0564	<0.0020
	Silicate (as SiO2) (mg/L)	3.69	4.30	4.27	3.85	<0.50
Sulfate (SO4) (mg/L)	8.21	14.8	15.4	19.1	<0.30	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	8.74	3.32	3.41	4.51	
	Total Organic Carbon (mg/L)	12.0	3.72	4.80	5.58	<0.50

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Dissolved Organic Carbon	MS-B	L2140599-1, -2, -3, -4
Matrix Spike	Dissolved Organic Carbon	MS-B	L2140599-1, -2, -3, -4
Matrix Spike	Total Organic Carbon	MS-B	L2140599-1, -2, -3, -4, -5
Matrix Spike	Total Organic Carbon	MS-B	L2140599-1, -2, -3, -4, -5

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Weston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus

Reference Information

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Report To		Report Form:		(Rush Turnaround Time (TAT) is not available for all tests)																
Company: Tetratech		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)		R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																
Contact: Danielle MacDonald		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT																
Address: 14940-123 Ave NW Edmonton, AB T5V 1B4		<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked		E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																
Phone: 780-886-3055		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																
		Email 1 or Fax: danielle.macdonald@tetratech.com		Specify Date Required for E2, E or P:																
		Email 2:		Analysis Request																
Invoice To: Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Invoice Distribution:		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below						Number of Containers										
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																		
Company:		Email 1 or Fax: ebaaccounts@tetratech.com																		
Contact:		Email 2: danielle.macdonald@tetratech.com																		
Project Information		Oil and Gas Required Fields (client use)																		
ALS Quote #: Q53931		Approver ID:		Cost Center:																
Job #: VENW03060-02-002		GL Account:		Routing Code:																
PO / AFE:		Activity Code:																		
LSD:		Location:																		
ALS Lab Work Order # (lab use only) L2140599		ALS Contact: Brent Mack		Sampler: Danielle MacDonald																
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type														
	Moberly River - Downstream (MD)			AUG	0939	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	3
	Lower Site C Reservoir (PR3)			2	0915	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	3
	Peace at Pine (PD1)			2018	1012	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	3
	Pine River (Pine)			↓	1047	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	3
	TRIP			-	-	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	2
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)		SAMPLE CONDITION AS RECEIVED (lab use only)																
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources.		Frozen <input type="checkbox"/>		SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>														
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/>		Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>														
				Cooling Initiated <input type="checkbox"/>		INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C												
				15°C		1.4		4												
								6												
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																
Released by: [Signature]		Received by: [Signature]		Received by: JC		[Signature]														
Date: Aug 2/18		Date: Aug 2/18		Date: 8/3/18		Time: 1105AM														
Time: 1310		Time: 1310		Time: 1310																

B



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 02-AUG-18
Report Date: 14-AUG-18 17:46 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2140393
Project P.O. #: NOT SUBMITTED
Job Reference: VENW003060-02.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2140393-9 WATER 01-AUG-18 19:00 FIELD				
Grouping	Analyte				
FILTER					
Plant Pigments	Chlorophyll a (ug/L)	<0.010			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2140393-1 WATER 01-AUG-18 10:23 PEACE AT BEATTON (PD2)	L2140393-2 WATER 01-AUG-18 11:05 BEATTON RIVER (BEATTON)	L2140393-3 WATER 01-AUG-18 12:25 PEACE AT KISKATINAW (PD3)	L2140393-4 WATER 01-AUG-18 12:47 KISKATINAW RIVER (KR)	L2140393-5 WATER 01-AUG-18 13:22 PEACE AT POUCE COUPE (PD4)	
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	17.7	160	18.3	78.3	19.4
	Conductivity (uS/cm)	236	239	228	287	223
	pH (pH)	8.29	8.14	8.28	8.37	8.18
	Total Suspended Solids (mg/L)	80.6	28.4	82.4	754	85.8
	Total Dissolved Solids (mg/L)	171	225	151	361	143
	Turbidity (NTU)	50.6	59.5	47.8	985	57.2
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	111	84.1	109	160	102
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	4.8	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	111	84.1	109	164	102
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	0.0493	0.0060
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	<0.50	0.98	<0.50	1.24	<0.50
	Fluoride (F) (mg/L)	0.062	0.110	0.060	0.096	0.058
	Nitrate and Nitrite (as N) (mg/L)	0.0579	<0.0051	0.0556	0.0218	0.0540
	Nitrate (as N) (mg/L)	0.0579	<0.0050	0.0556	0.0187	0.0540
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	0.0031	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.249	0.702	0.235	1.53	0.243
	Total Nitrogen (mg/L)	0.235	0.675	0.241	1.31	0.249
	Orthophosphate-Dissolved (as P) (mg/L)	0.0027	0.0049	0.0027	0.0087	0.0029
	Phosphorus (P)-Total Dissolved (mg/L)	0.0048	0.0175	0.0049	0.0153	0.0058
	Phosphorus (P)-Total (mg/L)	0.093	0.0793	0.116	0.584	0.112
	Silicate (as SiO2) (mg/L)	3.82	6.06	4.07	4.78	3.94
	Sulfate (SO4) (mg/L)	18.3	40.5	18.3	15.2	18.8
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	3.85	22.9	4.13	17.4	4.62
	Total Organic Carbon (mg/L)	5.59	25.3	5.62	30.4	5.92

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2140393-6 WATER 01-AUG-18 13:54 POUCE COUPE (POUCE)	L2140393-7 WATER 01-AUG-18 15:07 PEACE AT MANY ISLANDS (PD5)	L2140393-8 WATER 01-AUG-18 12:00 DUPLICATE 1 (DUP 1)	L2140393-9 WATER 01-AUG-18 19:00 FIELD	
Grouping	Analyte				
WATER					
Physical Tests	Colour, True (CU)	130	27.5	18.5	<5.0
	Conductivity (uS/cm)	310	238	238	<2.0
	pH (pH)	7.93	8.21	8.31	5.54
	Total Suspended Solids (mg/L)	3480	347	86.2	<3.0
	Total Dissolved Solids (mg/L)	304	202	161	<10
	Turbidity (NTU)	>4000 ^{TMV}	393	47.5	0.16 ^{RRV}
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	117	110	109	<1.0
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	2.6	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	117	110	112	<1.0
	Ammonia, Total (as N) (mg/L)	0.0919	0.0165	<0.0050	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	5.41	0.67	<0.50	<0.50
	Fluoride (F) (mg/L)	0.169	0.071	0.061	<0.020
	Nitrate and Nitrite (as N) (mg/L)	0.192	0.0641	0.0576	<0.0051
	Nitrate (as N) (mg/L)	0.183	0.0631	0.0576	<0.0050
	Nitrite (as N) (mg/L)	0.0098	0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	1.06	0.618	0.258	<0.050
	Total Nitrogen (mg/L)	2.65	0.61 ^{RRV}	0.253	<0.030
	Orthophosphate-Dissolved (as P) (mg/L)	0.0138	0.0063	0.0026	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	0.0325	0.0094	0.0040	<0.0020
	Phosphorus (P)-Total (mg/L)	2.04	0.376	0.098	<0.0020
	Silicate (as SiO2) (mg/L)	5.88	3.90	3.99	<0.50
	Sulfate (SO4) (mg/L)	66.3	21.5	18.3	<0.30
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	26.7	6.20	4.13	<0.50
	Total Organic Carbon (mg/L)	85.8	13.6	5.31	<0.50

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Dissolved Organic Carbon	B	L2140393-1
Matrix Spike	Dissolved Organic Carbon	MS-B	L2140393-2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Dissolved Organic Carbon	MS-B	L2140393-2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Dissolved Organic Carbon	MS-B	L2140393-1
Matrix Spike	Dissolved Organic Carbon	MS-B	L2140393-1
Matrix Spike	Total Organic Carbon	MS-B	L2140393-2, -3, -5, -7, -8, -9
Matrix Spike	Total Organic Carbon	MS-B	L2140393-1
Matrix Spike	Total Organic Carbon	MS-B	L2140393-1
Matrix Spike	Phosphorus (P)-Total	MS-B	L2140393-1, -2, -3, -4, -5, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis
TMV	Turbidity exceeded upper limit of the nephelometric method. Minimum value reported.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0
This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174

Reference Information

This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

Reference Information

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



L2140393-COFC

Request Form

Report To			Report Format / Distribution				Rush Turnaround Time (TAT) is not available for all tests																																																									
Company: Tetrattech			Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)				R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																																																									
Contact: Danielle MacDonald			Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT																																																									
Address: 14940-123 Ave NW Edmonton, AB T5V 1B4			<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked				E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																																																									
Phone: 780-886-3055			Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX				E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																																																									
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Invoice Distribution				Specify Date Required for E2, E or P:																																																									
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																																																													
Company:			Email 1 or Fax ebaaccounts payable@tetrattech.com				<table border="1" style="width:100%; border-collapse: collapse; font-size: small;"> <tr> <td colspan="12" style="text-align: center;">Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td>P</td><td>F/P</td><td>P</td><td>F/P</td><td>P</td><td>F/P</td><td>P</td><td>F/P</td><td></td><td></td><td></td><td></td> </tr> <tr> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">Alk-Species</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Anions by IC</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">NO2+NO2Calc</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Color-True</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">EC, pH, TSS, TDS-Calc</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Turbidity, Silicate, Ortho PO4, Ion Balance</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">TOC, TN, TP, TDP, TKN, NH3</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">DOC</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Total Metals (CCME+ICP+Hardness)</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Dissolved Metals (CCME+ICP+Hardness)</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Total Hg (ultra low detection limit)</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Dissolved Hg (ultra low detection limit)</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Total MeHg (ultra low detection limit)</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Dissolved MeHg (ultra low detection limit)</td><td></td><td></td><td></td><td></td> </tr> </table>										Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																		P	F/P	P	F/P	P	F/P	P	F/P					Alk-Species	Anions by IC	NO2+NO2Calc	Color-True	EC, pH, TSS, TDS-Calc	Turbidity, Silicate, Ortho PO4, Ion Balance	TOC, TN, TP, TDP, TKN, NH3	DOC	Total Metals (CCME+ICP+Hardness)	Dissolved Metals (CCME+ICP+Hardness)	Total Hg (ultra low detection limit)	Dissolved Hg (ultra low detection limit)	Total MeHg (ultra low detection limit)	Dissolved MeHg (ultra low detection limit)				
Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																																
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Contact:			Email 2 danielle.macdonald@tetrattech.com																																																													
Project Information			Oil and Gas Required Fields (client use)				Chloey Surface Water Sample Form of Containers																																																									
ALS Quote #: Q53931			Approver ID:		Cost Center:																																																											
Job #: VENW003060-02.002			GL Account:		Routing Code:																																																											
PO / AFE:			Activity Code:																																																													
LSD:			Location:																																																													
ALS Lab Work Order # (lab use only) L2140393			ALS Contact: Brent Mack		Sampler: D. Macdonald																																																											
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																																																										
	Peace at Bearton (PD2)			AUG	10:23	Water	R	R	R	R	R											3																																										
	Bearton River (Bearton)			1	11:05	Water	R	R	R	R	R											3																																										
	Peace at Kiskatinaw (PD3)			2018	12:25	Water	R	R	R	R	R											3																																										
	Kiskatinaw River (KR)			1	12:47	Water	R	R	R	R	R											3																																										
	Peace at Pouce Coupe (PD4)			1	13:22	Water	R	R	R	R	R											3																																										
	Pouce Coupe (Pouce)			1	13:54	Water	R	R	R	R	R											3																																										
	Peace at Many Islands (PD5)			1	15:07	Water	R	R	R	R	R											3																																										
	DUPLICATE 1 (DUPI) Field			↓	-	Water	R	R	R	R	R											3																																										
				↓	1900	Water	R	R	R	R	R									R		4																																										
Drinking Water (DW) Samples (client use)			Special Instructions / Specify Criteria to add on report (client use)				SAMPLE CONDITION AS RECEIVED (lab use only)																																																									
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life. samples were taken from surface water				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																																																									
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No							Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																																																									
							Cooling Initiated <input type="checkbox"/>					INITIAL COOLER TEMPERATURES °C					FINAL COOLER TEMPERATURES °C																																															
							8/10°C					1					4, 4, 6																																															
SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)																																																									
Released by: [Signature]			Date: AUG 1 / 18		Time: 2:00		Received by: Shybin				Date: Aug 02 / 18		Time: 9:00am		Received by: JC				Date: AUG - 3 2018		Time: 11:05AM																																											



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 11-SEP-18
Report Date: 24-SEP-18 16:41 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2162370
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060-02.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2162370-1 Water 11-SEP-18 14:00 WILLISTON SHALLOW (W1- SHALLOW)	L2162370-2 Water 11-SEP-18 14:30 WILLISTON SHALLOW (W1- DEEP)	L2162370-3 Water 11-SEP-18 11:30 DINOSAUR SHALLOW (D1- SHALLOW)	L2162370-4 Water 11-SEP-18 12:00 DINOSAUR DEEP (D1-DEEP)	L2162370-5 Water 11-SEP-18 DUPLICATE 2 (DUP 2)
Grouping	Analyte					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	1.61	0.160	1.45	1.32	1.45

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2162370-1 Water 11-SEP-18 14:00 WILLISTON SHALLOW (W1- SHALLOW)	L2162370-2 Water 11-SEP-18 14:30 WILLISTON SHALLOW (W1- DEEP)	L2162370-3 Water 11-SEP-18 11:30 DINOSAUR SHALLOW (D1- SHALLOW)	L2162370-4 Water 11-SEP-18 12:00 DINOSAUR DEEP (D1-DEEP)	L2162370-5 Water 11-SEP-18 DUPLICATE 2 (DUP 2)
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	5.8	6.6	6.2	8.1	7.2
	Conductivity (uS/cm)	173	175	181	181	182
	pH (pH)	8.20	8.19	8.20	8.20	8.21
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0	<3.0
	Total Dissolved Solids (mg/L)	107	103	107	104	104
	Turbidity (NTU)	0.48	0.49	1.08	1.07	1.21
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	81.8	81.0	83.1	83.3	83.6
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	81.8	81.0	83.1	83.3	83.6
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50
	Fluoride (F) (mg/L)	0.035	0.036	0.038	0.036	0.038
	Nitrate and Nitrite (as N) (mg/L)	0.0481	0.0483	0.0607	0.0607	0.0596
	Nitrate (as N) (mg/L)	0.0453	0.0454	0.0595	0.0595	0.0585
	Nitrite (as N) (mg/L)	0.0027	0.0029	0.0012	0.0011	0.0011
	Total Kjeldahl Nitrogen (mg/L)	0.120	0.106	0.103	0.103	0.114
	Total Nitrogen (mg/L)	0.147	0.146	0.146	0.148	0.155
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	0.0010	0.0012	<0.0010	<0.0010
	Phosphorus (P)-Total Dissolved (mg/L)	0.0022	<0.0020	<0.0020	<0.0020	<0.0020
	Phosphorus (P)-Total (mg/L)	0.0035	0.0035	0.0030	0.0034	0.0049
	Silicate (as SiO2) (mg/L)	4.31	4.11	4.26	4.52	4.27
Sulfate (SO4) (mg/L)	12.7	12.7	13.7	13.7	13.7	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.91	2.91	2.68	2.88	2.79
	Total Organic Carbon (mg/L)	2.84	3.00	2.87	2.94	2.97

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2162370-6			
		Water			
		11-SEP-18			
		10:20			
		PEACE CANYON (PC1)			
Grouping	Analyte				
WATER					
Physical Tests	Colour, True (CU)	6.1			
	Conductivity (uS/cm)	189			
	pH (pH)	8.21			
	Total Suspended Solids (mg/L)	<3.0			
	Total Dissolved Solids (mg/L)	112			
	Turbidity (NTU)	1.11			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	86.4			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)	86.4			
	Ammonia, Total (as N) (mg/L)	<0.0050			
	Bromide (Br) (mg/L)	<0.050			
	Chloride (Cl) (mg/L)	0.50			
	Fluoride (F) (mg/L)	0.038			
	Nitrate and Nitrite (as N) (mg/L)	0.0625			
	Nitrate (as N) (mg/L)	0.0625			
	Nitrite (as N) (mg/L)	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	0.101			
	Total Nitrogen (mg/L)	0.145			
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010			
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020			
	Phosphorus (P)-Total (mg/L)	0.0037			
	Silicate (as SiO2) (mg/L)	4.62			
	Sulfate (SO4) (mg/L)	14.0			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.82			
	Total Organic Carbon (mg/L)	2.76			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Dissolved Organic Carbon	MS-B	L2162370-1, -2, -3, -4, -5, -6
Matrix Spike	Total Organic Carbon	MS-B	L2162370-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0
This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

Reference Information

P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
<p>This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.</p> <p>Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.</p> <p>Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.</p>			
P-TD-COL-VA	Water	Total Dissolved P in Water by Colour	APHA 4500-P Phosphorus
<p>This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.</p> <p>Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.</p> <p>Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.</p>			
PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value
<p>This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode</p> <p>It is recommended that this analysis be conducted in the field.</p>			
PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus
<p>This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.</p> <p>Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.</p> <p>Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.</p>			
SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.
<p>This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.</p>			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC
<p>This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.</p>			
TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.
<p>This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.</p>			
TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC
<p>This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.</p> <p>Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.</p>			
TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity
<p>This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.</p>			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Short Holding Time

Rush Processing

658 9878



L2162370-COFC

Page 1 of 1

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Report To	Report Format / Distribution	Analysis Request
Company: Tetratech	Select Report Format: <input type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)	R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)
Contact: Danielle MacDonald	Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address: 14940-123 Ave NW Edmonton, AB T5V 1B4	<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked	E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
Phone: 780-886-3055	Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge
	Email 1 or Fax danielle.macdonald@tetratech.com	Specify Date Required for E2, E or P:
	Email 2 lucas.hennecker@tetratech.com	

Invoice To	Invoice Distribution	Analysis Request																						
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																						
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Email 1 or Fax ebaaccountspayable@tetratech.com																							
Company:	Email 2 danielle.macdonald@tetratech.com																							
Contact:																								
Project Information		Oil and Gas Required Fields (client use)																						
ALS Quote #: Q53931	Approver ID:	Alk-Species Anions by IC, NO2+NO2Calc																						
Job #: VENW03060-02.002	Cost Center:	Color-True, EC, pH, TSS, TDS-Calc	Turbidity, Silicate, Ortho PO4, Ion Balance	TOC, TN, TP, TDP, TKN, NH3	DOC	Total Metals (CCME+CP+Hardness)	Dissolved Metals (CCME+CP+Hardness)	Total Hg (ultra-low-detection limit)	Dissolved Hg (ultra-low-detection limit)	Total Mercury (ultra-low-detection limit)	Dissolved Mercury (ultra-low-detection limit)	Chlorophyll a (field filtered 250 mL)	Number of Containers											
PO/AFE:	Routing Code:																							
LSD:	Location:																							

ALS Lab Work Order # (lab use only)	L2162370	ALS Contact: Brent Mack	Sampler: Lucas Hennecker
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ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	R	R	R	R	R															
	Williston Shallow (W1 - Shallow)	11-Sept-18	14:00	Water	R	R	R	R	R														R	4
	Williston Deep (W1 - Deep)		14:30	Water	R	R	R	R	R														R	4
	Dinosaur Shallow (D1 - Shallow)		11:30	Water	R	R	R	R	R														R	4
	Dinosaur Deep (D1 - Deep)		12:00	Water	R	R	R	R	R														R	4
	Duplicate 1 (DUP1) Duplicate 2 (DUP2)			Water	R	R	R	R	R														R	4
	Peace Canyon (PCI)		10:20	Water	R	R	R	R	R														R	3
	PANALB																							
	Old for Red																							

Drinking Water (DW) Samples (client use)	Special Instructions / Specify Criteria to add on report (client use)	SAMPLE CONDITION AS RECEIVED (lab use only)	
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources. Please add: nich.burnett@bchydro.com brent.finnistead@tetratech.com	Frozen <input type="checkbox"/>	SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Ice packs Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>
		Cooling Initiated <input checked="" type="checkbox"/>	
		INITIAL COOLER TEMPERATURES °C	
		FINAL COOLER TEMPERATURES °C	
		4.8°C	1 7 6

SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)				
Released by: Lucas Hennecker	Date: Sept 11/18	Time: 16:35	Received by: Shybin	Date: Sep 11/18	Time: 4:53	Received by: HA	Date: 9/11/18	Time: 12:25P				



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 13-SEP-18
Report Date: 24-SEP-18 16:49 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2163952
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060-02.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2163952-5 Water 13-SEP-18 11:00 FIELD BLANK				
Grouping	Analyte				
FILTER					
Plant Pigments	Chlorophyll a (ug/L)	<0.010			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L2163952-1	L2163952-2	L2163952-3	L2163952-4	L2163952-5
					Water	Water	Water	Water	Water
		13-SEP-18	08:36		13-SEP-18	13-SEP-18	13-SEP-18	13-SEP-18	13-SEP-18
					08:36	08:58	10:11		11:00
					HALFWAY RIVER - DOWNSTREAM (HD)	MIDDLE SITE C RESERVOIR (PR2)	UPPER SITE C RESERVOIR (PR1)	DUPLICATE 1 (DUP 1)	FIELD BLANK
Grouping	Analyte								
WATER									
Physical Tests	Colour, True (CU)	10.9	6.7	6.2	6.2	<5.0			
	Conductivity (uS/cm)	432	184	181	184	<2.0			
	Hardness (as CaCO3) (mg/L)	230	91.9	90.6	92.1	<0.50			
	pH (pH)	8.46	8.18	8.20	8.21	5.41			
	Total Suspended Solids (mg/L)	33.0	<3.0	<3.0	<3.0	<3.0			
	TDS (Calculated) (mg/L)	258	100	99.2	100	<1.0			
	Turbidity (NTU)	22.2	1.07	0.57	1.14	0.17			RRV
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	181	84.3	84.5	84.3	<1.0			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	11.0	<1.0	<1.0	<1.0	<1.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)	192	84.3	84.5	84.3	<1.0			
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050			
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050			
	Chloride (Cl) (mg/L)	0.52	<0.50	<0.50	<0.50	<0.50			
	Fluoride (F) (mg/L)	0.109	0.038	0.037	0.038	<0.020			
	Nitrate and Nitrite (as N) (mg/L)	<0.0051	0.0577	0.0635	0.0635	<0.0051			
	Nitrate (as N) (mg/L)	<0.0050	0.0577 ^{HTD}	0.0635	0.0635	<0.0050			
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	0.172	0.091	0.084	0.095	<0.050			
	Total Nitrogen (mg/L)	0.137	0.143	0.147	0.147	<0.030			
	Orthophosphate-Dissolved (as P) (mg/L)	0.0028	0.0013	0.0013	0.0013	<0.0010			
	Phosphorus (P)-Total Dissolved (mg/L)	0.0046	0.0034	0.0031	0.0030	<0.0020			RRV
	Phosphorus (P)-Total (mg/L)	0.0418	0.0053	0.0036	0.0038	0.0068			
	Silicate (as SiO2) (mg/L)	3.80	4.19	4.41	4.44	<0.50			
	Sulfate (SO4) (mg/L)	54.3	13.6	13.4	13.6	<0.30			
	Anion Sum (meq/L)	4.99	1.97	1.97	1.97	<0.10			
	Cation Sum (meq/L)	4.79	1.84	1.81	1.84	<0.10			
	Cation - Anion Balance (%)	-2.1	-3.6	-4.3	-3.4	0.0			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	3.53	2.77	2.59	2.54	<0.50			
	Total Organic Carbon (mg/L)	3.64	3.15	2.51	2.85	<0.50			
Bacteriological Tests	E. coli (MPN/100mL)	10	1	<1	3	<1			
	HPC (CFU/1mL)	73	8	9	28	12			
	Coliform Bacteria - Total (MPN/100mL)	317	101	35	70	<1			
Total Metals	Aluminum (Al)-Total (mg/L)	0.678	0.0429	0.0246	0.0480	<0.0050			
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050			
	Arsenic (As)-Total (mg/L)	0.00062	<0.00050	<0.00050	<0.00050	<0.00050			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2163952-6			
		Description	Water			
		Sampled Date	13-SEP-18			
		Sampled Time				
		Client ID	TRIP BLANK			
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	<5.0				
	Conductivity (uS/cm)	<2.0				
	Hardness (as CaCO3) (mg/L)	<0.50 ^{HTC}				
	pH (pH)	5.34				
	Total Suspended Solids (mg/L)	<3.0				
	TDS (Calculated) (mg/L)	<1.0				
	Turbidity (NTU)	<0.10				
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	<1.0				
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0				
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0				
	Alkalinity, Total (as CaCO3) (mg/L)	<1.0				
	Ammonia, Total (as N) (mg/L)	<0.0050				
	Bromide (Br) (mg/L)	<0.050				
	Chloride (Cl) (mg/L)	<0.50				
	Fluoride (F) (mg/L)	<0.020				
	Nitrate and Nitrite (as N) (mg/L)	<0.0051				
	Nitrate (as N) (mg/L)	<0.0050				
	Nitrite (as N) (mg/L)	<0.0010				
	Total Kjeldahl Nitrogen (mg/L)	<0.050				
	Total Nitrogen (mg/L)	<0.030				
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010				
	Phosphorus (P)-Total Dissolved (mg/L)	<0.0020				
	Phosphorus (P)-Total (mg/L)	<0.0020				
	Silicate (as SiO2) (mg/L)	<0.50				
	Sulfate (SO4) (mg/L)	<0.30				
	Anion Sum (meq/L)	<0.10				
	Cation Sum (meq/L)	<0.10				
Cation - Anion Balance (%)	0.0					
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)					
	Total Organic Carbon (mg/L)	<0.50				
Bacteriological Tests	E. coli (MPN/100mL)	<1				
	HPC (CFU/1mL)	<1				
	Coliform Bacteria - Total (MPN/100mL)	<1				
Total Metals	Aluminum (Al)-Total (mg/L)	<0.0050				
	Antimony (Sb)-Total (mg/L)	<0.00050				
	Arsenic (As)-Total (mg/L)	<0.00050				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2163952-1	L2163952-2	L2163952-3	L2163952-4	L2163952-5
		Description	Water	Water	Water	Water	Water
		Sampled Date	13-SEP-18	13-SEP-18	13-SEP-18	13-SEP-18	13-SEP-18
		Sampled Time	08:36	08:58	10:11		11:00
		Client ID	HALFWAY RIVER - DOWNSTREAM (HD)	MIDDLE SITE C RESERVOIR (PR2)	UPPER SITE C RESERVOIR (PR1)	DUPLICATE 1 (DUP 1)	FIELD BLANK
Grouping	Analyte						
WATER							
Total Metals	Barium (Ba)-Total (mg/L)		0.115	0.033	0.031	0.034	<0.020
	Beryllium (Be)-Total (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)		<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B)-Total (mg/L)		<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)		0.0000777	0.0000210	0.0000182	0.0000171	<0.0000050
	Calcium (Ca)-Total (mg/L)		60.6	26.5	25.8	26.1	<0.10
	Chromium (Cr)-Total (mg/L)		0.0013	<0.0010	<0.0010	<0.0010	<0.0010
	Cobalt (Co)-Total (mg/L)		0.00059	<0.00030	<0.00030	<0.00030	<0.00030
	Copper (Cu)-Total (mg/L)		0.0017	<0.0010	<0.0010	<0.0010	<0.0010
	Iron (Fe)-Total (mg/L)		1.01	0.051	0.031	0.055	<0.030
	Lead (Pb)-Total (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Lithium (Li)-Total (mg/L)		0.0082	0.0012	0.0011	0.0012	<0.0010
	Magnesium (Mg)-Total (mg/L)		17.8	6.19	6.14	6.13	<0.10
	Manganese (Mn)-Total (mg/L)		0.0254	0.00190	0.00159	0.00198	0.00021 ^{RRV}
	Mercury (Hg)-Total (mg/L)		<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Total (mg/L)		0.0038	<0.0010	<0.0010	<0.0010	<0.0010
	Nickel (Ni)-Total (mg/L)		0.0035	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total (mg/L)		<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)		<2.0	<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Total (mg/L)		0.00124	0.000245	0.000260	0.000258	<0.000050
	Silicon (Si)-Total (mg/L)		2.84	2.10	2.08	2.16	<0.10
	Silver (Ag)-Total (mg/L)		<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Total (mg/L)		3.6	<2.0	<2.0	<2.0	<2.0
	Strontium (Sr)-Total (mg/L)		0.322	0.103	0.102	0.103	<0.0050
	Thallium (Tl)-Total (mg/L)		0.000027	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)		0.011	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)		0.00091	0.00045	0.00046	0.00046	<0.00020
	Vanadium (V)-Total (mg/L)		0.00332	0.00052	<0.00050	0.00052	<0.00050
	Zinc (Zn)-Total (mg/L)		0.0074	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved Metals	Dissolved Fe2 Filtration Location		FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location		FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)		0.205	0.0128	<0.0050	0.0160	<0.0050
	Antimony (Sb)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Barium (Ba)-Dissolved (mg/L)		0.109	0.036	0.034	0.036	<0.020

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2163952-6	Water	13-SEP-18	TRIP BLANK
Grouping	Analyte				
WATER					
Total Metals	Barium (Ba)-Total (mg/L)	<0.020			
	Beryllium (Be)-Total (mg/L)	<0.00010			
	Bismuth (Bi)-Total (mg/L)	<0.20			
	Boron (B)-Total (mg/L)	<0.10			
	Cadmium (Cd)-Total (mg/L)	<0.0000050			
	Calcium (Ca)-Total (mg/L)	<0.10			
	Chromium (Cr)-Total (mg/L)	<0.0010			
	Cobalt (Co)-Total (mg/L)	<0.00030			
	Copper (Cu)-Total (mg/L)	<0.0010			
	Iron (Fe)-Total (mg/L)	<0.030			
	Lead (Pb)-Total (mg/L)	<0.00050			
	Lithium (Li)-Total (mg/L)	<0.0010			
	Magnesium (Mg)-Total (mg/L)	<0.10			
	Manganese (Mn)-Total (mg/L)	<0.00010			
	Mercury (Hg)-Total (mg/L)	<0.0000050			
	Molybdenum (Mo)-Total (mg/L)	<0.0010			
	Nickel (Ni)-Total (mg/L)	<0.0010			
	Phosphorus (P)-Total (mg/L)	<0.30			
	Potassium (K)-Total (mg/L)	<2.0			
	Selenium (Se)-Total (mg/L)	<0.000050			
	Silicon (Si)-Total (mg/L)	<0.10			
	Silver (Ag)-Total (mg/L)	<0.000020			
	Sodium (Na)-Total (mg/L)	<2.0			
	Strontium (Sr)-Total (mg/L)	<0.0050			
	Thallium (Tl)-Total (mg/L)	<0.000010			
	Tin (Sn)-Total (mg/L)	<0.00050			
	Titanium (Ti)-Total (mg/L)	<0.010			
	Uranium (U)-Total (mg/L)	<0.00020			
	Vanadium (V)-Total (mg/L)	<0.00050			
	Zinc (Zn)-Total (mg/L)	<0.0050			
Dissolved Metals	Dissolved Fe2 Filtration Location				
	Dissolved Mercury Filtration Location				
	Dissolved Metals Filtration Location				
	Aluminum (Al)-Dissolved (mg/L)				
	Antimony (Sb)-Dissolved (mg/L)				
	Arsenic (As)-Dissolved (mg/L)				
	Barium (Ba)-Dissolved (mg/L)				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2163952-1 Water 13-SEP-18 08:36 HALFWAY RIVER - DOWNSTREAM - (HD)	L2163952-2 Water 13-SEP-18 08:58 MIDDLE SITE C RESERVOIR (PR2)	L2163952-3 Water 13-SEP-18 10:11 UPPER SITE C RESERVOIR (PR1)	L2163952-4 Water 13-SEP-18 DUPLICATE 1 (DUP 1)	L2163952-5 Water 13-SEP-18 11:00 FIELD BLANK	
Grouping	Analyte					
WATER						
Dissolved Metals	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Dissolved (mg/L)	0.0000428	0.0000132	0.0000117	0.0000127	<0.0000050
	Calcium (Ca)-Dissolved (mg/L)	62.4	26.5	26.1	26.6	<0.10
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cobalt (Co)-Dissolved (mg/L)	0.00034	<0.00030	<0.00030	<0.00030	<0.00030
	Copper (Cu)-Dissolved (mg/L)	0.0012	<0.0010	<0.0010	0.0014	<0.0010
	Iron (Fe)-Dissolved (mg/L)	0.266	<0.030	<0.030	<0.030	<0.030
	Ferrous Iron, Dissolved (mg/L)	0.085	<0.020	<0.020	<0.020	<0.020
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Lithium (Li)-Dissolved (mg/L)	0.0077	0.0011	0.0011	0.0012	<0.0010
	Magnesium (Mg)-Dissolved (mg/L)	17.9	6.22	6.15	6.26	<0.10
	Manganese (Mn)-Dissolved (mg/L)	0.0163	0.00090	0.00064	0.00095	<0.00010
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)	0.0038	<0.0010	<0.0010	<0.0010	<0.0010
	Nickel (Ni)-Dissolved (mg/L)	0.0024	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Dissolved (mg/L)	0.00114	0.000280	0.000229	0.000253	<0.000050
	Silicon (Si)-Dissolved (mg/L)	1.94	1.90	1.90	1.96	<0.050
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Dissolved (mg/L)	3.7	<2.0	<2.0	<2.0	<2.0
	Strontium (Sr)-Dissolved (mg/L)	0.322	0.102	0.102	0.103	<0.0050
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.00088	0.00045	0.00045	0.00044	<0.00020
	Vanadium (V)-Dissolved (mg/L)	0.00100	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2163952-6	Water	13-SEP-18	TRIP BLANK
Grouping	Analyte				
WATER					
Dissolved Metals	Beryllium (Be)-Dissolved (mg/L) Bismuth (Bi)-Dissolved (mg/L) Boron (B)-Dissolved (mg/L) Cadmium (Cd)-Dissolved (mg/L) Calcium (Ca)-Dissolved (mg/L) Chromium (Cr)-Dissolved (mg/L) Cobalt (Co)-Dissolved (mg/L) Copper (Cu)-Dissolved (mg/L) Iron (Fe)-Dissolved (mg/L) Ferrous Iron, Dissolved (mg/L) Lead (Pb)-Dissolved (mg/L) Lithium (Li)-Dissolved (mg/L) Magnesium (Mg)-Dissolved (mg/L) Manganese (Mn)-Dissolved (mg/L) Mercury (Hg)-Dissolved (mg/L) Molybdenum (Mo)-Dissolved (mg/L) Nickel (Ni)-Dissolved (mg/L) Phosphorus (P)-Dissolved (mg/L) Potassium (K)-Dissolved (mg/L) Selenium (Se)-Dissolved (mg/L) Silicon (Si)-Dissolved (mg/L) Silver (Ag)-Dissolved (mg/L) Sodium (Na)-Dissolved (mg/L) Strontium (Sr)-Dissolved (mg/L) Thallium (Tl)-Dissolved (mg/L) Tin (Sn)-Dissolved (mg/L) Titanium (Ti)-Dissolved (mg/L) Uranium (U)-Dissolved (mg/L) Vanadium (V)-Dissolved (mg/L) Zinc (Zn)-Dissolved (mg/L)				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Dissolved Organic Carbon	MS-B	L2163952-1, -2, -3, -4, -5
Matrix Spike	Dissolved Organic Carbon	MS-B	L2163952-1, -2, -3, -4, -5
Matrix Spike	Total Organic Carbon	MS-B	L2163952-1, -2, -3
Matrix Spike	Total Organic Carbon	MS-B	L2163952-4, -5, -6
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2163952-1, -2, -3, -4, -5
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2163952-1, -2, -3, -4, -5
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2163952-5
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2163952-1, -2, -3, -4, -5
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2163952-5
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2163952-1, -2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2163952-5
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L2163952-1, -2, -3, -4, -5
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2163952-1, -2, -3, -4, -5
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2163952-5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2163952-1, -2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2163952-5
Matrix Spike	Boron (B)-Total	MS-B	L2163952-1, -2, -3, -4, -5, -6
Matrix Spike	Copper (Cu)-Total	MS-B	L2163952-1, -2, -3, -4, -5, -6
Matrix Spike	Silicon (Si)-Total	MS-B	L2163952-1, -2, -3, -4, -5, -6
Matrix Spike	Sodium (Na)-Total	MS-B	L2163952-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0
This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOC Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.			

Reference Information

Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.

EC-PCT-VA Water Conductivity (Automated) APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

EC-SCREEN-VA Water Conductivity Screen (Internal Use Only) APHA 2510

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

ECOLI-COLI-ENV-VA Water E.coli by Colilert APHA METHOD 9223

This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.

F-IC-N-VA Water Fluoride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

FE2-D-COL-VA Water Diss. Ferrous Iron in Water by Colour APHA 3500-Fe B/James Ball et al (1999)

This analysis is carried out using procedures adapted from APHA 3500-Fe B and "A New Method for the Direct Determination of Dissolved Iron Concentration in Acid Mine Waters" published by James W. Ball et al (1999). The procedure involves preliminary sample filtration, and ferrous iron is determined using the "FerroZine" colourimetric method.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA Water Total Mercury in Water by CVAAS or CVAFS EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HPC-PP-ENV-VA Water HPC by pour plate APHA METHOD 9215

This analysis is carried out using procedures adapted from APHA Method 9215 "Heterotropic Plate Count". Heterotropic plate count (standard plate count or total plate count) is determined by culturing and colony counting using the pour plate method with a 48 hour incubation period. The test measures colonies formed by heterotropic bacteria.

IONBALANCE-VA Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

N-T-COL-VA Water Total Nitrogen in water by Colour APHA4500-P(J)/NEMI9171/USGS03-4174

This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

Reference Information

NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample. Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.			
Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.			
P-TD-COL-VA	Water	Total Dissolved P in Water by Colour	APHA 4500-P Phosphorous
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter. Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.			
Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.			
PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value
This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode			
It is recommended that this analysis be conducted in the field.			
PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.			
Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.			
SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.
This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
TCOLI-COLI-ENV-VA	Water	Total coliform by Colilert	APHA METHOD 9223
This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is quantified by a statistical estimation of bacteria density (most probable number).			
TDS-CALC-VA	Water	TDS (Calculated)	APHA 1030E (20TH EDITION)
This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses". The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.			
TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.
This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.			
TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC
This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.			
TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity
This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Reference Information

Laboratory Definition Code **Laboratory Location**

VA ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																																																						
Company:	Tetratech	Select Report Format:	<input checked="" type="checkbox"/> PDF	<input checked="" type="checkbox"/> EXCEL	<input checked="" type="checkbox"/> EDD (DIGITAL)	R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																																																					
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Phone:	780-886-3055	Email 1 or Fax:	danielle.macdonald@tetratech.com			<table border="1"> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>																																																					
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ALS Lab Work Order # (lab use only)	L2163952	ALS Contact:	Brent Mack	Sampler:	Lucas Hennecker	<table border="1"> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>																																																					
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	Aik-Species/Anions by IC, NO2+NO3Calc	Color-True, EC, pH, TSS, TDS-Calc	Turbidity, Silicate, Ortho PO4, Ion Balance	TOC, TN, TP, TDP, TKN, NH3	DOC	Total Metals (COME+ICP+Hardness) & Hg	Dissolved Metals (CCME+ICP+Hardness)/H	Total Hg (ultra-low detection limit)	Dissolved Hg (ultra-low detection limit)	Total Hg (ultra-low detection limit)	Total Coliform, E. coli, HPC	Ferrous Iron	Number of Containers																																										
	Halfway River - Downstream (HD)	13-Sep-18	08:36	Water	R	R	R	R	R	R	R	R	R	R	R	R	9																																										
	Middle Site C Reservoir (PR2)		08:58	Water	R	R	R	R	R	R	R	R	R	R	R	R	9																																										
	Peace Canyon (PC+)			Water	R	R	R	R	R	R	R	R	R	R	R	R																																											
	Upper Site C Reservoir (PR1)		10:11	Water	R	R	R	R	R	R	R	R	R	R	R	R	9																																										
	Duplicate # (DUP #)			Water	R	R	R	R	R	R	R	R	R	R	R	R	9																																										
	Field Blank		11:00	Water	R	R	R	R	R	R	R	R	R	R	R	R	10																																										
	TRIP Blank			Water	R	R	R	R	R	R	R	R	R	R	R	R	5																																										
Drinking Water (DW) Samples (client use)					Special Instructions / Specify Criteria to add on report (client Use)					SAMPLE CONDITION AS RECEIVED (lab use only)																																																	
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources. *chlorophyll a filtered w/ 250ml *add lucas.hennecker@tetratech.com brent.finnestad@tetratech.com nich.burrows@bchydro.com					Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/>																																																	
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No										INITIAL COOLER TEMPERATURES °C: 8°C FINAL COOLER TEMPERATURES °C:																																																	
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Lucas Hennecker		Sep 13/18	14:25	Shylam		Sep 13/18	2:30h																																																				

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 10-SEP-18
Report Date: 19-SEP-18 13:57 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2161498
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03058-02A.002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L2161498-1	L2161498-2	L2161498-3	L2161498-4
					L2161498-1 Water 10-SEP-18 16:25 MOVERLY RIVER - DOWNSTREAM - (MD)	L2161498-2 Water 10-SEP-18 15:50 LOWER SITE C RESERVOIR (PR3)	L2161498-3 Water 10-SEP-18 15:00 PEACE AT PINE (PD1)	L2161498-4 Water 10-SEP-18 14:22 PINE RIVER (PINE)
Grouping	Analyte							
WATER								
Physical Tests	Colour, True (CU)	24.9	5.8	6.1	7.4			
	Conductivity (uS/cm)	268	214	217	348			
	Hardness (as CaCO3) (mg/L)	139	108	114	185			
	pH (pH)	8.30	8.21	8.22	8.41			
	Total Suspended Solids (mg/L)	88.6	9.4	12.8	289			
	TDS (Calculated) (mg/L)	160	120	123	216			
	Turbidity (NTU)	126	7.25	9.18	235			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	136	97.9	98.5	163			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	7.8			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)	136	97.9	98.5	171			
	Ammonia, Total (as N) (mg/L)	0.0073	0.0079	0.0050	0.0103			
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050			
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	1.27			
	Fluoride (F) (mg/L)	0.088	0.047	0.047	0.097			
	Nitrate and Nitrite (as N) (mg/L)	<0.0051	0.0557	0.0467	0.0663			
	Nitrate (as N) (mg/L)	<0.0050	0.0541	0.0467	0.0663			
	Nitrite (as N) (mg/L)	<0.0010	0.0016	<0.0010	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	0.432	0.099	0.118	0.636			
	Total Nitrogen (mg/L)	0.291 ^{RRV}	0.136	0.143	0.340 ^{RRV}			
	Orthophosphate-Dissolved (as P) (mg/L)	0.0038	0.0013	0.0013	0.0026			
	Phosphorus (P)-Total Dissolved (mg/L)	0.0058	<0.0020	<0.0020	0.0024			
	Phosphorus (P)-Total (mg/L)	0.138	0.0119	0.0167	0.314			
	Silicate (as SiO2) (mg/L)	3.38	4.35	4.16	3.09			
	Sulfate (SO4) (mg/L)	16.5	19.3	19.9	34.2			
	Anion Sum (meq/L)	3.06	2.37	2.39	4.17			
	Cation Sum (meq/L)	2.93	2.17	2.27	3.92			
	Cation - Anion Balance (%)	-2.1	-4.4	-2.5	-3.0			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	6.95	3.03	3.01	3.32			
	Total Organic Carbon (mg/L)	9.62	3.15	3.36	8.14			
Bacteriological Tests	E. coli (MPN/100mL)	55	6	3	59			
	HPC (CFU/1mL)	272	23	92	440			
	Coliform Bacteria - Total (MPN/100mL)	1410	147	179	1410			
Total Metals	Aluminum (Al)-Total (mg/L)	2.61	0.248	0.293	5.02			
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050			
	Arsenic (As)-Total (mg/L)	0.00205	<0.00050	<0.00050	0.00406			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2161498-1	L2161498-2	L2161498-3	L2161498-4
		Description	Water	Water	Water	Water
		Sampled Date	10-SEP-18	10-SEP-18	10-SEP-18	10-SEP-18
		Sampled Time	16:25	15:50	15:00	14:22
		Client ID	MOVERLY RIVER - DOWNSTREAM (MD)	LOWER SITE C RESERVOIR (PR3)	PEACE AT PINE (PD1)	PINE RIVER (PINE)
Grouping	Analyte					
WATER						
Total Metals	Barium (Ba)-Total (mg/L)		0.202	0.045	0.050	0.261
	Beryllium (Be)-Total (mg/L)		0.00015	<0.00010	<0.00010	0.00034
	Bismuth (Bi)-Total (mg/L)		<0.20	<0.20	<0.20	<0.20
	Boron (B)-Total (mg/L)		<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)		0.000185	0.0000348	0.0000364	0.000376
	Calcium (Ca)-Total (mg/L)		40.1	29.4	30.1	56.4
	Chromium (Cr)-Total (mg/L)		0.0045	<0.0010	<0.0010	0.0086
	Cobalt (Co)-Total (mg/L)		0.00218	<0.00030	<0.00030	0.00457
	Copper (Cu)-Total (mg/L)		0.0065	<0.0010	0.0011	0.0118
	Iron (Fe)-Total (mg/L)		4.70	0.291	0.390	10.6
	Lead (Pb)-Total (mg/L)		0.00240	<0.00050	<0.00050	0.00563
	Lithium (Li)-Total (mg/L)		0.0077	0.0023	0.0025	0.0161
	Magnesium (Mg)-Total (mg/L)		11.4	7.45	7.58	15.8
	Manganese (Mn)-Total (mg/L)		0.0866	0.00758	0.00942	0.149
	Mercury (Hg)-Total (mg/L)		<0.00010 ^{DLM}	<0.0000050	<0.0000050	<0.00010 ^{DLM}
	Molybdenum (Mo)-Total (mg/L)		<0.0010	0.0011	0.0011	0.0013
	Nickel (Ni)-Total (mg/L)		0.0092	0.0014	0.0016	0.0164
	Phosphorus (P)-Total (mg/L)		<0.30	<0.30	<0.30	0.31
	Potassium (K)-Total (mg/L)		<2.0	<2.0	<2.0	2.4
	Selenium (Se)-Total (mg/L)		0.000355	0.000386	0.000375	0.000877
	Silicon (Si)-Total (mg/L)		5.47	2.39	2.48	8.49
	Silver (Ag)-Total (mg/L)		0.000045	<0.000020	<0.000020	0.000106
	Sodium (Na)-Total (mg/L)		3.1	<2.0	<2.0	5.0
	Strontium (Sr)-Total (mg/L)		0.106	0.122	0.124	0.194
	Thallium (Tl)-Total (mg/L)		0.000074	<0.000010	0.000011	0.000150
	Tin (Sn)-Total (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)		0.025	<0.010	<0.010	0.031
	Uranium (U)-Total (mg/L)		0.00063	0.00056	0.00055	0.00098
	Vanadium (V)-Total (mg/L)		0.00967	0.00122	0.00141	0.0178
	Zinc (Zn)-Total (mg/L)		0.0240	<0.0050	<0.0050	0.0557
Dissolved Metals	Dissolved Fe2 Filtration Location		FIELD	FIELD	FIELD	FIELD
	Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location		FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)		0.0347	0.0748	0.0130	0.0307
	Antimony (Sb)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
	Barium (Ba)-Dissolved (mg/L)		0.134	0.043	0.042	0.100

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L2161498-1	L2161498-2	L2161498-3	L2161498-4
					L2161498-1 Water 10-SEP-18 16:25 MOVERLY RIVER - DOWNSTREAM - (MD)	L2161498-2 Water 10-SEP-18 15:50 LOWER SITE C RESERVOIR (PR3)	L2161498-3 Water 10-SEP-18 15:00 PEACE AT PINE (PD1)	L2161498-4 Water 10-SEP-18 14:22 PINE RIVER (PINE)
Grouping	Analyte							
WATER								
Dissolved Metals	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20			
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10	<0.10			
	Cadmium (Cd)-Dissolved (mg/L)	0.0000135	0.0000145	0.0000107	0.0000103			
	Calcium (Ca)-Dissolved (mg/L)	37.7	30.3	31.5	49.5			
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010			
	Cobalt (Co)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030			
	Copper (Cu)-Dissolved (mg/L)	0.0017	<0.0010	<0.0010	<0.0010			
	Iron (Fe)-Dissolved (mg/L)	0.046	0.044	<0.030	<0.030			
	Ferrous Iron, Dissolved (mg/L)	0.022	<0.020	<0.020	<0.020			
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050			
	Lithium (Li)-Dissolved (mg/L)	0.0045	0.0022	0.0023	0.0091			
	Magnesium (Mg)-Dissolved (mg/L)	10.9	7.81	8.46	15.0			
	Manganese (Mn)-Dissolved (mg/L)	0.0175	0.00372	0.00290	0.00639			
	Mercury (Hg)-Dissolved (mg/L)	<0.0000050	0.0000051	<0.0000050	<0.0000050			
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0010	0.0011	0.0011	0.0011			
	Nickel (Ni)-Dissolved (mg/L)	0.0028	0.0011	0.0011	0.0018			
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30			
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0	<2.0	<2.0			
	Selenium (Se)-Dissolved (mg/L)	0.000173	0.000348	0.000315	0.000532			
	Silicon (Si)-Dissolved (mg/L)	1.61	2.06	1.93	1.40			
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020			
	Sodium (Na)-Dissolved (mg/L)	3.4	<2.0	<2.0	5.1			
	Strontium (Sr)-Dissolved (mg/L)	0.106	0.132	0.130	0.186			
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020			
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050			
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010			
	Uranium (U)-Dissolved (mg/L)	0.00039	0.00048	0.00048	0.00054			
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050			
	Zinc (Zn)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2161498-1, -2, -3, -4
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2161498-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2161498-1, -2, -3, -4
Matrix Spike	Barium (Ba)-Total	MS-B	L2161498-1, -2, -3, -4
Matrix Spike	Calcium (Ca)-Total	MS-B	L2161498-1, -2, -3, -4
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2161498-1, -2, -3, -4
Matrix Spike	Sodium (Na)-Total	MS-B	L2161498-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Total	MS-B	L2161498-1, -2, -3, -4
Matrix Spike	Nitrate (as N)	MS-B	L2161498-1, -2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
ECOLI-COLI-ENV-VA	Water	E.coli by Colilert	APHA METHOD 9223
This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
FE2-D-COL-VA	Water	Diss. Ferrous Iron in Water by Colour	APHA 3500-Fe B/James Ball et al (1999)

Reference Information

This analysis is carried out using procedures adapted from APHA 3500-Fe B and "A New Method for the Direct Determination of Dissolved Iron Concentration in Acid Mine Waters" published by James W. Ball et al (1999). The procedure involves preliminary sample filtration, and ferrous iron is determined using the "FerroZine" colourimetric method.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 µm), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-T-CVAA-VA Water Total Mercury in Water by CVAAS or CVAFS EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HPC-PP-ENV-VA Water HPC by pour plate APHA METHOD 9215

This analysis is carried out using procedures adapted from APHA Method 9215 "Heterotropic Plate Count". Heterotropic plate count (standard plate count or total plate count) is determined by culturing and colony counting using the pour plate method with a 48 hour incubation period. The test measures colonies formed by heterotropic bacteria.

IONBALANCE-VA Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

$$\text{Ion Balance (\%)} = \frac{[\text{Cation Sum} - \text{Anion Sum}]}{[\text{Cation Sum} + \text{Anion Sum}]}$$

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 µm), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

N-T-COL-VA Water Total Nitrogen in water by Colour APHA4500-P(J)/NEMI9171/USGS03-4174

This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are

Reference Information

available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TCOLI-COLI-ENV-VA Water Total coliform by Colilert APHA METHOD 9223

This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is quantified by a statistical estimation of bacteria density (most probable number).

TDS-CALC-VA Water TDS (Calculated) APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".

The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



L2161498-COFC

Report To		Report Format / Distrib.			Turnaround Time (TAT) is not available for all tests																																																																																																																																																																																
Company: Tetratech		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																																																																																																																																																																																
Contact: Danielle MacDonald		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT																																																																																																																																																																																
Address: 14940-123 Ave NW Edmonton, AB T5V 1B4		Criteria on Report - provide details below if box checked: Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																																																																																																																																																																																
Phone: 780-886-3055		Email 1 or Fax: danielle.macdonald@tetratech.com			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																																																																																																																																																																																
		Email 2: molly.brevis@bchydro.com			Specify Date Required for E2, E or P:																																																																																																																																																																																
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		Pine River (Pine)			2018				Water		R R R R R R R R R R						9																																																																																																																																																																				
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Drinking Water (DW) Samples ¹ (client use)				Special Instructions / Specify Criteria to add on report (client use)				SAMPLE CONDITION AS RECEIVED (lab use only)																																																																																																																																																																													
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources. Add brent.finnesterde@tetratech.com lucas.hennecker@tetratech.com				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>					Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																																																																																								
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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Tetra Tech Canada Inc.
ATTN: Danielle MacDonald
14940 - 123 Avenue, NW
Edmonton AB T5V 1B4

Date Received: 13-SEP-18
Report Date: 27-SEP-18 17:36 (MT)
Version: FINAL

Client Phone: 780-886-3055

Certificate of Analysis

Lab Work Order #: L2163509
Project P.O. #: NOT SUBMITTED
Job Reference: VENW003060-02-002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2163509-1 Water 12-SEP-18 11:07 PEACE AT BEATTON (PD2)	L2163509-2 Water 12-SEP-18 11:33 BEATTON RIVER (BEATTON)	L2163509-3 Water 12-SEP-18 12:05 PEACE AT KISKATINAW (PD3)	L2163509-4 Water 12-SEP-18 12:21 KISKATINAW RIVER (KR)	L2163509-5 Water 12-SEP-18 13:14 PEACE AT POUCE COUPE (PD4)	
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	7.1	106	9.2	13.8	<5.0
	Conductivity (uS/cm)	199	374	214	504	215
	pH (pH)	8.22	8.34	8.27	8.57	8.26
	Total Suspended Solids (mg/L)	21.4	35.8	35.8	347	55.4
	Total Dissolved Solids (mg/L)	128	315	140	381	138
	Turbidity (NTU)	13.3	72.6	23.3	280	27.8
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	93.1	127	98.1	227	99.0
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	3.8	<1.0	20.4	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	93.1	131	98.1	247	99.0
	Ammonia, Total (as N) (mg/L)	<0.0050	0.0310	<0.0050	0.0300	<0.0050
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl) (mg/L)	<0.50	3.04	<0.50	1.75	<0.50
	Fluoride (F) (mg/L)	0.044	0.131	0.048	0.107	0.046
	Nitrate and Nitrite (as N) (mg/L)	0.0570	0.0961	0.0581	0.118	0.0560
	Nitrate (as N) (mg/L)	0.0570	0.0922	0.0581	0.115	0.0560
	Nitrite (as N) (mg/L)	<0.0010	0.0039	<0.0010	0.0024	<0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.128	0.704	0.152	0.962 ^{RRV}	0.173
	Total Nitrogen (mg/L)	0.180	0.746	0.173	0.541 ^{RRV}	0.177
	Orthophosphate-Dissolved (as P) (mg/L)	0.0020	0.0071	0.0016	0.0039	0.0020
	Phosphorus (P)-Total Dissolved (mg/L)	0.0026	0.0167	0.0023	0.0061	0.0027
	Phosphorus (P)-Total (mg/L)	0.0215	0.0656	0.0392	0.182	0.0456
	Silicate (as SiO2) (mg/L)	4.28	4.21	4.09	4.86	4.35
Sulfate (SO4) (mg/L)	15.8	64.2	17.1	47.1	17.1	
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.80	19.5	2.87	7.84	3.21
	Total Organic Carbon (mg/L)	3.01	21.4	3.61	12.3	4.28

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2163509-6 Water 12-SEP-18 14:45 POUCE COUPE (POUCE)	L2163509-7 Water 12-SEP-18 16:15 PEACE AT MANY ISLANDS (PD5)		
Grouping	Analyte				
WATER					
Physical Tests	Colour, True (CU)	30.3	5.6		
	Conductivity (uS/cm)	991	222		
	pH (pH)	8.50	8.28		
	Total Suspended Solids (mg/L)	27.8	42.6		
	Total Dissolved Solids (mg/L)	716	141		
	Turbidity (NTU)	47.3	36.7		
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	195	104		
	Alkalinity, Carbonate (as CaCO3) (mg/L)	15.6	<1.0		
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0		
	Alkalinity, Total (as CaCO3) (mg/L)	211	104		
	Ammonia, Total (as N) (mg/L)	0.0371	0.0058		
	Bromide (Br) (mg/L)	<0.25 ^{DLDS}	<0.050		
	Chloride (Cl) (mg/L)	10.2	<0.50		
	Fluoride (F) (mg/L)	0.29	0.050		
	Nitrate and Nitrite (as N) (mg/L)	0.202	0.0572		
	Nitrate (as N) (mg/L)	0.192	0.0572		
	Nitrite (as N) (mg/L)	0.0105	<0.0010		
	Total Kjeldahl Nitrogen (mg/L)	0.838	0.181		
	Total Nitrogen (mg/L)	1.01	0.202		
	Orthophosphate-Dissolved (as P) (mg/L)	0.0020	0.0022		
	Phosphorus (P)-Total Dissolved (mg/L)	0.0066	0.0033		
	Phosphorus (P)-Total (mg/L)	0.0531	0.0449		
	Silicate (as SiO2) (mg/L)	1.18	4.02		
	Sulfate (SO4) (mg/L)	321	18.8		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	15.6	3.12		
	Total Organic Carbon (mg/L)	17.2	3.93		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Phosphorus (P)-Total	B	L2163509-1, -2, -3, -4, -5, -6, -7
Method Blank	Phosphorus (P)-Total Dissolved	B	L2163509-2
Matrix Spike	Dissolved Organic Carbon	MS-B	L2163509-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Dissolved Organic Carbon	MS-B	L2163509-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Total Organic Carbon	MS-B	L2163509-1, -2, -3, -4, -5, -6, -7

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.			
Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Weston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-VA Water Total Dissolved Solids by Gravimetric APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Tetra Tech Canada Inc.
ATTN: Lucas Hennecker
1000-885 Dunsmuir Street, 10th Floor
Vancouver BC V6E 1N5

Date Received: 19-OCT-18
Report Date: 29-OCT-18 16:26 (MT)
Version: FINAL

Client Phone: 604-685-0275

Certificate of Analysis

Lab Work Order #: L2184476
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060 TASK 002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2184476-1 Water 19-OCT-18 09:30 WILLISTON SHALLOW (W1- SHALLOW)	L2184476-2 Water 19-OCT-18 09:45 WILLISTON DEEP (W1-DEEP)	L2184476-3 Water 19-OCT-18 12:45 DINOSAUR SHALLOW (D1- SHALLOW)	L2184476-4 Water 19-OCT-18 12:30 DINOSAUR DEEP (D1-DEEP)	L2184476-5 Water 19-OCT-18 12:45 DUPLICATE 2 (DUP 2)
Grouping	Analyte					
FILTER						
Plant Pigments	Chlorophyll a (ug/L)	1.60	1.50	1.24	1.81	1.48

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L2184476-1	L2184476-2	L2184476-3	L2184476-4	L2184476-5
					Water	Water	Water	Water	Water
		19-OCT-18	09:30		19-OCT-18	19-OCT-18	19-OCT-18	19-OCT-18	19-OCT-18
					09:30	09:45	12:45	12:30	12:45
					WILLISTON SHALLOW (W1-SHALLOW)	WILLISTON DEEP (W1-DEEP)	DINOSAUR SHALLOW (D1-SHALLOW)	DINOSAUR DEEP (D1-DEEP)	DUPLICATE 2 (DUP 2)
Grouping	Analyte								
WATER									
Physical Tests	Colour, True (CU)	6.7	5.8	5.7	6.2	6.7			
	Conductivity (uS/cm)	184	186	185	186	187			
	Hardness (as CaCO3) (mg/L)	90.1	89.6	86.7	91.4	91.0			
	pH (pH)	8.11	8.09	8.09	8.11	8.10			
	Total Suspended Solids (mg/L)	<3.0	<3.0	<3.0	<3.0	<3.0			
	TDS (Calculated) (mg/L)	98.4	97.9	96.7	98.3	97.0			
	Turbidity (NTU)	0.36	0.38	0.57	0.64	0.51			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	82.7	82.4	81.3	81.8	80.2			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)	82.7	82.4	81.3	81.8	80.2			
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050			
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050			
	Chloride (Cl) (mg/L)	<0.50	<0.50	<0.50	<0.50	<0.50			
	Fluoride (F) (mg/L)	0.038	0.038	0.038	0.038	0.038			
	Nitrate and Nitrite (as N) (mg/L)	0.0582	0.0598	0.0583	0.0579	0.0596			
	Nitrate (as N) (mg/L)	0.0582	0.0598	0.0583	0.0579	0.0596			
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	0.101	0.089	0.080	0.066	0.086			
	Total Nitrogen (mg/L)	0.134	0.142	0.129	0.136	0.130			
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	0.0010	0.0011	<0.0010			
	Phosphorus (P)-Total Dissolved (mg/L)	0.0036	0.0023	0.0032	0.0030	0.0030			
	Phosphorus (P)-Total (mg/L)	0.0029	0.0030	0.0028	0.0038	0.0042			
	Silicate (as SiO2) (mg/L)	4.53	4.31	4.46	4.25	4.46			
	Sulfate (SO4) (mg/L)	13.9	13.9	13.8	13.8	13.8			
	Anion Sum (meq/L)	1.95	1.94	1.92	1.93	1.90			
	Cation Sum (meq/L)	1.80	1.79	1.73	1.83	1.82			
	Cation - Anion Balance (%)	-3.9	-4.1	-5.1	-2.7	-2.1			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.60	2.38	2.44	2.60	2.50			
	Total Organic Carbon (mg/L)	2.57	2.45	2.65	2.67	2.44			
Total Metals	Aluminum (Al)-Total (mg/L)	0.0137	0.0137	0.0188	0.0237	0.0168			
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050			
	Arsenic (As)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050			
	Barium (Ba)-Total (mg/L)	0.030	0.030	0.031	0.031	0.031			
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010			
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2184476-6 Water 19-OCT-18 15:05 PEACE CANYON (PC1)	L2184476-7 Water 19-OCT-18 15:56 UPPER SITE C RESERVOIR (PR1)		
Grouping	Analyte				
WATER					
Physical Tests	Colour, True (CU)	8.2	6.8		
	Conductivity (uS/cm)	187	185		
	Hardness (as CaCO3) (mg/L)	89.1	90.2		
	pH (pH)	8.12	8.10		
	Total Suspended Solids (mg/L)	<3.0	<3.0		
	TDS (Calculated) (mg/L)	98.5	97.8		
	Turbidity (NTU)	0.59	0.65		
	Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	83.9	81.9	
Alkalinity, Carbonate (as CaCO3) (mg/L)		<1.0	<1.0		
Alkalinity, Hydroxide (as CaCO3) (mg/L)		<1.0	<1.0		
Alkalinity, Total (as CaCO3) (mg/L)		83.9	81.9		
Ammonia, Total (as N) (mg/L)		<0.0050	<0.0050		
Bromide (Br) (mg/L)		<0.050	<0.050		
Chloride (Cl) (mg/L)		<0.50	<0.50		
Fluoride (F) (mg/L)		0.038	0.038		
Nitrate and Nitrite (as N) (mg/L)		0.0576	0.0577		
Nitrate (as N) (mg/L)		0.0576	0.0577		
Nitrite (as N) (mg/L)		<0.0010	<0.0010		
Total Kjeldahl Nitrogen (mg/L)		0.073	0.082		
Total Nitrogen (mg/L)		0.135	0.137		
Orthophosphate-Dissolved (as P) (mg/L)		0.0012	<0.0010		
Phosphorus (P)-Total Dissolved (mg/L)		0.0030	0.0029		
Phosphorus (P)-Total (mg/L)		0.0040	0.0040		
Silicate (as SiO2) (mg/L)		4.24	4.41		
Sulfate (SO4) (mg/L)		13.8	13.8		
Anion Sum (meq/L)		1.97	1.93		
Cation Sum (meq/L)		1.78	1.80		
Cation - Anion Balance (%)	-5.0	-3.4			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.51	2.41		
	Total Organic Carbon (mg/L)	2.54	2.60		
Total Metals	Aluminum (Al)-Total (mg/L)	0.0196	0.0248		
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050		
	Arsenic (As)-Total (mg/L)	<0.00050	<0.00050		
	Barium (Ba)-Total (mg/L)	0.031	0.031		
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010		
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2184476-1	L2184476-2	L2184476-3	L2184476-4	L2184476-5
		Description	Water	Water	Water	Water	Water
		Sampled Date	19-OCT-18	19-OCT-18	19-OCT-18	19-OCT-18	19-OCT-18
		Sampled Time	09:30	09:45	12:45	12:30	12:45
		Client ID	WILLISTON SHALLOW (W1-SHALLOW)	WILLISTON DEEP (W1-DEEP)	DINOSAUR SHALLOW (D1-SHALLOW)	DINOSAUR DEEP (D1-DEEP)	DUPLICATE 2 (DUP 2)
Grouping	Analyte						
WATER							
Total Metals	Boron (B)-Total (mg/L)		<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)		0.0000146	0.0000128	0.0000149	0.0000172	0.0000139
	Calcium (Ca)-Total (mg/L)		26.9	25.8	26.7	26.6	26.6
	Chromium (Cr)-Total (mg/L)		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cobalt (Co)-Total (mg/L)		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Copper (Cu)-Total (mg/L)		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Iron (Fe)-Total (mg/L)		<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)-Total (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Lithium (Li)-Total (mg/L)		0.0010	0.0010	0.0011	0.0011	0.0011
	Magnesium (Mg)-Total (mg/L)		6.35	6.28	6.25	6.46	6.33
	Manganese (Mn)-Total (mg/L)		0.00109	0.00110	0.00132	0.00149	0.00132
	Mercury (Hg)-Total (ug/L)		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Molybdenum (Mo)-Total (mg/L)		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Nickel (Ni)-Total (mg/L)		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Phosphorus (P)-Total (mg/L)		<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)		<2.0	<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Total (mg/L)		0.000224	0.000278	0.000298	0.000222	0.000270
	Silicon (Si)-Total (mg/L)		2.07	2.10	2.09	2.08	2.07
	Silver (Ag)-Total (mg/L)		<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Total (mg/L)		<2.0	<2.0	<2.0	<2.0	<2.0
	Strontium (Sr)-Total (mg/L)		0.109	0.108	0.104	0.104	0.105
	Thallium (Tl)-Total (mg/L)		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)		<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)		0.00045	0.00045	0.00043	0.00045	0.00045
	Vanadium (V)-Total (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dissolved Metals	Dissolved MeHg Filtration Location		FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location		FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Barium (Ba)-Dissolved (mg/L)		0.030	0.031	0.032	0.031	0.031
	Beryllium (Be)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)		<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)		<0.10	<0.10	<0.10	<0.10	<0.10

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2184476-6 Water 19-OCT-18 15:05 PEACE CANYON (PC1)	L2184476-7 Water 19-OCT-18 15:56 UPPER SITE C RESERVOIR (PR1)		
Grouping	Analyte				
WATER					
Total Metals	Boron (B)-Total (mg/L)	<0.10	<0.10		
	Cadmium (Cd)-Total (mg/L)	0.0000144	0.0000165		
	Calcium (Ca)-Total (mg/L)	25.9	26.5		
	Chromium (Cr)-Total (mg/L)	<0.0010	<0.0010		
	Cobalt (Co)-Total (mg/L)	<0.00030	<0.00030		
	Copper (Cu)-Total (mg/L)	<0.0010	<0.0010		
	Iron (Fe)-Total (mg/L)	<0.030	0.031		
	Lead (Pb)-Total (mg/L)	<0.00050	<0.00050		
	Lithium (Li)-Total (mg/L)	0.0011	0.0011		
	Magnesium (Mg)-Total (mg/L)	6.27	6.48		
	Manganese (Mn)-Total (mg/L)	0.00145	0.00154		
	Mercury (Hg)-Total (ug/L)	<0.00050	<0.00050		
	Molybdenum (Mo)-Total (mg/L)	<0.0010	<0.0010		
	Nickel (Ni)-Total (mg/L)	<0.0010	<0.0010		
	Phosphorus (P)-Total (mg/L)	<0.30	<0.30		
	Potassium (K)-Total (mg/L)	<2.0	<2.0		
	Selenium (Se)-Total (mg/L)	0.000268	0.000284		
	Silicon (Si)-Total (mg/L)	2.07	2.10		
	Silver (Ag)-Total (mg/L)	<0.000020	<0.000020		
	Sodium (Na)-Total (mg/L)	<2.0	<2.0		
	Strontium (Sr)-Total (mg/L)	0.105	0.105		
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010		
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050		
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010		
	Uranium (U)-Total (mg/L)	0.00045	0.00044		
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050		
	Zinc (Zn)-Total (mg/L)	<0.0050	<0.0050		
Dissolved Metals	Dissolved MeHg Filtration Location	FIELD	FIELD		
	Dissolved Mercury Filtration Location	FIELD	FIELD		
	Dissolved Metals Filtration Location	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)	<0.0050	<0.0050		
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050		
	Arsenic (As)-Dissolved (mg/L)	<0.00050	<0.00050		
	Barium (Ba)-Dissolved (mg/L)	0.031	0.032		
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010		
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20		
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L2184476-1	L2184476-2	L2184476-3	L2184476-4	L2184476-5
					Water	Water	Water	Water	Water
		19-OCT-18	09:30		19-OCT-18	19-OCT-18	19-OCT-18	19-OCT-18	19-OCT-18
					09:30	09:45	12:45	12:30	12:45
					WILLISTON SHALLOW (W1-SHALLOW)	WILLISTON DEEP (W1-DEEP)	DINOSAUR SHALLOW (D1-SHALLOW)	DINOSAUR DEEP (D1-DEEP)	DUPLICATE 2 (DUP 2)
Grouping	Analyte								
WATER									
Dissolved Metals	Cadmium (Cd)-Dissolved (mg/L)	0.0000104	0.0000102	0.0000104	0.0000086	0.0000087			
	Calcium (Ca)-Dissolved (mg/L)	25.8	25.6	25.7	26.1	25.9			
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	0.0017	<0.0010			
	Cobalt (Co)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030			
	Copper (Cu)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010			
	Iron (Fe)-Dissolved (mg/L)	<0.030	<0.030	<0.030	<0.030	<0.030			
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050			
	Lithium (Li)-Dissolved (mg/L)	0.0010	0.0010	0.0010	0.0010	0.0010			
	Magnesium (Mg)-Dissolved (mg/L)	6.24	6.24	5.46	6.34	6.37			
	Manganese (Mn)-Dissolved (mg/L)	0.00020	0.00022	0.00042	0.00111	0.00033			
	Mercury (Hg)-Dissolved (ug/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050			
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	0.0012			
	Nickel (Ni)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	0.0048 ^{DTMF}	<0.0010			
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30			
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0			
	Selenium (Se)-Dissolved (mg/L)	0.000257	0.000259	0.000225	0.000292	0.000259			
	Silicon (Si)-Dissolved (mg/L)	2.02	2.02	1.88	2.00	1.98			
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020			
	Sodium (Na)-Dissolved (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0			
	Strontium (Sr)-Dissolved (mg/L)	0.104	0.103	0.102	0.104	0.104			
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020			
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050			
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010			
	Uranium (U)-Dissolved (mg/L)	0.00042	0.00042	0.00047	0.00042	0.00042			
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050			
	Zinc (Zn)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050			
Speciated Metals	Methylmercury (as MeHg)-Dissolved (ug/L)	0.000026	0.000023	0.000046	0.000028	0.000028			
	Methylmercury (as MeHg)-Total (ug/L)	0.000024	<0.000020	<0.000020	<0.000020	<0.000020			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2184476-6 Water 19-OCT-18 15:05 PEACE CANYON (PC1)	L2184476-7 Water 19-OCT-18 15:56 UPPER SITE C RESERVOIR (PR1)		
Grouping	Analyte				
WATER					
Dissolved Metals	Cadmium (Cd)-Dissolved (mg/L)	0.0000079	0.0000104		
	Calcium (Ca)-Dissolved (mg/L)	25.2	25.7		
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010		
	Cobalt (Co)-Dissolved (mg/L)	<0.00030	<0.00030		
	Copper (Cu)-Dissolved (mg/L)	<0.0010	<0.0010		
	Iron (Fe)-Dissolved (mg/L)	<0.030	<0.030		
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050		
	Lithium (Li)-Dissolved (mg/L)	0.0010	0.0010		
	Magnesium (Mg)-Dissolved (mg/L)	6.33	6.32		
	Manganese (Mn)-Dissolved (mg/L)	0.00031	0.00028		
	Mercury (Hg)-Dissolved (ug/L)	<0.00050	<0.00050		
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0010	<0.0010		
	Nickel (Ni)-Dissolved (mg/L)	<0.0010	<0.0010		
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30		
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0		
	Selenium (Se)-Dissolved (mg/L)	0.000268	0.000306		
	Silicon (Si)-Dissolved (mg/L)	2.01	1.97		
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020		
	Sodium (Na)-Dissolved (mg/L)	<2.0	<2.0		
	Strontium (Sr)-Dissolved (mg/L)	0.102	0.103		
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020		
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050		
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010		
	Uranium (U)-Dissolved (mg/L)	0.00041	0.00040		
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)	<0.0050	<0.0050		
Speciated Metals	Methylmercury (as MeHg)-Dissolved (ug/L)	0.000029	0.000033		
	Methylmercury (as MeHg)-Total (ug/L)	0.000088	<0.000020		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Total Organic Carbon	MS-B	L2184476-4
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2184476-1, -2, -4, -5, -6, -7
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2184476-3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2184476-1, -2, -4, -5, -6, -7
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2184476-3
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2184476-1, -2, -4, -5, -6, -7
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2184476-3
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2184476-1, -2, -4, -5, -6, -7
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2184476-3
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2184476-1, -2, -4, -5, -6, -7
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2184476-3
Matrix Spike	Uranium (U)-Dissolved	MS-B	L2184476-3
Matrix Spike	Barium (Ba)-Total	MS-B	L2184476-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Calcium (Ca)-Total	MS-B	L2184476-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2184476-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Manganese (Mn)-Total	MS-B	L2184476-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Potassium (K)-Total	MS-B	L2184476-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Sodium (Na)-Total	MS-B	L2184476-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Strontium (Sr)-Total	MS-B	L2184476-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Total Nitrogen	MS-B	L2184476-1, -2, -3, -4, -5, -6, -7
Matrix Spike	Phosphorus (P)-Total	MS-B	L2184476-1, -2, -3, -4, -5, -6, -7

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DTMF	Dissolved concentration exceeds total for field-filtered metals sample. Metallic contaminants may have been introduced to dissolved sample during field filtration.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CHLOROA-F-VA	Filter	Chlorophyll a by Fluorometer (Filter)	EPA 445.0
This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.			
Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment.			

Reference Information

Concurrent measurement of sample pH is recommended.

EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO ₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
HG-D-U-CVAF-VA	Water	Diss. Mercury in Water by CVAFS (Ultra)	APHA 3030 B / EPA 1631 REV. E
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure may involve preliminary sample treatment by filtration (APHA 3030B) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.			
HG-T-U-CVAF-VA	Water	Total Mercury in Water by CVAFS (Ultra)	EPA 1631 REV. E
This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.			
IONBALANCE-VA	Water	Ion Balance Calculation	APHA 1030E
Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.			
Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:			
Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]			
MEHG-D-GCAF-VA	Water	Diss. Methylmercury in Water by GCAFS	EPA 1630
This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".			
MEHG-T-GCAF-VA	Water	Total Methylmercury in Water by GCAFS	EPA 1630
This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method. Arsenic (5+) above 100 mg/L is a negative interference on this test.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-CALC-VA Water TDS (Calculated) APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".

The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)															
Company: Tetratech		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge															
Contact: Lucas Hennecker		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No																		
Address: Suite 1000, 10th Floor, 885 Dunsmuir Street, Vancouver, BC V6C 1N5		<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked																		
Phone: 1 (604) 313-9067		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			Specify Date Required for E2, E or P:															
Email 1 or Fax: Lucas.Hennecker@tetratech.com (see notes)		Email 2: Brent.Finnestad@tetratech.com																		
Invoice To		Invoice Distribution			Analysis Request															
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below															
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: ebaaccountspayable@tetratech.com																		
Company:		Email 2: Lucas.Hennecker@tetratech.com (see notes)																		
Contact:																				
Project Information		Oil and Gas Required Fields (client use)																		
ALS Quote #: Q53931		Approver ID:																		
Job #: VENW0300 task 002		Cost Center:																		
PO / AFE:		GL Account:																		
LSD:		Routing Code:																		
Activity Code:		Location:																		
ALS Lab Work Order # (lab use only)		ALS Contact:																		
L2184476		Brant Mack																		
Sampler:		Lucas Hennecker																		
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Alk-Species	Antions by IC	NO2+NO2+NO3+Calc	Color-True, EC, pH, TSS, TDS-Calc	Turbidity, Silicate, Ortho PO4, Ion Balance	TOC, TN, TP, TDP, TKN, NH3	DOC	Total Metals (CCME+ICP+Hardness)	Dissolved Metals (CCME+ICP+Hardness)	Total Hg (ultra low detection limit)	Dissolved Hg (ultra low detection limit)	Total MerHg (ultra low detection limit)	Dissolved MerHg (ultra low detection limit)	chlorophyll a (field filtered 250 mL)	Number of Containers	
	Williston Shallow (W1 - Shallow)	19-Oct-18	9:30	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R		10
	Williston Deep (W1 - Deep)		9:45	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R		10
	Dinosaur Shallow (D1 - Shallow)		12:45	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R		10
	Dinosaur Deep (D1 - Deep)		12:30	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R		10
	Duplicate 1 (DUP 1)			Water	R															
	Field Blank			Water	R															
	Duplicate 2 (DUP 2)		12:45	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R		10
	Peace Canyon (PCI)		15:05	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R		9
	Upper Site C Reservoir (PRI)		15:56	Water	R	R	R	R	R	R	R	R	R	R	R	R	R	R		9
Drinking Water (DW) Samples (client use)		Special Instructions / Specify Criteria to add on report (client Use)			SAMPLE CONDITION AS RECEIVED (lab use only)															
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources. Please add nich.burnett@bchydro.com to distribution list for results			Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input checked="" type="checkbox"/>															
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					INITIAL COOLER TEMPERATURES °C: 9 FINAL COOLER TEMPERATURES °C:															
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)															
Released by: Lucas Hennecker		Received by: Geoff			Received by:															
Date: Oct 19/18		Date: Oct 19/18			Date:															
Time: 18:25		Time: 18:25			Time:															

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FRM020a-08-Printed January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Tetra Tech Canada Inc.
ATTN: Lucas Hennecker
1000-885 Dunsmuir Street, 10th Floor
Vancouver BC V6E 1N5

Date Received: 20-OCT-18
Report Date: 02-NOV-18 15:11 (MT)
Version: FINAL

Client Phone: 604-685-0275

Certificate of Analysis

Lab Work Order #: L2184609
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060 TASK 002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L2184609-1	L2184609-2	L2184609-3	L2184609-4
					L2184609-1 Water 20-OCT-18 09:15 HALFWAY RIVER - DOWNSTREAM - (HD)	L2184609-2 Water 20-OCT-18 08:36 MIDDLE SITE C RESERVOIR (PR2)	L2184609-3 Water 20-OCT-18 10:06 FIELD BLANK	L2184609-4 Water 20-OCT-18 TRIP BLANK
Grouping	Analyte							
WATER								
Physical Tests	Colour, True (CU)	14.3	7.7	<5.0	<5.0			
	Conductivity (uS/cm)	420	184	<2.0	<2.0			
	Hardness (as CaCO3) (mg/L)	216	90.8	<0.50	<0.50 ^{HTC}			
	pH (pH)	8.37	8.15	5.44	5.40			
	Total Suspended Solids (mg/L)	18.3	3.3	<3.0	<3.0			
	TDS (Calculated) (mg/L)	248	99.8	<1.0	<1.0			
	Turbidity (NTU)	22.0	1.44	<0.10	<0.10			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	179	84.4	<1.0	<1.0			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	6.6	<1.0	<1.0	<1.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)	186	84.4	<1.0	<1.0			
	Ammonia, Total (as N) (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050			
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050			
	Chloride (Cl) (mg/L)	0.64	<0.50	<0.50	<0.50			
	Fluoride (F) (mg/L)	0.099	0.037	<0.020	<0.020			
	Nitrate and Nitrite (as N) (mg/L)	<0.0051	0.0601	<0.0051	<0.0051			
	Nitrate (as N) (mg/L)	<0.0050	0.0601	<0.0050	<0.0050			
	Nitrite (as N) (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	0.155	0.068	<0.050	<0.050			
	Total Nitrogen (mg/L)	0.149	0.150	<0.030	<0.030			
	Orthophosphate-Dissolved (as P) (mg/L)	0.0021	0.0014	<0.0010	<0.0010			
	Phosphorus (P)-Total Dissolved (mg/L)	0.0034	0.0023	<0.0020	<0.0020			
	Phosphorus (P)-Total (mg/L)	0.0290	0.0047	<0.0020	<0.0020			
	Silicate (as SiO2) (mg/L)	3.58	4.22	<0.50	<0.50			
	Sulfate (SO4) (mg/L)	52.5	13.9	<0.30	<0.30			
	Anion Sum (meq/L)	4.83	1.98	<0.10	<0.10			
	Cation Sum (meq/L)	4.48	1.81	<0.10	<0.10			
	Cation - Anion Balance (%)	-3.7	-4.4	0.0	0.0			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	3.80	2.67	<0.50	<0.50			
	Total Organic Carbon (mg/L)	4.17	2.65	<0.50	<0.50			
Total Metals	Aluminum (Al)-Total (mg/L)	0.553	0.0506	<0.0050	<0.0050			
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050			
	Arsenic (As)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050			
	Barium (Ba)-Total (mg/L)	0.110	0.032	<0.020	<0.020			
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010			
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	<0.20			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L2184609-1	L2184609-2	L2184609-3	L2184609-4
					L2184609-1 Water 20-OCT-18 09:15 HALFWAY RIVER - DOWNSTREAM (HD)	L2184609-2 Water 20-OCT-18 08:36 MIDDLE SITE C RESERVOIR (PR2)	L2184609-3 Water 20-OCT-18 10:06 FIELD BLANK	L2184609-4 Water 20-OCT-18 TRIP BLANK
Grouping	Analyte							
WATER								
Total Metals	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10			
	Cadmium (Cd)-Total (mg/L)	0.0000551	0.0000165	<0.0000050	<0.0000050			
	Calcium (Ca)-Total (mg/L)	58.6	26.6	<0.10	<0.10			
	Chromium (Cr)-Total (mg/L)	0.0011	<0.0010	<0.0010	<0.0010			
	Cobalt (Co)-Total (mg/L)	0.00036	<0.00030	<0.00030	<0.00030			
	Copper (Cu)-Total (mg/L)	0.0014	<0.0010	<0.0010	<0.0010			
	Iron (Fe)-Total (mg/L)	0.798	0.060	<0.030	<0.030			
	Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050			
	Lithium (Li)-Total (mg/L)	0.0075	0.0012	<0.0010	<0.0010			
	Magnesium (Mg)-Total (mg/L)	17.0	6.13	<0.10	<0.10			
	Manganese (Mn)-Total (mg/L)	0.0179	0.00217	0.00011	<0.00010			
	Mercury (Hg)-Total (ug/L)	0.00241	0.00100	<0.00050	<0.00050			
	Molybdenum (Mo)-Total (mg/L)	0.0034	<0.0010	<0.0010	<0.0010			
	Nickel (Ni)-Total (mg/L)	0.0026	<0.0010	<0.0010	<0.0010			
	Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30			
	Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0			
	Selenium (Se)-Total (mg/L)	0.00127	0.000281	<0.000050	<0.000050			
	Silicon (Si)-Total (mg/L)	2.65	2.15	<0.10	<0.10			
	Silver (Ag)-Total (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020			
	Sodium (Na)-Total (mg/L)	3.5	<2.0	<2.0	<2.0			
	Strontium (Sr)-Total (mg/L)	0.306	0.103	<0.0050	<0.0050			
	Thallium (Tl)-Total (mg/L)	0.000019	<0.000010	<0.000010	<0.000010			
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050			
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	<0.010			
	Uranium (U)-Total (mg/L)	0.00080	0.00043	<0.00020	<0.00020			
	Vanadium (V)-Total (mg/L)	0.00263	0.00056	<0.00050	<0.00050			
	Zinc (Zn)-Total (mg/L)	0.0050	<0.0050	<0.0050	<0.0050			
Dissolved Metals	Dissolved MeHg Filtration Location	FIELD	FIELD	FIELD				
	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD				
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD				
	Aluminum (Al)-Dissolved (mg/L)	0.0077	0.0065	<0.0050				
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050				
	Arsenic (As)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050				
	Barium (Ba)-Dissolved (mg/L)	0.098	0.033	<0.020				
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010				
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20				
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2184609-1	L2184609-2	L2184609-3	L2184609-4
		Description	Water	Water	Water	Water
		Sampled Date	20-OCT-18	20-OCT-18	20-OCT-18	20-OCT-18
		Sampled Time	09:15	08:36	10:06	
		Client ID	HALFWAY RIVER - DOWNSTREAM (HD)	MIDDLE SITE C RESERVOIR (PR2)	FIELD BLANK	TRIP BLANK
Grouping	Analyte					
WATER						
Dissolved Metals	Cadmium (Cd)-Dissolved (mg/L)		0.0000138	0.0000118	<0.0000050	
	Calcium (Ca)-Dissolved (mg/L)		58.5	26.1	<0.10	
	Chromium (Cr)-Dissolved (mg/L)		<0.0010	<0.0010	<0.0010	
	Cobalt (Co)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030	
	Copper (Cu)-Dissolved (mg/L)		<0.0010	<0.0010	<0.0010	
	Iron (Fe)-Dissolved (mg/L)		<0.030	<0.030	<0.030	
	Lead (Pb)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	
	Lithium (Li)-Dissolved (mg/L)		0.0073	0.0012	<0.0010	
	Magnesium (Mg)-Dissolved (mg/L)		17.1	6.21	<0.10	
	Manganese (Mn)-Dissolved (mg/L)		0.00746	0.00051	<0.00010	
	Mercury (Hg)-Dissolved (ug/L)		0.00079	<0.00050	<0.00050	
	Molybdenum (Mo)-Dissolved (mg/L)		0.0033	<0.0010	<0.0010	
	Nickel (Ni)-Dissolved (mg/L)		0.0016	<0.0010	<0.0010	
	Phosphorus (P)-Dissolved (mg/L)		<0.30	<0.30	<0.30	
	Potassium (K)-Dissolved (mg/L)		<2.0	<2.0	<2.0	
	Selenium (Se)-Dissolved (mg/L)		0.00122	0.000266	<0.000050	
	Silicon (Si)-Dissolved (mg/L)		1.69	2.03	<0.050	
	Silver (Ag)-Dissolved (mg/L)		<0.000020	<0.000020	<0.000020	
	Sodium (Na)-Dissolved (mg/L)		3.7	<2.0	<2.0	
	Strontium (Sr)-Dissolved (mg/L)		0.294	0.100	<0.0050	
	Thallium (Tl)-Dissolved (mg/L)		<0.00020	<0.00020	<0.00020	
	Tin (Sn)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	
	Titanium (Ti)-Dissolved (mg/L)		<0.010	<0.010	<0.010	
	Uranium (U)-Dissolved (mg/L)		0.00084	0.00045	<0.00020	
	Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	
	Zinc (Zn)-Dissolved (mg/L)		<0.0050	<0.0050	<0.0050	
Speciated Metals	Methylmercury (as MeHg)-Dissolved (ug/L)		0.000041	0.000031	0.000071 ^{RRV}	
	Methylmercury (as MeHg)-Total (ug/L)		0.000026	<0.000020	<0.000020	<0.000020

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Total Nitrogen	B	L2184609-1, -2, -3
Method Blank	Methylmercury (as MeHg)-Total	MB-LOR	L2184609-2, -3
Matrix Spike	Dissolved Organic Carbon	MS-B	L2184609-1, -2, -3
Matrix Spike	Total Organic Carbon	MS-B	L2184609-4
Matrix Spike	Total Organic Carbon	MS-B	L2184609-1, -2, -3
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2184609-3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2184609-1, -2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2184609-3
Matrix Spike	Cobalt (Co)-Dissolved	MS-B	L2184609-1, -2, -3
Matrix Spike	Lithium (Li)-Dissolved	MS-B	L2184609-1, -2, -3
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2184609-1, -2, -3
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2184609-3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2184609-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2184609-3
Matrix Spike	Nickel (Ni)-Dissolved	MS-B	L2184609-1, -2, -3
Matrix Spike	Potassium (K)-Dissolved	MS-B	L2184609-1, -2, -3
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2184609-1, -2, -3
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2184609-3
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2184609-1, -2, -3
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2184609-3
Matrix Spike	Uranium (U)-Dissolved	MS-B	L2184609-1, -2, -3
Matrix Spike	Copper (Cu)-Total	MS-B	L2184609-1, -2, -3, -4
Matrix Spike	Manganese (Mn)-Total	MS-B	L2184609-1, -2, -3, -4
Matrix Spike	Sodium (Na)-Total	MS-B	L2184609-1, -2, -3, -4
Matrix Spike	Nitrate (as N)	MS-B	L2184609-1, -2, -3, -4
Matrix Spike	Silicate (as SiO ₂)	MS-B	L2184609-1, -2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
<p>This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.</p> <p>Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.</p>			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
<p>This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.</p>			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
<p>Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.</p>			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
<p>Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.</p>			
HG-D-U-CVAF-VA	Water	Diss. Mercury in Water by CVAFS (Ultra)	APHA 3030 B / EPA 1631 REV. E
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure may involve preliminary sample treatment by filtration (APHA 3030B) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.</p>			
HG-T-U-CVAF-VA	Water	Total Mercury in Water by CVAFS (Ultra)	EPA 1631 REV. E
<p>This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.</p>			
IONBALANCE-VA	Water	Ion Balance Calculation	APHA 1030E
<p>Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.</p> <p>Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:</p> <p>Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]</p>			
MEHG-D-GCAF-VA	Water	Diss. Methylmercury in Water by GCAFS	EPA 1630
<p>This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".</p>			
MEHG-T-GCAF-VA	Water	Total Methylmercury in Water by GCAFS	EPA 1630
<p>This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".</p>			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
<p>Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.</p> <p>Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.</p>			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
<p>Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.</p> <p>Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.</p>			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA4500-P(J)/NEMI9171/USGS03-4174
<p>This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.</p>			

Reference Information

NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.			
Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.			
P-TD-COL-VA	Water	Total Dissolved P in Water by Colour	APHA 4500-P Phosphorous
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.			
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.			
Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.			
PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value
This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode			
It is recommended that this analysis be conducted in the field.			
PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.			
Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.			
Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.			
SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.
This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method. Arsenic (5+) above 100 mg/L is a negative interference on this test.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
TDS-CALC-VA	Water	TDS (Calculated)	APHA 1030E (20TH EDITION)
This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".			
The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.			
TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.
This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.			
TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC
This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.			
Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.			
TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity
This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
----------------------------	---------------------

Reference Information

VA

ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L2184609-COFC

COC Number: 14 -

Page 1 of 1

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Report To				Report Format / Dist.								Turnaround Time (TAT) is not available for all tests																																											
Company: Tetrtech				Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)								R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																																											
Contact: Lucas Hennecker				Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No								P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT																																											
Address: Suite 1000, 10th Floor, 885 Dunsmuir Street, Vancouver, BC V6C 1N5				<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked								E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																																											
Phone: 1 (604) 313-9067				Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX								E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																																											
Invoice To: Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				Invoice Distribution								Analysis Request																																											
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX								Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																											
Company:				Email 1 or Fax: ebaaccounts payable@tetrtech.com								<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td></td><td></td><td></td><td></td><td>P</td><td>F/P</td><td>P</td><td>F/P</td><td>F</td><td>P</td><td>F/P</td><td>P</td><td>F/P</td><td></td><td></td> </tr> <tr> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">Alk-Species</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Anions by IC</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">NO2+NO3+Calc</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Color-True, EC, pH, TSS, TDS-Calc</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Turbidity, Silicate, Ortho PO4, Ion Balance</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">TOC, TN, TP, TDP, TKN, NH3</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">DOC</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Total Metals (CCME+ICP+Hardness)</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Dissolved Metals (CCME+ICP+Hardness)</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Total Hg (ultra low detection limit)</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Dissolved Hg (ultra low detection limit)</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Total MerHg (ultra low detection limit)</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Dissolved MerHg (ultra low detection limit)</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Fluoride</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Cadmium, Barium, Lead, Hg, PCBs</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Dissolved Ferric-Iron</td><td style="writing-mode: vertical-rl; transform: rotate(180deg);">Number of Containers</td> </tr> </table>																P	F/P	P	F/P	F	P	F/P	P	F/P			Alk-Species	Anions by IC	NO2+NO3+Calc	Color-True, EC, pH, TSS, TDS-Calc	Turbidity, Silicate, Ortho PO4, Ion Balance	TOC, TN, TP, TDP, TKN, NH3	DOC	Total Metals (CCME+ICP+Hardness)	Dissolved Metals (CCME+ICP+Hardness)	Total Hg (ultra low detection limit)	Dissolved Hg (ultra low detection limit)	Total MerHg (ultra low detection limit)	Dissolved MerHg (ultra low detection limit)	Fluoride	Cadmium, Barium, Lead, Hg, PCBs	Dissolved Ferric-Iron	Number of Containers
				P	F/P	P	F/P	F	P	F/P	P													F/P																															
Alk-Species	Anions by IC	NO2+NO3+Calc	Color-True, EC, pH, TSS, TDS-Calc	Turbidity, Silicate, Ortho PO4, Ion Balance	TOC, TN, TP, TDP, TKN, NH3	DOC	Total Metals (CCME+ICP+Hardness)	Dissolved Metals (CCME+ICP+Hardness)	Total Hg (ultra low detection limit)	Dissolved Hg (ultra low detection limit)	Total MerHg (ultra low detection limit)													Dissolved MerHg (ultra low detection limit)	Fluoride	Cadmium, Barium, Lead, Hg, PCBs	Dissolved Ferric-Iron	Number of Containers																											
Contact:				Email 2: Lucas.Hennecker@tetrtech.com (see notes)																																																			
Project Information				Oil and Gas Required Fields (client use)																																																			
ALS Quote #: Q53931				Approver ID:				Cost Center:																																															
Job #: VENW03060 task 002				GL Account:				Routing Code:																																															
PO / AFE:				Activity Code:																																																			
LSD:				Location:																																																			
ALS Lab Work Order # (lab use only) L2184609				ALS Contact: Brent Mack				Sampler: <i>Lucas Hennecker</i>																																															
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)				Date (dd-mmm-yy)		Time (hh:mm)		Sample Type																																													
		Halfway River - Downstream (HD)								Water		R		R R R R R R R R R R		9																																							
		Middle Site C Reservoir (PR2)								Water		R		R R R R R R R R R R		9																																							
		Peace Canyon (PCT)								Water		B																																											
		Upper Site C Reservoir (PR1)								Water		B																																											
		Duplicate 2 (DUP 2)								Water		B																																											
		Field Blank								Water		R		R R R R R R R R R R		9																																							
		Trip Blank								Water		R		R R R R R R R R R R		5																																							

Drinking Water (DW) Samples¹ (client use)				Special Instructions / Specify Criteria to add on report (client use)								SAMPLE CONDITION AS RECEIVED (lab use only)											
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources. Please add nich.burnett@bchydro.com to distribution list for results								Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>											
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No												Ice packs <input checked="" type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>											
												Cooling Initiated <input checked="" type="checkbox"/>											
												INITIAL COOLER TEMPERATURES °C: 8 FINAL COOLER TEMPERATURES °C:											
SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)								FINAL SHIPMENT RECEPTION (lab use only)											
Released by: <i>Lucas Hennecker</i>		Date: <i>Oct 20/18</i>		Time: <i>12:10</i>		Received by: <i>Geoff</i>		Date: <i>Oct 20/18</i>		Time: <i>15:30</i>		Received by:				Date:				Time:			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0256 V08 Form04 January 2016

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Tetra Tech Canada Inc.
ATTN: Lucas Hennecker
1000-885 Dunsmuir Street, 10th Floor
Vancouver BC V6E 1N5

Date Received: 17-OCT-18
Report Date: 29-OCT-18 13:45 (MT)
Version: FINAL

Client Phone: 604-685-0275

Certificate of Analysis

Lab Work Order #: L2182905
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060 TASK 002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2182905-1	L2182905-2	L2182905-3	L2182905-4
		Description	Water	Water	Water	Water
		Sampled Date	17-OCT-18	17-OCT-18	12-OCT-18	17-OCT-18
		Sampled Time	14:02	13:07	11:41	10:13
		Client ID	MOBERLY RIVER - DOWNSTREAM (MD)	LOWER SITE C RESERVOIR (PR3)	PEACE AT PINE (PD1)	PINE RIVER (PINE)
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	27.6	6.6	7.2	9.4	
	Conductivity (uS/cm)	265	183	185	333	
	Hardness (as CaCO3) (mg/L)	141	94.5	96.9	181	
	pH (pH)	8.29	8.16	8.16	8.38	
	Total Suspended Solids (mg/L)	24.0	6.4	5.4	20.0	
	TDS (Calculated) (mg/L)	158	102	104	201	
	Turbidity (NTU)	43.7	3.69	2.76	33.0	
	Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	137	85.6	86.2	156
Alkalinity, Carbonate (as CaCO3) (mg/L)		<1.0	<1.0	<1.0	5.8	
Alkalinity, Hydroxide (as CaCO3) (mg/L)		<1.0	<1.0	<1.0	<1.0	
Alkalinity, Total (as CaCO3) (mg/L)		137	85.6	86.2	162	
Ammonia, Total (as N) (mg/L)		<0.0050	<0.0050	<0.0050	<0.0050	
Bromide (Br) (mg/L)		<0.050	<0.050	<0.050	<0.050	
Chloride (Cl) (mg/L)		0.71	<0.50	<0.50	1.43	
Fluoride (F) (mg/L)		0.084	0.041	0.041	0.082	
Nitrate and Nitrite (as N) (mg/L)		<0.0051	0.0549	0.0537	0.0633	
Nitrate (as N) (mg/L)		<0.0050	0.0549	0.0537	0.0623	
Nitrite (as N) (mg/L)		<0.0010	<0.0010	<0.0010	0.0010	
Total Kjeldahl Nitrogen (mg/L)		0.296	0.097	0.083	0.177	
Total Nitrogen (mg/L)		0.245	0.128	0.133	0.185	
Orthophosphate-Dissolved (as P) (mg/L)		0.0019	<0.0010	<0.0010	<0.0010	
Phosphorus (P)-Total Dissolved (mg/L)		0.0061	0.0021	0.0028	0.0033	
Phosphorus (P)-Total (mg/L)		0.0442	0.0076	0.0072	0.0338	
Silicate (as SiO2) (mg/L)		3.38	4.42	4.39	3.00	
Sulfate (SO4) (mg/L)		13.5	14.4	14.9	29.9	
Anion Sum (meq/L)		3.04	2.02	2.04	3.91	
Cation Sum (meq/L)		2.96	1.89	1.94	3.84	
Cation - Anion Balance (%)	-1.3	-3.2	-2.6	-0.9		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	7.27	2.68	2.79	3.36	
	Total Organic Carbon (mg/L)	8.88	2.66	2.67	3.87	
Total Metals	Aluminum (Al)-Total (mg/L)	0.807	0.0678	0.0857	0.679	
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	
	Arsenic (As)-Total (mg/L)	0.00076	<0.00050	<0.00050	<0.00050	
	Barium (Ba)-Total (mg/L)	0.176	0.034	0.037	0.139	
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	<0.20	

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2182905-1	L2182905-2	L2182905-3	L2182905-4
		Description	Water	Water	Water	Water
		Sampled Date	17-OCT-18	17-OCT-18	12-OCT-18	17-OCT-18
		Sampled Time	14:02	13:07	11:41	10:13
		Client ID	MOBERLY RIVER - DOWNSTREAM (MD)	LOWER SITE C RESERVOIR (PR3)	PEACE AT PINE (PD1)	PINE RIVER (PINE)
Grouping	Analyte					
WATER						
Total Metals	Boron (B)-Total (mg/L)		<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)		0.0000555	0.0000214	0.0000278	0.0000456
	Calcium (Ca)-Total (mg/L)		41.8	28.1	28.1	50.3
	Chromium (Cr)-Total (mg/L)		0.0014	<0.0010	<0.0010	0.0012
	Cobalt (Co)-Total (mg/L)		0.00065	<0.00030	<0.00030	0.00049
	Copper (Cu)-Total (mg/L)		0.0025	<0.0010	<0.0010	0.0015
	Iron (Fe)-Total (mg/L)		1.36	0.083	0.117	0.944
	Lead (Pb)-Total (mg/L)		0.00072	<0.00050	<0.00050	0.00052
	Lithium (Li)-Total (mg/L)		0.0049	0.0013	0.0014	0.0080
	Magnesium (Mg)-Total (mg/L)		11.6	6.54	7.05	14.5
	Manganese (Mn)-Total (mg/L)		0.0330	0.00349	0.00413	0.0189
	Mercury (Hg)-Total (ug/L)		0.00335	0.00063	0.00071	0.00285
	Molybdenum (Mo)-Total (mg/L)		<0.0010	<0.0010	<0.0010	<0.0010
	Nickel (Ni)-Total (mg/L)		0.0035	<0.0010	<0.0010	0.0023
	Phosphorus (P)-Total (mg/L)		<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)		<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Total (mg/L)		0.000212	0.000286	0.000303	0.000558
	Silicon (Si)-Total (mg/L)		2.63	2.07	2.12	2.43
	Silver (Ag)-Total (mg/L)		<0.000020	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Total (mg/L)		3.3	<2.0	<2.0	4.3
	Strontium (Sr)-Total (mg/L)		0.0977	0.106	0.103	0.182
	Thallium (Tl)-Total (mg/L)		0.000024	<0.000010	<0.000010	0.000019
	Tin (Sn)-Total (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)		<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Total (mg/L)		0.00041	0.00047	0.00046	0.00049
	Vanadium (V)-Total (mg/L)		0.00313	0.00055	0.00065	0.00249
	Zinc (Zn)-Total (mg/L)		0.0072	0.0090	<0.0050	0.0054
Dissolved Metals	Dissolved MeHg Filtration Location		FIELD	FIELD	FIELD	FIELD
	Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location		FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)		0.0367	0.0055	<0.0050	0.189
	Antimony (Sb)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
	Barium (Ba)-Dissolved (mg/L)		0.146	0.031	0.033	0.126
	Beryllium (Be)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)		<0.20	<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)		<0.10	<0.10	<0.10	<0.10

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2182905-1	L2182905-2	L2182905-3	L2182905-4
		Description	Water	Water	Water	Water
		Sampled Date	17-OCT-18	17-OCT-18	12-OCT-18	17-OCT-18
		Sampled Time	14:02	13:07	11:41	10:13
		Client ID	MOBERLY RIVER - DOWNSTREAM (MD)	LOWER SITE C RESERVOIR (PR3)	PEACE AT PINE (PD1)	PINE RIVER (PINE)
Grouping	Analyte					
WATER						
Dissolved Metals	Cadmium (Cd)-Dissolved (mg/L)		0.0000098	0.0000093	0.0000068	0.0000182
	Calcium (Ca)-Dissolved (mg/L)		39.0	27.4	28.1	50.6
	Chromium (Cr)-Dissolved (mg/L)		<0.0010	<0.0010	<0.0010	<0.0010
	Cobalt (Co)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030	<0.00030
	Copper (Cu)-Dissolved (mg/L)		0.0011	<0.0010	<0.0010	<0.0010
	Iron (Fe)-Dissolved (mg/L)		0.106	<0.030	<0.030	0.174
	Lead (Pb)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
	Lithium (Li)-Dissolved (mg/L)		0.0036	0.0012	0.0013	0.0076
	Magnesium (Mg)-Dissolved (mg/L)		10.5	6.36	6.50	13.3
	Manganese (Mn)-Dissolved (mg/L)		0.0133	0.00105	0.00063	0.00766
	Mercury (Hg)-Dissolved (ug/L)		0.00098	<0.00050	<0.00050	0.00140
	Molybdenum (Mo)-Dissolved (mg/L)		<0.0010	<0.0010	<0.0010	<0.0010
	Nickel (Ni)-Dissolved (mg/L)		0.0018	<0.0010	<0.0010	0.0013
	Phosphorus (P)-Dissolved (mg/L)		<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)		<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Dissolved (mg/L)		0.000151	0.000273	0.000264	0.000576
	Silicon (Si)-Dissolved (mg/L)		1.55	1.89	1.94	1.66
	Silver (Ag)-Dissolved (mg/L)		<0.000020	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Dissolved (mg/L)		3.2	<2.0	<2.0	4.4
	Strontium (Sr)-Dissolved (mg/L)		0.0986	0.103	0.104	0.175
	Thallium (Tl)-Dissolved (mg/L)		<0.00020	<0.00020	<0.00020	<0.00020
	Tin (Sn)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Dissolved (mg/L)		<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)		0.00037	0.00047	0.00048	0.00050
	Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050	0.00064
	Zinc (Zn)-Dissolved (mg/L)		<0.0050	<0.0050	<0.0050	<0.0050
Speciated Metals	Methylmercury (as MeHg)-Dissolved (ug/L)		0.000038	0.000021	<0.000020	0.000021
	Methylmercury (as MeHg)-Total (ug/L)		0.000047	<0.000020	<0.000020	0.000023

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
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Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength
This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
HG-D-U-CVAF-VA	Water	Diss. Mercury in Water by CVAFS (Ultra)	APHA 3030 B / EPA 1631 REV. E
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure may involve preliminary sample treatment by filtration (APHA 3030B) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.			
HG-T-U-CVAF-VA	Water	Total Mercury in Water by CVAFS (Ultra)	EPA 1631 REV. E
This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.			
IONBALANCE-VA	Water	Ion Balance Calculation	APHA 1030E
Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.			
Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:			
Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]			
MEHG-D-GCAF-VA	Water	Diss. Methylmercury in Water by GCAFS	EPA 1630

Reference Information

This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".

MEHG-T-GCAF-VA Water Total Methylmercury in Water by GCAFS EPA 1630

This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

N-T-COL-VA Water Total Nitrogen in water by Colour APHA4500-P(J)/NEMI9171/USGS03-4174

This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method. Arsenic (5+) above 100 mg/L is a negative interference on this test.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Reference Information

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-CALC-VA Water TDS (Calculated) APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".
 The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

- mg/kg - milligrams per kilogram based on dry weight of sample.*
- mg/kg wwt - milligrams per kilogram based on wet weight of sample.*
- mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.*
- mg/L - milligrams per litre.*
- < - Less than.*

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Chain of Custody (COC) / Analytical Request Form



COC Number: 14 -

Page 1 of 1

Canada Toll Free: 1 800 668 9878

L2182905-COFC

www.alsglobal.com

Report To		Report Format / Distribution		Rush Turnaround Time (TAT) is not available for all tests																																																																																																																																																																																																																																											
Company: Tetrattech		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)		R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																																																																																																																																																																																																																																											
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Email 1 or Fax: Lucas.Hennecker@tetrattech.com (see notes)		Email 2: Brent.Finnestad@tetrattech.com		Specify Date Required for E2,E or P:																																																																																																																																																																																																																																											
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Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: ebaaccounts@tetrattech.com		<table border="1"> <tr> <td></td><td></td><td></td><td></td><td></td><td>P</td><td>F/P</td><td>P</td><td>F/P</td><td></td><td>F</td><td>P</td><td>F/P</td><td>P</td><td>F/P</td><td></td> </tr> <tr> <td>Alk-Species</td><td>Anions by IC</td><td>NO2+NO2</td><td>Calc</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Color-True</td><td>EC</td><td>pH</td><td>TSS</td><td>TDS</td><td>Calc</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Turbidity</td><td>Silicate</td><td>Ortho PO4</td><td>Ion Balance</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>TOC</td><td>TN</td><td>TP</td><td>TDP</td><td>TKN</td><td>NH3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>DOC</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Total Metals</td><td>(CCME+ICP+Hardness)</td><td>Hardness</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Dissolved Metals</td><td>(CCME+ICP+Hardness)</td><td>Hardness</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Total Hg</td><td>(ultra low detection limit)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Dissolved Hg</td><td>(ultra low detection limit)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Total MeHg</td><td>(ultra low detection limit)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Dissolved MeHg</td><td>(ultra low detection limit)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Total Coliform</td><td>E. coli</td><td>HPC</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Dissolved Ferrous</td><td>Iron</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>																	P	F/P	P	F/P		F	P	F/P	P	F/P		Alk-Species	Anions by IC	NO2+NO2	Calc													Color-True	EC	pH	TSS	TDS	Calc											Turbidity	Silicate	Ortho PO4	Ion Balance													TOC	TN	TP	TDP	TKN	NH3											DOC																Total Metals	(CCME+ICP+Hardness)	Hardness														Dissolved Metals	(CCME+ICP+Hardness)	Hardness														Total Hg	(ultra low detection limit)															Dissolved Hg	(ultra low detection limit)															Total MeHg	(ultra low detection limit)															Dissolved MeHg	(ultra low detection limit)															Total Coliform	E. coli	HPC														Dissolved Ferrous	Iron														
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		Moberly River - Downstream (MD)		17-Oct-18		14:02		Water		R R R R R R R R R R R R R R						9																																																																																																																																																																																																																															
		Lower Site C Reservoir (PR3)		17-Oct-18		13:07		Water		R R R R R R R R R R R R R R						9																																																																																																																																																																																																																															
		Peace at Pine (PD1)		17-Oct-18		11:41		Water		R R R R R R R R R R R R R R						9																																																																																																																																																																																																																															
		Pine River (Pine)		17-Oct-18		10:13		Water		R R R R R R R R R R R R R R						9																																																																																																																																																																																																																															
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Drinking Water (DW) Samples¹ (client use)				Special Instructions / Specify Criteria to add on report (client Use)				SAMPLE CONDITION AS RECEIVED (lab use only)																																																																																																																																																																																																																																							
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources. Please and nich.burnett@bchydro.com to distribution list for results				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																																																																																																																																																							
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No								Ice packs Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																																																																																																																																																							
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Released by: Lucas Hennecker		Date: Oct 17/18		Time: 16:40		Received by: Geoff		Date: Oct 17/18		Time: 16:40		Received by: WA		Date: 10/18		Time: 11:40am																																																																																																																																																																																																																															



Tetra Tech Canada Inc.
ATTN: Lucas Hennecker
1000-885 Dunsmuir Street, 10th Floor
Vancouver BC V6E 1N5

Date Received: 18-OCT-18
Report Date: 01-NOV-18 18:35 (MT)
Version: FINAL

Client Phone: 604-685-0275

Certificate of Analysis

Lab Work Order #: L2183715
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060 TASK 002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L2183715-1	L2183715-2	L2183715-3	L2183715-4	L2183715-5
					Water	Water	Water	Water	Water
		18-OCT-18	08:10	PEACE AT BEATTON (PD2)	18-OCT-18	18-OCT-18	18-OCT-18	18-OCT-18	18-OCT-18
					08:10	08:55	09:44	10:13	11:18
					PEACE AT BEATTON (PD2)	BEATTON RIVER (BEA)	PEACE AT KISKATINAW (PD3)	KISKATINAW RIVER (KR)	PEACE AT POUCE COUPE (PD4)
Grouping	Analyte								
WATER									
Physical Tests	Colour, True (CU)	7.9	164	7.7	24.0	8.3			
	Conductivity (uS/cm)	211	354	206	429	207			
	Hardness (as CaCO3) (mg/L)	101	132	103	223	103			
	pH (pH)	8.20	8.23	8.21	8.53	8.21			
	Total Suspended Solids (mg/L)	11.2	7.0	11.2	63.6	12.6			
	TDS (Calculated) (mg/L)	113	235	113	261	114			
	Turbidity (NTU)	6.80	26.6	6.06	119	8.02			
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	94.7	117	94.1	214	94.9			
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	15.8	<1.0			
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0			
	Alkalinity, Total (as CaCO3) (mg/L)	94.7	117	94.1	230	94.9			
	Ammonia, Total (as N) (mg/L)	0.0051	0.0095	0.0110	0.0179	<0.0050			
	Bromide (Br) (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050			
	Chloride (Cl) (mg/L)	<0.50	3.09	<0.50	1.74	<0.50			
	Fluoride (F) (mg/L)	0.046	0.122	0.044	0.087	0.044			
	Nitrate and Nitrite (as N) (mg/L)	0.0554	0.0166	0.0532	0.0150	0.0533			
	Nitrate (as N) (mg/L)	0.0554	0.0151	0.0532	0.0138	0.0533			
	Nitrite (as N) (mg/L)	<0.0010	0.0015	<0.0010	0.0012	<0.0010			
	Total Kjeldahl Nitrogen (mg/L)	0.092	0.649	0.101	0.536	0.105			
	Total Nitrogen (mg/L)	0.151	0.605	0.163	0.427	0.155			
	Orthophosphate-Dissolved (as P) (mg/L)	0.0028	0.0121	<0.0010	0.0029	<0.0010			
	Phosphorus (P)-Total Dissolved (mg/L)	0.0030	0.0241	0.0027	0.0050	0.0025			
	Phosphorus (P)-Total (mg/L)	0.0133	0.0626	0.0171	0.109	0.0147			
	Silicate (as SiO2) (mg/L)	4.03	2.22	4.26	4.58	4.23			
	Sulfate (SO4) (mg/L)	16.6	64.3	16.2	19.7	16.4			
	Anion Sum (meq/L)	2.25	3.78	2.22	5.05	2.24			
	Cation Sum (meq/L)	2.02	3.91	2.08	4.94	2.06			
	Cation - Anion Balance (%)	-5.2	1.7	-3.4	-1.2	-4.3			
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	2.90	21.6	3.14	10.1	3.05			
	Total Organic Carbon (mg/L)	3.12	22.0	3.25	12.1	3.38			
Total Metals	Aluminum (Al)-Total (mg/L)	0.208	0.929	0.188	2.32	0.198			
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050			
	Arsenic (As)-Total (mg/L)	<0.00050	0.00127	<0.00050	0.00190	<0.00050			
	Barium (Ba)-Total (mg/L)	0.049	0.088	0.047	0.215	0.048			
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	0.00013	<0.00010			
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20			

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2183715-6 Water 18-OCT-18 11:51 POUCE COUPE (POUCE)	L2183715-7 Water 18-OCT-18 13:29 PEACE AT MANY ISLANDS (PD5)	L2183715-8 Water 18-OCT-18 13:29 DUP1	
Grouping	Analyte				
WATER					
Physical Tests	Colour, True (CU)	43.5	7.7	8.1	
	Conductivity (uS/cm)	882	210	210	
	Hardness (as CaCO3) (mg/L)	364	103	102	
	pH (pH)	8.43	8.22	8.22	
	Total Suspended Solids (mg/L)	7.2	9.2	9.4	
	TDS (Calculated) (mg/L)	582	114	113	
	Turbidity (NTU)	22.1	7.57	6.61	
	Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	199	95.0	93.6
Alkalinity, Carbonate (as CaCO3) (mg/L)		10.4	<1.0	<1.0	
Alkalinity, Hydroxide (as CaCO3) (mg/L)		<1.0	<1.0	<1.0	
Alkalinity, Total (as CaCO3) (mg/L)		209	95.0	93.6	
Ammonia, Total (as N) (mg/L)		0.0247	<0.0050	<0.0050	
Bromide (Br) (mg/L)		<0.25 ^{DLDS}	<0.050	<0.050	
Chloride (Cl) (mg/L)		19.1	<0.50	<0.50	
Fluoride (F) (mg/L)		0.15	0.044	0.045	
Nitrate and Nitrite (as N) (mg/L)		0.148	0.0520	0.0517	
Nitrate (as N) (mg/L)		0.148	0.0520	0.0517	
Nitrite (as N) (mg/L)		<0.0050 ^{DLDS}	<0.0010	<0.0010	
Total Kjeldahl Nitrogen (mg/L)		0.812	0.098	0.086	
Total Nitrogen (mg/L)		0.858	0.144	0.151	
Orthophosphate-Dissolved (as P) (mg/L)		0.0048	0.0023	0.0019	
Phosphorus (P)-Total Dissolved (mg/L)		0.0139	0.0092	0.0021	
Phosphorus (P)-Total (mg/L)		0.0451	0.0197	0.0151	
Silicate (as SiO2) (mg/L)		<0.50	4.21	4.03	
Sulfate (SO4) (mg/L)		232	16.9	17.0	
Anion Sum (meq/L)		9.57	2.26	2.23	
Cation Sum (meq/L)		9.75	2.06	2.05	
Cation - Anion Balance (%)	0.9	-4.5	-4.3		
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	19.1	3.22	3.14	
	Total Organic Carbon (mg/L)	19.3	3.24	3.17	
Total Metals	Aluminum (Al)-Total (mg/L)	0.290	0.200	0.199	
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Arsenic (As)-Total (mg/L)	0.00104	<0.00050	<0.00050	
	Barium (Ba)-Total (mg/L)	0.064	0.048	0.049	
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L2183715-1 Water 18-OCT-18 08:10 PEACE AT BEATTON (PD2)	L2183715-2 Water 18-OCT-18 08:55 BEATTON RIVER (BEA)	L2183715-3 Water 18-OCT-18 09:44 PEACE AT KISKATINAW (PD3)	L2183715-4 Water 18-OCT-18 10:13 KISKATINAW RIVER (KR)	L2183715-5 Water 18-OCT-18 11:18 PEACE AT POUCE COUPE (PD4)
Grouping	Analyte					
WATER						
Total Metals	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)	0.0000299	0.0000570	0.0000320	0.000113	0.0000265
	Calcium (Ca)-Total (mg/L)	28.4	33.6	29.7	60.7	29.2
	Chromium (Cr)-Total (mg/L)	<0.0010	0.0017	<0.0010	0.0036	<0.0010
	Cobalt (Co)-Total (mg/L)	<0.00030	0.00056	<0.00030	0.00158	<0.00030
	Copper (Cu)-Total (mg/L)	<0.0010	0.0027	<0.0010	0.0052	<0.0010
	Iron (Fe)-Total (mg/L)	0.299	2.63	0.258	3.75	0.272
	Lead (Pb)-Total (mg/L)	<0.00050	0.00072	<0.00050	0.00199	<0.00050
	Lithium (Li)-Total (mg/L)	0.0019	0.0081	0.0018	0.0053	0.0018
	Magnesium (Mg)-Total (mg/L)	7.47	10.8	7.34	17.5	7.28
	Manganese (Mn)-Total (mg/L)	0.00647	0.0522	0.00640	0.0685	0.00708
	Mercury (Hg)-Total (ug/L)	0.00118	0.00428	0.00104	0.00720	0.00113
	Molybdenum (Mo)-Total (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Nickel (Ni)-Total (mg/L)	0.0010	0.0051	<0.0010	0.0064	0.0011
	Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Total (mg/L)	0.000354	0.000244	0.000341	0.000292	0.000335
	Silicon (Si)-Total (mg/L)	2.29	2.92	2.23	5.65	2.18
	Silver (Ag)-Total (mg/L)	<0.000020	<0.000020	<0.000020	0.000036	<0.000020
	Sodium (Na)-Total (mg/L)	<2.0	26.5	<2.0	9.5	<2.0
	Strontium (Sr)-Total (mg/L)	0.121	0.140	0.114	0.256	0.118
	Thallium (Tl)-Total (mg/L)	<0.000010	0.000022	<0.000010	0.000061	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)	<0.010	0.026	<0.010	0.021	<0.010
	Uranium (U)-Total (mg/L)	0.00048	0.00095	0.00048	0.00078	0.00049
	Vanadium (V)-Total (mg/L)	0.00106	0.00405	0.00099	0.00882	0.00103
	Zinc (Zn)-Total (mg/L)	<0.0050	0.0070	<0.0050	0.0185	<0.0050
Dissolved Metals	Dissolved MeHg Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0095	0.106	0.0525	0.226	0.0061
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Arsenic (As)-Dissolved (mg/L)	<0.00050	0.00064	<0.00050	0.00060	<0.00050
	Barium (Ba)-Dissolved (mg/L)	0.043	0.060	0.042	0.170	0.041
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2183715-6 Water 18-OCT-18 11:51 POUCE COUPE (POUCE)	L2183715-7 Water 18-OCT-18 13:29 PEACE AT MANY ISLANDS (PD5)	L2183715-8 Water 18-OCT-18 13:29 DUP1	
Grouping	Analyte				
WATER					
Total Metals	Boron (B)-Total (mg/L)	<0.10	<0.10	<0.10	
	Cadmium (Cd)-Total (mg/L)	0.0000282	0.0000295	0.0000300	
	Calcium (Ca)-Total (mg/L)	97.2	31.5	29.6	
	Chromium (Cr)-Total (mg/L)	<0.0010	<0.0010	<0.0010	
	Cobalt (Co)-Total (mg/L)	0.00078	<0.00030	<0.00030	
	Copper (Cu)-Total (mg/L)	0.0032	<0.0010	<0.0010	
	Iron (Fe)-Total (mg/L)	0.934	0.304	0.296	
	Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Lithium (Li)-Total (mg/L)	0.0169	0.0020	0.0020	
	Magnesium (Mg)-Total (mg/L)	31.7	7.41	7.51	
	Manganese (Mn)-Total (mg/L)	0.0385	0.00906	0.00740	
	Mercury (Hg)-Total (ug/L)	0.00296	0.00108	0.00103	
	Molybdenum (Mo)-Total (mg/L)	<0.0010	<0.0010	<0.0010	
	Nickel (Ni)-Total (mg/L)	0.0079	0.0012	0.0013	
	Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	
	Potassium (K)-Total (mg/L)	5.5	<2.0	<2.0	
	Selenium (Se)-Total (mg/L)	0.000357	0.000306	0.000321	
	Silicon (Si)-Total (mg/L)	0.50	2.21	2.22	
	Silver (Ag)-Total (mg/L)	<0.000020	<0.000020	<0.000020	
	Sodium (Na)-Total (mg/L)	50.6	2.0	2.0	
	Strontium (Sr)-Total (mg/L)	0.355	0.117	0.117	
	Thallium (Tl)-Total (mg/L)	0.000014	<0.000010	<0.000010	
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.010	
	Uranium (U)-Total (mg/L)	0.00225	0.00045	0.00046	
	Vanadium (V)-Total (mg/L)	0.00121	0.00107	0.00111	
	Zinc (Zn)-Total (mg/L)	<0.0050	<0.0050	<0.0050	
Dissolved Metals	Dissolved MeHg Filtration Location	FIELD	FIELD	FIELD	
	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	
	Aluminum (Al)-Dissolved (mg/L)	0.0840	0.0470	0.0404	
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	
	Arsenic (As)-Dissolved (mg/L)	0.00060	<0.00050	<0.00050	
	Barium (Ba)-Dissolved (mg/L)	0.058	0.043	0.042	
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	
	Boron (B)-Dissolved (mg/L)	<0.10	<0.10	<0.10	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2183715-1 Water 18-OCT-18 08:10 PEACE AT BEATTON (PD2)	L2183715-2 Water 18-OCT-18 08:55 BEATTON RIVER (BEA)	L2183715-3 Water 18-OCT-18 09:44 PEACE AT KISKATINAW (PD3)	L2183715-4 Water 18-OCT-18 10:13 KISKATINAW RIVER (KR)	L2183715-5 Water 18-OCT-18 11:18 PEACE AT POUCE COUPE (PD4)	
Grouping	Analyte					
WATER						
Dissolved Metals	Cadmium (Cd)-Dissolved (mg/L)	0.0000111	0.0000244	0.0000174	0.0000364	0.0000145
	Calcium (Ca)-Dissolved (mg/L)	28.1	34.8	29.5	62.4	29.6
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Cobalt (Co)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	0.00040	<0.00030
	Copper (Cu)-Dissolved (mg/L)	<0.0010	0.0015	<0.0010	0.0020	<0.0010
	Iron (Fe)-Dissolved (mg/L)	<0.030	0.903	0.065	0.535	<0.030
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Lithium (Li)-Dissolved (mg/L)	0.0019	0.0079	0.0018	0.0037	0.0018
	Magnesium (Mg)-Dissolved (mg/L)	7.52	10.9	7.23	16.2	7.06
	Manganese (Mn)-Dissolved (mg/L)	0.00139	0.0300	0.00315	0.0209	0.00104
	Mercury (Hg)-Dissolved (ug/L)	<0.00050	0.00222	0.00064	0.00283	<0.00050
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Nickel (Ni)-Dissolved (mg/L)	<0.0010	0.0039	<0.0010	0.0024	<0.0010
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0
	Selenium (Se)-Dissolved (mg/L)	0.000327	0.000184	0.000315	0.000141	0.000358
	Silicon (Si)-Dissolved (mg/L)	1.75	1.02	1.79	2.22	1.74
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Sodium (Na)-Dissolved (mg/L)	<2.0	27.9	<2.0	9.9	<2.0
	Strontium (Sr)-Dissolved (mg/L)	0.114	0.132	0.114	0.243	0.116
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.00046	0.00085	0.00045	0.00070	0.00048
	Vanadium (V)-Dissolved (mg/L)	<0.00050	0.00052	<0.00050	0.00095	<0.00050
	Zinc (Zn)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	0.0056	<0.0050
Speciated Metals	Methylmercury (as MeHg)-Dissolved (ug/L)	0.000021	0.000225	0.000022	0.000045	<0.000020
	Methylmercury (as MeHg)-Total (ug/L)	0.000021	0.000251	0.000024	0.000068	<0.000020

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2183715-6	L2183715-7	L2183715-8
		Description	Water	Water	Water
		Sampled Date	18-OCT-18	18-OCT-18	18-OCT-18
		Sampled Time	11:51	13:29	13:29
		Client ID	POUCE COUPE (POUCE)	PEACE AT MANY ISLANDS (PD5)	DUP1
Grouping	Analyte				
WATER					
Dissolved Metals	Cadmium (Cd)-Dissolved (mg/L)	0.0000158	0.0000210	0.0000221	
	Calcium (Ca)-Dissolved (mg/L)	94.1	29.2	28.9	
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	
	Cobalt (Co)-Dissolved (mg/L)	0.00050	<0.00030	<0.00030	
	Copper (Cu)-Dissolved (mg/L)	0.0025	<0.0010	<0.0010	
	Iron (Fe)-Dissolved (mg/L)	0.094	0.057	0.056	
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	
	Lithium (Li)-Dissolved (mg/L)	0.0161	0.0018	0.0018	
	Magnesium (Mg)-Dissolved (mg/L)	31.3	7.25	7.26	
	Manganese (Mn)-Dissolved (mg/L)	0.0197	0.00252	0.00246	
	Mercury (Hg)-Dissolved (ug/L)	0.00148	<0.00050	0.00050	
	Molybdenum (Mo)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	
	Nickel (Ni)-Dissolved (mg/L)	0.0069	<0.0010	<0.0010	
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	
	Potassium (K)-Dissolved (mg/L)	6.2	<2.0	<2.0	
	Selenium (Se)-Dissolved (mg/L)	0.000372	0.000319	0.000332	
	Silicon (Si)-Dissolved (mg/L)	0.169	1.79	1.82	
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	
	Sodium (Na)-Dissolved (mg/L)	53.0	<2.0	<2.0	
	Strontium (Sr)-Dissolved (mg/L)	0.352	0.115	0.113	
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	
	Uranium (U)-Dissolved (mg/L)	0.00225	0.00047	0.00048	
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	
	Zinc (Zn)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	
Speciated Metals	Methylmercury (as MeHg)-Dissolved (ug/L)	0.000082	<0.000020	<0.000020	
	Methylmercury (as MeHg)-Total (ug/L)	0.000120	<0.000020	<0.000020	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Methylmercury (as MeHg)-Dissolved	MB-LOR	L2183715-5, -7, -8
Method Blank	Methylmercury (as MeHg)-Total	MB-LOR	L2183715-5, -7, -8
Matrix Spike	Dissolved Organic Carbon	MS-B	L2183715-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Total Organic Carbon	MS-B	L2183715-1, -3, -4, -5, -6, -7, -8
Matrix Spike	Total Organic Carbon	MS-B	L2183715-1, -3, -4, -5, -6, -7, -8
Matrix Spike	Aluminum (Al)-Dissolved	MS-B	L2183715-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2183715-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2183715-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2183715-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2183715-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2183715-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2183715-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Aluminum (Al)-Total	MS-B	L2183715-6, -7, -8
Matrix Spike	Barium (Ba)-Total	MS-B	L2183715-1, -2, -3, -4, -5
Matrix Spike	Barium (Ba)-Total	MS-B	L2183715-6, -7, -8
Matrix Spike	Calcium (Ca)-Total	MS-B	L2183715-1, -2, -3, -4, -5
Matrix Spike	Calcium (Ca)-Total	MS-B	L2183715-6, -7, -8
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2183715-1, -2, -3, -4, -5
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2183715-6, -7, -8
Matrix Spike	Manganese (Mn)-Total	MS-B	L2183715-6, -7, -8
Matrix Spike	Potassium (K)-Total	MS-B	L2183715-6, -7, -8
Matrix Spike	Sodium (Na)-Total	MS-B	L2183715-1, -2, -3, -4, -5
Matrix Spike	Sodium (Na)-Total	MS-B	L2183715-6, -7, -8
Matrix Spike	Strontium (Sr)-Total	MS-B	L2183715-1, -2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Total	MS-B	L2183715-6, -7, -8
Matrix Spike	Silicate (as SiO ₂)	MS-B	L2183715-1, -2, -3, -4, -5, -6, -7, -8

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
ANIONS-N+N-CALC-VA	Water	Nitrite & Nitrate in Water (Calculation)	EPA 300.0
Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).			
BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310B
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.			
CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310B TOTAL ORGANIC CARBON (TOC)
This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength

Reference Information

This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.

Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.

EC-PCT-VA Water Conductivity (Automated) APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

EC-SCREEN-VA Water Conductivity Screen (Internal Use Only) APHA 2510

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

F-IC-N-VA Water Fluoride in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-U-CVAF-VA Water Diss. Mercury in Water by CVAFS (Ultra) APHA 3030 B / EPA 1631 REV. E

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure may involve preliminary sample treatment by filtration (APHA 3030B) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.

HG-T-U-CVAF-VA Water Total Mercury in Water by CVAFS (Ultra) EPA 1631 REV. E

This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.

IONBALANCE-VA Water Ion Balance Calculation APHA 1030E

Cation Sum, Anion Sum, and Ion Balance (as % difference) are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Because all aqueous solutions are electrically neutral, the calculated ion balance (% difference of cations minus anions) should be near-zero.

Cation and Anion Sums are the total meq/L concentration of major cations and anions. Dissolved species are used where available. Minor ions are included where data is present. Ion Balance is calculated as:

Ion Balance (%) = [Cation Sum-Anion Sum] / [Cation Sum+Anion Sum]

MEHG-D-GCAF-VA Water Diss. Methylmercury in Water by GCAFS EPA 1630

This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".

MEHG-T-GCAF-VA Water Total Methylmercury in Water by GCAFS EPA 1630

This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolyzed to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

N-T-COL-VA Water Total Nitrogen in water by Colour APHA4500-P(J)/NEMI9171/USGS03-4174

This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et

Reference Information

al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorus is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

PO4-DO-COL-VA Water Diss. Orthophosphate in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

Samples with very high dissolved solids (i.e. seawaters, brackish waters) may produce a negative bias by this method. Alternate methods are available for these types of samples.

Arsenic (5+), at elevated levels, is a positive interference on colourimetric phosphate analysis.

SILICATE-COL-VA Water Silicate by Colourimetric analysis APHA 4500-SiO2 E.

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method. Arsenic (5+) above 100 mg/L is a negative interference on this test.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TDS-CALC-VA Water TDS (Calculated) APHA 1030E (20TH EDITION)

This analysis is carried out using procedures adapted from APHA 1030E "Checking Correctness of Analyses".

The Total Dissolved Solids result is calculated from measured concentrations of anions and cations in the sample.

TKN-F-VA Water TKN in Water by Fluorescence APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA Water Total Suspended Solids by Gravimetric APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
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VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA
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Reference Information

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Tetra Tech Canada Inc.
ATTN: Lucas Hennecker
1000-885 Dunsmuir Street, 10th Floor
Vancouver BC V6E 1N5

Date Received: 19-OCT-18
Report Date: 29-OCT-18 13:47 (MT)
Version: FINAL

Client Phone: 604-685-0275

Certificate of Analysis

Lab Work Order #: L2184475
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060 TASK 002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2184475-1 Soil 19-OCT-18 10:00 WILLISTON RESERVOIR (W1)	L2184475-2 Soil 19-OCT-18 13:00 DINOSAUR RESERVOIR (D1)	L2184475-3 Soil 19-OCT-18 10:00 DUPLICATE 2 (DUP 2)	L2184475-4 Soil 19-OCT-18 15:05 PEACE CANYON (PC1)	L2184475-5 Soil 19-OCT-18 15:56 UPPER SITE C RESERVOIR (PR1)
Grouping	Analyte				
SOIL					
Physical Tests	pH (1:2 soil:water) (pH)				
	8.54	8.14	8.57	8.68	7.75
Particle Size	% Gravel (>2mm) (%)				
	<1.0	<1.0	<1.0	<1.0	27.2
	% Sand (2.00mm - 1.00mm) (%)				
	<1.0	<1.0	<1.0	10.4	6.7
	% Sand (1.00mm - 0.50mm) (%)				
	<1.0	<1.0	<1.0	11.9	4.4
	% Sand (0.50mm - 0.25mm) (%)				
	<1.0	<1.0	<1.0	19.0	7.3
	% Sand (0.25mm - 0.125mm) (%)				
	<1.0	5.1	<1.0	18.8	12.0
	% Sand (0.125mm - 0.063mm) (%)				
	28.3	13.2	27.1	12.4	9.4
	% Silt (0.063mm - 0.0312mm) (%)				
	36.0	31.9	36.5	11.0	14.0
	% Silt (0.0312mm - 0.004mm) (%)				
	32.2	38.8	32.8	11.9	15.9
	% Clay (<4um) (%)				
	2.5	10.1	2.7	4.6	3.1
	Texture				
	Silt loam	Silt loam	Silt loam	Loamy sand	Sandy loam
Leachable Anions & Nutrients	Total Kjeldahl Nitrogen (%)				
	0.023	0.104	<0.020	0.073	0.174
Anions and Nutrients	Total Nitrogen by LECO (%)				
	0.079	0.120	0.030	0.083	0.185
Organic / Inorganic Carbon	Total Organic Carbon (%)				
	4.2	1.73	1.39	1.30	3.07
Plant Available Nutrients	Available Ammonium-N (mg/kg)				
	<1.0	1.6	<1.0	2.1	3.7
	Nitrate+Nitrite-N (mg/kg)				
	<2.0	<2.0	<2.0	<2.0	3.0 ^{DLM}
	Nitrate-N (mg/kg)				
	<2.0	<2.0	<2.0	<2.0	3.0 ^{DLM}
	Nitrite-N (mg/kg)				
	<0.40	<0.40	<0.40	<0.40	<1.2 ^{DLM}
	Available Phosphate-P (mg/kg)				
	<2.0	<2.0	<2.0	<2.0	3.6
Metals	Aluminum (Al) (mg/kg)				
	5300	7590	5650	7210	6110
	Antimony (Sb) (mg/kg)				
	0.73	1.10	0.72	0.52	0.70
	Arsenic (As) (mg/kg)				
	4.39	7.20	4.70	6.15	6.76
	Barium (Ba) (mg/kg)				
	96.9	461	105	278	169
	Beryllium (Be) (mg/kg)				
	0.20	0.39	0.19	0.34	0.29
	Bismuth (Bi) (mg/kg)				
	<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)				
	<5.0	7.6	<5.0	6.1	6.7
	Cadmium (Cd) (mg/kg)				
	0.882	0.963	0.888	0.588	0.822
	Calcium (Ca) (mg/kg)				
	67200	37000	68300	41100	25800
	Chromium (Cr) (mg/kg)				
	17.1	18.1	18.3	26.4	16.6
	Cobalt (Co) (mg/kg)				
	5.59	6.98	5.74	6.50	5.60
	Copper (Cu) (mg/kg)				
	11.8	20.6	11.9	16.9	14.0
	Iron (Fe) (mg/kg)				
	14600	16400	14600	22000	17400
	Lead (Pb) (mg/kg)				
	5.88	9.63	5.84	9.07	7.53
	Lithium (Li) (mg/kg)				
	7.5	9.2	7.6	10.4	7.6
	Magnesium (Mg) (mg/kg)				
	18300	10700	19700	9300	10300

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2184475-1	L2184475-2	L2184475-3	L2184475-4	L2184475-5
		Description	Soil	Soil	Soil	Soil	Soil
		Sampled Date	19-OCT-18	19-OCT-18	19-OCT-18	19-OCT-18	19-OCT-18
		Sampled Time	10:00	13:00	10:00	15:05	15:56
		Client ID	WILLISTON RESERVOIR (W1)	DINOSAUR RESERVOIR (D1)	DUPLICATE 2 (DUP 2)	PEACE CANYON (PC1)	UPPER SITE C RESERVOIR (PR1)
Grouping	Analyte						
SOIL							
Metals	Manganese (Mn) (mg/kg)		306	312	314	261	259
	Mercury (Hg) (mg/kg)		0.0295	0.0519	0.0181	0.0405	0.0534
	Molybdenum (Mo) (mg/kg)		1.22	1.36	1.15	0.84	1.16
	Nickel (Ni) (mg/kg)		18.1	23.8	18.6	20.8	21.9
	Phosphorus (P) (mg/kg)		894	809	881	781	910
	Potassium (K) (mg/kg)		550	1490	630	1100	1000
	Selenium (Se) (mg/kg)		0.26	0.53	0.20	0.33	0.65
	Silver (Ag) (mg/kg)		<0.10	0.28	<0.10	0.15	0.16
	Sodium (Na) (mg/kg)		91	109	93	112	85
	Strontium (Sr) (mg/kg)		123	84.8	126	119	59.0
	Sulfur (S) (mg/kg)		<1000	<1000	<1000	<1000	<1000
	Thallium (Tl) (mg/kg)		0.131	0.202	0.130	0.110	0.146
	Tin (Sn) (mg/kg)		<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)		298	96.7	338	159	133
	Tungsten (W) (mg/kg)		<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)		0.814	0.778	0.853	0.615	0.837
	Vanadium (V) (mg/kg)		36.3	41.1	38.6	52.0	35.9
	Zinc (Zn) (mg/kg)		48.7	77.9	49.6	77.8	66.5
	Zirconium (Zr) (mg/kg)		3.6	1.8	3.7	2.0	<1.0

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Mercury (Hg)	DUP-H	L2184475-1, -2, -3, -4, -5

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
C-TIC-PCT-SK	Soil	Total Inorganic Carbon in Soil	CSSS (2008) P216-217
A known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.			
C-TOC-CALC-SK	Soil	Total Organic Carbon Calculation	CSSS (2008) 21.2
Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon. (TIC)			
C-TOT-LECO-SK	Soil	Total Carbon by combustion method	CSSS (2008) 21.2
The sample is ignited in a combustion analyzer where carbon in the reduced CO ₂ gas is determined using a thermal conductivity detector.			
HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)
Soil samples are digested with hot nitric and hydrochloric acids, followed by CVAAS analysis. This method is fully compliant with the BC SALM strong acid leachable metals digestion method.			
IC-CACO3-CALC-SK	Soil	Inorganic Carbon as CaCO ₃ Equivalent	Calculation
MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)
Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.			
Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H ₂ S) may be excluded if lost during sampling, storage, or digestion.			
N-TOT-LECO-SK	Soil	Total Nitrogen by combustion method	CSSS (2008) 22.4
The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.			
N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen	CSSS (2008) 22.2.3
The soil is digested with sulfuric acid in the presence of CuSO ₄ and K ₂ SO ₄ catalysts. Ammonia in the soil extract is determined colorimetrically at 660 nm.			
N2/N3-AVAIL-SK	Soil	Nitrate, Nitrite and Nitrate+Nitrite-N	APHA 4500 NO ₃ F
Available Nitrate and Nitrite are extracted from the soil using a dilute calcium chloride solution. Nitrate plus Nitrite is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. The resulting water soluble dye has a magenta color which is measured at colorimetrically at 520nm. Nitrite is determined on the same extract by following the same instrumental procedure without a cadmium column. Reference: Recommended Methods of Soil Analysis for Canadian Prairie Agricultural Soils. Alberta Agriculture (1988) p. 19 and 28			
NH4-AVAIL-SK	Soil	Available Ammonium-N	CSSS Carter 6.2 / Comm Soil Sci 19(6)
Ammonium (NH ₄ -N) is extracted from the soil using 2 N KCl. Ammonium in the extract is mixed with hypochlorite and salicylate to form indophenol blue, which is determined colorimetrically by auto analysis at 660 nm.			
PH-1:2-VA	Soil	pH in Soil (1:2 Soil:Water Extraction)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL
This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. The pH of the solution is then measured using a standard pH probe.			
PO4-AVAIL-SK	Soil	Available Phosphate-P	Comm. Soil Sci. Plant Anal. 25 (5&6)
Plant available phosphorus is extracted from the soil using Modified Kelowna solution. Phosphorous in the soil extract is determined colorimetrically at 880 nm.			
PSA-PIPET-DETAIL-SK	Soil	Particle size - Sieve and Pipette	SSIR-51 METHOD 3.2.1
Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.			

Reference Information

Reference:

Burt, R. (2009). Soil Survey Field and Laboratory Methods Manual. Soil Survey Investigations Report No. 5. Method 3.2.1.2.2. United States Department of Agriculture Natural Resources Conservation Service.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Report To		Report Format / Distribution			<small>ash Turnaround Time (TAT) is not available for all tests)</small>												
Company: Tetratech		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)												
Contact: Lucas Hennecker		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT												
Address: Suite 1000, 10th Floor, 885 Dunsmuir Street, Vancouver, BC V6C 1N5		<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT												
Phone: 1 (604) 313-9067		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge												
		Email 1 or Fax Lucas.Hennecker@tetratech.com (see notes)			Specify Date Required for E2, E or P:												
		Email 2 Brent.Finnestad@tetratech.com			Analysis Request												
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below												
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX															
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax ebaaccountspayable@tetratech.com															
Company:		Email 2 Lucas.Hennecker@tetratech.com (see notes)															
Project Information		Oil and Gas Required Fields (client use)															
ALS Quote #: Q53931		Approver ID:															
Job #: VENW03060 task 002		Cost Center:															
PO / AFE:		GL Account:															
LSD:		Routing Code:															
		Activity Code:															
		Location:															
ALS Lab Work Order # (lab use only)		ALS Contact:															
L2184475		Brent Mack															
		Sampler: <i>Lucas Hennecker</i>															
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, TN, TP, TDP, TKN, NH3	Particle Size	Total Metals (CCME+ICP+Hardness) & Hg								Number of Containers		
	Williston Reservoir (W1)	19-Oct-18	10:00	Soil	R	R	R										3
	Dinosaur Reservoir (D1)		13:00	Soil	R	R	R										3
	Duplicate 2 (DUP 2)		10:00	Soil	R	R	R										3
	Peace Canyon (PCI)		15:05	Soil	R	R	R										3
	Upper site C Reservoir (PRI)		15:56	Soil	R	R	R										3
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)			SAMPLE CONDITION AS RECEIVED (lab use only)												
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources. Please add nich.burnett@bchydro.com to distribution list for results			Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>												
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Ice packs Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>												
					Cooling Initiated <input checked="" type="checkbox"/>												
					INITIAL COOLER TEMPERATURES °C					FINAL COOLER TEMPERATURES °C							
					9												
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)												
Released by: <i>Lucas Hennecker</i>		Received by: <i>Geoff</i>			Received by:												
Date: <i>Oct 19/18</i>		Date: <i>Oct 19/18</i>			Date:												
Time: <i>18:25</i>		Time: <i>18:25</i>			Time:												

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0226-109 Rev 04 January 2014



Tetra Tech Canada Inc.
ATTN: Lucas Hennecker
1000-885 Dunsmuir Street, 10th Floor
Vancouver BC V6E 1N5

Date Received: 20-OCT-18
Report Date: 30-OCT-18 15:25 (MT)
Version: FINAL

Client Phone: 604-685-0275

Certificate of Analysis

Lab Work Order #: L2184608
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060 TASK 002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
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ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2184608-1 Soil 20-OCT-18 09:15 HALFWAY RIVER - DOWNSTREAM - (HD)	L2184608-2 Soil 20-OCT-18 08:36 MIDDLE SITE C RESERVOIR (PR2)		
Grouping	Analyte				
SOIL					
Physical Tests	pH (1:2 soil:water) (pH)	8.32	8.20		
Particle Size	% Gravel (>2mm) (%)	1.1	1.7		
	% Sand (2.00mm - 1.00mm) (%)	2.0	<1.0		
	% Sand (1.00mm - 0.50mm) (%)	7.4	<1.0		
	% Sand (0.50mm - 0.25mm) (%)	30.6	2.3		
	% Sand (0.25mm - 0.125mm) (%)	33.8	6.0		
	% Sand (0.125mm - 0.063mm) (%)	5.5	18.3		
	% Silt (0.063mm - 0.0312mm) (%)	5.2	26.6		
	% Silt (0.0312mm - 0.004mm) (%)	9.0	34.5		
	% Clay (<4um) (%)	5.6	9.3		
	Texture	Loamy sand	Silt loam		
Leachable Anions & Nutrients	Total Kjeldahl Nitrogen (%)	0.070	0.083		
Anions and Nutrients	Total Nitrogen by LECO (%)	0.108	0.143		
Organic / Inorganic Carbon	Total Organic Carbon (%)	0.73	0.87		
Plant Available Nutrients	Available Ammonium-N (mg/kg)	1.3	1.9		
	Nitrate+Nitrite-N (mg/kg)	<2.0	<2.0		
	Nitrate-N (mg/kg)	<2.0	<2.0		
	Nitrite-N (mg/kg)	<0.40	<0.40		
	Available Phosphate-P (mg/kg)	3.0	<2.0		
Metals	Aluminum (Al) (mg/kg)	6390	8470		
	Antimony (Sb) (mg/kg)	0.72	0.76		
	Arsenic (As) (mg/kg)	9.12	6.39		
	Barium (Ba) (mg/kg)	414	385		
	Beryllium (Be) (mg/kg)	0.47	0.40		
	Bismuth (Bi) (mg/kg)	<0.20	<0.20		
	Boron (B) (mg/kg)	7.8	7.5		
	Cadmium (Cd) (mg/kg)	0.495	0.846		
	Calcium (Ca) (mg/kg)	18100	33200		
	Chromium (Cr) (mg/kg)	11.6	19.0		
	Cobalt (Co) (mg/kg)	7.00	7.64		
	Copper (Cu) (mg/kg)	14.8	19.8		
	Iron (Fe) (mg/kg)	23000	18700		
	Lead (Pb) (mg/kg)	8.39	8.09		
	Lithium (Li) (mg/kg)	9.3	11.2		
	Magnesium (Mg) (mg/kg)	4250	12700		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L2184608-1 Soil 20-OCT-18 09:15 HALFWAY RIVER - DOWNSTREAM - (HD)	L2184608-2 Soil 20-OCT-18 08:36 MIDDLE SITE C RESERVOIR (PR2)			
Grouping	Analyte				
SOIL					
Metals	Manganese (Mn) (mg/kg)	249	302		
	Mercury (Hg) (mg/kg)	0.0412	0.0542		
	Molybdenum (Mo) (mg/kg)	1.85	1.23		
	Nickel (Ni) (mg/kg)	19.5	24.3		
	Phosphorus (P) (mg/kg)	1120	822		
	Potassium (K) (mg/kg)	1370	1400		
	Selenium (Se) (mg/kg)	0.69	0.58		
	Silver (Ag) (mg/kg)	0.15	0.21		
	Sodium (Na) (mg/kg)	86	133		
	Strontium (Sr) (mg/kg)	62.4	72.7		
	Sulfur (S) (mg/kg)	1700	<1000		
	Thallium (Tl) (mg/kg)	0.119	0.171		
	Tin (Sn) (mg/kg)	<2.0	<2.0		
	Titanium (Ti) (mg/kg)	<33 ^{DLM}	169		
	Tungsten (W) (mg/kg)	<0.50	<0.50		
	Uranium (U) (mg/kg)	0.958	0.825		
	Vanadium (V) (mg/kg)	27.0	40.7		
	Zinc (Zn) (mg/kg)	82.6	78.3		
	Zirconium (Zr) (mg/kg)	2.4	2.6		

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
C-TIC-PCT-SK	Soil	Total Inorganic Carbon in Soil	CSSS (2008) P216-217
		A known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.	
C-TOC-CALC-SK	Soil	Total Organic Carbon Calculation	CSSS (2008) 21.2
		Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon. (TIC)	
C-TOT-LECO-SK	Soil	Total Carbon by combustion method	CSSS (2008) 21.2
		The sample is ignited in a combustion analyzer where carbon in the reduced CO ₂ gas is determined using a thermal conductivity detector.	
HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)
		Soil samples are digested with hot nitric and hydrochloric acids, followed by CVAAS analysis. This method is fully compliant with the BC SALM strong acid leachable metals digestion method.	
IC-CACO3-CALC-SK	Soil	Inorganic Carbon as CaCO ₃ Equivalent	Calculation
MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)
		Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.	
		Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H ₂ S) may be excluded if lost during sampling, storage, or digestion.	
N-TOT-LECO-SK	Soil	Total Nitrogen by combustion method	CSSS (2008) 22.4
		The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.	
N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen	CSSS (2008) 22.2.3
		The soil is digested with sulfuric acid in the presence of CuSO ₄ and K ₂ SO ₄ catalysts. Ammonia in the soil extract is determined colorimetrically at 660 nm.	
N2/N3-AVAIL-SK	Soil	Nitrate, Nitrite and Nitrate+Nitrite-N	APHA 4500 NO ₃ F
		Available Nitrate and Nitrite are extracted from the soil using a dilute calcium chloride solution. Nitrate plus Nitrite is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. The resulting water soluble dye has a magenta color which is measured at colorimetrically at 520nm. Nitrite is determined on the same extract by following the same instrumental procedure without a cadmium column. Reference: Recommended Methods of Soil Analysis for Canadian Prairie Agricultural Soils. Alberta Agriculture (1988) p. 19 and 28	
NH4-AVAIL-SK	Soil	Available Ammonium-N	CSSS Carter 6.2 / Comm Soil Sci 19(6)
		Ammonium (NH ₄ -N) is extracted from the soil using 2 N KCl. Ammonium in the extract is mixed with hypochlorite and salicylate to form indophenol blue, which is determined colorimetrically by auto analysis at 660 nm.	
PH-1:2-VA	Soil	pH in Soil (1:2 Soil:Water Extraction)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL
		This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. The pH of the solution is then measured using a standard pH probe.	
PO4-AVAIL-SK	Soil	Available Phosphate-P	Comm. Soil Sci. Plant Anal. 25 (5&6)
		Plant available phosphorus is extracted from the soil using Modified Kelowna solution. Phosphorous in the soil extract is determined colorimetrically at 880 nm.	
PSA-PIPET-DETAIL-SK	Soil	Particle size - Sieve and Pipette	SSIR-51 METHOD 3.2.1
		Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.	

Reference:

Burt, R. (2009). Soil Survey Field and Laboratory Methods Manual. Soil Survey Investigations Report No. 5. Method 3.2.1.2.2. United States

Reference Information

Department of Agriculture Natural Resources Conservation Service.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



L2184608-COFC

Report To Company: Tetratech Contact: Lucas Hennecker Address: Suite 1000, 10th Floor, 885 Dunsmuir Street, Vancouver, BC V6C 1N5 Phone: 1 (604) 313-9067		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: Lucas.Hennecker@tetratech.com (see notes) Email 2: Brent.Finnestad@tetratech.com		Turnaround Time (TAT) is not available for all tests R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P:											
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: ebaaccountspayable@tetratech.com Email 2: Lucas.Hennecker@tetratech.com (see notes)		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below											
Project Information ALS Quote #: Q53931 Job #: VENW03060 task 002 PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: GL Account: Activity Code: Location:		TOC, TN, TP, TDP, TKN, NH3 Particle Size Total Metals (COME+ICP+Hardness) & Hg Number of Containers											
ALS Lab Work Order # (lab use only) L2184608		ALS Contact: Brent Mack Sampler: <i>Lucas Hennecker</i>													
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type									
	Halfway River - Downstream (HD)					Soil	R	R	R					3	
	Middle Site C Reservoir (PR2)					Soil	R	R	R					3	
	Lower Canyon (PC1)					Soil	R	R	R					3	
	Upper Site C Reservoir (PB1)					Soil	R	R	R					3	
	Duplicate 1 (DUP 1)					Soil	R	R	R					3	
Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Special Instructions / Specify Criteria to add on report (client use) Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources. Please add nich.burnett@bchydro.com to distribution list for results				SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input checked="" type="checkbox"/>				INITIAL COOLER TEMPERATURES °C: 9 FINAL COOLER TEMPERATURES °C:			
SHIPMENT RELEASE (client use) Released by: <i>Lucas Hennecker</i> Date: <i>Oct 20/18</i> Time: <i>12:10</i>				INITIAL SHIPMENT RECEPTION (lab use only) Received by: <i>Gloft</i> Date: <i>Oct 20/18</i> Time: <i>5:30</i>				FINAL SHIPMENT RECEPTION (lab use only) Received by: Date: Time:							

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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NA-FM-0220e M02 Form 04 January 2014

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Tetra Tech Canada Inc.
ATTN: Lucas Hennecker
1000-885 Dunsmuir Street, 10th Floor
Vancouver BC V6E 1N5

Date Received: 17-OCT-18
Report Date: 29-OCT-18 15:48 (MT)
Version: FINAL

Client Phone: 604-685-0275

Certificate of Analysis

Lab Work Order #: L2182906
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060 TASK 002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2182906-1	L2182906-2	L2182906-3	L2182906-4
		Description	Soil	Soil	Soil	Soil
		Sampled Date	17-OCT-18	17-OCT-18	17-OCT-18	17-OCT-18
		Sampled Time	14:02	13:07	11:41	10:13
		Client ID	MOBERLY RIVER - DOWNSTREAM (MD)	LOWER SITE C RESERVOIR (PR3)	PEACE AT PINE (PD1)	PINE RIVER (PINE)
Grouping	Analyte					
SOIL						
Physical Tests	pH (1:2 soil:water) (pH)		8.16	7.74	8.11	8.41
Particle Size	% Gravel (>2mm) (%)		<1.0	<1.0	<1.0	4.5
	% Sand (2.00mm - 1.00mm) (%)		<1.0	<1.0	<1.0	<1.0
	% Sand (1.00mm - 0.50mm) (%)		<1.0	<1.0	<1.0	2.7
	% Sand (0.50mm - 0.25mm) (%)		14.3	<1.0	<1.0	55.3
	% Sand (0.25mm - 0.125mm) (%)		38.1	2.5	10.7	23.6
	% Sand (0.125mm - 0.063mm) (%)		20.8	15.6	32.8	4.7
	% Silt (0.063mm - 0.0312mm) (%)		9.5	33.2	24.7	3.0
	% Silt (0.0312mm - 0.004mm) (%)		9.7	38.8	23.8	3.7
	% Clay (<4um) (%)		7.2	9.4	7.7	2.1
		Texture		Loamy sand	Silt loam	Sandy loam
Leachable Anions & Nutrients	Total Kjeldahl Nitrogen (%)		0.086	0.112	0.084	0.045
Anions and Nutrients	Total Nitrogen by LECO (%)		0.088	0.127	0.095	0.043
Organic / Inorganic Carbon	Total Organic Carbon (%)		1.30	1.74	1.47	0.62
Plant Available Nutrients	Available Ammonium-N (mg/kg)		2.1	10.3	6.2	<1.0
	Nitrate+Nitrite-N (mg/kg)		<2.0	<2.0	<2.0	<2.0
	Nitrate-N (mg/kg)		<2.0	<2.0	<2.0	<2.0
	Nitrite-N (mg/kg)		<0.40	0.49	<0.40	<0.40
	Available Phosphate-P (mg/kg)		<2.0	<2.0	<2.0	<2.0
Metals	Aluminum (Al) (mg/kg)		5840	5760	5900	3760
	Antimony (Sb) (mg/kg)		0.63	0.67	0.64	0.67
	Arsenic (As) (mg/kg)		7.36	6.61	6.63	9.25
	Barium (Ba) (mg/kg)		265	424	406	240
	Beryllium (Be) (mg/kg)		0.38	0.42	0.37	0.39
	Bismuth (Bi) (mg/kg)		<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)		5.5	6.1	6.0	<5.0
	Cadmium (Cd) (mg/kg)		0.488	0.752	0.649	0.458
	Calcium (Ca) (mg/kg)		15400	23500	22500	20200
	Chromium (Cr) (mg/kg)		12.4	13.1	13.3	8.88
	Cobalt (Co) (mg/kg)		7.31	6.65	6.37	5.46
	Copper (Cu) (mg/kg)		15.3	15.7	14.1	9.07
	Iron (Fe) (mg/kg)		17800	16400	16200	29400
	Lead (Pb) (mg/kg)		7.69	7.83	7.35	6.37
	Lithium (Li) (mg/kg)		8.0	8.5	8.2	5.7
Magnesium (Mg) (mg/kg)		5220	8560	7630	3580	

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2182906-1	L2182906-2	L2182906-3	L2182906-4
		Description	Soil	Soil	Soil	Soil
		Sampled Date	17-OCT-18	17-OCT-18	17-OCT-18	17-OCT-18
		Sampled Time	14:02	13:07	11:41	10:13
		Client ID	MOBERLY RIVER - DOWNSTREAM (MD)	LOWER SITE C RESERVOIR (PR3)	PEACE AT PINE (PD1)	PINE RIVER (PINE)
Grouping	Analyte					
SOIL						
Metals	Manganese (Mn) (mg/kg)		276	242	214	273
	Mercury (Hg) (mg/kg)		0.0339	0.0520	0.0450	0.0255
	Molybdenum (Mo) (mg/kg)		1.51	1.55	1.35	1.92
	Nickel (Ni) (mg/kg)		23.2	21.3	20.5	19.0
	Phosphorus (P) (mg/kg)		696	838	804	955
	Potassium (K) (mg/kg)		970	980	1030	740
	Selenium (Se) (mg/kg)		0.49	0.62	0.67	0.47
	Silver (Ag) (mg/kg)		0.13	0.18	0.16	0.11
	Sodium (Na) (mg/kg)		84	81	74	170
	Strontium (Sr) (mg/kg)		47.2	61.0	61.3	59.4
	Sulfur (S) (mg/kg)		<1000	1400	1100	1200
	Thallium (Tl) (mg/kg)		0.113	0.155	0.141	0.104
	Tin (Sn) (mg/kg)		<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)		68.0	44.3	54.1	27.4
	Tungsten (W) (mg/kg)		<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)		0.747	0.843	0.795	0.734
	Vanadium (V) (mg/kg)		25.4	27.2	28.0	22.1
	Zinc (Zn) (mg/kg)		68.9	82.9	75.4	73.2
	Zirconium (Zr) (mg/kg)		2.1	1.5	1.8	1.9

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
---------------------	-----------	-----------	-----------------------------

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
C-TIC-PCT-SK	Soil	Total Inorganic Carbon in Soil	CSSS (2008) P216-217
A known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.			
C-TOC-CALC-SK	Soil	Total Organic Carbon Calculation	CSSS (2008) 21.2
Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon. (TIC)			
C-TOT-LECO-SK	Soil	Total Carbon by combustion method	CSSS (2008) 21.2
The sample is ignited in a combustion analyzer where carbon in the reduced CO2 gas is determined using a thermal conductivity detector.			
HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)
Soil samples are digested with hot nitric and hydrochloric acids, followed by CVAAS analysis. This method is fully compliant with the BC SALM strong acid leachable metals digestion method.			
IC-CACO3-CALC-SK	Soil	Inorganic Carbon as CaCO3 Equivalent	Calculation
MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)
Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.			
Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.			
N-TOT-LECO-SK	Soil	Total Nitrogen by combustion method	CSSS (2008) 22.4
The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.			
N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen	CSSS (2008) 22.2.3
The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts. Ammonia in the soil extract is determined colorimetrically at 660 nm.			
N2/N3-AVAIL-SK	Soil	Nitrate, Nitrite and Nitrate+Nitrite-N	APHA 4500 NO3F
Available Nitrate and Nitrite are extracted from the soil using a dilute calcium chloride solution. Nitrate plus Nitrite is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. The resulting water soluble dye has a magenta color which is measured at colorimetrically at 520nm. Nitrite is determined on the same extract by following the same instrumental procedure without a cadmium column.			
Reference: Recommended Methods of Soil Analysis for Canadian Prairie Agricultural Soils. Alberta Agriculture (1988) p. 19 and 28			
NH4-AVAIL-SK	Soil	Available Ammonium-N	CSSS Carter 6.2 / Comm Soil Sci 19(6)
Ammonium (NH4-N) is extracted from the soil using 2 N KCl. Ammonium in the extract is mixed with hypochlorite and salicylate to form indophenol blue, which is determined colorimetrically by auto analysis at 660 nm.			
PH-1:2-VA	Soil	pH in Soil (1:2 Soil:Water Extraction)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL
This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. The pH of the solution is then measured using a standard pH probe.			
PO4-AVAIL-SK	Soil	Available Phosphate-P	Comm. Soil Sci. Plant Anal. 25 (5&6)
Plant available phosphorus is extracted from the soil using Modified Kelowna solution. Phosphorous in the soil extract is determined colorimetrically at 880 nm.			
PSA-PIPET-DETAIL-SK	Soil	Particle size - Sieve and Pipette	SSIR-51 METHOD 3.2.1
Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.			

Reference:

Burt, R. (2009). Soil Survey Field and Laboratory Methods Manual. Soil Survey Investigations Report No. 5. Method 3.2.1.2.2. United States Department of Agriculture Natural Resources Conservation Service.

Reference Information

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Chain of Custody (COC) / Analytical Request Form



COC Number: 14 -

Canada Toll Free: 1 800 668 9878

L2182906-COFC

Page 1 of 1

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Report To		Report Format / Distribution			Turnaround Time (TAT) is not available for all tests)										
Company: Tetratech		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge										
Contact: Lucas Hennecker		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Specify Date Required for E2,E or P:										
Address: Suite 1000, 10th Floor, 885 Dunsmuir Street, Vancouver, BC V6C 1N5		<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked													
Phone: 1 (604) 313-9067		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX													
Email 1 or Fax: Lucas.Hennecker@tetratech.com (see notes)		Email 1 or Fax: ebaaccountspayable@tetratech.com			Analysis Request										
Email 2: Brent.Finnestad@tetratech.com		Email 2: Lucas.Hennecker@tetratech.com (see notes)													
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below										
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX													
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: ebaaccountspayable@tetratech.com													
Company:		Email 2: Lucas.Hennecker@tetratech.com (see notes)													
Contact:															
Project Information		Oil and Gas Required Fields (client use)													
ALS Quote #: Q53931		Approver ID:			Cost Center:									Number of Containers	
Job #: VENW03060 task 002		GL Account:			Routing Code:										
PO / AFE:		Activity Code:													
LSD:		Location:													
ALS Lab Work Order # (lab use only)		ALS Contact: Brent Mack			Sampler: Lucas Hennecker										
L2182906															
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, TN, TP, TDP, TKN, NH3	Particle Size	Total Metals (Cd+Cr+Cu+Pb+Mn+Hg)								
	Moberly River - Downstream (MD)	17-Oct-18	14:02	Soil	R	R	R								3
	Lower Site C Reservoir (PR3)	17-Oct-18	13:07	Soil	R	R	R								3
	Peace at Pine (PD1)	17-Oct-18	11:41	Soil	R	R	R								3
	Pine River (Pine)	17-Oct-18	10:13	Soil	R	R	R								3
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)			SAMPLE CONDITION AS RECEIVED (lab use only)										
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources. Please add nich.burnett@bchydro.com to distribution list for results			Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input checked="" type="checkbox"/>										
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					INITIAL COOLER TEMPERATURES °C: 12 FINAL COOLER TEMPERATURES °C: 4										
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)										
Released by: Lucas Hennecker		Date: Oct. 17/18	Time: 16:40	Received by: Geoff	Date: Oct 17/18	Time: 16:40	Received by: HA	Date: 10/18	Time: 11:40am						

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326a v60 From 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Tetra Tech Canada Inc.
ATTN: Lucas Hennecker
1000-885 Dunsmuir Street, 10th Floor
Vancouver BC V6E 1N5

Date Received: 18-OCT-18
Report Date: 30-OCT-18 14:22 (MT)
Version: FINAL

Client Phone: 604-685-0275

Certificate of Analysis

Lab Work Order #: L2183717
Project P.O. #: NOT SUBMITTED
Job Reference: VENW03060 TASK 002
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2183717-1	L2183717-2	L2183717-3	L2183717-4	L2183717-5
		Description	Soil	Soil	Soil	Soil	Soil
		Sampled Date	18-OCT-18	18-OCT-18	18-OCT-18	18-OCT-18	18-OCT-18
		Sampled Time	08:10	08:55	09:44	10:13	11:18
		Client ID	PEACE AT BEATTON (PD2)	BEATTON RIVER (BEA)	PEACE AT KISKATINAW (PD3)	KISKATINAW RIVER (KR)	PEACE AT POUCE COUPE (PD4)
Grouping	Analyte						
SOIL							
Physical Tests	pH (1:2 soil:water) (pH)		8.31	8.10	8.02	8.26	8.14
Particle Size	% Gravel (>2mm) (%)		19.8	31.3	11.2	17.0	<1.0
	% Sand (2.00mm - 1.00mm) (%)		10.8	<1.0	<1.0	<1.0	<1.0
	% Sand (1.00mm - 0.50mm) (%)		7.4	<1.0	<1.0	<1.0	<1.0
	% Sand (0.50mm - 0.25mm) (%)		7.5	1.2	2.9	1.0	<1.0
	% Sand (0.25mm - 0.125mm) (%)		18.7	13.4	8.4	2.4	7.4
	% Sand (0.125mm - 0.063mm) (%)		19.3	13.3	19.1	2.2	36.4
	% Silt (0.063mm - 0.0312mm) (%)		7.9	16.9	24.5	30.2	26.7
	% Silt (0.0312mm - 0.004mm) (%)		5.8	15.4	22.9	33.5	23.0
	% Clay (<4um) (%)		2.7	6.9	10.0	12.2	6.4
	Texture		Loamy sand	Loam	Silt loam	Silt loam	Sandy loam
Leachable Anions & Nutrients	Total Kjeldahl Nitrogen (%)		0.042	0.079	0.092	0.105	0.075
Anions and Nutrients	Total Nitrogen by LECO (%)		0.049	0.082	0.099	0.110	0.079
Organic / Inorganic Carbon	Total Organic Carbon (%)		0.72	0.940	1.24	1.66	1.28
Plant Available Nutrients	Available Ammonium-N (mg/kg)		1.1	1.4	5.4	2.4	3.8
	Nitrate+Nitrite-N (mg/kg)		<2.0	<2.0	<2.0	<2.0	<2.0
	Nitrate-N (mg/kg)		<2.0	<2.0	<2.0	<2.0	<2.0
	Nitrite-N (mg/kg)		<0.40	<0.40	<0.40	<0.40	<0.40
	Available Phosphate-P (mg/kg)		<2.0	<2.0	<2.0	<2.0	<2.0
Metals	Aluminum (Al) (mg/kg)		5150	7980	9290	11000	6410
	Antimony (Sb) (mg/kg)		0.67	3.78	0.61	0.76	0.65
	Arsenic (As) (mg/kg)		8.17	23.0	8.39	7.95	7.69
	Barium (Ba) (mg/kg)		367	401	436	421	418
	Beryllium (Be) (mg/kg)		0.37	0.60	0.57	0.73	0.46
	Bismuth (Bi) (mg/kg)		<0.20	<0.20	<0.20	<0.20	<0.20
	Boron (B) (mg/kg)		5.2	7.7	8.3	8.6	6.5
	Cadmium (Cd) (mg/kg)		0.476	0.614	0.492	0.701	0.568
	Calcium (Ca) (mg/kg)		22600	5390	13800	21200	20000
	Chromium (Cr) (mg/kg)		11.1	16.7	19.1	21.6	14.0
	Cobalt (Co) (mg/kg)		6.96	12.8	8.84	9.69	7.36
	Copper (Cu) (mg/kg)		11.3	20.1	19.0	24.6	15.1
	Iron (Fe) (mg/kg)		18500	25000	20300	20800	17400
	Lead (Pb) (mg/kg)		6.89	20.2	10.2	11.7	8.46
	Lithium (Li) (mg/kg)		7.3	11.4	13.8	16.3	9.5
	Magnesium (Mg) (mg/kg)		5120	3660	5560	7720	6480

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2183717-6 Soil 18-OCT-18 11:51 POUCE COUPE (POUCE)	L2183717-7 Soil 18-OCT-18 13:29 PEACE AT MANY ISLANDS (PD5)	L2183717-8 Soil 18-OCT-18 13:29 DUP1	
Grouping	Analyte				
SOIL					
Physical Tests	pH (1:2 soil:water) (pH)	8.32	8.18	8.13	
Particle Size	% Gravel (>2mm) (%)	37.3	<1.0	<1.0	
	% Sand (2.00mm - 1.00mm) (%)	<1.0	<1.0	<1.0	
	% Sand (1.00mm - 0.50mm) (%)	6.7	<1.0	<1.0	
	% Sand (0.50mm - 0.25mm) (%)	28.1	<1.0	<1.0	
	% Sand (0.25mm - 0.125mm) (%)	6.3	<1.0	<1.0	
	% Sand (0.125mm - 0.063mm) (%)	4.5	30.1	29.2	
	% Silt (0.063mm - 0.0312mm) (%)	5.3	33.9	33.7	
	% Silt (0.0312mm - 0.004mm) (%)	7.1	27.9	28.5	
	% Clay (<4um) (%)	4.4	7.4	8.1	
		Texture	Sandy loam	Silt loam	Silt loam
Leachable Anions & Nutrients	Total Kjeldahl Nitrogen (%)	0.044	0.060	0.059	
Anions and Nutrients	Total Nitrogen by LECO (%)	0.045	0.065	0.070	
Organic / Inorganic Carbon	Total Organic Carbon (%)	0.661	0.793	0.834	
Plant Available Nutrients	Available Ammonium-N (mg/kg)	1.6	2.7	2.4	
	Nitrate+Nitrite-N (mg/kg)	<2.0	<2.0	<2.0	
	Nitrate-N (mg/kg)	<2.0	<2.0	<2.0	
	Nitrite-N (mg/kg)	<0.40	<0.40	<0.40	
	Available Phosphate-P (mg/kg)	2.5	2.1	<2.0	
Metals	Aluminum (Al) (mg/kg)	5950	7100	7040	
	Antimony (Sb) (mg/kg)	0.51	0.59	0.58	
	Arsenic (As) (mg/kg)	10.9	7.79	7.80	
	Barium (Ba) (mg/kg)	261	398	395	
	Beryllium (Be) (mg/kg)	0.54	0.44	0.44	
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	
	Boron (B) (mg/kg)	7.9	6.8	6.7	
	Cadmium (Cd) (mg/kg)	0.276	0.409	0.408	
	Calcium (Ca) (mg/kg)	7990	11200	11400	
	Chromium (Cr) (mg/kg)	12.1	15.0	14.7	
	Cobalt (Co) (mg/kg)	7.40	7.46	7.72	
	Copper (Cu) (mg/kg)	11.4	14.3	14.2	
	Iron (Fe) (mg/kg)	29900	17600	18000	
	Lead (Pb) (mg/kg)	7.21	8.87	8.68	
	Lithium (Li) (mg/kg)	8.6	9.9	10.0	
	Magnesium (Mg) (mg/kg)	3250	4810	4830	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L2183717-1	L2183717-2	L2183717-3	L2183717-4	L2183717-5
		Description	Soil	Soil	Soil	Soil	Soil
		Sampled Date	18-OCT-18	18-OCT-18	18-OCT-18	18-OCT-18	18-OCT-18
		Sampled Time	08:10	08:55	09:44	10:13	11:18
		Client ID	PEACE AT BEATTON (PD2)	BEATTON RIVER (BEA)	PEACE AT KISKATINAW (PD3)	KISKATINAW RIVER (KR)	PEACE AT POUCE COUPE (PD4)
Grouping	Analyte						
SOIL							
Metals	Manganese (Mn) (mg/kg)		306	328	284	326	271
	Mercury (Hg) (mg/kg)		0.125	0.159	0.0754	0.0902	0.0646
	Molybdenum (Mo) (mg/kg)		1.26	1.93	1.22	1.13	1.28
	Nickel (Ni) (mg/kg)		21.3	44.0	26.1	31.8	22.7
	Phosphorus (P) (mg/kg)		645	682	769	637	799
	Potassium (K) (mg/kg)		860	1350	1540	1690	1100
	Selenium (Se) (mg/kg)		0.56	1.33	0.68	0.92	0.61
	Silver (Ag) (mg/kg)		0.11	0.30	0.17	0.25	0.16
	Sodium (Na) (mg/kg)		61	118	93	111	78
	Strontium (Sr) (mg/kg)		49.5	37.9	51.6	58.5	52.1
	Sulfur (S) (mg/kg)		<1000	2900	<1000	<1000	<1000
	Thallium (Tl) (mg/kg)		0.110	0.331	0.167	0.207	0.147
	Tin (Sn) (mg/kg)		<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)		62.3	49.1	66.0	53.6	<51 ^{DLM}
	Tungsten (W) (mg/kg)		<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U) (mg/kg)		0.757	0.997	1.01	0.976	0.871
	Vanadium (V) (mg/kg)		24.6	33.3	34.5	39.8	28.3
	Zinc (Zn) (mg/kg)		70.5	103	89.3	104	81.4
	Zirconium (Zr) (mg/kg)		2.2	3.3	3.2	4.1	2.5

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L2183717-6 Soil 18-OCT-18 11:51 POUCE COUPE (POUCE)	L2183717-7 Soil 18-OCT-18 13:29 PEACE AT MANY ISLANDS (PD5)	L2183717-8 Soil 18-OCT-18 13:29 DUP1	
Grouping	Analyte				
SOIL					
Metals	Manganese (Mn) (mg/kg)	351	251	252	
	Mercury (Hg) (mg/kg)	0.0380	0.0521	0.0578	
	Molybdenum (Mo) (mg/kg)	1.03	1.08	1.04	
	Nickel (Ni) (mg/kg)	20.5	22.3	22.6	
	Phosphorus (P) (mg/kg)	591	734	699	
	Potassium (K) (mg/kg)	1060	1240	1190	
	Selenium (Se) (mg/kg)	0.46	0.41	0.52	
	Silver (Ag) (mg/kg)	<0.10	0.16	0.15	
	Sodium (Na) (mg/kg)	113	77	81	
	Strontium (Sr) (mg/kg)	33.5	45.5	43.3	
	Sulfur (S) (mg/kg)	<1000	1000	1000	
	Thallium (Tl) (mg/kg)	0.107	0.142	0.135	
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	
	Titanium (Ti) (mg/kg)	55.6	65.9	63.7	
	Tungsten (W) (mg/kg)	<0.50	<0.50	<0.50	
	Uranium (U) (mg/kg)	0.674	1.04	0.973	
	Vanadium (V) (mg/kg)	31.0	29.1	28.8	
	Zinc (Zn) (mg/kg)	70.8	77.0	78.1	
	Zirconium (Zr) (mg/kg)	3.0	3.8	3.7	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Mercury (Hg)	DUP-H	L2183717-7, -8

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
C-TIC-PCT-SK	Soil	Total Inorganic Carbon in Soil	CSSS (2008) P216-217
A known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.			
C-TOC-CALC-SK	Soil	Total Organic Carbon Calculation	CSSS (2008) 21.2
Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon. (TIC)			
C-TOT-LECO-SK	Soil	Total Carbon by combustion method	CSSS (2008) 21.2
The sample is ignited in a combustion analyzer where carbon in the reduced CO ₂ gas is determined using a thermal conductivity detector.			
HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAAS	EPA 200.2/1631E (mod)
Soil samples are digested with hot nitric and hydrochloric acids, followed by CVAAS analysis. This method is fully compliant with the BC SALM strong acid leachable metals digestion method.			
IC-CACO3-CALC-SK	Soil	Inorganic Carbon as CaCO ₃ Equivalent	Calculation
MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)
Soil/sediment is dried, disaggregated, and sieved (2 mm). Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.			
Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H ₂ S) may be excluded if lost during sampling, storage, or digestion.			
N-TOT-LECO-SK	Soil	Total Nitrogen by combustion method	CSSS (2008) 22.4
The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.			
N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen	CSSS (2008) 22.2.3
The soil is digested with sulfuric acid in the presence of CuSO ₄ and K ₂ SO ₄ catalysts. Ammonia in the soil extract is determined colorimetrically at 660 nm.			
N2/N3-AVAIL-SK	Soil	Nitrate, Nitrite and Nitrate+Nitrite-N	APHA 4500 NO ₃ F
Available Nitrate and Nitrite are extracted from the soil using a dilute calcium chloride solution. Nitrate plus Nitrite is quantitatively reduced to nitrite by passage of the sample through a copperized cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. The resulting water soluble dye has a magenta color which is measured at colorimetrically at 520nm. Nitrite is determined on the same extract by following the same instrumental procedure without a cadmium column. Reference: Recommended Methods of Soil Analysis for Canadian Prairie Agricultural Soils. Alberta Agriculture (1988) p. 19 and 28			
NH4-AVAIL-SK	Soil	Available Ammonium-N	CSSS Carter 6.2 / Comm Soil Sci 19(6)
Ammonium (NH ₄ -N) is extracted from the soil using 2 N KCl. Ammonium in the extract is mixed with hypochlorite and salicylate to form indophenol blue, which is determined colorimetrically by auto analysis at 660 nm.			
PH-1:2-VA	Soil	pH in Soil (1:2 Soil:Water Extraction)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL
This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. The pH of the solution is then measured using a standard pH probe.			
PO4-AVAIL-SK	Soil	Available Phosphate-P	Comm. Soil Sci. Plant Anal. 25 (5&6)
Plant available phosphorus is extracted from the soil using Modified Kelowna solution. Phosphorous in the soil extract is determined colorimetrically at 880 nm.			
PSA-PIPET-DETAIL-SK	Soil	Particle size - Sieve and Pipette	SSIR-51 METHOD 3.2.1
Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.			

Reference Information

Reference:

Burt, R. (2009). Soil Survey Field and Laboratory Methods Manual. Soil Survey Investigations Report No. 5. Method 3.2.1.2.2. United States Department of Agriculture Natural Resources Conservation Service.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.

mg/L - milligrams per litre.

< - Less than.

D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L2183717-COFC

CO Number: 14 -

Page 1 of 1

Report To		Report Format / Distribution			(turnaround Time (TAT) is not available for all tests)												
Company: Tetrattech		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input checked="" type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)												
Contact: Lucas Hennecker		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT												
Address: Suite 1000, 10th Floor, 885 Dunsmuir Street, Vancouver, BC V6C 1N5		<input checked="" type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT												
Phone: 1 (604) 313-9067		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge												
		Email 1 or Fax Lucas.Hennecker@tetrattech.com (see notes)			Specify Date Required for E2,E or P:												
		Email 2 Brent.Finnestad@tetrattech.com			Analysis Request												
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below												
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX															
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax ebaaccountspayable@tetrattech.com															
Company:		Email 2 Lucas.Hennecker@tetrattech.com (see notes)															
Contact:																	
Project Information				Oil and Gas Required Fields (client use)													
ALS Quote #: Q53931				Approver ID:		Cost Center:											
Job #: VENW03060 task 002				GL Account:		Routing Code:											
PO / AFE:				Activity Code:													
LSD:				Location:													
ALS Lab Work Order # (lab use only) L2183717				ALS Contact: Brent Mack		Sampler: Lucas Hennecker											
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TOC, TN, TP, TDP, TKN, NH3	Particle Size	Total Metals (CCME+ICP+Hardness) & Hg						Number of Containers		
	Peace at Beatton (PD2)			18-Oct-18	8:10	Soil	R	R	R								3
	Beatton River (BEA)				8:55	Soil	R	R	R								3
	Peace at Kiskatinaw (PD3)				9:44	Soil	R	R	R								3
	Kiskatinaw River (KR)				10:13	Soil	R	R	R								3
	Peace at Pouce Coupe (PD4)				11:18	Soil	R	R	R								3
	Pouce Coupe (POUCE)				11:51	Soil	R	R	R								3
	Peace at Many Islands (PD5)				13:29	Soil	R	R	R								3
	DUP1				13:29	Soil	R	R	R								3
Short Holding Time																	
Rush Processing																	
Drinking Water (DW) Samples¹ (client use)				Special Instructions / Specify Criteria to add on report (client Use)				SAMPLE CONDITION AS RECEIVED (lab use only)									
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				Please use criteria: BC MOE 2018 Approved and Working Water Quality Guidelines for freshwater aquatic life and Health Canada Guidelines for Drinking Water. samples were taken from pre-treatment water sources. Please add nich.burnett@bchydro.com to distribution list for results				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>									
Are samples for human drinking water use? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No								Ice packs Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>									
								Cooling Initiated <input checked="" type="checkbox"/>									
								INITIAL COOLER TEMPERATURES °C					FINAL COOLER TEMPERATURES °C				
								6/7					4 3,6 2,2				
SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)									
Released by: Lucas Hennecker		Date: Oct 18/18		Time: 17:15		Received by: Geoff		Date: Oct 18/18		Time: 17:15		Received by: JC		Date: OCT 19 2018		Time: 11:05 AM	

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0226a v09 Front04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.