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 2 (2016)

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Peace River and Site C Reservoir
2016 Water and Sediment Quality Monitoring Programs

PRESENTED TO

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LIMITATIONS OF REPORT

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1.0 BACKGROUND

As part of the 2016 Water and Sediment Quality Monitoring Programs (Monitoring Program), the Saulteau EBA Environmental Services Joint Venture (SEES JV) has conducted the 2016 events (May to October) associated with Site C Clean Energy Project (Project) on behalf of the BC Hydro and Power Authority (BC Hydro).

In accordance with Provincial Environmental Assessment Certificate Condition No. 7[1] for BC Hydro's Site C Clean Energy Project (the Project), BC Hydro has developed the Site C Fisheries and Aquatic Habitat Monitoring and Follow-up Program (FAHMFP[2]). The overall Fisheries and Aquatic Habitat Monitoring and Follow-up Program includes two sub-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.
- 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.

The timeline for the annual Monitoring Programs encompasses years 2 to 9 (2016 to 2023) of the construction phase and years 1 to 10 of the operation phase of the Project. This report provides and overview of the Site C Mon-8 and Site C Mon-9 sub Monitoring Programs for year 2 of the construction phase. The programs were carried out between May and October, 2016.

Site C is located along the Peace River and Pine River, in the City of Fort St. John region between the Districts of Hudson's Hope and Taylor, BC, accessible via Highways 97 and 29. A station location map has been provided as Figure 1. All surface water monitoring stations (stations) can be accessed by either boat via public boat launch (road accessible). Station Locations have been identified in Figures 2a and 2b.

The Site C Mon-8 study area includes monitoring of eight (8) 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 (PCD) downstream to the Site C dam site, and those sections of the Halfway and Moberly tributary rivers that will be inundated following reservoir creation (approximately 10 km sections). Reference stations selected to monitor water flowing into the Site C Reach are located in Dinosaur and Williston reservoirs near the outlets.

The Site C Mon-9 study area includes monitoring of nine (9) stations within the Peace River from the Site C dam site downstream to the Many Islands area in Alberta, a distance of approximately 120 km.

1.1 Program Objectives

The overall objectives of the 2016 Water and Sediment Quality Monitoring Programs 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;

[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

- 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 this program will contribute to the information used to address the 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?

This broad question requires a number of 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 Hypothesis

To address the management questions, the program will test the following hypotheses, as provided in the monitoring plans:

Mon-8:

H_1: During construction, modeled water quality predictions presented in the Environmental Impact Statement (EIS) are similar to measured water quality in the Site C Reach.

H_2: During operation, modeled water quality predictions presented in the EIS are similar to measured water quality in the Site C Reach.

H_3: During construction, water and sediment quality for non-modeled parameters remain within background ranges of concentrations, or comply with relevant environmental guidelines[3] in the Site C Reach.

H_4: 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:

[3] As described in the Construction Environmental Management Plan for the Project

H_5: During construction, mitigation methods employed are effective in maintaining/protecting water and sediment quality in the Site C Reach.

H_6: During operation, mitigation methods employed are effective in maintaining/protecting water and sediment quality in the Site C Reach.

Mon-9:

H_1: 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.

H_2: 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.

H_3: 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.

H_4: 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.

H_5: 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.

H_6: 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 will require several years of data to be collected. This report is the first year of data collection for these programs under the Fisheries and Aquatic Habitat Monitoring and Follow-up Program.

2.0 METHODS

To maintain compliance with the FAHMFP Program Objectives, a field sampling methodology was developed for collecting water and sediment quality data representative of 19 stations included within the 2016 Monitoring Program. Standard practices available from the British Columbia Field Sampling Manual (Clark, 2002) were used to develop the following 2016 Monitoring Program procedures:

- Sampling within surface water flow (and bottle submerged) 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 was avoided.
- Water quality samples were collected from each station within 0.2 m depth from surface, and additionally, depth profile sample data was collected from reservoir stations at Williston (W1) and Dinosaur (D1). Water quality samples were collected monthly from each station between May and October 2016; the first and final events included more extensive analytical testing than others.

- Sediment quality samples were collected from depositional areas of the reservoir stations at Williston (W1) and Dinosaur (D1) during the October event using a Wildco Petite Ponar sampling device. Depth of samples were determined in the field based on accessibility and obtaining samples representative of adequate quantities of sediment deposition within the water body (i.e. low coarse material content). Sediment samples collected using a grab sampling device were extracted from the centre of the soil mass collected.
- Samples were collected from near the bow via the side access of a jet engine boat, pointing the vessel upstream at all times to collect upstream flow representative samples and to avoid contamination that could be introduced to the sample from the vessel.
- *In situ* surface water quality measurements were determined using an YSI ProDSS Multimeter which recorded sample depth, specific conductivity, electrical conductivity, pH, temperature, dissolved oxygen, salinity, 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 analysis bottles were filled directly from the water source 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 using a Wildco Kemmerer sampler.
- Decontamination of sampling equipment between monitoring locations by triple rinsing field parameter and 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).
- Where dissolved parameters were filtered by laboratory staff, the samples were not preserved in the field. Dissolved parameters filtered in the field (using new high capacity Waterra filters) were field preserved.
- 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 event, 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 2016 Monitoring Program is derived from the British Columbia Approved and Working Water Quality Guidelines (BC MOE 2015 and 2016).
- Samples were delivered to the ALS Environmental laboratory depot in Fort St. John, BC.
- Water quality samples were laboratory analyzed for the following parameters:
  - Monthly from May to October: 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;

  - Monthly (May to October): chlorophyll *a* was analyzed for reservoir samples only; and
  - May and October only: 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, molybdenum, nickel, selenium, silver, thallium, tin, titanium, uranium, vanadium, and zinc).

- Sediment quality samples were laboratory analyzed for the following parameters:
  - October only: 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.
- Field measurement and sample collection occurred during the following dates:
  - May 29 to June 2, 2016
  - June 20 to 22, 2016
  - July 25 to 27, 2016
  - August 23 to 25, 2016
  - September 20 to 22, 2016
  - October 21, and October 24 to 25, 2016

Field parameter measurements and laboratory analytical results have been compiled in Tables 1 to 9.

3.0 RESULTS

Results, both *in-situ* and laboratory, were compared between the sampling seasons and between stations (from upstream to downstream reaches). The objective of data analysis is to identify differences and identify parameter concentrations that differ from guidelines.

Water quality results are presented in Tables 1 to 9 and the Appendix A (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;
- Exceedances of the British Columbia Approved and Working Water Quality Guidelines are bolded and shaded in grey (BC MOE 2015 and 2016). Guidelines for freshwater aquatic life for short term maximums were applied for water quality under the approved and working guidelines. However, working water quality guidelines were limited for most parameters, therefore, only approved guideline values were generated and presented in the tables. As approved guidelines for sediment quality are not available, only working guidelines were applied. Moving forward, the British Columbia Approved and Working Water Quality Guidelines (BC WQG) will be referred to as the guidelines in this document;
- Relative per cent differences (RPD) between the laboratory results for the duplicate sample pairs are presented in Table 9B;

3.1 Peace River Water Quality Results: Site C Reservoir and Downstream Reach

The Site C Mon-8 study area includes monitoring of eight (8) 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 (PCD) downstream to the Site C dam site, and those sections of the Halfway and Moberly tributary 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)
  - Moberly River Upstream (MU) and Downstream (MD)

The Site C Mon-9 study area includes monitoring of nine (9) stations within the Peace River from the Site C dam site downstream to the Many Islands area in Alberta, a distance of approximately 120 km.

- Downstream Reach Station IDs:
  - Peace at Pine (PD1)
  - Pine River (PINE)
  - Peace at Beatton (PD2)
  - Beatton River (BEATTON)
  - Peace at Kiskatinaw River (PD3)
  - Kiskatinaw River (KR)
  - Peace at Pouce Coupe (PD4)
  - Pouce Coupe (POUCE)
  - Peace at Many Islands (PD5)

PC1 is considered the most upstream sample location and PD5 is considered the most downstream sample location within the lotic sample set. Samples were collected from designated stations relating to the aforementioned 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. Generally, samples were collected approximately 150 m upstream of the confluence with the Peace River unless referring to MU (approximately 30 km upstream of the confluence) and HU (approximately 60 km upstream of the confluence). Due to heavy precipitation generated runoff, tributary samples were omitted for the Moberly Upstream location during all events except for May 2016, and for the Halfway Upstream location during the August, September, and October 2016 events, as they could not be safely accessed (i.e. extreme turbulence or large woody debris observed).

Throughout the sampling events, dissolved oxygen, electrical conductivity and specific electrical conductivity remained generally stable within the Peace River from PC1 to PD1. Results within the tributaries was consistently elevated above Peace River results. Field measured water temperatures generally increased from upstream to downstream locations, however, the temperature within tributaries was found to be generally elevated over that of the Peace River, notably during June to August months when temperatures within the tributaries were elevated above guideline values. In July, all temperatures measured downstream of BEATTON (Peace River and Tributary samples) were elevated above guidelines. The pH values remained within guidelines throughout the sample set and events, with the exception of June, when values were considered acidic and below guidelines within BEATTON, PD3, and PD5 (in June). The range of field measured pH was 5.71 to 8.68 over the Monitoring Program. 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.

Colour, total suspended solids (TSS), total dissolved solids, and turbidity were considered to be high throughout the sample set and over each sample event. Turbidity and TSS parameters were highest during the June, July, and August months, likely associated with heavy precipitation events. Since the BC WQG 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) to establish , the individual samples collected for the 2016 Monitoring Program were not compared to guidelines. Data collected from automated sampling equipment located within the Peace River in the upstream vicinity of Moberly and Pine tributary rivers is further discussed in Section 3.3 of this report.

Hardness increased from upstream to downstream as tributary waters contributed to the flow, analyzed between 64.20 to 250.0 mg/L for all samples collected in May, September, and October, which ranges from moderately soft to very hard water (ESRD 2014).

Anions and nutrients analyzed within the lotic sample set were not observed to exceed guidelines, however, results for the tributary source waters were observed to be elevated above the Peace River samples. Total organic carbon (TOC) concentrations were within normal range (1 to 30 mg/L) for natural waterbodies (BC MELP 1998). 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 further within the Discussion and QA/QC sections of this memo.

Total and dissolved metals and metalloid analysis was conducted for May and October events only. Exceedances of guidelines were observed for total iron at HU, HD, MD, BEATTON, KR, PD4, POUCE, and PD5 during the May event, as well as for total copper and zinc at the BEATTON station. Total iron was also exceeded at MD, PINE, BEATTON, KR, PD4, POUCE, and PD5 during the October event, in addition to dissolved iron and aluminum at BEATTON.

No other exceedances of guidelines were observed within the lotic sample set.

3.2 Williston and Dinosaur Reservoirs Water and Sediment Quality Results

Two (2) 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.

Samples were collected at least 25 m from the shoreline, within the middle of the reservoir towards the outlet. Depth profiles were developed by measuring field parameters throughout the water column, however, a distinct hypolimnion could not be identified within the first 9.0 m of the thermocline during the May event. Therefore, measurements were collected at 0.5 m intervals between 0.2 and 5.0 m depths for the remaining sampling events. Water column samples were collected for analysis from the 0.2 and 5.0 m depths between June and October. A sample at 0.2 m was collected for May.

Water quality results are presented in Tables 1 to 6; depth profiles have been provided in Table 8; and sediment quality results are presented in Table 7, all located within the Tables section attached to this report.

Throughout the sampling events, dissolved oxygen, electrical conductivity and specific electrical conductivity remained generally stable within both W1 and D1. Field measured water temperatures generally increased then decreased with the seasonal changes from May to October. Throughout the water column, temperatures generally decreased slightly with depth, however, a distinct hypolimnion could not be identified as there was no stratification observed within the top 9 m at any time, meaning the upper portions of the reservoirs were well mixed throughout the summer. July and August measurements were the most elevated temperatures recorded over the course of events, and exceeded the guidelines for all water column measurements at W1.

The pH values remained within guidelines throughout the water column measurements of both reservoirs over the course of events, with the exception of one measurement collected at surface (0.0 m) at D1 in July. A pH value of 4.48 was is acidic and below the guideline range of values, however, this was in contrast to the overall water column measured (above 8.13 pH). 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.

Colour, total suspended solids, total dissolved solids, and turbidity were considered to be moderate to low throughout the sample set and over each sample event. Secchi depth ranged from 1.5 to 5.0 m below surface for D1 and 2.0 to 5.0 m for W1. It is likely that the lower secchi depth results were due to significant precipitation runoff events observed in June to August. Hardness concentrations ranged from 86.6 to 99.5 mg/L for all samples collected in May and October, which is considered moderately hard to hard water (ESRD 2014).

Since the BC WQG 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) to establish, the individual samples collected for the 2016 Monitoring Program were not compared to guidelines. Data collected from automated sampling equipment located within the Peace River in the upstream vicinity of Moberly and Pine tributary rivers is further discussed in Section 3.3 of this report. SEES JV did not review data collected by automated equipment upstream of these stations.

Anions and nutrients analyzed within the lentic sample set were not observed to exceed available guidelines, and were considered to be consistent with analysis conducted for the Peace River samples, which are located downstream of W1 and D1. TOC concentrations were within normal range (1 to 30 mg/L) for natural waterbodies (BC MELP 1998). DOC concentrations were found to exceed the TOC concentration, which was attributed to the use of polyethersulfone based filters and is discussed further within the Discussion and QA/QC sections of this report.

Total and dissolved metals and metalloid analysis for water quality was conducted for May and October events only. No exceedance of guidelines was observed within the lentic sample set for metals or metalloid parameters, or for any other water quality parameters within the lentic sample set.

Sediment quality samples were collected for D1 and W1 within the benthic layers of the littoral zone at 13.5 m and 22.5 m depths, respectively, as a means to collect samples with a high fines to coarse material ratio. Particle size analysis of each sample determined that Dinosaur sediment was classified as silt and Williston as silt loam.

Sediment anions and nutrient levels were considered moderately low and close to detection limits, and pH was within a normal range. Both D1 and W1 samples exceeded the guidelines for arsenic, cadmium, iron, and nickel. No other exceedance of guidelines was observed within the sediment quality analysis.

3.3 Turbidity Monitoring Station Results

In compliance with the FAHMFP, BC Hydro operates automatic instream turbidity measurement probes located in the Site C Reservoir and Downstream Reach sections of the Peace River. In relation to the Monitoring Program, data collected from four (4) separate probe locations is included in this report:

- Peace Above Moberly – Right Bank (PAM-RB): located on the right bank of the Peace River, directly upstream of the confluence with the Moberly River;
- Peace Above Moberly – Left Bank (PAM-LB): located on the left bank of the Peace River, directly upstream of the confluence with the Moberly River;
- Peace Above Pine – Right Bank (PAP-RB): located on the right bank of the Peace River, directly upstream of the confluence with the Pine River; and
- Peace Above Pine – Left Bank (PAP-LB): located on the left bank of the Peace River, directly upstream of the confluence with the Pine River.

Figures 3 to 6 present the graph representations of data sets collected from each of the aforementioned turbidity monitoring stations, which includes daily averages of turbidity data collected throughout 2016.

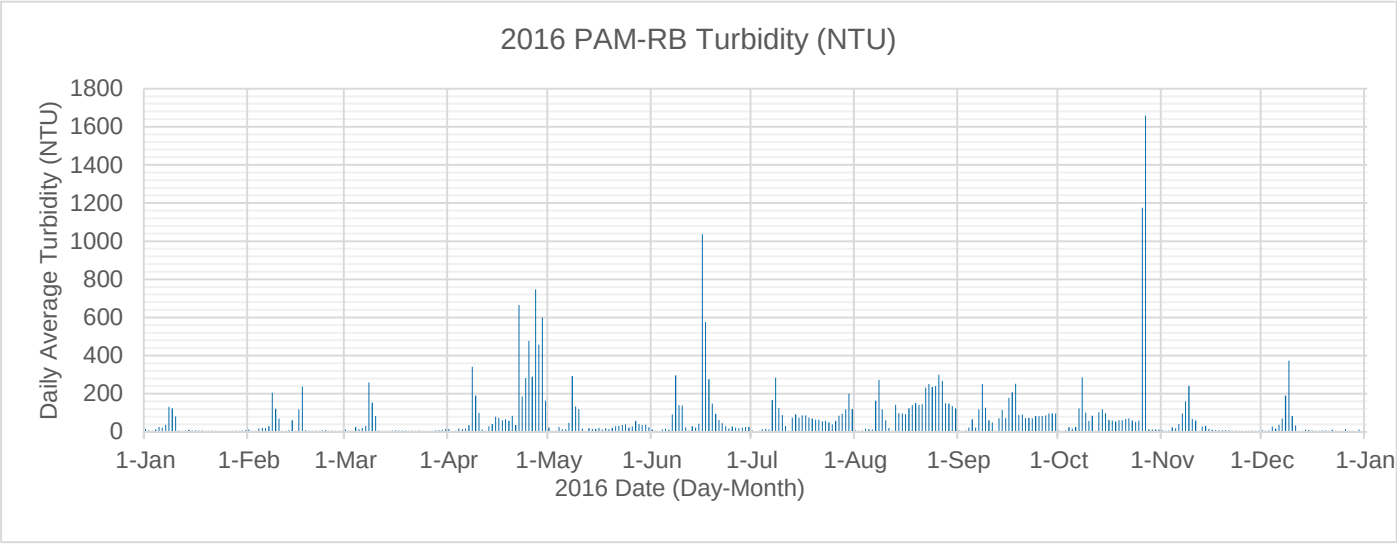

Figure 3: 2016 Daily Average Turbidity Measurements for Peace Above Moberly - Right Bank (PAM-RB)

The PAM-RB station was positioned within a straight section of the channel on the right bank, the watercourse banks and substrate of which were visually observed in the field to be of low or flattened slope. Flow rates were visually observed to be consistent during average flow periods, and therefore, the probe remained in place and instrument function was considered to be in good condition. Elevated turbidity levels observed during the spring period is likely attributed to increased seasonal precipitation; calibration of equipment took place during late October and therefore, increases exceeding 1000 NTU during that time are not representative of instream turbidity conditions.

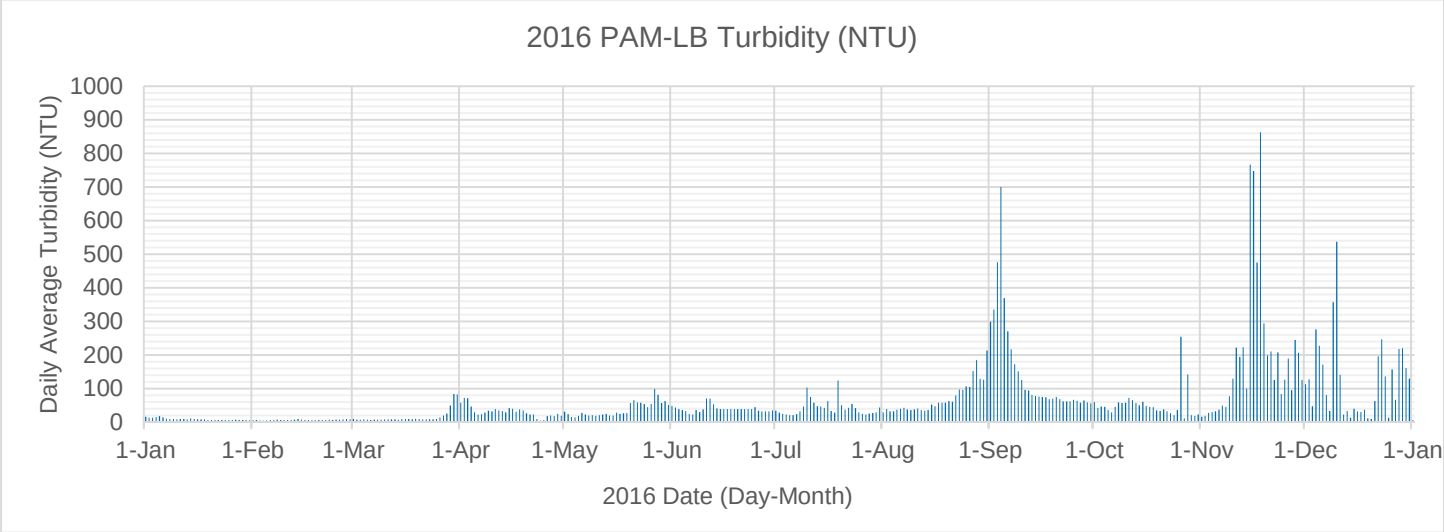

Figure 4: 2016 Daily Average Turbidity Measurements for Peace Above Moberly - Left Bank (PAM-LB)

The PAM-LB station is located within a straight section of the Peace River on the left bank, where the probe is positioned on moderately sloping channel substrate and below high, vertical banks. During late march, field maintenance operations performed on the station may have shifted the turbidity probe, causing the noticeable increase in average readings observed following that event (e.g. exposure of probe to instream conditions may have been changed when rotated or moved).

Low battery voltage was observed in mid-November, however, field response was delayed by the replacement equipment delivery, and therefore, erratic data observed following this event is more likely attributed to equipment malfunction than instream turbidity conditions.

A noticeable elevation in turbidity during late August leading through the end of September is characterized by steady increases in turbidity, gradually increasing to almost 700 NTU before decreasing again, which may correlate to an instream event if compared to precipitation and flow level data for the Peace River, which was considered outside the scope of this report.

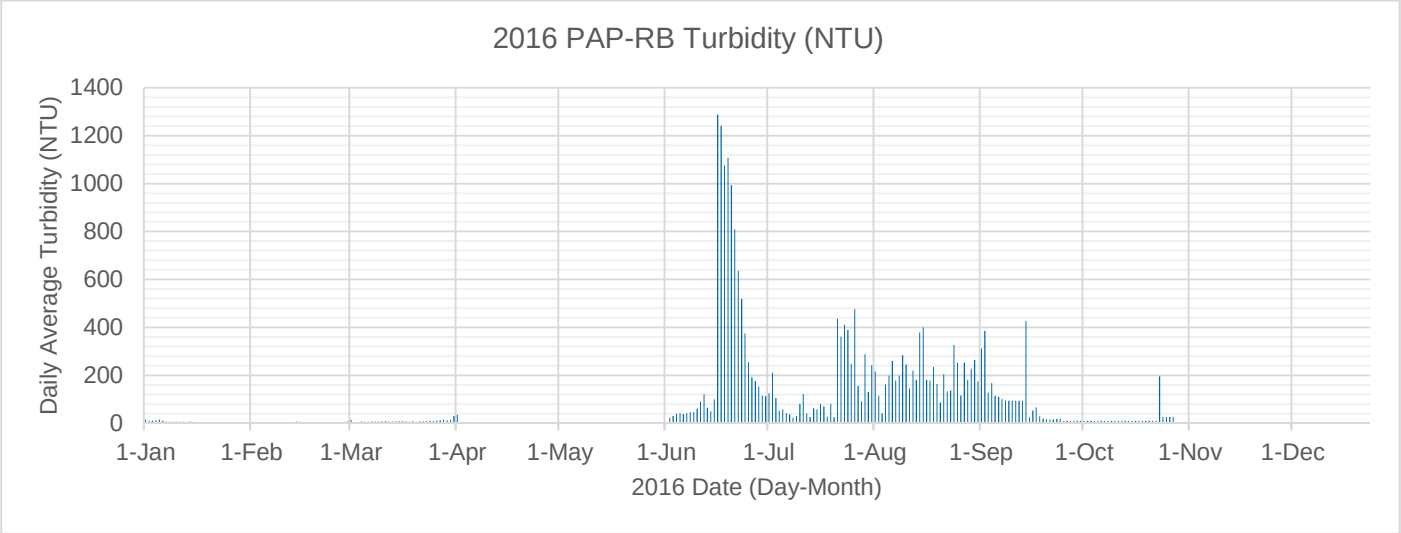

Figure 5: 2016 Daily Average Turbidity Measurements for Peace Above Pine - Right Bank (PAP-RB)

The PAP-RB station was positioned within a straight section of the channel on the right bank, the watercourse banks and substrate of which were visually observed in the field to be of low or flattened slope. Flow rates were visually observed to be consistent during average flow periods, however, deposition of sediment and debris was frequently observed throughout 2016 field visits. In July, 2016, the equipment position and operation was found to be compromised by an uprooted spruce tree, the weight of which strained the cable between the probe and upland mounted controller cabinet. High precipitation rates and regional flood conditions were observed by field staff in June, 2016, and it is estimated that elevated turbidity measurements during this time period are attributed to both regional fluctuations of turbidity related to seasonal conditions as well as debris interference of the sensor operation.

The probe was repositioned and cleared of debris during the July 2016 field event, however, erratic data measurements continued to occur throughout the following months until late September when the station communicated no response from the probe. The station controller was found to require a new power source and unit controller terminal strip. Overall low or erratic measurements observed in 2016 may be attributed to overall poorly functioning equipment.

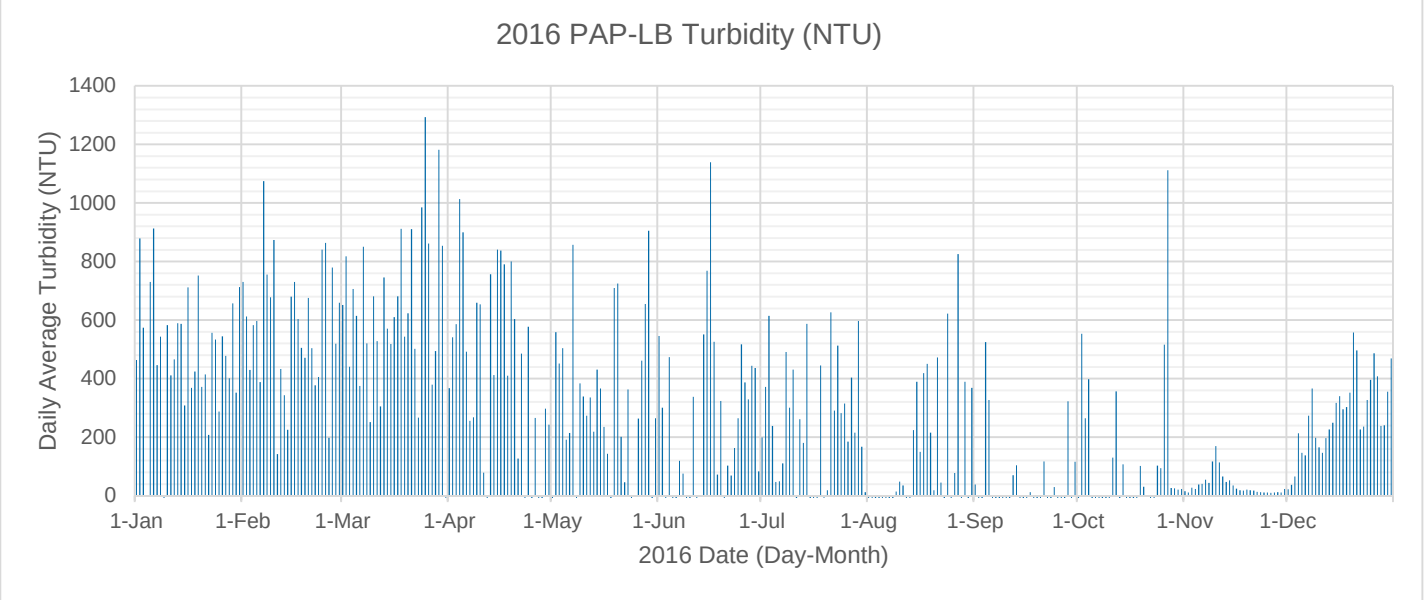

Figure 6: 2016 Daily Average Turbidity Measurements for Peace Above Pine – Left Bank (PAP-LB)

The PAP-LB station is located on the left bank and directly downstream of the outside of a bend in the Peace River. The probe is positioned on steep sloping channel substrate and below high, vertical banks. Erratic turbidity measurements were recorded throughout the 2016 Monitoring Program, attributed to a high level of turbulent flow conditions visually observed by field staff at the location. Unstable flow and steep sides of the channel substrate where the probe was installed may have contributed to rotation of the probe base, air bubbles trapped over the sensor lens, and inconsistent exposure of the probe to flow.

4.0 DISCUSSION

Water quality parameters usually vary widely both temporally and spatially. Monitoring over several years during construction and detailed assessment including statistical analyses is required to definitively establish if trends exist or if a parameter is problematic and/or to effectively determine its source. Sampling has occurred over six events between May and October at each sample location within the Monitoring Programs. Trend analyses will occur following data collection in future years.

Both laboratory and field measured pH has been neutral to slightly acidic. Alkalinity (as CaCO3), which is a measure of water's ability to neutralize acids, has been consistent, with the exception of occurrences of acidic pH values that are reported below the allowable guideline range, where alkalinity has been lower than average. Temperature fluctuations are attributed to seasonal effects of the climate in the region.

Although DOC has been reported as consistently higher than TOC values (as well as being present in field filtered de-ionized water provided by the lab), indicating that the sampling filtration equipment is likely introducing organic carbons to the samples and not an indicator of source water elevations, the TOC values are considered stable and within natural levels for lentic and lotic systems. Further evaluation of the filtration methodology is required to resolve the effect of filter material on DOC concentrations.

Most water and sediment metal parameters analyzed have been consistently below the BC guidelines with the exception of exceedances reported for total iron, copper, silver, and zinc, and for dissolved iron and aluminum in May and October 2016 water quality. Sediment metal parameter exceedances included arsenic, cadmium, iron and nickel. A single exceedance is not an indication of impairment and no conclusive trend towards impairment can yet be established. The source(s) of the exceeded parameter cannot be conclusively determined. Most of the tributary rivers are large rivers with a substantial flow rate draining from communities in nearby areas, which also have vertical banks composed of fine materials. Given the location of exceedances (tributary downstream Peace River samples), it is possible that the exceedances are the result of natural processes (i.e. regional geology and erosion), anthropogenic sources (i.e. nearby communities), or a combination of these and other factors.

Sediment monitoring of all stations including the Site C reach and downstream to Many Islands are planned in 2017 and following monitoring years. These samples will be collected during the fall to collate sediment data with data collected under the Peace River Fish Food Organisms Monitoring Program (Mon-7) and Site C Reservoir Fish Food Organisms Monitoring Program (Mon-8).

Turbidity monitoring will continue at the four stations identified in the 2016 Monitoring Program. Power restoration at PAM-LB and PAP-RB, controller repairs at PAP-RB, and relocation of the PAP-LB probe to a stable flow environment is expected to improve the automatic equipment function of the turbidity monitoring program in 2017.

4.1 Quality Assurance and Quality Control

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 Table 9.

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 shown in equation 1:

RPD % = [Sample – Duplicate]/(X)*100 (Equation 1)

In which X is the average concentration of the sample and it's duplicate.

The duplicate analysis is compared to the sample by evaluating the RPD, where the target RPD is less than a 30% difference. RPD is calculated for results that are higher than five times the reported detection limit. Results of RPD analysis are presented in Table 9. Approximately 6.9% of all duplicates were found to generate an exceedance of 30% RPD analysis. The exceedances were attributed to the following parameters: DOC, aluminum, manganese, and chlorophyll a. Overall, 6.9 % exceedance is considered to be within an acceptable quality control range.

Trip or travel blanks are deionized water sealed in a bottle provided by the laboratory and are introduced for the purpose of travelling with the samples for the duration of the event. Elevations above the reported detection limit may indicate laboratory or transit introduced errors outside of the field methodology. Table 9 indicates elevations above reported detection limits of ammonia in August and electrical conductivity in July. A one-time elevation of ammonia does not indicate major error.

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 likely attributed to the acidity of the deionized water and not sampling and analytical methodologies. For this reason as well as limited hold times of 15 minutes, field measured pH and not laboratory analyzed pH is interpreted for data analysis.

Field blank analysis is used for identifying the introduction of elevated parameter concentrations not attributed to the source water but by field sampling methodologies (or laboratory analysis). Table 9 indicates elevations above reported detection limits of total phosphorus in September and DOC for June, July, August, and September field events. A one-time elevation of total phosphorus does not indicate major error. The relatively consistent elevation of field blank DOC above reported detection limits and TOC concentrations indicates the sample is subject to the addition of carbon through the field filtration process. The Waterra High Capacity filters utilize a polyethersulfone filtration paper, which potentially introduces organic carbon into the samples, as well as the field blank.

In general, the QA/QC program confirmed that the majority of blank and duplicates samples had parameter concentrations within acceptable quality ranges, therefore the overall analytical program is considered to accurately characterize water quality conditions at the sample stations.

5.0 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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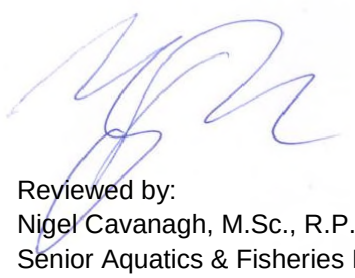

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TABLES

Table 1: May Surface Water Quality Results

Parameter	Unit	Reported Detection Limit (RDL)	BC MOE 2016	Existing Reservoir Sites		Future Site C Reservoir								Downstream of Site C Reservoir								
			Approved	DINOSAUR (D1 - Shallow)	WILLISTON (W1 - Shallow)	PEACE CANYON (PC1)	UPPER SITE C RESERVOIR (PR1)	MIDDLE SITE C RESERVOIR (PR2)	HALFWAY RIVER DOWNSTREAM (HD)	HALFWAY RIVER UPSTREAM (HU)	LOWER SITE C RESERVOIR (PR3)	MOBERLY RIVER UPSTREAM (MU)	MOBERLY RIVER DOWNSTREAM (MD)	PEACE AT PINE (PD1)	PINE RIVER (PINE)	PEACE AT BEATTON (PD2)	BEATTON RIVER (BEATTON)	PEACE AT KISKATINAW (PD3)	KISKATINAW RIVER (KISKATINAW)	PEACE AT POUCE COUPE (PD4)	POUCE COUPE (POUCE)	MANY ISLANDS (PDS)
Sample Date				29-May-2016	29-May-2016	31-May-2016	30-May-2016	30-May-2016	30-May-2016	31-May-2016	31-May-2016	2-Jun-2016	2-Jun-2016	31-May-2016	31-May-2016	1-Jun-2016	1-Jun-2016	1-Jun-2016	1-Jun-2016	1-Jun-2016	1-Jun-2016	1-Jun-2016
Laboratory Identification Number				L1775119-1	L1775119-2	L1775541-1	L1775540-1/ L1775541-2	L1775540-2/ L1775541-4	L1775540-3/ L1775541-3	L1776275-1	L1776275-2/ L1776273-1	L1777575-1	L1777575-2	L1776273-2/ L1776275-3	L1776273-3	L1777078-7	L1777078-8	L1777078-5	L1777078-6	L1777078-4	L1777078-3	L1777078-1
Field Measurements																						
Sample Depth	m	-	-	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	0.2	0.2	0.2
Total Depth	m	-	-	20.2	65.1	17.8	4.3	3.5	3.4	1.2	4.7	-	-	2.5	2.1	5.4	1.0	2.4	0.8	4.2	2.4	8.3
Specific Conductivity (SPC)	SPCµS/cm	-	-	182.0	182.0	182.5	177.0	182.2	330.0	248.4	195.5	166.7	84.1	174.4	186.6	203.4	156.3	203.3	401.6	200.7	367.3	204.9
Electrical Conductivity (EC)	µS/cm	-	-	114.9	110.1	111.2	111.3	150.8	232.5	176.2	123.7	102.4	38.5	113.5	130.0	137.1	123.3	203.3	338.8	138.4	282.9	143.5
pH	pH Units	-	6.5-9.0	8.10	8.17	8.11	8.60	8.22	8.38	8.36	8.20	8.35	8.35	8.23	8.38	8.10	7.93	8.29	8.68	8.25	8.33	8.25
Temperature	°C	-	15	5.7	4.3	4.5	4.7	5.4	9.6	9.1	6.0	13.0	14.0	6.6	12.1	7.9	14.0	8.3	**16.8**	8.8	12.4	9.4
Dissolved Oxygen (DO)	mg/L	-	Minimum 5 [#1]	12.36	12.23	12.36	12.37	12.45	11.01	10.67	11.86	9.70	9.74	11.42	10.21	11.40	9.66	11.55	9.42	11.08	10.26	10.89
Salinity	parts per trillion	-	-	0.09	0.09	0.09	0.09	0.09	0.16	0.13	0.09	0.07	0.02	0.07	0.09	0.10	0.07	0.10	0.19	0.10	0.18	0.10
Turbidity	nephelometric units	-	-	1.3	0.8	1.4	1.4	5.2	119.0	67.3	14.4	27.9	38.0	21.3	20.0	17.0	469.0	22.9	102.0	67.1	202.0	58.0
Physical Parameters																						
Colour	Col. Unit	5.0	-	10.3	8.6	6.4	6.5	6.7	28.3	32.2	8.6	16.9	15.9	9.0	12.2	10.7	129	9.7	23.0	20.5	41.0	18.9
Hardness as $CaCO_3$	µg/L	500	-	99,500	99,100	98,700	100,000	101,000	187,000	184,000	108,000	116,000	117,000	111,000	122,000	111,000	64,200	111,000	213,000	108,000	174,000	111,000
pH	pH Units	0.10	6.5-9.0	7.78	7.80	7.99	8.00	8.04	8.18	8.32	8.15	8.25	8.23	8.18	8.25	8.19	7.62	8.22	8.52	8.16	8.13	8.14
Total Suspended Solids (TSS)	µg/L	3000	-	<3000	<3000	<3000	<3000	14500	226000	96400	20200	51100	82500	38400	28700	26000	966000	38500	1210000	124000	2320000	106000
Total Dissolved Solids (TDS)	µg/L	13000	-	105,000	112,000	117,000	108,000	119,000	226,000	264,000	119,000	137,000	139,000	123,000	129,000	132,000	183,000	129,000	286,000	148,000	263,000	148,000
Anions and Nutrients																						
Total Alkalinity as $CaCO_3$	µg/L	1000	-	77,300	78,800	82,400	81,800	84,100	147,000	145,000	88,300	109,000	111,000	92,700	107,000	95,800	46,500	94,300	209,000	91,100	108,000	92,300
Ammonia, Total (as N)	µg/L	5.0	See narrative [#2]	<5.0	<5.0	<5.0	<5.0	<5.0	12.0	7.6	<5.0	8.1	9.4	6.0	<5.0	5.4	54.4	<5.0	14.9	12.3	60.9	9.2
Bromide (Br)	µg/L	50	-	-	-	<50	<50	<50	<50	-	<50	-	-	<50	<50	-	-	-	-	-	-	-
Chloride (Cl)	µg/L	500	600,000	-	-	<500	<500	<500	<500	-	<500	-	-	<500	540	-	-	-	-	-	-	-
Fluoride (F)	µg/L	20	See equation [#3]	-	-	40	40	41	93	-	45	-	-	48	59	-	-	-	-	-	-	-
Nitrate and Nitrite (as N)	µg/L	5.1	-	75.8	72.8	75.6	75.3	71.7	24.1	16.1	66.8	19	16	64.6	21.5	56.5	16.8	55	21.2	55	161	53.9
Nitrate (as N)	µg/L	5.0	32,800	75.8	72.8	75.6	75.3	71.7	24.1	16.1	66.8	19.0	16.0	64.6	21.5	56.5	14.6	55.0	19.3	55.0	152	53.9
Nitrite (as N)	µg/L	1.0	60-600 [#4]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.2	<1.0	1.9	<1.0	9.5	<1.0
Total Kjeldahl Nitrogen	µg/L	50	-	115	107	90	78	170	745	464	162	282	340	198	165	128	2020	120	568	340	1050	274
Total Nitrogen	µg/L	30	-	140	136	137	156	141	387	335	160	275	290	190	134	138	1110	145	495	248	910	226
Orthophosphate (as P)	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	4.4	2.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.6	<1.0	<1.0	1.6	7.2	1.1
Phosphorus (P)-Total Dissolved	µg/L	2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	7.2	7.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	20.2	<2.0	2.2	3.1	13.7	3.3
Phosphorus (P)-Total	µg/L	2.0	-	4.1	3.4	2.6	3.3	15.5	251	141	27.4	47.9	98.8	55.2	23.5	32.4	885	35.4	139	133	268	95.9
Silicate (as SiO2)	µg/L	500	-	-	-	4570	4440	4380	3570	-	4420	-	-	4510	2240	-	-	-	-	-	-	-
Sulfate (SO4)	µg/L	300	-	-	-	13,100	13,100	13,300	37,500	-	15,500	-	-	16,900	12,300	-	-	-	-	-	-	-
Organic and Inorganic Carbon																						
Dissolved Organic Carbon (DOC)	µg/L	500	-	2630	2420	2910	3450	3480	7320	7790	4630	6570	8020	8770	4650	4300	23500	3400	10200	6520	16900	6490
Total Organic Carbon (TOC)	µg/L	500	-	3630	3400	2460	2690	2790	7820	9440	3530	6660	6610	3890	3660	3300	24800	3580	12000	6550	17500	5820
Total Metals																						
Aluminum	µg/L	5.0	-	26.5	27.0	31.2	42.5	133	3580	2610	552	845	1000	721	753	665	14100	624	3610	2210	8520	1780
Antimony	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	2.33	1.47	<0.50	0.66	0.84	0.57	<0.50	0.52	10.5	<0.50	2.04	1.52	4.66	1.26
Barium	µg/L	20	-	33	32	32	33	36	187	146	51	162	175	60	88	60	465	61	215	109	185	98
Beryllium	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth	µg/L	0.050	-	<200	<200	<0.050	<0.050	<0.050	0.102	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<200	<200	<200	<200	<200	<200	<200
Boron	µg/L	100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Cadmium	µg/L	0.0050	-	0.0180	0.0146	0.0194	0.0171	0.0384	0.264	0.197	0.0431	0.0540	0.0670	0.0634	0.0387	0.0560	0.722	0.0465	0.121	0.114	0.161	0.0620
Calcium	µg/L	100	-	29500	30000	28900	28800	28400	54900	53600	32600	31700	33200	33000	35300	32400	21800	32500	61400	31400	48600	32700
Chromium	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	6.5	4.4	1.0	1.7	1.9	1.3	1.2	1.5	24.1	1.2	5.8	3.9	10.9	3.1
Cobalt	µg/L	0.30	110	<0.30	<0.30	<0.30	<0.30	<0.30	2.14	1.31	<0.30	0.53	0.74	0.39	0.40	0.35	11.3	0.34	1.71	1.35	3.69	1.07
Copper	µg/L	1.0	See equation [#5]	<1.0	<1.0	<1.0	<1.0	1.0	6.8	4.0	1.4	2.3	2.9	1.8	1.3	1.6	**29.3**	1.5	6.0	4.2	11.2	3.5
Iron	µg/L	30	1000	40	32	66	64	277	**5140**	**3160**	652	1250	**1660**	984	935	854	**24600**	824	**4320**	**3290**	**9150**	**2630**
Lead	µg/L	0.50	See equation [#6]	<0.50	<0.50	<0.50	<0.50	<0.50	2.67	1.68	<0.50	0.68	0.92	<0.50	<0.50	<0.50	13.3	<0.50	2.26	1.72	4.92	1.34
Lithium	µg/L	1.0	-	<1.0	<1.0	<1.0	1.3	1.4	9.4	7.6	2.0	4.1	4.5	2.2	4.3	2.4	24.2	2.5	7.0	4.5	14.6	4.1
Magnesium	µg/L	100	-	6060	6180	6020	6070	6210	14700	14100	7070	8570	9010	7400	8130	7210	8880	7210	15800	7460	14600	7700
Manganese	µg/L	0.10	See equation [#7]	2.28	1.89	2.41	2.59	6.49	73.1	49.7	10.8	22.2	30.8	15.1	14.6	13.5	370	13.0	63.9	45.2	124	37.2
Mercury	µg/L	0.0050	-	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.025	<0.0050	<0.0050	<0.0050	0.0054	<0.0050	<0.0050	<0.0050	0.067	<0.0050	<0.025	<0.025	<0.025	0.0064
Molybdenum	µg/L	1.0	2000	<1.0	<1.0	<1.0	<1.0	<1.0	2.9	2.9	1.0	<1.0	<1.0	1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	1.2	<1.0
Nickel	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	1.1	8.6	6.4	1.5	2.9	3.4	2.1	1.7	1.9	36.6	1.8	7.2	5.2	14.4	4.1
Phosphorus	µg/L	300	-	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	720	<300	<300	<300	<300	<300
Potassium	µg/L	2000	-	<2000	<2000	<2000	<2000	<2000	2200	<2000	<2000	<2000	<2000	<2000	<2000	<2000	5200	<2000	3100	<2000	6100	<2000
Selenium	µg/L	0.050	-	0.249	0.230	0.248	0.231	0.246	1.44	1.26	0.350	0.246	0.247	0.380	0.435	0.404	1.05	0.367	0.370	0.468	0.561	0.411
Silicon	µg/L	50	-	2180	2230	2210	2220	2390	9810	7430	3090	2780	3130	3480	2370	3260	26700	3080	10600	6360	19900	5670
Silver	µg/L	0.020	0.1 or 3.0 [#8]	<0.020	<0.020	<0.020	<0.020	<0.020	0.072	0.043	<0.020	<0.020	0.020	<0.020	<0.020	<0.020	**0.265**	<0.020	0.047	0.035	0.075	0.029
Sodium	µg/L	2000	-	<2000	<2000	<2000	<2000	<2000	<2000	2900	3000	2000	2200	<2000	2000	<2000	8800	<2000	11600	2400	15000	2600
Strontium	µg/L	5.0	-	108	111	110	111	109	236	229	122	73.6	77.7	126	112	118	110	114	242	116	188	118
Thallium	µg/L	0.20	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.31	<0.20	<0.20	<0.20	<0.20	<0.20
Tin	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Titanium	µg/L	10	-	<10	<10	<10	<10	<10	97	72	14	26	29	19	18	20	214	17	123	52	245	48
Uranium	µg/L	0.20	-	0.46	0.48	0.46	0.47	0.47	0.89	0.80	0.51	0.24	0.27	0.50	0.26	0.50	1.57	0.46	0.84	0.59	1.15	0.55
Vanadium	µg/L	0.50	-	<0.50	<0.50	<0.50	0.52	1.03	15.6	11.7	2.40	3.20	3.84	3.11	2.65	3.07	48.4	2.54	13.1	8.70	23.8	6.67
Zinc	µg/L	5.0	See equation [#9]	<5.0	<5.0	<5.0	<5.0	<5.0	29.3	18.3	5.2	6.2	8.5	6.0	<5.0	5.7	**113**	<5.0	18.6	15.8	37.4	12.2
Dissolved Metals																						
Aluminum	µg/L	5.0	100 [#10]	<5.0	<5.0	<5.0	<5.0	<5.0	13.7	17.9	<5.0	5.1	7.8	11.2	9.2	8.1	73.1	6.0	6.5	8.8	44.1	8.0
Antimony	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.65	<0.50	<0.50	<0.50	0.51	<0.50
Barium	µg/L	20	-	32	31	31	31	32	66	71	36	135	135	39	71	46	41	45	137	43	38	45
Beryllium	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth	µg/L	0.050	-	<200	<200	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<200	<200	<200	<200	<200	<200	<200
Boron	µg/L	100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Cadmium	µg/L	0.0050	See equation [#11]	0.0104	0.0088	0.0078	0.0115	0.0088	0.0182	0.0225	0.0082	0.0091	0.0078	0.0078	0.0107	0.0107	0.0396	0.0132	0.0080	0.0262	0.0175	0.0240
Calcium	µg/L	100	-	29800	29800	29800	30100	30300	52400	51800	32000	32300	32900	36000	32600	17700	32700	60600	31900	48100	32800	
Chromium	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt	µg/L	0.30	-	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Copper	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	1.2	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	3.9	<1.0	2.1	<1.0	2.4	<1.0
Iron	µg/L	30	350	<30	<30	<30	<30	<30	32	46	<30	<30	<30	<30	<30	<30	**565**	<30	<30	49	65	32
Lead	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Lithium	µg/L	1.0	-	<1.0	<1.0	1.3	1.2	1.3	5.7	5.1	1.4	3.5	3.6	1.5	3.8	2.3	4.6	2.1	3.7	2.4	6.8	2.5
Magnesium	µg/L	100	-	6070	5990	5920	6050	6040	13700	13400	6780	8510	8560	7090	7910	7060	4850	7070	14900	6940	13000	7090
Manganese	µg/L	0.10	-	0.84	0.65	0.84	0.91	0.76	4.92	7.34	1.06	1.99	2.13	1.57	1.44	1.48	16.8	1.29	1.39	3.04	5.12	2.39
Mercury	µg/L	0.0050	-	0.0062	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0073	<0.0050	<0.0050	<0.0050	0.0054	<0.0050
Molybdenum	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	2.5	2.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	1.9	2.1	<1.0	1.2	1.1	<1.0	<1.0	<1.0	4.2	<1.0	1.4	1.2	3.1	<1.0
Phosphorus	µg/L	300	-	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300
Potassium	µg/L	2000	-	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	3400	<2000
Selenium	µg/L	0.050	-	0.258	0.253	0.239	0.268	0.268	1.26	1.14	0.316	0.206	0.176	0.356	0.445	0.350	0.344	0.349	0.243	0.336	0.383	0.402
Silicon	µg/L	50	-	2140	2160	2160	2150	2170	1760	1740	2110	1140	1100	2110	1080	1780	2490	1880	1650	1950	1750	1880
Silver	µg/L	0.020	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Sodium	µg/L	2000	-	<2000	<2000	<2000	<2000	<2000	2900	3000	<2000	2000	2100	<2000	<2000	<2000	8200	<2000	11300	2300	14500	2400
Strontium	µg/L	5.0	-	107	107	108	108	108	227	220	118	72.4	73.8	123	109	112	65.6	113	234	111	165	112
Thallium	µg/L	0.20	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Tin	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Titanium	µg/L	10	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Uranium	µg/L	0.20	-	0.41	0.41	0.43	0.40	0.41	0.59	0.56	0.41	<0.20	<0.20	0.41	<0.20	0.40	0.29	0.40	0.62	0.42	0.70	0.42
Vanadium	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.58	<0.50	<0.50	<0.50	<0.50	<0.50
Zinc	µg/L	5.0	-	<5.0	6.5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Plant Pigments																						
Chlorophyll a (reservoirs only)	µg/L	0.010	-	0.308	0.533	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

NOTES:

BC MOE 2016 — BC MOE. 2016. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Protection and Sustainability Branch. British Columbia Ministry of Environment. Freshwater Aquatic Life - Short-term Maximum criteria applied.

#1 — Dissolved Oxygen guideline protects all life stages other than buried embryo/alevin

#2 — Guideline/standard for ammonia varies with pH and temperature.

#3 — Standard for fluoride varies with hardness. Calculated based on equation: -51.73 + 92.57*log(Hardness)

#4 — Guideline/standard for nitrite varies with chloride concentrations.

#5 — Water quality guideline for copper is calculated as 0.094(H)+2

#6 — Standard for lead is 3 ug/L at H<8 mg/L, or calculated as e(1.273*ln(H)-1.460) when H>8 mg/L

#7 — Guideline for manganese calculated as (0.011102*H)+0.54

#8 — Criteria for silver varies with hardness, 0.1 µg/L at H<100 mg/L or 3.0 µg/L at H>100 mg/L

#9 — Guideline for zinc calculated as 33+0.75*(H-90)

#10 — Standard for aluminum varies with pH. Standard is 0.05 mg/L if pH is greater than or equal to 6.5, or calculated as $e^{(1.209-2.426(pH)+0.286K)}$ where K=(pH)^2

#11 — Standard for cadmium is calculated as $e^{(1.237ln(H)-5.274)}$

H — Hardness

- — 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.

TETRA TECH

Table 2: June Surface Water Quality Results

Parameter	Unit	Reported Detection Limit (RDL)	BC MOE 2016	Existing Reservoir Sites				Future Site C Reservoir								Downstream of Site C Reservoir								
			Approved	DINOSAUR (D1 - Deep)	DINOSAUR (D1 - Shallow)	WILLISTON (W1 - Shallow)	WILLISTON (W1 - Deep)	PEACE CANYON (PC1)	UPPER SITE C RESERVOIR (PR1)	MIDDLE SITE C RESERVOIR (PR2)	HALFWAY RIVER DOWNSTREAM (HD)	HALFWAY RIVER UPSTREAM (HU)	LOWER SITE C RESERVOIR (PR3)	MOBERLY RIVER UPSTREAM (MU)	MOBERLY RIVER DOWNSTREAM (MD)	PEACE AT PINE (PD1)	PINE RIVER (PINE)	PEACE AT BEATTON (PD2)	BEATTON RIVER (BEATTON)	PEACE AT KISKATINAW (PD3)	KISKATINAW RIVER (KISKATINAW)	PEACE AT POUCE COUPE (PD4)	POUCE COUPE (POUCE)	MANY ISLANDS (PDS)
Sample Date				21-Jun-2016	21-Jun-2016	21-Jun-2016	22-Jun-2016	21-Jun-2016	21-Jun-2016	22-Jun-2016	22-Jun-2016	22-Jun-2016	22-Jun-2016	-	24-Jun-2016	22-Jun-2016	22-Jun-2016	20-Jun-2016	20-Jun-2016	20-Jun-2016	20-Jun-2016	20-Jun-2016	20-Jun-2016	20-Jun-2016	20-Jun-2016
Laboratory Identification Number				L1786823-6	L1786823-5	L1786823-4	L1788272-1	L1786825-1	L1786825-2	L1788272-7	L1788272-6	L1788272-5	L1788272-3	Not Sampled	L1789102-1	L1788272-2	L1788272-4	L1786063-1	L1786063-2	L1786063-3	L1786063-4	L1786063-5	L1786063-6	L1786063-7
Field Measurements																								
Sample Depth	m	-	-	4.5	0.2	0.2	6.5	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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Specific Conductivity (EC)	SPCµS/cm	-	-	181.9	182.5	181.2	181.2	181.5	181.0	183.9	361.4	358.7	200.7	-	212.5	211.7	226.7	218.8	126.5	211.2	223.6	193.6	260.4	206.2
Electrical Conductivity (EC)	µS/cm	-	-	126.8	128.3	131.3	128.6	156	125.5	130.3	299.0	286.0	148.0	-	187.2	158.6	176.6	156.3	97.9	156.5	174.0	146.1	210.1	157.2
pH	pH Units	-	6.5-9.0	7.83	**6.17**	8.04	8.05	8.03	8.09	8.13	8.36	8.36	8.17	-	8.14	8.16	8.09	6.68	**5.71**	**6.22**	6.76	6.65	6.53	**6.20**
Temperature	°C	-	15	9.2	9.4	10.6	9.8	8.9	8.9	9.7	**15.9**	14.4	11.3	-	**18.7**	11.9	14.9	11.5	13.2	11.5	13.4	12.1	15.0	12.6
Dissolved Oxygen (DO)	mg/L	-	Minimum 5 [#1]	11.47	11.29	11.22	11.39	11.15	11.27	10.75	9.59	9.81	10.82	-	8.89	10.66	9.82	10.45	9.94	10.28	10.17	10.16	9.61	10.16
Salinity	parts per trillion	-	-	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.17	0.17	0.10	-	0.10	0.10	0.11	0.10	0.06	0.10	0.11	0.09	0.13	0.01
Turbidity	nephelometric units	-	-	1.8	0.7	2.7	2.9	4.6	4.2	9.3	60.2	29.4	15.2	-	450.7	33.8	220.0	311.3	1089.4	377.6	2180.4	478.8	2046.0	857.0
Physical Parameters																								
Colour	Col. Unit	5.0	-	<5.0	46.9	8.2	7.7	<5.0	<5.0	12.0	22.8	23.5	13.2	-	28.7	13.8	29.4	30.3	177	30.3	288	166	129	54.3
pH	pH Units	0.10	6.5-9.0	8.07	8.08	8.08	7.84	8.07	8.08	8.10	8.33	8.32	8.11	-	8.00	8.02	8.11	8.04	7.37	8.03	8.00	8.01	7.89	7.98
Total Suspended Solids (TSS)	µg/L	3000	-	4600	7400	<3000	<3000	4700	5500	19,900	78,900	32,900	28,700	-	914,000	57,700	418,000	697,000	2,420,000	740,000	3,970,000	1,280,000	5,640,000	1,310,000
Total Dissolved Solids (TDS)	µg/L	13000	-	125,000	113,000	118,000	121,000	121,000	118,000	126,000	238,000	238,000	143,000	-	172,000	157,000	187,000	182,000	202,000	175,000	294,000	220,000	283,000	236,000
Anions and Nutrients																								
Total Alkalinity as $CaCO_3$	µg/L	1000	-	81,700	81,100	79,900	92,500	79,900	80,500	81,300	156,000	154,000	87,800	-	104,000	90,700	110,000	95,500	30,200	96,800	127,000	93,000	82,500	88,100
Ammonia, Total (as N)	µg/L	5.0	See narrative [#2]	<5.0	5.9	<5.0	<5.0	<5.0	<5.0	<5.0	5.6	<5.0	<5.0	-	21.3	9.0	7.8	15.2	47.2	15.4	123	24.5	276	48.0
Nitrate and Nitrite (as N)	µg/L	5.1	-	67.6	68	61.2	61.4	67.7	68	66.3	<5.1	<5.1	60	-	40.7	58.5	79.1	71	27.8	71.9	23	65.1	58.1	64.6
Nitrate (as N)	µg/L	5.0	32,800	67.6	68.0	61.2	61.4	67.7	68.0	66.3	<5.0	<5.0	60.0	-	40.7	58.5	79.1	71.0	27.8	71.9	21.8	65.1	54.3	64.6
Nitrite (as N)	µg/L	1.0	60-600 [#4]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	3.9	<1.0
Total Kjeldahl Nitrogen	µg/L	50	-	84	110	79	85	122	161	78	334	231	157	-	1720	211	757	878	3570	1110	5640	1500	12000	2260
Total Nitrogen	µg/L	30	-	216	193	133	172	169	166	165	239	251	185	-	860	193	505	420	1400	550	2200	750	3800	960
Orthophosphate (as P)	µg/L	1.0	-	<1.0	1.0	<1.0	<1.0	<1.0	2.5	<1.0	3.4	2.3	1.2	-	4.4	1.5	4.0	4.3	4.3	4.4	4.4	3.7	7.0	4.9
Phosphorus (P)-Total Dissolved	µg/L	2.0	-	2.0	2.6	4.0	<2.0	<2.0	<2.0	<2.0	4.2	3.2	2.1	-	8.7	2.7	6.6	9.2	42.7	7.9	16.5	11.3	44.4	16.7
Phosphorus (P)-Total	µg/L	2.0	-	8.1	17.7	3.8	5.9	14.1	13.5	18.4	91.6	58.4	35.5	-	950	47.5	318	437	1360	645	2640	79.0	3480	982
Organic and Inorganic Carbon			-																					
Dissolved Organic Carbon (DOC)	µg/L	500	-	10300	4830	8350	4540	5480	5020	8160	11400	6230	10200	-	8870	9860	7110	8850	28700	8810	26200	17800	28200	15700
Total Organic Carbon (TOC)	µg/L	500	-	2990	3160	2370	2700	3080	3500	3650	6560	5640	3880	-	23100	4980	6100	14200	51700	17700	70400	28100	76900	30900
Plant Pigments																								
Chlorophyll a (reservoirs only)	µg/L	0.010	-	0.619	0.645	0.474	1.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

NOTES:

BC MOE 2016	BC MOE. 2016. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Protection and Sustainability Branch. British Columbia Ministry of Environment. Freshwater Aquatic Life - Short-term Maximum criteria applied.
#1	Dissolved Oxygen guideline protects all life stages other than buried embryo/alevin
#2	Guideline/standard for ammonia varies with pH and temperature.
#3	Standard for fluoride varies with hardness. Calculated based on equation: -51.73 + 92.57*log(Hardness)
#4	Guideline/standard for nitrite varies with chloride concentrations.
H	Hardness
Background	For criteria comparison, the background monitoring stations was considered to be the most upstream located station observed within the sample set at the time of sampling. PR1 is located at the most upstream point within the system. Results are presented from upstream to downstream locations, left to right within the table.
-	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 3: July Surface Water Quality Results

Parameter	Unit	Reported Detection Limit (RDL)	BC MOE 2016 Approved	Existing Reservoir Sites				Future Site C Reservoir								Downstream of Site C Reservoir								
				DINOSAUR (D1 - Deep)	DINOSAUR (D1 - Shallow)	WILLISTON (W1 - Shallow)	WILLISTON (W1 - Deep)	PEACE CANYON (PC1)	UPPER SITE C RESERVOIR (PR1)	MIDDLE SITE C RESERVOIR (PR2)	HALFWAY RIVER DOWNSTREAM (HD)	HALFWAY RIVER UPSTREAM (HU)	LOWER SITE C RESERVOIR (PR3)	MOBERLY RIVER UPSTREAM (MU)	MOBERLY RIVER DOWNSTREAM (MD)	PEACE AT PINE (PD1)	PINE RIVER (PINE)	PEACE AT BEATTON (PD2)	BEATTON RIVER (BEATTON)	PEACE AT KISKATINAW (PD3)	KISKATINAW RIVER (KISKATINAW)	PEACE AT POUCE COUPE (PD4)	POUCE COUPE (POUCE)	MANY ISLANDS (PDS)
Sample Date				26-Jul-2016	26-Jul-2016	26-Jul-2016	26-Jul-2016	26-Jul-2016	26-Jul-2016	27-Jul-2016	27-Jul-2016	27-Jul-2016	25-Jul-2016	-	25-Jul-2016	25-Jul-2016	25-Jul-2016	27-Jul-2016	27-Jul-2016	27-Jul-2016	27-Jul-2016	27-Jul-2016	27-Jul-2016	27-Jul-2016	27-Jul-2016
Laboratory Identification Number				L1804199-4	L1804199-3	L1804199-1	L1804199-2	L1804199-7	L1804199-8	L1804941-3	L1804941-2	L1804941-1	L1803379-3	Not Sampled	L1803379-4	L1803379-2	L1803379-1	L1805724-1	L1805724-2	L1805724-3	L1805724-4	L1805724-5	L1805724-6	L1805724-7
Field Measurements																								
Sample Depth	m	-	-	3.0	0.2	0.2	4.0	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	-	-	20.2	20.2	150.0	150.0	-	-	-	1.5	-	-	-	-	-	-	-	-	-	-	-	-	4.0
Specific Conductivity (EC)	SPCµS/cm	-	-	168.9	169.4	165.0	165.0	162.4	167.3	153.4	389.4	389.6	179.2	-	241.8	171.0	102.1	193.4	140.1	199.0	355.4	191.6	670.0	194.7
Electrical Conductivity (EC)	µS/cm	-	-	130.4	134.8	141.5	141.0	124.3	127.0	150.3	329.4	323.1	136.4	-	223.0	147.2	-	155.7	130.9	163.5	341.5	158.8	659.0	162.1
pH	pH Units	-	6.5-9.0	8.15	8.20	8.31	8.25	8.14	8.18	8.07	8.43	8.40	8.22	-	8.36	8.16	8.42	8.33	8.15	8.32	8.51	8.32	8.49	8.32
Temperature	°C	-	15	12.9	14.3	**17.5**	**17.4**	12.7	12.7	12.6	**17.0**	**16.2**	12.6	-	**20.9**	12.3	**18.0**	14.9	**21.5**	**15.7**	**22.9**	**16.0**	**23.5**	**16.3**
Dissolved Oxygen (DO)	mg/L	-	Minimum 5 [#1]	10.24	10.15	9.10	9.09	10.16	10.37	9.92	9.26	9.33	10.26	-	8.51	10.31	9.37	9.92	8.48	9.69	8.36	9.67	8.15	9.51
Salinity	parts per trillion	-	-	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.19	0.19	0.08	-	0.11	0.08	0.13	0.09	0.07	0.09	0.17	0.09	0.33	0.09
Turbidity	nephelometric units	-	-	4.4	4.3	5.8	7.7	5.9	5.9	5.0	35.1	20.4	7.6	-	41.4	80.6	14.0	8.5	90.8	8.5	198.5	14.4	53.6	17.7
Physical Parameters																								
Colour	Col. Unit	5.0	-	7.1	6.9	7.0	7.2	11.2	6.8	6.8	23.6	23.2	19.4	-	22.3	12.5	11.0	10.3	275	11.6	62.9	25.5	85.0	23.3
pH	pH Units	0.10	6.5-9.0	8.01	8.05	8.07	8.09	8.05	8.09	8.00	8.35	8.33	8.11	-	8.27	8.12	8.32	7.98	7.35	7.89	8.31	7.86	8.34	7.91
Total Suspended Solids (TSS)	µg/L	3000	-	<3000	<3000	<3000	<3000	3300	<3000	5300	32,200	15,600	9000	-	122,000	14,900	16,900	10,600	96,400	10,600	146,000	18,600	23,200	18,900
Total Dissolved Solids (TDS)	µg/L	20000	-	105,000	108,000	102,000	107,000	108,000	105,000	108,000	268,000	263,000	114,000	-	152,000	122,000	162,000	132,000	184,000	125,000	303,000	127,000	517,000	132,000
Anions and Nutrients																								
Total Alkalinity as $CaCO_3$	µg/L	1000	-	76,500	75,800	73,600	76,200	76,600	77,100	78,100	173,000	173,000	84,400	-	121,000	88,400	130,000	95,400	44,400	92,300	190,000	88,900	189,000	91,600
Ammonia, Total (as N)	µg/L	5.0	See narrative [#2]	5.0	5.3	<5.0	5.4	<5.0	5.5	<5.0	<5.0	<5.0	<5.0	-	<5.0	<5.0	<5.0	<5.0	9.7	<5.0	18.1	<5.0	17.5	<5.0
Nitrate and Nitrite (as N)	µg/L	5.1	-	54.3	55.9	46.2	42.2	55.8	56.4	56.4	<5.1	<5.1	51.9	-	<5.1	50.7	17.9	36.1	<5.1	37.1	72.1	35.6	<25	36.5
Nitrate (as N)	µg/L	5.0	32,800	54.3	55.9	44.8	42.2	55.8	55.4	56.4	<5.0	<5.0	51.9	-	<5.0	49.7	17.9	36.1	<5.0	37.1	72.1	35.6	<25	36.5
Nitrite (as N)	µg/L	1.0	60-600 [#4]	<1.0	<1.0	1.4	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.2	<1.0
Total Kjeldahl Nitrogen	µg/L	50	-	107	119	107	146	124	117	97	267	219	121	-	317	145	144	161	1110	139	1080	228	1440	219
Total Nitrogen	µg/L	30	-	132	143	129	175	138	139	137	211	221	140	-	262	157	103	121	878	136	670	179	1140	167
Orthophosphate (as P)	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	1.1	<1.0	-	1.9	1.3	<1.0	<1.0	7.1	<1.0	5.5	<1.0	1.3	<1.0
Phosphorus (P)-Total Dissolved	µg/L	2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.7	2.7	<2.0	-	4.7	<2.0	<2.0	<2.0	24.9	<2.0	10.6	2.3	13.6	2.2
Phosphorus (P)-Total	µg/L	2.0	-	3.4	4.3	5.8	8.7	4.4	4.2	5.6	61.3	30.2	9.9	-	50.9	18.9	16.2	11.0	91.0	9.9	179	20.7	47.5	17.6
Organic and Inorganic Carbon																								
Dissolved Organic Carbon (DOC)	µg/L	500	-	4910	4460	5350	5220	5220	4950	10300	11600	13800	5350	-	13200	5290	4740	9990	39600	7550	21200	12300	34500	10500
Total Organic Carbon (TOC)	µg/L	500	-	2860	3100	3120	3250	2910	3020	3080	6860	6100	3280	-	7800	3770	3050	3240	39100	3280	21100	5180	28000	5310
Plant Pigments																								
Chlorophyll a (reservoirs only)	µg/L	0.010	-	0.359	0.873	0.372	1.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

NOTES:

BC MOE 2016	BC MOE. 2016. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Protection and Sustainability Branch. British Columbia Ministry of Environment. Freshwater Aquatic Life - Short-term Maximum criteria applied.
#1	Dissolved Oxygen guideline protects all life stages other than buried embryo/alevin
#2	Guideline/standard for ammonia varies with pH and temperature.
#3	Standard for fluoride varies with hardness. Calculated based on equation: -51.73 + 92.57*log(Hardness)
#4	Guideline/standard for nitrite varies with chloride concentrations.
H	Hardness
<	Concentration is less than the laboratory detection limit indicated.
-	No applicable standard/guideline or analysis was not conducted.
Bold	Bold and shaded indicates an exceedance of one of the applicable standards/guidelines.

Table 4: August Surface Water Quality Results

Parameter	Unit	Reported Detection Limit (RDL)	BC MOE 2016	Existing Reservoir Sites				Future Site C Reservoir								Downstream of Site C Reservoir								
			Approved	DINOSAUR (D1 - Deep)	DINOSAUR (D1 - Shallow)	WILLISTON (W1 - Shallow)	WILLISTON (W1 - Deep)	PEACE CANYON (PC1)	UPPER SITE C RESERVOIR (PR1)	MIDDLE SITE C RESERVOIR (PR2)	HALFWAY RIVER DOWNSTREAM (HD)	HALFWAY RIVER UPSTREAM (HU)	LOWER SITE C RESERVOIR (PR3)	MOBERLY RIVER UPSTREAM (MU)	MOBERLY RIVER DOWNSTREAM (MD)	PEACE AT PINE (PD1)	PINE RIVER (PINE)	PEACE AT BEATTON (PD2)	BEATTON RIVER (BEATTON)	PEACE AT KISKATINAW (PD3)	KISKATINAW RIVER (KISKATINAW)	PEACE AT POUCE COUPE (PD4)	POUCE COUPE (POUCE)	MANY ISLANDS (PDS)
Sample Date				24-Aug-2016	24-Aug-2016	24-Aug-2016	24-Aug-2016	24-Aug-2016	24-Aug-2016	24-Aug-2016	24-Aug-2016	-	23-Aug-2016	-	23-Aug-2016	23-Aug-2016	23-Aug-2016	25-Aug-2016	25-Aug-2016	25-Aug-2016	25-Aug-2016	25-Aug-2016	25-Aug-2016	25-Aug-2016
Laboratory Identification Number				L1820026-3	L1820026-4	L1820026-2	L1820026-1	L1820026-5	L1820026-6	L1820026-7	L1820026-8	Not Sampled	L1818712-1	Not Sampled	L1818712-2	L1818712-3	L1818712-4	L1819424-1	L1819424-2	L1819424-3	L1819424-4	L1819424-5	L1819424-6	L1819424-7
Field Measurements																								
Sample Depth	m	-	-	4.0	0.2	0.2	4.0	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	-	-	-	-	-	-	-	-	-	-													
Specific Conductivity (EC)	SPCµS/cm	-	-	174.4	174.3	167.7	167.5	174.4	174.4	175.0	427.7	-	182.0	-	257.6	185.3	325.5	189.5	199.2	187.1	401.5	198.0	732.3	202.9
Electrical Conductivity (EC)	µS/cm	-	-	126.1	126.9	147.4	146.2	126.6	126.9	129.7	371.9	-	134.8	-	229.8	138.4	386.0	142.5	170.8	149.9	343.1	151.8	623.0	158.7
pH	pH Units	-	6.5-9.0	8.05	8.29	8.29	8.28	8.10	8.17	8.17	8.47	-	8.15	-	8.38	8.21	8.47	8.35	8.04	8.29	8.64	8.36	8.51	8.41
Temperature	°C	-	15	10.5	10.8	**19.0**	**18.4**	10.6	10.8	11.5	**18.2**	-	11.4	-	**19.3**	11.7	**18.7**	12.0	**17.6**	12.5	**17.4**	12.9	**17.1**	13.7
Dissolved Oxygen (DO)	mg/L	-	Minimum 5 [#1]	10.45	10.75	8.68	8.69	10.61	10.63	10.91	9.68	-	10.74	-	9.00	10.72	9.24	10.53	8.94	10.43	9.56	10.34	9.65	10.36
Salinity	parts per trillion	-	-	0.08	0.07	0.08	0.08	0.08	0.08	0.08	0.21	-	ns	-	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
Turbidity	nephelometric units	-	-	2.6	2.4	2.8	2.9	2.5	2.6	3.4	8.8	-	4.1	-	9.2	4.6	14.3	8.8	25.8	9.2	59.3	11.0	47.8	10.3
Physical Parameters																								
Colour	Col. Unit	5.0	-	<5.0	6.8	6.8	5.9	6.3	7.3	5.3	5.4	-	5.2	-	13.3	6.7	<5.0	6.5	318	9.1	45.5	10.8	62.2	11.4
pH	pH Units	0.10	6.5-9.0	8.10	8.11	8.12	8.11	8.12	8.11	8.12	8.46	-	8.10	-	8.30	8.13	8.37	8.15	7.88	8.15	8.54	8.10	8.44	8.16
Total Suspended Solids (TSS)	µg/L	3000	-	<3000	<3000	<3000	<3000	<3000	3800	7700	9300	-	4600	-	5800	6100	8400	12,400	9500	11,800	27,700	15,200	24,800	13,400
Total Dissolved Solids (TDS)	µg/L	20000	-	118,000	108,000	110,000	108,000	112,000	114,000	121,000	271,000	-	117,000	-	155,000	124,000	198,000	115,000	216,000	122,000	285,000	124,000	540,000	119,000
Anions and Nutrients																								
Total Alkalinity as $CaCO_3$	µg/L	1000	-	83,800	83,700	81,000	80,500	84,000	84,600	84,600	193,000	-	87,500	-	132,000	89,800	153,000	88,900	64,800	92,000	212,000	93,100	204,000	94,800
Ammonia, Total (as N)	µg/L	5.0	See narrative [#2]	<5.0	<5.0	11.1	12.3	<5.0	<5.0	<5.0	<5.0	-	<5.0	-	<5.0	6.2	<5.0	<5.0	9.2	<5.0	9.3	<5.0	17.3	<5.0
Nitrate and Nitrite (as N)	µg/L	5.1	-	69.6	69	35.2	35.2	69.6	68.3	64.4	<5.1	-	60.5	-	<5.1	60.4	<5.1	59.3	<10	68	<5.1	63.4	<25	44.9
Nitrate (as N)	µg/L	5.0	32,800	69.6	69.0	35.2	35.2	69.6	68.3	64.4	<5.0	-	60.5	-	<5.0	59.3	<5.0	59.3	<10	68.0	<5.0	63.4	<25	44.9
Nitrite (as N)	µg/L	1.0	60-600 [#4]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	-	<1.0	1.2	<1.0	<1.0	<2.0	<1.0	<1.0	<1.0	<5.0	<1.0
Total Kjeldahl Nitrogen	µg/L	50	-	106	95	120	135	99	93	100	124	-	99	-	193	94	99	111	1010	121	680	135	970	136
Total Nitrogen	µg/L	30	-	140	133	127	272	130	131	127	94	-	134	-	179	131	80	140	950	164	548	163	919	149
Orthophosphate (as P)	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	-	1.7	1.1	<1.0	<1.0	18.2	<1.0	1.4	<1.0	1.3	<1.0
Phosphorus (P)-Total Dissolved	µg/L	2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0	-	3.1	<2.0	<2.0	<2.0	40.3	<2.0	5.1	<2.0	10.8	<2.0
Phosphorus (P)-Total	µg/L	2.0	-	2.7	3.6	2.9	4.1	3.0	2.9	8.2	9.5	-	6.8	-	11.3	7.1	9.5	7.8	41.9	10.8	38.8	10.8	33.6	11.1
Organic and Inorganic Carbon																								
Dissolved Organic Carbon (DOC)	µg/L	500	-	6570	8600	8140	6900	5780	6990	6940	6360	-	8410	-	12400	7610	7670	6920	46400	6200	19200	6950	26600	9500
Total Organic Carbon (TOC)	µg/L	500	-	2750	2840	2990	2990	2770	3000	3090	3030	-	2730	-	5840	3130	2170	2810	42800	3250	16200	3470	23200	3900
Plant Pigments																								
Chlorophyll a (reservoirs only)	µg/L	0.010	-	0.265	0.301	0.675	0.715	nr	nr	nr	nr	ns	nr	ns	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr

NOTES:

BC MOE 2016	BC MOE. 2016. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Protection and Sustainability Branch. British Columbia Ministry of Environment. Freshwater Aquatic Life - Short-term Maximum criteria applied.
#1	Dissolved Oxygen guideline protects all life stages other than buried embryo/alevin
#2	Guideline/standard for ammonia varies with pH and temperature.
#3	Standard for fluoride varies with hardness. Calculated based on equation: -51.73 + 92.57*log(Hardness)
#4	Guideline/standard for nitrite varies with chloride concentrations.
H	Hardness
-	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 5: September Surface Water Quality Results

Parameter	Unit	Reported Detection Limit (RDL)	BC MOE 2016	Existing Reservoir Sites				Future Site C Reservoir								Downstream of Site C Reservoir								
				DINOSAUR (D1 - Deep)	DINOSAUR (D1 - Shallow)	WILLISTON (W1 - Shallow)	WILLISTON (W1 - Deep)	PEACE CANYON (PC1)	UPPER SITE C RESERVOIR (PR1)	MIDDLE SITE C RESERVOIR (PR2)	HALFWAY RIVER DOWNSTREAM (HD)	HALFWAY RIVER UPSTREAM (HU)	LOWER SITE C RESERVOIR (PR3)	MOBERLY RIVER UPSTREAM (MU)	MOBERLY RIVER DOWNSTREAM (MD)	PEACE AT PINE (PD1)	PINE RIVER (PINE)	PEACE AT BEATTON (PD2)	BEATTON RIVER (BEATTON)	PEACE AT KISKATINAW (PD3)	KISKATINAW RIVER (KISKATINAW)	PEACE AT POUCE COUPE (PD4)	POUCE COUPE (POUCE)	MANY ISLANDS (PDS)
			Approved																					
Sample Date				22-Sep-2016	22-Sep-2016	22-Sep-2016	22-Sep-2016	21-Sep-2016	21-Sep-2016	21-Sep-2016	21-Sep-2016	-	21-Sep-2016	-	21-Sep-2016	21-Sep-2016	21-Sep-2016	20-Sep-2016	20-Sep-2016	20-Sep-2016	20-Sep-2016	20-Sep-2016	20-Sep-2016	20-Sep-2016
Laboratory Identification Number				L1833036-4	L1833036-3	L1833036-2	L1833036-1	L1832389-3	L1832389-4	L1832389-2	L1832389-1	Not Sampled	L1832388-2	Not Sampled	L1832388-1	L1832388-3	L1832388-4	L1831599-1	L1831599-2	L1831599-4	L1831599-5	L1831599-6	L1831599-7	L1831599-8
Field Measurements																								
Sample Depth	m	-	-	2.5	0.2	0.2	3.5	0.2	0.2	0.2	0.2	-	0.2	-	0.2	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total Depth	m	-	-	-	-	45.3	45.3	-	-	-	-		-		-	-	-	-	-	-	-	-	-	-
Specific Conductivity (EC)	SPCµS/cm	-	-	169.9	169.8	167.1	167.4	170.3	170.2	174.9	413.7	-	176.2	-	214.8	188.1	258.7	188.7	164.8	193.2	350.8	198.3	393.3	201.5
Electrical Conductivity (EC)	µS/cm	-	-	130.8	131.2	132.9	133.1	130.8	130.8	132.6	293.3	-	133.6	-	150.9	142.1	180.6	143.2	117.6	146.3	254.7	149.6	280.6	152.3
pH	pH Units	-	6.5-9.0	8.27	8.34	8.32	8.31	8.35	8.30	8.27	8.44	-	8.28	-	8.30	8.31	8.40	8.30	7.99	8.23	8.59	8.47	8.22	8.44
Temperature	°C	-	15	13.0	13.1	14.3	14.3	12.9	12.9	13.3	9.8	-	12.3	-	9.4	12.1	9.2	12.4	10.0	12.3	10.7	12.1	10.0	12.2
Dissolved Oxygen (DO)	mg/L	-	Minimum 5 [#1]	9.86	9.89	9.34	9.32	10.10	10.05	10.22	11.06	-	10.13	-	11.22	10.17	11.05	10.19	10.75	10.23	10.78	10.36	10.85	10.54
Salinity	parts per trillion	-	-	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.20	-	0.08	-	0.10	0.09	0.12	-	0.08	0.09	0.17	0.09	0.09	0.10
Turbidity	nephelometric units	-	-	3.7	3.6	2.1	2.2	3.9	3.9	8.7	26.0	-	12.8	-	55.0	20.1	16.2	24.5	142.2	24.4	134.9	30.4	95.0	40.1
Physical Parameters																								
Colour	Col. Unit	5.0	-	5.7	5.3	6.9	6.2	7.0	6.4	6.0	19.4	-	7.0	-	27.9	6.5	9.6	6.9	307	11.2	48.9	21.0	156	24.8
Electrical Conductivity (EC)	µS/cm	2.0	-	167	167	166	161	164	164	164	400	-	171	-	205	176	249	182	162	188	340	191	374	193
Hardness as $CaCO_3$	µg/L	500	-	-	-	-	-	-	83,300	82,300	225,000	-	86,400	-	-	-	-	-	-	-	-	-	-	-
pH	pH Units	0.10	6.5-9.0	8.11	8.11	8.08	8.10	8.03	7.97	8.03	8.30	-	8.04	-	8.10	8.06	8.20	8.08	7.44	8.09	8.41	8.09	7.94	8.04
Total Suspended Solids (TSS)	µg/L	3000	-	3500	<3000	<3000	<3000	5800	3600	22,500	35,300		22,200		40,200	36,900	17,500	61,600	136,000	65,800	98,400	114,000	88,900	127,000
Total Dissolved Solids (TDS)	µg/L	1000	-	110,000	115,000	108,000	116,000	87,000	91,800	91,600	249,000	-	96,600	-	156,000	126,000	149,000	127,000	222,000	127,000	288,000	132,000	345,000	135,000
Turbidity	NTU	0.10	-	2.49	2.75	1.60	1.66	3.27	3.36	6.22	30.0	-	11.3	-	48.1	16.8	13.5	22.6	122	26.1	147	34.0	116	37.1
Anions and Nutrients												-		-										
Bicarbonate as $CaCO_3$	µg/L	1000	-	80,700	82,500	80,300	78,800	80,300	78,900	78,900	176,000	-	82,300	-	108,000	84,200	125,000	87,800	37,100	89,800	180,000	90,600	115,000	91,500
Carbonate as $CaCO_3$	µg/L	1000	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	2200	-	<1000	-	<1000	<1000	<1000	<1000	<1000	<1000	6800	<1000	<1000	<1000
Hydroxide as $CaCO_3$	µg/L	1000	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	-	<1000	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Total Alkalinity as $CaCO_3$	µg/L	1000	-	80,700	82,500	80,300	78,800	80,300	78,900	78,900	178,000	-	82,300	-	108,000	84,200	125,000	87,800	37,100	89,800	187,000	90,600	115,000	91,500
Ammonia, Total (as N)	µg/L	5.0	See narrative [#2]	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	<5.0	-	5.5	5.1	<5.0	<5.0	13.8	5.1	32.8	5.5	32.7	<5.0
Bromide	µg/L	50	-	<50	<50	<50	<50	<50	<50	<50	<50	-	<50	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Chloride	µg/L	500	600,000	<500	<500	<500	<500	<500	<500	<500	<500	-	<500	-	<500	<500	640	<500	620	<500	620	<500	3020	<500
Fluoride	µg/L	20	See equation [#3]	34	31	33	33	37	37	38	100	-	40	-	73	43	62	36	66	38	73	40	113	42
Nitrate and Nitrite (as N)	µg/L	5.1	-	51.3	51.8	43.9	43.4	50.9	50.8	46.9	<5.1	-	48.9	-	35.4	47.7	22.3	48.8	6.3	46.5	37.6	45	110	43.6
Nitrate (as N)	µg/L	5.0	32,800	51.3	51.8	43.9	43.4	50.9	50.8	46.9	<5.0	-	48.9	-	35.4	47.7	22.3	48.8	6.3	46.5	33.2	45.0	101	43.6
Nitrite (as N)	µg/L	1.0	60-600 [#4]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.3	<1.0	9.2	<1.0
Total Kjeldahl Nitrogen	µg/L	50	-	101	92	105	104	95	100	101	220	-	120	-	324	140	148	157	1230	135	790	198	1410	238
Total Nitrogen	µg/L	30	-	134	131	132	165	116	119	122	164	-	129	-	311	150	133	149	1020	145	579	195	1300	206
Orthophosphate (as P)	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	1.0	1.2	1.1	2.2	-	2.4	-	2.5	1.5	<1.0	1.6	10.9	1.3	3.9	2.5	10.9	2.3
Phosphorus (P)-Total Dissolved	µg/L	2.0	-	2.0	2.3	<2.0	<2.0	<2.0	<2.0	<2.0	5.4	-	3.1	-	5.9	2.9	2.6	-	-	-	-	-	-	-
Phosphorus (P)-Total	µg/L	2.0	-	5.6	6.8	4.5	4.8	6.6	7.2	14.3	27.7	-	15.2	-	42.4	27.8	18.3	43.8	169	44.0	129	53.0	151	80.6
Silicate (as SiO_2)	µg/L	500	-	4390	4190	4310	4320	4410	4190	4200	3730	-	4080	-	3270	4160	2230	4300	7010	4350	5130	4310	5820	4350
Sulphate	µg/L	300	-	11,500	11,500	11,100	11,200	11,600	11,600	11,700	54,400	-	12,900	-	10,200	14,800	18,600	14,700	40,300	15,100	14,000	16,000	85,900	17,300
Anions Total	meq/L	-		-	-	-	-	-	1.82	1.83	4.7	-	1.92	-	-	-	2.91	-	-	-	-	-	-	-
Cations Total	meq/L	-	-	-	-	-	-	-	1.66	1.64	4.62	-	1.73	-	-	-	2.84	-	-	-	-	-	-	-
Ionic Balance	N/A	-	-	-	-	-	-	-	-4.6	-5.2	-0.8	-	-5.3	-	-	-	-1.3	-	-	-	-	-	-	-
Organic and Inorganic Carbon												-		-										
Dissolved Organic Carbon (DOC)	µg/L	1000	-	8600	6000	6520	6640	6800	6200	6700	9400	-	8300	-	10200	6300	5900	8600	50700	9200	18300	10000	36800	7500
Total Organic Carbon (TOC)	µg/L	1000	-	2720	2700	2780	2810	2700	2800	2900	5900	-	3100	-	8300	3800	3300	4400	47400	4700	17400	6900	37000	6400

NOTES:

BC MOE 2016	BC MOE. 2016. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Protection and Sustainability Branch. British Columbia Ministry of Environment. Freshwater Aquatic Life - Short-term Maximum criteria applied.
#1	Dissolved Oxygen guideline protects all life stages other than buried embryo/alevin
#2	Guideline/standard for ammonia varies with pH and temperature.
#3	Standard for fluoride varies with hardness. Calculated based on equation: -51.73 + 92.57*log(Hardness)
#4	Guideline/standard for nitrite varies with chloride concentrations.
H	Hardness
-	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 6: October Surface Water Quality Results

Parameter	Unit	Reported Detection Limit (RDL)	BC MOE 2016 Approved	Existing Reservoir Sites				Future Site C Reservoir								Downstream of Site C Reservoir								
				DINOSAUR (D1 - Deep)	DINOSAUR (D1 - Shallow)	WILLISTON (W1 - Shallow)	WILLISTON (W1 - Deep)	PEACE CANYON (PC1)	UPPER SITE C RESERVOIR (PR1)	MIDDLE SITE C RESERVOIR (PR2)	HALFWAY RIVER DOWNSTREAM (HD)	HALFWAY RIVER UPSTREAM (HU)	LOWER SITE C RESERVOIR (PR3)	MOBERLY RIVER UPSTREAM (MU)	MOBERLY RIVER DOWNSTREAM (MD)	PEACE AT PINE (PD1)	PINE RIVER (PINE)	PEACE AT BEATTON (PD2)	BEATTON RIVER (BEATTON)	PEACE AT KISKATINAW (PD3)	KISKATINAW RIVER (KISKATINAW)	PEACE AT POUCE COUPE (PD4)	POUCE COUPE (POUCE)	MANY ISLANDS (PD5)
Sample Date				24-Oct-2016	24-Oct-2016	24-Oct-2016	24-Oct-2016	24-Oct-2016	24-Oct-2016	24-Oct-2016	24-Oct-2016	-	25-Oct-2016	-	25-Oct-2016	25-Oct-2016	25-Oct-2016	21-Oct-2016	21-Oct-2016	21-Oct-2016	21-Oct-2016	21-Oct-2016	21-Oct-2016	21-Oct-2016
Laboratory Identification Number				L1848454-4	L1848454-3	L1848454-1	L1848454-2	L1848455-1	L1848455-2	L1848452-2	L1848452-1	Not Sampled	L1848477-2	Not Sampled	L1848477-1	L1848477-3	L1848477-4	L1847680-1	L1847680-2	L1847680-3	L1847680-4	L1847680-5	L1847680-6	L1847680-7
Field Measurements																								
Sample Depth	m	-	-	5.0	0.2	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	-	-	13.5	13.5	54.2	54.2			4.0	3.4							1.4	4.3	1.2	4.9	0.3	4.7	
Specific Conductivity (EC)	SPC/µS/cm	-	-	174.9	174.9	174.4	174.1	172.6	173.5	158.8	445.3	-	185.5	-	251.1	187.4	331.2	194.2	229.5	198.2	403.2	198.7	536.0	207.2
Electrical Conductivity (EC)	µS/cm	-	-	119.7	119.8	119.9	119.7	119.7	119.7	110.4	248.8	-	124.2	-	142.8	125.4	187.7	125.0	120.5	129.6	222.3	129.0	310.1	134.1
pH	pH Units	-	6.5-9.0	8.16	8.19	8.14	8.14	8.20	8.21	8.24	8.37	-	8.19	-	8.24	8.23	8.34	8.19	7.79	8.22	8.47	8.19	8.15	8.17
Temperature	°C	-	15	8.5	8.5	8.7	8.7	8.5	8.5	8.3	2.0	-	7.7	-	2.4	7.7	2.3	6.9	0.1	6.9	1.5	-	3.0	6.6
Dissolved Oxygen (DO)	mg/L	-	Minimum 5 [#1]	10.52	10.58	10.36	10.32	10.70	10.77	11.12	12.16	-	10.98	-	13.07	11.12	12.36	11.36	13.73	11.38	13.04	11.47	13.07	11.38
Salinity	parts per trillion	-	-	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.21	-	0.09	-	0.12	0.09	0.16	0.09	0.11	0.09	0.19	0.09	0.26	0.10
Turbidity	nephelometric units	-	-	1.5	1.5	1.4	1.6	9.1	1.6	9.2	17.9	-	4.2	-	33.2	5.4	52.4	-	110.0	17.9	122.9	29.2	353.1	37.8
Physical Parameters																								
Colour	Col. Unit	5.0	-	5.0	<5.0	7.0	6.2	5.6	5.4	<5.0	8.9	-	5.2	-	26.9	7.1	7.3	7.2	235	6.0	36.8	11.1	84.5	14.0
Electrical Conductivity (EC)	µS/cm	2.0	-	165	162	164	163	165	165	174	415	-	174	-	232	168	299	190	218	193	375	190	498	204
Hardness as $CaCO_3$	µg/L	500	-	90100	87200	89300	86600	87800	86700	89900	250000	-	92100	-	130000	87900	178000	99000	94700	103000	202000	102000	217000	103000
pH	pH Units	0.10	6.5-9.0	7.98	8.01	7.99	8.01	8.00	8.00	8.15	8.27	-	7.98	-	8.15	8.00	8.19	8.15	7.63	8.18	8.40	8.15	8.05	8.11
Total Suspended Solids (TSS)	µg/L	3000	-	<3000	<3000	<3000	<3000	<3000	<3000	13500	16700		5300		22900	7400	72200	15900	164000	29600	326000	41500	481000	54100
Total Dissolved Solids (TDS)	µg/L	1000	-	96500	95700	96600	94500	95500	95100	97800	270000	-	122000	-	181000	124000	219000	109000	177000	111000	249000	116000	354000	121000
Turbidity	NTU	0.10	-	1.06	1.25	0.80	1.11	1.37	1.01	3.82	19.3	-	4.53	-	36.2	4.59	64.8	11.5	166	17.5	298	33.5	549	49.8
Anions and Nutrients																								
Bicarbonate as $CaCO_3$	µg/L	1000	-	81300	81200	81500	80000	81300	81100	83100	191000	-	83100	-	122000	87200	152000	91700	56000	94100	201000	91500	142000	94500
Carbonate as $CaCO_3$	µg/L	1000	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	-	<1000	-	<1000	<1000	<1000	<1000	<1000	<1000	7600	<1000	<1000	<1000
Hydroxide as $CaCO_3$	µg/L	1000	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	-	<1000	-	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Total Alkalinity as $CaCO_3$	µg/L	1000	-	81300	81200	81500	80000	81300	81100	83100	191000	-	83100	-	122000	87200	152000	91700	56000	94100	209000	91500	142000	94500
Ammonia, Total (as N)	µg/L	5.0	See narrative [#2]	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	<5.0	-	5.0	8.0	8.0	<5.0	20.1	<5.0	29.4	<5.0	126	<5.0
Bromide	µg/L	50	-	<50	<50	<50	<50	<50	<50	<50	<50	-	<50	-	<50	<50	<50	<50	<50	<500	<50	<50	<50	<50
Chloride	µg/L	500	600,000	<500	<500	<500	<500	<500	<500	<500	500	-	<500	-	570	<500	1300	<500	2700	<5000	2660	510	14200	610
Fluoride	µg/L	20	See equation [#3]	35	35	34	34	35	34	35	99	-	38	-	73	38	73	41	72	<200	81	40	136	43
Nitrate and Nitrite (as N)	µg/L	5.1		48.8	47.6	46	46.2	48.2	48.1	46	<5.1	-	47.6	-	21.1	46.6	94.2	57.3	29.2	58	66.9	59.1	262	59.6
Nitrate (as N)	µg/L	5.0	32,800	48.8	47.6	46.0	46.2	48.2	48.1	46.0	<5.0	-	47.6	-	21.1	46.6	94.2	57.3	29.2	58	66.9	59.1	257	59.6
Nitrite (as N)	µg/L	1.0	60-600 [#4]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<10	<1.0	<1.0	5.2	<1.0
Total Kjeldahl Nitrogen	µg/L	50	-	105	97	86	103	88	96	114	167	-	136	-	339	113	280	120	1240	142	890	192	1850	219
Total Nitrogen	µg/L	30	-	128	125	134	200	119	119	141	133	-	129	-	324	242	227	147	1030	163	723	191	1670	201
Orthophosphate (as P)	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.1	-	<1.0	-	2.5	<1.0	2.3	<1.0	12.0	<1.0	4.3	<1.0	12.1	1.7
Phosphorus (P)-Total Dissolved	µg/L	2.0	-	<2.0	<2.0	2.4	2.1	<2.0	<2.0	<2.0	3.1	-	2.4	-	6.7	2.5	3.1	2.7	35.5	2.9	10.6	3.1	28.8	3.7
Phosphorus (P)-Total	µg/L	2.0	-	3.7	3.6	2.4	2.6	3.0	3.3	15.5	22.7	-	5.1	-	20.7	10.4	75.6	17.3	133	22.1	230	27.4	312	37.2
Silicate (as SiO_2)	µg/L	500	-	4400	4310	4350	4440	4290	4420	4360	3600	-	4230	-	2790	4200	2750	4260	7450	4230	5240	4320	5700	4370
Sulphate	µg/L	300	-	12300	12300	12300	12400	12300	12300	12500	58800	-	13500	-	13500	14500	28400	15000	52400	14000	23700	17000	118000	18600
Anions Total	meq/L	-	-	1.89	1.88	1.89	1.86	1.89	1.88	1.93	5.07	-	1.95	-	2.75	2.05	3.67	2.15	2.29	2.18	4.75	2.2	5.72	2.3
Cations Total	meq/L	-	-	1.8	1.74	1.78	1.73	1.75	1.73	1.8	5.16	-	1.84	-	2.72	1.76	3.74	1.98	2.51	2.06	4.49	2.15	5.63	2.16
Ionic Balance	N/A	-	-	-2.3	-3.9	-2.9	-3.6	-3.6	-4.1	-3.5	0.9	-	-2.8	-	-0.6	-7.7	1	-4.2	4.5	-2.8	-2.8	-1.3	-0.8	-3.2
Organic and Inorganic Carbon																								
Dissolved Organic Carbon (DOC)	µg/L	500	-	2800	2800	2870	2730	3200	3440	3260	4300	-	3470	-	8200	3610	3680	3240	38900	3220	13800	4960	25300	6360
Total Organic Carbon (TOC)	µg/L	500	-	2900	3180	3050	2800	2700	2870	3020	4200	-	3090	-	9050	3070	4640	3000	41600	3350	15200	4660	28700	5700
Total Metals																								
Aluminum	µg/L	5.0	-	22.1	26.3	18.2	14.4	24.2	34.9	174	516	-	137	-	784	123	1960	448	3080	550	4830	657	7900	1200
Antimony	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	0.85	-	<0.50	<0.50	1.44	<0.50	3.03	0.60	3.78	0.60	7.72	0.95
Barium	µg/L	20	-	32	31	31	30	32	32	37	106	-	38	-	169	38	154	52	117	55	267	55	237	69
Beryllium	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth	µg/L	200	-	<200	<200	<200	<200	<200	<200	<200	<200	-	<200	-	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
Boron	µg/L	100	-	<100	<100	<100	<100	<100	<100	<100	<100	-	<100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Cadmium	µg/L	0.0050	-	0.0186	0.0145	0.0170	0.0126	0.0152	0.0146	0.0488	0.0651	-	0.0236	-	0.0542	0.0267	0.114	0.0286	0.178	0.0402	0.278	0.0504	0.281	0.0672
Calcium	µg/L	100	-	26700	26000	26700	25900	26100	26400	29300	69000	-	30200	-	39500	30700	52200	32700	29400	33500	68800	32400	68000	33900
Chromium	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	-	1.4	<1.0	3.3	<1.0	5.5	1.0	8.4	1.2	13.3	2.0
Cobalt	µg/L	0.30	4	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	0.49	<0.30	-	0.65	-	<0.30	<0.30	1.65	<0.30	3.15	0.39	3.94	0.50	7.22	0.82
Copper	µg/L	1.0	See equation [#5]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	-	2.6	-	<1.0	<1.0	4.6	1.4	7.6	1.6	11.5	1.8	18.7	2.7
Iron	µg/L	30	1000	30	37	<30	<30	37	50	263	854	-	181	-	**1460**	143	**3390**	688	**7250**	852	**8800**	**1180**	**15900**	**1900**
Lead	µg/L	0.50	See equation [#6]	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	0.75	-	<0.50	<0.50	1.76	<0.50	3.08	<0.50	5.02	0.58	8.68	0.94
Lithium	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	8.2	-	1.4	-	4.2	1.5	9.5	1.8	10.6	1.9	9.4	2.2	19.2	3.0
Magnesium	µg/L	100	-	5880	5740	5940	5770	5800	5910	6210	18500	-	6510	-	10400	6610	13400	6890	8890	7040	17000	6940	21200	7430
Manganese	µg/L	0.10	See equation [#7]	1.46	1.48	1.10	1.17	1.64	1.64	7.86	20.0	-	4.29	-	27.0	5.42	52.1	12.0	118	14.1	137	17.7	243	26.6
Mercury	µg/L	0.0050	-	<0.0050	0.0071	<0.0050	<0.0050	0.0053	0.0057	0.0063	0.0066	-	<0.0050	-	0.0057	0.0061	0.013	0.0076	0.028	0.0076	0.035	0.0083	0.048	0.0083
Molybdenum	µg/L	1.0	2000	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.5	-	<1.0	-	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0
Nickel	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.2	-	3.8	-	<1.0	<1.0	6.3	1.8	12.5	2.0	14.2	2.4	25.8	3.4
Phosphorus	µg/L	300	-	<300	<300	<300	<300	<300	<300	<300	<300	-	<300	-	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300
Potassium	µg/L	2000	-	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	-	<2000	-	<2000	<2000	<2000	<2000	2600	<2000	3000	<2000	6600	<2000
Selenium	µg/L	0.050	-	0.196	0.266	0.257	0.253	0.260	0.242	0.247	1.39	-	0.268	-	0.233	0.280	0.657	0.332	0.430	0.333	0.532	0.307	0.878	0.365
Silicon	µg/L	50	-	2160	2100	2130	2060	2130	2130	2320	2560	-	2370	-	2360	2210	4160	2890	8040	2920	9890	3170	16100	3980
Silver	µg/L	0.020	0.1 or 3.0 [#8]	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-	<0.020	-	<0.020	<0.020	0.036	<0.020	0.061	<0.020	0.100	<0.020	0.114	<0.020
Sodium	µg/L	2000	-	<2000	<2000	<2000	<2000	<2000	<2000	<2000	4000	-	<2000	-	2800	<2000	4100	<2000	11400	<2000	9900	2100	25400	2400
Strontium	µg/L	5.0	-	103	101	105	102	101	103	101	323	-	115	-	94.9	112	178	115	103	117	243	115	262	120
Thallium	µg/L	0.20	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	-	<0.20	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Tin	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Titanium	µg/L	10	-	<10	<10	<10	<10	<10	<10	<10	15	-	<10	-	<10	<10	26	12	23	11	36	12	51	17
Uranium	µg/L	0.20	-	0.40	0.40	0.40	0.40	0.45	0.44	0.44	0.91	-	0.45	-	0.37	0.44	0.64	0.49	0.61	0.49	1.00	0.50	1.64	0.55
Vanadium	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	1.24	2.34	-	0.77	-	3.27	0.79	6.96	1.86	11.5	2.25	17.9	2.68	27.2	4.50
Zinc	µg/L	5.0	See equation [#9]	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	7.9	-	<5.0	-	7.5	<5.0	18.0	<5.0	32.7	6.9	45.5	6.3	69.4	10.2
Dissolved Metals																								
Aluminum	µg/L	5.0	100 [#10]	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	23.7	-	5.4	-	21.7	8.3	35.7	6.6	**133**	7.2	<5.0	12.5	13.9	12.3
Antimony	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Arsenic	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	-	<0.50	<0.50	<0.50	<0.50	0.71	<0.50	<0.50	<0.50	0.76	<0.50
Barium	µg/L	20	-	31	30	29	29	30	29	31	94	-	33	-	130	31	96	34	37	36	104	37	34	37
Beryllium	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth	µg/L	200	-	<200	<200	<200	<200	<200	<200	<200	<200	-	<200	-	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200
Boron	µg/L	100	-	<100	<100	<100	<100	<100	<100	<100	<100	-	<100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Cadmium	µg/L	0.0050	See equation [#11]	0.0081	0.0084	0.0077	0.0094	0.0079	0.0065	0.0098	0.0232	-	0.0064	-	0.0152	0.0054	0.0171	0.0125	0.0581	0.0114	0.0126	0.0164	0.0234	0.0180
Calcium	µg/L	100	-	26500	25600	26400	25500	25700	25400	26400	69500	-	26900	-	36900	29500	51100	29300	25000	30600	57600	30100	57700	30100
Chromium	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cobalt	µg/L	0.30	-	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	-	<0.30	-	<0.30	<0.30	0.32	<0.30	0.94	<0.30	<0.30	<0.30	0.73	<0.30
Copper	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	-	1.7	-	<1.0	<1.0	<1.0	<1.0	1.9	<1.0	1.7	<1.0	2.8	<1.0
Iron	µg/L	30	350	<30	<30	<30	<30	<30	<30	<30	56	-	<30	-	97	<30	33	<30	**1460**	<30	35	55	288	46
Lead	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Lithium	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	7.7	-	1.1	-	3.6	1.3	7.6	1.5	6.9	1.3	2.8	1.9	9.2	1.9
Magnesium	µg/L	100	-	5810	5620	5690	5550	5730	5650	5800	18500	-	6050	-	9140	5860	12300	6290	7810	6440	14200	6560	17700	6620
Manganese	µg/L	0.10	-	0.24	0.24	0.16	0.18	0.33	0.22	0.27	11.3	-	0.77	-	12.9	1.53	16.1	1.53	72.3	1.97	25.2	4.76	84.4	4.86
Mercury	µg/L	0.0050	-	0.0062	<0.0050	<0.0050	<0.0050	0.0052	0.0081	0.0052	0.0079	-	0.0063	-	0.0052	0.0064	0.0063	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0103	0.0054
Molybdenum	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.3	-	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel	µg/L	1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.2	-	<1.0	-	2.0	<1.0	1.8	<1.0	5.7	<1.0	1.8	<1.0	6.0	<1.0
Phosphorus	µg/L	300	-	<300	<300	<300	<300	<300	<300	<300	<300	-	<300	-	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300
Potassium	µg/L	2000	-	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	-	<2000	-	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	4800	<2000
Selenium	µg/L	0.050	-	0.247	0.241	0.224	0.254	0.267	0.230	0.237	1.53	-	0.268	-	0.197	0.269	0.601	0.338	0.219	0.256	0.239	0.285	0.339	0.302
Silicon	µg/L	50	-	2100	2100	2070	2060	2040	2000	2050	1670	-	2000	-	1320	2000	1250	2030	3480	1980	2400	2120	2580	2050
Silver	µg/L	0.020	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-	<0.020	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Sodium	µg/L	2000	-	<2000	<2000	<2000	<2000	<2000	<2000	<2000	3900	-	<2000	-	2600	<2000	4100	<2000	12000	<2000	10200	2300	26200	2400
Strontium	µg/L	5.0	-	101	97.7	99.4	96.9	101	98.8	101	322	-	108	-	86.5	102	171	111	92.5	113	218	113	222	112
Thallium	µg/L	0.20	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	-	<0.20	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Tin	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Titanium	µg/L	10	-	<10	<10	<10	<10	<10	<10	<10	<10	-	<10	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Uranium	µg/L	0.20	-	0.36	0.41	0.41	0.42	0.38	0.40	0.41	0.86	-	0.41	-	0.32	0.34	0.49	0.37	0.31	0.41	0.51	0.38	1.01	0.35
Vanadium	µg/L	0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	<0.50	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Zinc	µg/L	5.0	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	<5.0	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Plant Pigments												-		-										
Chlorophyll a (reservoirs only)	µg/L	0.010	-	-	1.31	1.73	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

NOTES:

BC MOE 2016 — BC MOE. 2016. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Protection and Sustainability Branch. British Columbia Ministry of Environment. Freshwater Aquatic Life - Short-term Maximum criteria applied.

#1 — Dissolved Oxygen guideline protects all life stages other than buried embryo/alevin

#2 — Guideline/standard for ammonia varies with pH and temperature.

#3 — Standard for fluoride varies with hardness. Calculated based on equation: -51.73 + 92.57*log(Hardness)

#4 — Guideline/standard for nitrite varies with chloride concentrations.

#5 — Water quality guideline for copper is calculated as 0.094(H)^0.2

#6 — Standard for lead is 3 ug/L at H=8 mg/L, or calculated as e(1.273*(ln(H)-1.460) when H>8 mg/L

#7 — Guideline for manganese calculated as (0.01102*H)+0.54

#8 — Criteria for silver varies with hardness, 0.1 ug/L at H<100 mg/L or 3.0 µg/L at H>100 mg/L

#9 — Guideline for zinc calculated as 33+0.75*(H-90)

#10 — Standard for aluminum varies with pH. Standard is 0.05 mg/L if pH is greater than or equal to 6.5, or calculated as $e^{(1.209-2.426(pH-0.3896)}$ where K=(pH)^2

#11 — Standard for cadmium is calculated as $e^{(1.03*(ln(H))-3.274)}$

H — Hardness

- — 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.

TETRA TECH

Table 7: Reservoir Sediment Quality Results

Parameter	Unit	Reported Detection Limit (RDL)	BC MOE 2015 (mg/kg in dry weight)		Williston (W1)	Dinosaur (D1)
			Lower SWQG	Upper SWQG		
Sample Date					24-Oct-2016	24-Oct-2016
Laboratory Identification Number					L1848454-7	L1848454-8
Field Measurements						
Sample Depth (bottom)	m	-	-	-	22.5	13.5
Particle Size (Soil)						
% Gravel (>2mm)	%	1.0	-	-	<1.0	<1.0
% Sand (2.00mm - 1.00mm)	%	1.0	-	-	<1.0	<1.0
% Sand (1.00mm - 0.50mm)	%	1.0	-	-	<1.0	<1.0
% Sand (0.50mm - 0.25mm)	%	1.0	-	-	<1.0	<1.0
% Sand (0.25mm - 0.125mm)	%	1.0	-	-	<1.0	<1.0
% Sand (0.125mm - 0.063mm)	%	1.0	-	-	10.2	7.2
% Silt (0.063mm - 0.0312mm)	%	1.0	-	-	25.3	25.8
% Silt (0.0312mm - 0.004mm)	%	1.0	-	-	46.7	51.0
% Clay (<4um)	%	1.0	-	-	16.9	14.6
Texture	-	-	-	-	Silt loam	Silt
Physical Tests (Soil)						
pH (1:2 soil:water)	pH	0.10	-	-	8.38	8.35
Leachable Anions & Nutrients (Soil)						
Total Kjeldahl Nitrogen	%	0.020	-	-	0.054	0.076
Anions and Nutrients (Soil)						
Total Nitrogen by LECO	%	0.020	-	-	0.056	0.073
Plant Available Nutrients (Soil)						
Available Ammonium-N	mg/kg	1.0	-	-	4.9	2.8
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	2.0	-	-	<2.0	<2.0
Metals (Soil)						
Aluminum (Al)	mg/kg	50	-	-	7880	6890
Antimony (Sb)	mg/kg	0.10	-	-	0.92	0.86
Arsenic (As)	mg/kg	0.10	5.9 #1	17 #2	6.70	7.67
Barium (Ba)	mg/kg	0.50	-	-	178	275
Beryllium (Be)	mg/kg	0.10	-	-	0.37	0.40
Bismuth (Bi)	mg/kg	0.20	-	-	<0.20	<0.20
Boron (B)	mg/kg	5.0	-	-	<5.0	<5.0
Cadmium (Cd)	mg/kg	0.020	0.6 #1	3.5 #2	1.19	1.16
Calcium (Ca)	mg/kg	50	-	-	39900	25900
Chromium (Cr)	mg/kg	0.50	37.3 #1	90 #2	20.4	16.9
Cobalt (Co)	mg/kg	0.10	-	-	8.22	7.25
Copper (Cu)	mg/kg	0.50	35.7 #1	197 #2	20.4	19.2
Iron (Fe)	mg/kg	50	21,200 (about 2%) #3	43,766 (about 4%) #3	21600	20900
Lead (Pb)	mg/kg	0.50	35 #1	91.3 #2	8.89	9.50
Lithium (Li)	mg/kg	2.0	-	-	11.3	10.5
Magnesium (Mg)	mg/kg	20	-	-	13000	11400
Manganese (Mn)	mg/kg	1.0	460 #3	1100 #3	441	279
Mercury (Hg)	mg/kg	0.0050	0.17 #1	0.486 #2	0.0429	0.0622
Molybdenum (Mo)	mg/kg	0.10	-	-	1.27	1.23
Nickel (Ni)	mg/kg	0.50	16 #3	75 #3	28.3	26.3
Phosphorus (P)	mg/kg	50	-	-	886	924
Potassium (K)	mg/kg	100	-	-	1040	1100
Selenium (Se)	mg/kg	0.20	-	-	0.48	0.78
Silver (Ag)	mg/kg	0.10	0.5 #4	N/A #4	0.13	0.21
Sodium (Na)	mg/kg	50	-	-	104	95
Uranium (U)	mg/kg	0.050	-	-	0.861	0.894
Vanadium (V)	mg/kg	0.20	-	-	40.7	36.3
Zinc (Zn)	mg/kg	2.0	123 #1	315 #2	79.9	88.1
Zirconium (Zr)	mg/kg	1.0	-	-	3.1	1.6

NOTES:

BC MOE 2015	BC MOE. 2015. Working Water Quality Guidelines and Working Sediment Quality Guidelines for British Columbia. Water Protection and Sustainability Branch. British Columbia Ministry of Environment.
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.ccme.ca/en/index.html#void
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)).
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
<	Concentration is less than the laboratory detection limit indicated.
-	No applicable standard or guideline
Unshaded	Concentration < Lower SWQG: Rarely associated with adverse biological effects (BC MOE, 2015)
Shaded only	Concentration > Lower SWQG but < Upper SWQG are occasionally associated with adverse biological effects (BC MOE, 2015)
Shaded and Bolded	Concentrations > Upper SWQG are frequently associated with adverse biological effects (BC MOE, 2015)

Table 8: Reservoir Water Quality Depth Profile

Parameter (Unit)	BC MOE 2016	Sample Depth (m)	(D1) Dinosaur Reservoir						(W1) Williston Reservoir					
Sample Date			29-May-16	21-Jun-16	26-Jul-16	24-Aug-16	22-Sep-16	24-Oct-2016	29-May-2016	21-Jun-2016	26-Jul-2016	24-Aug-16	22-Sep-16	24-Oct-2016
Field Measurements														
Secchi Depth (m)	-		4.3	1.5	4.5	5.0	2.5	4.5	5.0	3.0	2.0	3.8	2.5	3.5
Total Depth (m)	-		20.2	-	20.2	-	-	13.5	65.1	-	150.0	-	45.3	54.5
Electrical Conductivity (µS/cm)	-	0.0	114.2	124.7	141.4	-	-	-	110.1	131.2	142.4	-	-	-
		0.2	114.9	128.3	141.5	126.7	131.2	119.8	110.1	131.3	134.8	148.5	132.9	119.9
		0.5	113.8	126.2	141.5	126.9	131.1	119.7	110.0	131.3	134.2	147.4	133.0	119.9
		1.0	111.1	126.8	141.4	126.8	131.0	119.7	109.8	131.2	132.4	146.8	133.0	119.9
		1.5	110.9	126.9	141.3	126.7	131.0	119.8	109.7	131.2	131.2	146.7	133.1	119.9
		2.0	110.9	126.1	141.3	126.5	139.9	119.7	109.4	131.3	130.6	146.6	133.1	119.9
		2.5	110.8	125.6	141.1	126.4	130.8	119.7	109.6	131.3	130.4	146.4	133.1	119.8
		3.0	111.1	126.7	141.2	126.3	-	119.8	109.3	131.3	130.6	146.4	133.0	119,8
		3.5	110.7	126.7	141.0	126.2	-	119.7	109.1	131.3	129.8	146.3	133.1	119.9
		4.0	110.7	126.8	141.0	126.1	-	119.7	109.3	131.3	129.7	146.2	-	119.8
		4.5	110.8	126.8	141.0	-	-	119.7	108.9	130.5	129.6	-	-	119.8
		5.0	110.7	126.8	141.0	-	-	119.7	109.2	130.3	129.5	-	-	119.7
		6.0	110.7	126.8	141.0	-	-	-	109.0	130.3	129.5	-	-	-
		7.0	110.7	126.8	141.0	-	-	-	109.0	127.7	129.4	-	-	-
		8.0	110.7	127.7	141.0	-	-	-	109.0	127.0	129.4	-	-	-
		9.0	110.7	125.6	141.0	-	-	-	108.9	126.3	129.3	-	-	-
		10.0	-	-	-	-	-	-	-	-	-	-	-	-
Specific Conductivity (SPCµS/cm)	-	0.0	183.8	181.4	171.4	-	-	-	181.8	181.1	165.0	-	-	-
		0.2	182.0	182.5	169.4	174.3	169.8	174.9	182.0	181.2	165.0	167.7	167.1	174.4
		0.5	182.8	180.2	169.6	174.3	169.9	174.9	181.9	181.1	165.1	167.7	167.4	174.3
		1.0	182.4	182.7	169.1	174.3	169.8	174.9	182.0	181.2	165.0	167.6	167.3	174.3
		1.5	182.4	182.4	169.0	174.3	169.9	175.0	182.1	181.1	165.0	167.6	167.4	174.3
		2.0	182.6	181.7	168.9	174.3	169.9	174.9	182.1	181.1	165.0	167.6	167.4	174.2
		2.5	182.4	181.1	168.9	174.3	169.9	174.9	182.1	181.1	165.0	167.6	167.4	174.2
		3.0	182.4	181.9	168.9	174.3	-	175.0	182.1	181.1	165.0	167.6	167.3	174.2
		3.5	182.5	181.9	168.9	174.4	-	174.9	182.1	181.1	164.9	167.5	167.4	174.2
		4.0	182.4	181.9	168.9	174.4	-	174.9	182.1	181.1	165.0	167.5	-	174.2
		4.5	182.4	181.9	168.9	-	-	174.9	182.2	181.1	165.0	-	-	174.1
		5.0	182.4	182.0	168.9	-	-	174.9	182.1	181.1	165.0	-	-	174.1
		6.0	182.5	182.0	168.9	-	-	-	182.2	181.1	165.0	-	-	-
		7.0	182.4	181.7	168.9	-	-	-	182.2	181.2	165.0	-	-	-
		8.0	182.4	181.9	168.9	-	-	-	182.2	181.0	165.0	-	-	-
		9.0	182.5	181.9	168.9	-	-	-	182.2	181.1	-	-	-	-
		10.0	-	-	-	-	-		-	-	-	-	-	-
pH (pH units)	6.5-9.0	0.0	8.09	7.57	**4.48**	-	-	-	8.18	8.05	8.32	-	-	-
		0.2	8.10	6.17	8.20	8.29	8.34	8.19	8.17	8.04	8.31	8.29	8.46	8.14
		0.5	8.10	6.92	8.19	8.12	8.29	8.19	8.16	8.05	8.29	8.28	8.32	8.15
		1.0	8.10	7.20	8.20	8.08	8.29	8.18	8.15	8.06	8.29	8.28	8.32	8.14
		1.5	8.10	7.40	8.18	8.07	8.29	8.17	8.15	8.06	8.28	8.28	8.31	8.15
		2.0	8.10	7.48	8.17	8.06	8.28	8.18	8.15	8.06	8.28	8.28	8.31	8.15
		2.5	8.12	7.57	8.16	8.06	8.27	8.19	8.15	8.06	8.27	8.28	8.31	8.15
		3.0	8.12	7.68	8.15	8.05	-	8.19	8.15	8.06	8.28	8.28	8.31	8.15
		3.5	8.12	7.75	8.14	8.05	-	8.18	8.15	8.06	8.26	8.28	8.31	8.15
		4.0	8.12	7.81	8.14	8.05	-	8.16	8.15	8.08	8.25	8.28	-	8.14
		4.5	8.13	7.83	8.14	-	-	8.16	8.15	8.10	8.26	-	-	8.14
		5.0	8.13	7.83	8.14	-	-	8.16	8.15	8.10	8.25	-	-	8.14
		6.0	8.13	7.83	8.14	-		-	8.15	8.04	8.25	-	-	-
		7.0	8.12	7.84	8.13	-	-	-	8.15	8.03	8.25	-	-	-
		8.0	8.13	7.85	8.13	-	-	-	8.15	8.03	8.25	-	-	-
		9.0	8.12	7.85	8.12	-	-	-	8.15	8.03	-	-	-	-
		10.0	-	-	-	-	-	-	-	-	-	-	-	-
Temperature (°C)	15	0.0	4.9	8.6	14.2	-	-	-	4.4	10.6	**17.5**	-	-	-
		0.2	5.7	9.4	14.3	10.8	13.1	8.5	4.3	10.6	**17.5**	**19.0**	14.3	8.6
		0.5	4.7	9.2	13.9	10.8	13.0	8.5	4.3	10.6	**17.5**	**18.6**	14.3	8.7
		1.0	4.5	9.1	13.6	10.7	13.0	8.5	4.2	10.6	**17.5**	**18.5**	14.3	8.7
		1.5	4.5	9.0	13.3	10.7	13.0	8.5	4.2	10.6	**17.5**	**18.5**	14.3	8.6
		2.0	4.5	9.0	13.1	10.7	13.0	8.5	4.2	10.6	**17.5**	**18.4**	14.3	8.7
		2.5	4.4	9.0	13.0	10.7	13.0	8.5	4.1	10.6	**17.4**	**18.4**	14.3	8.6
		3.0	4.5	9.1	12.9	10.6	-	8.5	4.1	10.6	**17.4**	**18.4**	14.3	8.7
		3.5	4.4	9.1	12.9	10.6	-	8.5	4.1	10.6	**17.4**	**18.4**	14.3	8.7
		4.0	4.4	9.1	12.9	10.5	-	8.5	4.0	10.6	**17.4**	**18.4**	-	8.7
		4.5	4.5	9.2	12.8	-	-	8.5	3.9	10.6	**17.4**	-	-	8.7
		5.0	4.4	9.1	12.8	-	-	8.5	4.0	10.4	**17.4**	-	-	8.7
		6.0	4.4	9.1	12.8	-	-	-	4.0	10.2	**17.4**	-	-	-
		7.0	4.4	9.1	12.8	-	-	-	4.0	9.4	**17.4**	-	-	-
		8.0	4.4	8.9	12.8	-	-	-	3.9	9.3	**17.4**	-	-	-
		9.0	4.4	8.8	12.8	-	-	-	3.9	9.1	-	-	-	-
		10.0	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen (DO; mg/L)	Minimum 5 mg/L (All life stages other than buried embryo/alevin)	0.0	12.42	11.40	9.66	-	-	-	12.02	11.14	9.08	-	-	-
		0.2	12.36	11.29	10.15	10.75	9.89	10.58	12.23	11.22	9.10	8.68	9.36	10.39
		0.5	12.34	11.44	10.20	10.55	9.88	10.57	12.32	11.23	9.10	8.69	9.34	10.36
		1.0	12.46	11.46	20.22	10.47	9.88	10.55	12.35	11.24	9.10	8.70	9.34	10.35
		1.5	12.46	11.47	10.24	10.45	9.88	10.55	12.36	11.23	9.11	8.70	9.33	10.34
		2.0	12.32	11.48	10.25	10.45	9.86	10.55	12.37	11.23	9.11	8.69	9.32	10.34
		2.5	12.39	11.48	10.24	10.44	9.86	10.55	12.36	11.23	9.10	8.69	9.32	10.33
		3.0	12.40	11.48	10.24	10.45	-	10.54	12.38	11.23	9.10	8.69	9.32	10.33
		3.5	12.43	11.47	10.24	10.45	-	10.53	12.39	11.22	9.09	8.69	9.32	10.32
		4.0	12.42	11.47	10.25	10.45	-	10.53	12.38	11.22	9.09	8.69	-	10.32
		4.5	12.42	11.47	10.24	-	-	10.52	12.38	11.22	9.08	-	-	10.32
		5.0	12.42	11.46	10.24	-	-	10.52	12.37	11.30	9.08	-	-	10.32
		6.0	12.42	11.46	10.24	-	-	-	12.37	11.33	9.07	-	-	-
		7.0	12.42	11.46	10.23	-	-	-	12.36	11.43	9.07	-	-	-
		8.0	12.41	11.49	10.22	-	-	-	12.36	11.42	9.07	-	-	-
		9.0	12.41	11.49	10.22	-	-	-	12.36	11.45	-	-	-	-
		10.0	-	-	-	-	-	-	-	-	-	-	-	-
Salinity (parts per trillion (ppt)	-	0.0	0.09	0.09	0.08	-	-	-	0.09	0.09	0.08	-	-	-
		0.2	0.09	0.09	0.08	0.07	0.08	0.08	0.09	0.09	0.08	0.08	0.08	0.08
		0.5	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.08	0.08
		1.0	0.09	0.09	0.04	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.08	0.08
		1.5	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.08	0.08
		2.0	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.08	0.08
		2.5	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.08	0.08
		3.0	0.09	0.09	0.08	0.08	-	0.08	0.09	0.09	0.08	0.08	0.08	0.08
		3.5	0.09	0.09	0.08	0.08	-	0.08	0.09	0.09	0.08	0.08	0.08	0.08
		4.0	0.09	0.09	0.08	0.08	-	0.08	0.09	0.09	0.08	0.08	-	0.08
		4.5	0.09	0.09	0.08	-	-	0.08	0.09	0.09	0.08	-	-	0.08
		5.0	0.09	0.09	0.08	-	-	0.08	0.09	0.09	0.08	-	-	0.08
		6.0	0.09	0.09	0.08	-	-	-	0.09	0.09	0.08	-	-	-
		7.0	0.09	0.09	0.08	-	-	-	0.09	0.09	0.08	-	-	-
		8.0	0.09	0.09	0.08	-	-	-	0.09	0.09	0.08	-	-	-
		9.0	0.09	0.09	0.08	-	-	-	0.09	0.09	-	-	-	-
		10.0	-	-	-	-	-	-	-		-	-	-	-
Turbidity (nephelometric units (NTU))	-	0.0	1.2	0.7	4.2	-	-	-	0.9	3.0	6.1	-	-	-
		0.2	1.6	0.7	4.3	2.4	3.6	1.5	0.8	2.7	5.8	2.8	2.3	1.3
		0.5	1.5	0.7	4.6	2.5	3.7	1.5	0.9	2.9	5.9	2.8	2.1	1.4
		1.0	1.3	1.1	4.4	2.5	3.6	1.5	0.9	3.0	5.9	2.8	2.2	1.3
		1.5	1.5	0.6	4.5	2.5	3.4	1.5	0.9	3.0	5.9	2.9	2.2	1.4
		2.0	1.3	0.7	4.6	2.4	3.5	1.5	1.0	3.0	6.0	3.1	2.3	1.6
		2.5	1.4	1.3	4.2	2.6	3.7	1.5	0.9	2.8	6.4	2.8	2.3	1.6
		3.0	1.3	2.3	4.4	2.5	-	1.5	0.9	3.0	6.6	2.9	2.2	1.5
		3.5	1.5	1.3	4.6	2.6	-	1.5	1.0	2.9	8.1	3.0	2.2	1.6
		4.0	1.4	1.4	4.5	2.6	-	1.4	1.0	2.8	7.7	2.9	-	1.6
		4.5	1.3	1.8	4.5	-	-	1.5	1.0	3.1	8.4	-	-	1.7
		5.0	1.5	1.7	4.5	-	-	1.5	1.0	3.0	7.7	-	-	1.6
		6.0	1.3	1.0	4.5	-	-	-	1.0	2.9	8.6	-	-	-
		7.0	1.4	0.9	4.6	-	-	-	1.0	3.1	11.4	-	-	-
		8.0	1.6	1.4	4.5	-	-	-	1.0	3.1	12.1	-	-	-
		9.0	1.5	2	4.5	-	-	-	1.0	2.9	-	-	-	-
		10.0	-	-	-	-	-	-	-	-	-	-	-	-

NOTES:

BC MOE 2016	BC MOE. 2016. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Protection and Sustainability Branch. British Columbia Ministry of Environment.
-	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 9a: Water Quality Assurance and Quality Control Results

Parameter	Unit	BC MOE 2016	TRIP BLANKS								
		Approved	Trip Blank	Trip Blank	Trip Blank	Trip Blank	Field Blank	Field Blank	Field Blank	Field Blank	Field Blank
Sample Date			1-Jul-2016	1-Aug-2016	1-Sep-2016	28-Oct-2016	21-Jun-2016	26-Jul-2016	24-Aug-2016	22-Sep-2016	24-Oct-2016
Laboratory Identification Number			L1805726-1	L1819424-8	L1833109-1	L1850471	L1786823-1	L1804199-6	L1820026-10	L1833036-6	L1848454-6
Physical Parameters											
Colour	Col. Unit	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Electrical Conductivity (EC)	µS/cm	-	-	-	<2.0	**331**	-	-	-	<2.0	<2.0
Hardness as $CaCO_3$	µg/L	-	-	-	<500	<500	-	-	-	<500	<500
pH	pH Units	6.5-9.0	**5.33**	**5.41**	**5.41**	**5.43**	**5.52**	**5.51**	**5.40**	**5.37**	**5.57**
Total Suspended Solids (TSS)	µg/L	-	<3000	<3000	<3000	<3000	<3000	<3000	<3000	<3000	<3000
Total Dissolved Solids (TDS)	µg/L	-	<10000	<10000	<1000	<1000	<10000	<10000	<10000	-	<1000
Anions and Nutrients							<1000				
Bicarbonate as $CaCO_3$	µg/L	-	-	-	<1000	<1000	-	-	-	<1000	<1000
Carbonate as $CaCO_3$	µg/L	-	-	-	<1000	<1000	-	-	-	<1000	<1000
Hydroxide as $CaCO_3$	µg/L	-	-	-	<1000	<1000	-	-	-	<1000	<1000
Total Alkalinity as $CaCO_3$	µg/L	-	<1000	<1000	<1000	<1000	<5.0	<1000	<1000	<1000	<1000
Ammonia, Total (as N)	µg/L	See narrative [#2]	<5.0	**10.3**	<5.0	-	-	<5.0	<5.0	<5.0	<5.0
Bromide	µg/L	-	-	-	<50	<50	-	-	-	<50	<50
Chloride	µg/L	600,000	-	-	<500	<500	-	-	-	<500	<500
Fluoride	µg/L	See equation [#3]	-	-	<20	<20	-	-	-	<20	<20
Nitrate and Nitrite (as N)	µg/L	-	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1	<5.1
Nitrate (as N)	µg/L	32,800	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Nitrite (as N)	µg/L	60-600 [#4]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Kjeldahl Nitrogen	µg/L	-	<50	<50	<50	-	<50	<50	<50	<50	<50
Total Nitrogen	µg/L	-	<30	<30	<30	-	<30	<30	<30	<30	<30
Orthophosphate (as P)	µg/L	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Phosphorus (P)-Total Dissolved	µg/L	-	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	<2.0	<2.0
Phosphorus (P)-Total	µg/L	-	<2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	**2.1**	<2.0
Silicate (as SiO_2)	µg/L	-	-	-	<500	<500	-	-	-	<500	<500
Sulphate	µg/L	-	-	-	<300	<300	-	-	-	<300	<300
Anions Total	meq/L	-	-	-	<0.10	<0.10	-	-	-	<0.10	<0.10
Cations Total	meq/L	-	-	-	<0.10	<0.10	-	-	-	<0.10	<0.10
Ionic Balance	N/A	-	-	-	0	0.0	-	-	-	0	0
Organic and Inorganic Carbon											
Dissolved Organic Carbon (DOC)	µg/L	-	Not Sampled	Not Sampled	Not Sampled	Not Sampled	**1950**	**3320**	**6960**	**4420**	<500
Total Organic Carbon (TOC)	µg/L	-	<500	<500	<500	<500	<500	<500	<500	<500	<500
Total Metals											
Aluminum	µg/L	-	-	-	<5.0	<5.0	-	-	-	<5.0	<5.0
Antimony	µg/L	-	-	-	<0.50	<0.50	-	-	-	<0.50	<0.50
Arsenic	µg/L	-	-	-	<0.50	<0.50	-	-	-	<0.50	<0.50
Barium	µg/L	-	-	-	<20	<20	-	-	-	<20	<20
Beryllium	µg/L	-	-	-	<1.0	<1.0	-	-	-	<1.0	<1.0
Bismuth	µg/L	-	-	-	<200	<200	-	-	-	<200	<200
Boron	µg/L	-	-	-	<100	<100	-	-	-	<100	<100
Cadmium	µg/L	-	-	-	<0.0050	<0.0050	-	-	-	<0.0050	<0.0050
Calcium	µg/L	-	-	-	<100	<100	-	-	-	<100	<100
Chromium	µg/L	-	-	-	<1.0	<1.0	-	-	-	<1.0	<1.0
Cobalt	µg/L	110	-	-	<0.30	<0.30	-	-	-	<0.30	<0.30
Copper	µg/L	See equation [#5]	-	-	<1.0	<1.0	-	-	-	<1.0	<1.0
Iron	µg/L	1000	-	-	<30	<30	-	-	-	<30	<30
Lead	µg/L	See equation [#6]	-	-	<0.50	<0.50	-	-	-	<0.50	<0.50
Lithium	µg/L	-	-	-	<1.0	<1.0	-	-	-	<1.0	<1.0
Magnesium	µg/L	-	-	-	<100	<100	-	-	-	<100	<100
Manganese	µg/L	See equation [#7]	-	-	<0.10	<0.10	-	-	-	<0.10	<0.10
Mercury	µg/L	-	-	-	<0.0050	<0.0050	-	-	-	<0.0050	<0.0050
Molybdenum	µg/L	2000	-	-	<1.0	<1.0	-	-	-	<1.0	<1.0
Nickel	µg/L	-	-	-	<1.0	<1.0	-	-	-	<1.0	<1.0
Phosphorus	µg/L	-	-	-	<300	<300	-	-	-	<300	<300
Potassium	µg/L	-	-	-	<2000	<2000	-	-	-	<2000	<2000
Selenium	µg/L	-	-	-	<0.050	<0.050	-	-	-	<0.050	<0.050
Silicon	µg/L	-	-	-	<50	<50	-	-	-	<50	<50
Silver	µg/L	0.1 or 3.0 [#8]	-	-	<0.020	<0.020	-	-	-	<0.020	<0.020
Sodium	µg/L	-	-	-	<2000	<2000	-	-	-	<2000	<2000
Strontium	µg/L	-	-	-	<5.0	<5.0	-	-	-	<5.0	<5.0
Thallium	µg/L	-	-	-	<0.20	<0.20	-	-	-	<0.20	<0.20
Tin	µg/L	-	-	-	<0.50	<0.50	-	-	-	<0.50	<0.50
Titanium	µg/L	-	-	-	<10	<10	-	-	-	<10	<10
Uranium	µg/L	-	-	-	<0.20	<0.20	-	-	-	<0.20	<0.20
Vanadium	µg/L	-	-	-	<0.50	<0.50	-	-	-	<0.50	<0.50
Zinc	µg/L	See equation [#9]	-	-	<5.0	<5.0	-	-	-	<5.0	<5.0

NOTES:

BC MOE 2015	BC MOE. 2015. Working Water Quality Guidelines and Working Sediment Quality Guidelines for British Columbia. Water Protection and Sustainability Branch. British Columbia Ministry of Environment. Freshwater
BC MOE 2016	BC MOE. 2016. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Protection and Sustainability Branch. British Columbia Ministry of Environment. Freshwater Aquatic Life - Short-term Maximum criteria applied.
#1	Dissolved Oxygen guideline protects all life stages other than buried embryo/alevin
#2	Guideline/standard for ammonia varies with pH and temperature.
#3	Standard for fluoride varies with hardness. Calculated based on equation: -51.73 + 92.57*log(Hardness)
#4	Guideline/standard for nitrite varies with chloride concentrations.
#5	Water quality guideline for copper is calculated as 0.094(H)+2
#6	Standard for lead is 3 ug/L at H<8 mg/L, or calculated as e(1.273*ln(H)-1.460) when H>8 mg/L
#7	Guideline for manganese calculated as (0.01102*H)+0.54
#8	Criteria for silver varies with hardness, 0.1 µg/L at H<100 mg/L or 3.0 µg/L at H>100 mg/L
#9	Guideline for zinc calculated as 33+0.75*(H-90)
#10	Standard for aluminum varies with pH. Standard is 0.05 mg/L if pH is greater than or equal to 6.5, or calculated as $e^{(1.209-2.426(pH)+0.286K)}$ where $K=(pH)^2$
#11	Standard for cadmium is calculated as $e^{(1.03*ln(H)-5.274)}$
H	Hardness
-	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.
Reported detection limit (RDL)	Reported detection limit varied between sampling events, therefore, was not presented with Quality Assurance/ Quality Control results, which presents multiple events within the same table

Table 9a: Water Quality Assurance and Quality Control Results

Parameter	Unit	BC MOE 2016	TRIP BLANKS								
		Approved	Trip Blank	Trip Blank	Trip Blank	Trip Blank	Field Blank	Field Blank	Field Blank	Field Blank	Field Blank
Sample Date			1-Jul-2016	1-Aug-2016	1-Sep-2016	28-Oct-2016	21-Jun-2016	26-Jul-2016	24-Aug-2016	22-Sep-2016	24-Oct-2016
Laboratory Identification Number			L1805726-1	L1819424-8	L1833109-1	L1850471	L1786823-1	L1804199-6	L1820026-10	L1833036-6	L1848454-6
Dissolved Metals											
Aluminum	µg/L	100 #10	-	-	-	-	-	-	-	<5.0	<5.0
Antimony	µg/L	-	-	-	-	-	-	-	-	<0.50	<0.50
Arsenic	µg/L	-	-	-	-	-	-	-	-	<0.50	<0.50
Barium	µg/L	-	-	-	-	-	-	-	-	<20	<20
Beryllium	µg/L	-	-	-	-	-	-	-	-	<1.0	<1.0
Bismuth	µg/L	-	-	-	-	-	-	-	-	<200	<200
Boron	µg/L	-	-	-	-	-	-	-	-	<100	<100
Cadmium	µg/L	See equation #11	-	-	-	-	-	-	-	<0.0050	<0.0050
Calcium	µg/L	-	-	-	-	-	-	-	-	<100	<100
Chromium	µg/L		-	-	-	-	-	-	-	<1.0	<1.0
Cobalt	µg/L	-	-	-	-	-	-	-	-	<0.30	<0.30
Copper	µg/L	-	-	-	-	-	-	-	-	<1.0	<1.0
Iron	µg/L	350	-	-	-	-	-	-	-	<30	<30
Lead	µg/L	-	-	-	-	-	-	-	-	<0.50	<0.50
Lithium	µg/L	-	-	-	-	-	-	-	-	<1.0	<1.0
Magnesium	µg/L	-	-	-	-	-	-	-	-	<100	<100
Manganese	µg/L	-	-	-	-	-	-	-	-	<0.10	<0.10
Mercury	µg/L	-	-	-	-	-	-	-	-	<0.0050	<0.0050
Molybdenum	µg/L	-	-	-	-	-	-	-	-	<1.0	<1.0
Nickel	µg/L		-	-	-	-	-	-	-	<1.0	<1.0
Phosphorus	µg/L	-	-	-	-	-	-	-	-	<300	<300
Potassium	µg/L	-	-	-	-	-	-	-	-	<2000	<2000
Selenium	µg/L	-	-	-	-	-	-	-	-	<0.050	<0.050
Silicon	µg/L	-	-	-	-	-	-	-	-	<50	<50
Silver	µg/L	-	-	-	-	-	-	-	-	<0.020	<0.020
Sodium	µg/L	-	-	-	-	-	-	-	-	<2000	<2000
Strontium	µg/L	-	-	-	-	-	-	-	-	<5.0	<5.0
Thallium	µg/L	-	-	-	-	-	-	-	-	<0.20	<0.20
Tin	µg/L	-	-	-	-	-	-	-	-	<0.50	<0.50
Titanium	µg/L	-	-	-	-	-	-	-	-	<10	<10
Uranium	µg/L	-	-	-	-	-	-	-	-	<0.20	<0.20
Vanadium	µg/L	-	-	-	-	-	-	-	-	<0.50	<0.50
Zinc	µg/L	-	-	-	-	-	-	-	-	<5.0	<5.0
Plant Pigments											
Chlorophyll a	µg/L	-	-	-	-	-	<0.010	-	-	<0.010	<0.010

NOTES:	
BC MOE 2015	BC MOE. 2015. Working Water Quality Guidelines and Working Sediment Quality Guidelines for British Columbia. Water Protection and Sustainability Branch. British Columbia Ministry of Environment. Freshwater Aquat
BC MOE 2016	BC MOE. 2016. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Protection and Sustainability Branch. British Columbia Ministry of Environment. Freshwater Aquatic Life - S
#1	Dissolved Oxygen guideline protects all life stages other than buried embryo/alevin
#2	Guideline/standard for ammonia varies with pH and temperature.
#3	Standard for fluoride varies with hardness. Calculated based on equation: -51.73 + 92.57*log(Hardness)
#4	Guideline/standard for nitrite varies with chloride concentrations.
#5	Water quality guideline for copper is calculated as 0.094(H)+2
#6	Standard for lead is 3 ug/L at H<8 mg/L, or calculated as e(1.273*ln(H)-1.460) when H>8 mg/L
#7	Guideline for manganese calculated as (0.01102*H)+0.54
#8	Criteria for silver varies with hardness, 0.1 µg/L at H<100 mg/L or 3.0 µg/L at H>100 mg/L
#9	Guideline for zinc calculated as 33+0.75*(H-90)
#10	Standard for aluminum varies with pH. Standard is 0.05 mg/L if pH is greater than or equal to 6.5, or calculated as $e^{(1.209-2.426(pH)+0.286K)}$ where $K=(pH)^2$
#11	Standard for cadmium is calculated as $e^{(1.03*ln(H)-5.274)}$
H	Hardness
-	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.
Reported detection limit (RDL)	Reported detection limit varied between sampling events, therefore, was not presented with Quality Assurance/ Quality Control results, which presents multiple events within the same table

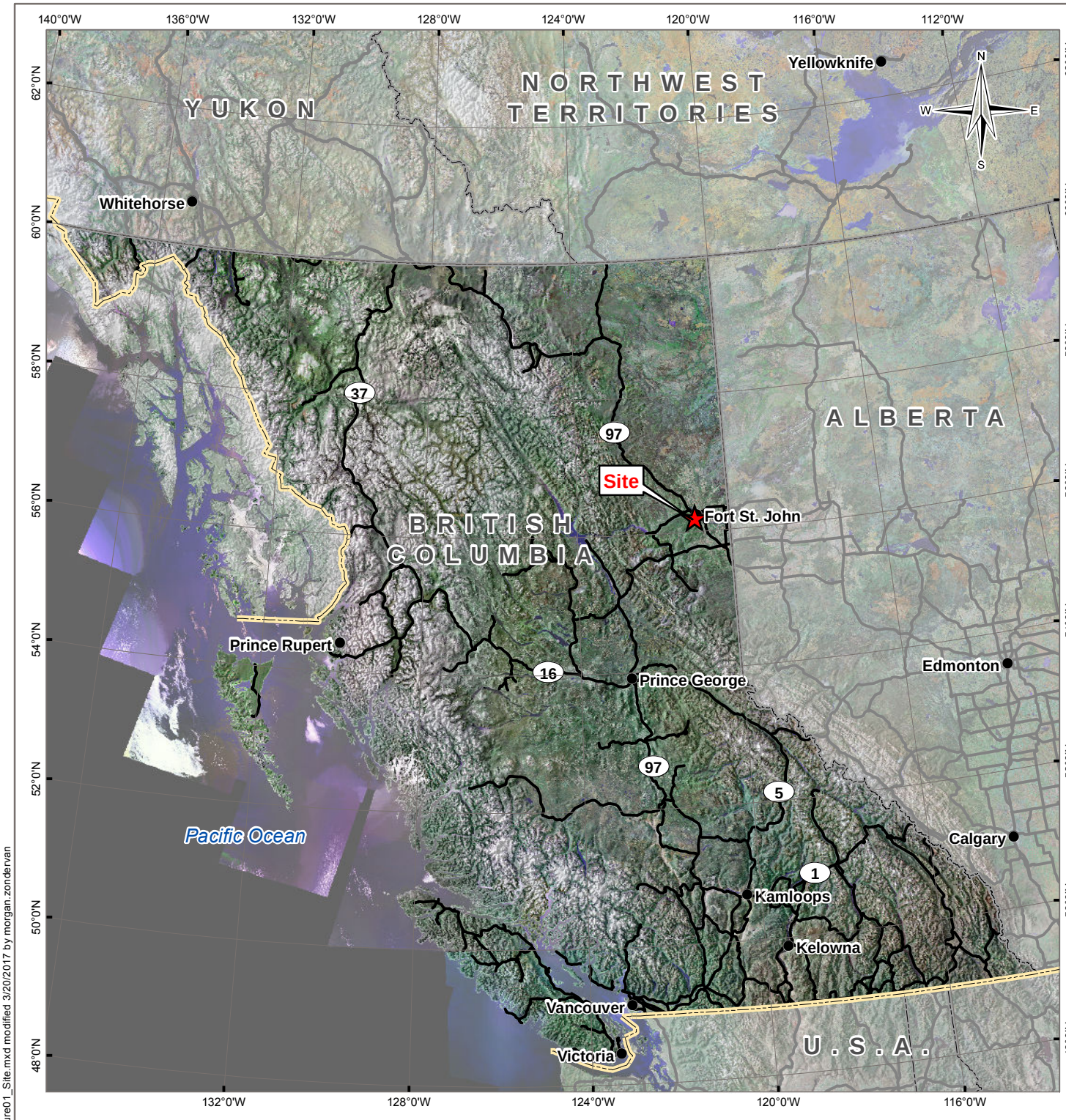
Table 9b: Water Quality Assurance and Quality Control Results

Parameter	Unit	MAY DUPLICATE				JUNE DUPLICATE										JULY DUPLICATE								AUGUST DUPLICATE								SEPTEMBER DUPLICATE								OCTOBER DUPLICATE							
		Reported Detection Limit (RDL)	PINE RIVER (PINE)	PINE RIVER DUPLICATE (DUP 1)	RPD Analysis	Reported Detection Limit (RDL)	MANY ISLANDS (POS)	MANY ISLANDS DUPLICATE (DUP 2)	RPD Analysis	Reported Detection Limit (RDL)	WILLISTON-SHALLOW (W1-SHALLOW)	DUPLICATE (DUP1)	RPD Analysis	Reported Detection Limit (RDL)	LOWER SITE C RESERVOIR (PR3)	DUPLICATE (DUP2)	RPD Analysis	Reported Detection Limit (RDL)	DINOSAUR SHALLOW (DI-SHALLOW)	DUPLICATE (DUP1)	RPD Analysis	Reported Detection Limit (RDL)	MIDDLE SITE C RESERVOIR (PR2)	DUPLICATE (DUP 2)	RPD Analysis	Reported Detection Limit (RDL)	BEATTON RIVER (BEATTON)	DUPLICATE (DUP 2)	RPD Analysis	Reported Detection Limit (RDL)	DINOSAUR SHALLOW (DI-SHALLOW)	DUPLICATE (DUP1)	RPD Analysis	Reported Detection Limit (RDL)	BEATTON RIVER (BEATTON)	DUPLICATE (DUP 2)	RPD Analysis	Reported Detection Limit (RDL)	DINOSAUR SHALLOW (DI-SHALLOW)	DUPLICATE (DUP1)	RPD Analysis	Reported Detection Limit (RDL)	DINOSAUR SHALLOW (DI-SHALLOW)	DUPLICATE (DUP1)	RPD Analysis	Reported Detection Limit (RDL)	MIDDLE SITE C RESERVOIR (PR2)	DUPLICATE (DUP 2)	RPD Analysis
Sample Date			31-May-2016	31-May-2016			1-Jun-2016	1-Jun-2016			21-Jun-2016	21-Jun-2016			22-Jun-2016	22-Jun-2016			26-Jul-2016	26-Jul-2016			27-Jul-2016	27-Jul-2016			25-Aug-2016	25-Aug-2016			24-Aug-2016	24-Aug-2016			20-Sep-2016	20-Sep-2016			22-Sep-2016	22-Sep-2016			24-Oct-2016	24-Oct-2016		
Laboratory Identification Number			L1776273-3	L1776273-4			L1777078-1	L1777078-2			L1786823-4	L1786823-2			L1788272-3	L1788272-8			L1804199-3	L1804199-5			L1804941-3	L1804941-4			L1819424-2	L1819424-9			L1820026-4	L1820026-9			L1835399-2	L1835399-3			L1833038-3	L1833038-5			L1848454-3	L1848454-5			24-Oct-2016	L1848452-2		
Physical Parameters																																																
Colour	Col. Unit	5.0	12.2	12.4	-	5.0	18.9	19.4	-	5.0	8.2	<5.0	-	5.0	13.2	12.2	-	5.0	6.9	6.7	-	5.0	6.8	6.2	-	5.0	318	317	0	5.0	6.8	5.9	-	5.0	307	311	1	5.0	5.3	<5.0	-	5.0	<5.0	<5.0	-	5.0	6.0		
Electrical Conductivity (EC)	µS/cm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	174	-	-	-	-	-	-	-	-	-	2.0	162	162	0	2.0	197	168	1	2.0	162	164	1	2.0	174	168	4				
Hardness as $CaCO_3$	µg/L	500	122000	122000	0	0.10	111000	111000	0	0.10	8.08	8.08	0	0.10	8.11	8.11	0	0.10	8.05	8.07	0	0.10	8.00	7.97	0	0.10	7.88	7.87	0	0.10	8.11	8.12	0	0.10	7.44	7.43	0	0.10	8.11	8.13	0	0.10	8.01	7.98	0	0.10	8.15	8.12	0		
pH	pH UNS	0.10	8.25	8.26	0																																										
Total Suspended Solids (TSS)	µg/L	3000	28700	27300	5	3000	106000	109500	3	<3000	<3000	<3000	-	3000	26200	26200	9	3000	<3000	<3000	-	3000	5300	5800	-	3000	9500	10200	-	3000	<3000	<3000	-	3000	13600	13600	-	3000	<3000	<3000	-	3000	<3000	<3000	-	13500	<3000		
Total Dissolved Solids (TDS)	µg/L	13000	129000	133000	3	13000	148000	155000	5	118000	120000	120000	2	143000	138000	138000	4	20000	108000	109000	1	108000	113000	113000	5	20000	216000	214000	1	108000	110000	110000	2	1000	222000	208000	7	115000	110000	110000	4	1000	95700	95700	0	97800	96800		
Anions and Nutrients																																																
Bicarbonate as $CaCO_3$	µg/L	-	-	-	-		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-		1000	37100	36800	1	82500	82800	0	1000	81200	80600	1	83100	81800	2		
Carbonate as $CaCO_3$	µg/L	-	-	-	-		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-		1000	<1000	<1000	-	<1000	<1000	-	-	1000	<1000	<1000	-	<1000	<1000	-	
Hydroxide as $CaCO_3$	µg/L	-	-	-	-		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-		-	-	-		1000	<1000	<1000	-	<1000	<1000	-	-	1000	<1000	<1000	-	<1000	<1000	-	
Total Alkalinity as $CaCO_3$	µg/L	1000	-	-	-	1000	-	-	-	79900	79600	79600	0	87800	87800	87800	0	1000	75800	76900	1	78100	78700	78700	1	1000	64800	65800	2	83700	82900	82900	1	1000	37100	36800	1	82500	82800	0	1000	81200	80600	1	83100	81800	2	
Ammonia, Total (as N)	µg/L	5.0	<5.0	<5.0	-	5.0	9.2	49.9	-	<5.0	<5.0	<5.0	-	<5.0	<5.0	<5.0	-	5.0	5.3	<5.0	-	<5.0	<5.0	<5.0	-	5.0	9.2	9.8	-	<5.0	6.5	<5.0	-	5.0	13.8	14.5	-	<5.0	<5.0	<5.0	-	5.0	<5.0	<5.0	-	<5.0	<5.0		
Bromide	µg/L	50	<50	<50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	<50	<50	-	<50	<50	-	-	50	<50	<50	-	<50	<50	-	
Chloride	µg/L	500	540	540	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	500	620	620	-	<500	<500	-	-	500	<500	<500	-	<500	<500	-	
Fluoride	µg/L	20	59	59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	44	44	0	32	32	0	20	36	34	2	35	34	2		
Nitrate and Nitrite (as N)	µg/L	5.1	23.5	21.1	-	5.1	53.9	54.5	1	61.2	60.6	60.6	1	60	61.8	61.8	3	5.1	55.9	55.2	1	56.4	56.2	56.2	0	5.1	<10	<10	-	69	67.9	67.9	2	5.1	6.3	5.2	-	51.8	51.7	51.7	0	5.1	47.6	47.6	0	46	47.6	47.6	3		
Nitrate (as N)	µg/L	5.0	21.5	21.1	2	5.0	53.9	54.5	1	61.2	60.6	60.6	1	60.0	61.8	61.8	3	5.0	55.9	55.2	1	56.4	56.2	56.2	0	5.0	<10	<10	-	69.0	67.9	67.9	2	5.0	6.3	5.2	-	51.8	51.7	51.7	0	5.0	47.6	47.6	0	46.0	47.6	47.6	3		
Nitrite (as N)	µg/L	1.0	<1.0	<1.0	-	1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	-	1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	-	1.0	<2.0	<2.0	-	<1.0	<1.0	<1.0	-	1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	-	1.0	<1.0	<1.0	-	<1.0	<1.0		
Total Kjeldahl Nitrogen	µg/L	50	165	169	-	50	274	290	6	79	75	75	5	157	148	-	10	50	119	106	-	97	88	-	10	50	1010	1050	4	95	89	-	10	50	1230	1230	0	92	90	2	50	97	97	0	114	92		
Total Nitrogen	µg/L	30	134	131	2	30	226	197	14	133	150	150	12	185	206	206	11	30	141	139	3	137	139	139	1	30	950	942	1	133	125	125	6	30	1020	1060	4	111	133	133	2	30	125	125	0	134	148	5	
Orthophosphate (as P)	µg/L	1.0	<1.0	<1.0	-	1.0	1.1	1.3	17	<1.0	1.1	1.1	-	1.2	1.1	-	9	1.0	<1.0	<1.0	-	<1.0	<1.0	<1.0	-	1.0	18.2	16.7	9	<1.0	<1.0	<1.0	-	1.0	10.9	11.7	7	<1.0	<1.0	<1.0	-	1.0	<1.0	<1.0	-	<1.0	<1.0		
Phosphorus (P)-Total Dissolved	µg/L	2.0	<2.0	<2.0	-	2.0	3.3	3.7	-	4.0	2.4	-	-	2.1	<2.0	-	-	2.0	<2.0	<2.0	-	<2.0	<2.0	<2.0	-	2.0	40.3	37.6	7	<2.0	<2.0	<2.0	-	2.0	169	160	5	2.3	<2.0	-	-	2.0	<2.0	<2.0	-	<2.0	<2.0		
Phosphorus (P)-Total	µg/L	2.0	23.5	25.4	8	2.0	95.9	81.2	17	3.8	4.9	-	-	35.5	26.4	29	-	2.0	4.3	3.6	-	5.6	6.4	-	-	2.0	41.9	42.8	2	3.6	3.0	-	-	2.0	7010	6750	4	6.8	5.2	27	2.0	3.6	4.3	-	-	15.5	3.6	-		
Silicate (as SiO_2)	µg/L	500	2240	2280	2																														500	40300	40200	0	4190	4280	2	500	4310	4280	1	4360	4460	2		
Sulphate	µg/L	300	12300	12300	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	300	12300	12300	0	11500	11400	1	300	12300	12300	0	12500	12300	2		
Anions Total	meq/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.88	1.87	1	1.93	1.9	1	
Cations Total	meq/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.74	1.78	2	1.8	1.79	1	
Ionic Balance	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-3.9	-2.4	48	-2.8	-3.5	19	
Organic and Inorganic Carbon																																															
Dissolved Organic Carbon (DOC)	µg/L	500	4650	3280	35	500	8490	4380	39	8350	3110	91	10200	5180	65	500	4460	4200	6	10300	5660	58	500	46400	46500	0	8600	6270	31	1000	50700	48800	4	6000	8510	35	500	2800	2920	4	3260	3230	1		
Total Organic Carbon (TOC)	µg/L	500	3660	3370	8	500	5820	5810	0	2370	2730	14	3880	3980	3	500	3100	2830	9	3080	2910	6	500	42800	42900	0	2840	3000	5	1000	47400	47200	0	2700	2840	5	500	3180	2800	13	3020	3040	1		
Total Metals																																															
Aluminum	µg/L	5.0	753	772	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	174	41.4		123
Antimony	µg/L	0.50	<0.50	<0.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.50	<0.50	<0.50	-		
Arsenic	µg/L	0.50	<0.50	<0.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.50	<0.50	<0.50	-		
Barium	µg/L	20	86	89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	31	30	3		
Beryllium	µg/L	1.0	<1.0	<1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	<1.0	<1.0	-		
Bismuth	µg/L	0.050	<0.050	0.064	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200	<200	<200	-		
Boron	µg/L	100	<100	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	<100	<100	-		
Cadmium	µg/L	0.0050	0.0307	0.0308	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0050	0.0145	0.0158	9	0.0486	0.0092		
Calcium	µg/L	100	35300	35200	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	26000	25900	0	26500	26000	10	
Chromium	µg/L	1.0	1.2	1.2	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	<1.0	<1.0	-	<1.0	<1.0		
Cobalt	µg/L	0.30	0.40	0.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.30	<0.30	<0.30	-	<0.30	<0.30		
Copper	µg/L	1.0	1.3	1.3	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	<1.0	<1.0	-	<1.0	<1.0		
Iron	µg/L	30	935	934	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	37	<30	-	46	<30		
Lead	µg/L	0.50	<0.50	<0.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.50	<0.50	<0.50	-	<0.50	<0.50		
Lithium	µg/L	1.0	4.1	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	<1.0	<1.0	-	1.1	1.1		
Magnesium	µg/L	100	8130	8130	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	5740	5720	0	6210	5780		
Manganese	µg/L	0.10	14.6	14.4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.10	1.48	1.39	6	1.84	7.86		124
Mercury	µg/L	0.0050	<0.0050	<0.0050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0050	0.0071	<0.0050	-	0.0063	0.0058		
Molybdenum	µg/L	1.0	<1.0	<1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	<1.0	<1.0	-	<1.0	<1.0		
Nickel	µg/L	1.0	1.7	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	<1.0	<1.0	-	1.0	<1.0		
Phosphorus	µg/L	300	<300	<300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	300	<300	<300	-	<300	<300		
Potassium	µg/L	2000	<2000	<2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2000	<2000	<2000	-	<2000	<2000		
Selenium	µg/L	0.050	0.435	0.463	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.050	0.266	0.246	8	0.259		5	
Silicon	µg/L	50	2370	2350	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	2100	2070	1	2320	2100	10	
Silver	µg/L	0.020	<0.020	<0.020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.020	<0.020	<0.020	-	<0.020	<0.020		
Sodium	µg/L	2000	2000	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2000	<2000	<2000	-	<2000	<2000		
Strontium	µg/L	5.0	112	111	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	101	100	1	101	98.4		3
Thallium	µg/L	0.20	<0.20	<0.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.20	<0.20	<0.20	-	<0.20	<0.20		
Tin	µg/L	0.50	<0.50	<0.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.50	<0.50	<0.50	-	<0.50	<0.50		
Titanium	µg/L	10	<10	<10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	<10	<10	-	<10	<10		
Uranium	µg/L	0.20	<0.20	0.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.20	0.41	0.35	-	0.41	0.41		0
Vanadium	µg/L	0.50	<0.50	<0.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.50	<0.50	<0.50	-	<0.50	<0.50		
Zinc	µg/L	5.0	<5.0	<5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	<5.0	<5.0	-	<5.0	<5.0		
Plant Pigments																																															
Chlorophyll a	µg/L	0.010	-	-	-	0.010	1.75	1.93	10	0.474	0.468	1	-	-	-	-	-	0.010	0.873	0.323	92	-	-	-	-	0.010	-	-	-	0.301	0.462	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

NOTES:

Reported detection limit (RDL)	Reported detection limit varied between sampling events, therefore, was not presented with Quality Assurance/ Quality Control results, which presents multiple events within the same table
-	No applicable standard/guideline or analysis was not conducted.
<	Concentration is less than the laboratory detection limit indicated.
RPD	RPD is Relative Percentage Difference calculated as RPD=(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 greater than the RDL
BOLD	RPDs greater than 30% are in bold
	RPD is calculated for parameters that are more than 5 times the detection limit

FIGURES



LEGEND

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

NOTES
Base data source:
ESRI Data & Maps

STATUS
ISSUED FOR USE

WATER AND SEDIMENT QUALITY MONITORING PROGRAMS SITE C, FORT ST. JOHN, BC

Site Location

PROJECTION	DATUM	CLIENT
BC Albers	NAD83	BC hydro

Scale: 1:9,000,000
100 50 0 100
Kilometres

TETRA TECH

FILE NO.				
VENV03118-01_Figure01_Site.mxd				
OFFICE	**DWN**	**CKD**	**APVD**	**REV**
Tt-VANC	MEZ	SL	DM	0
DATE	**PROJECT NO.**			
March 20, 2017	ENV.VENV03118-01			

Figure 1

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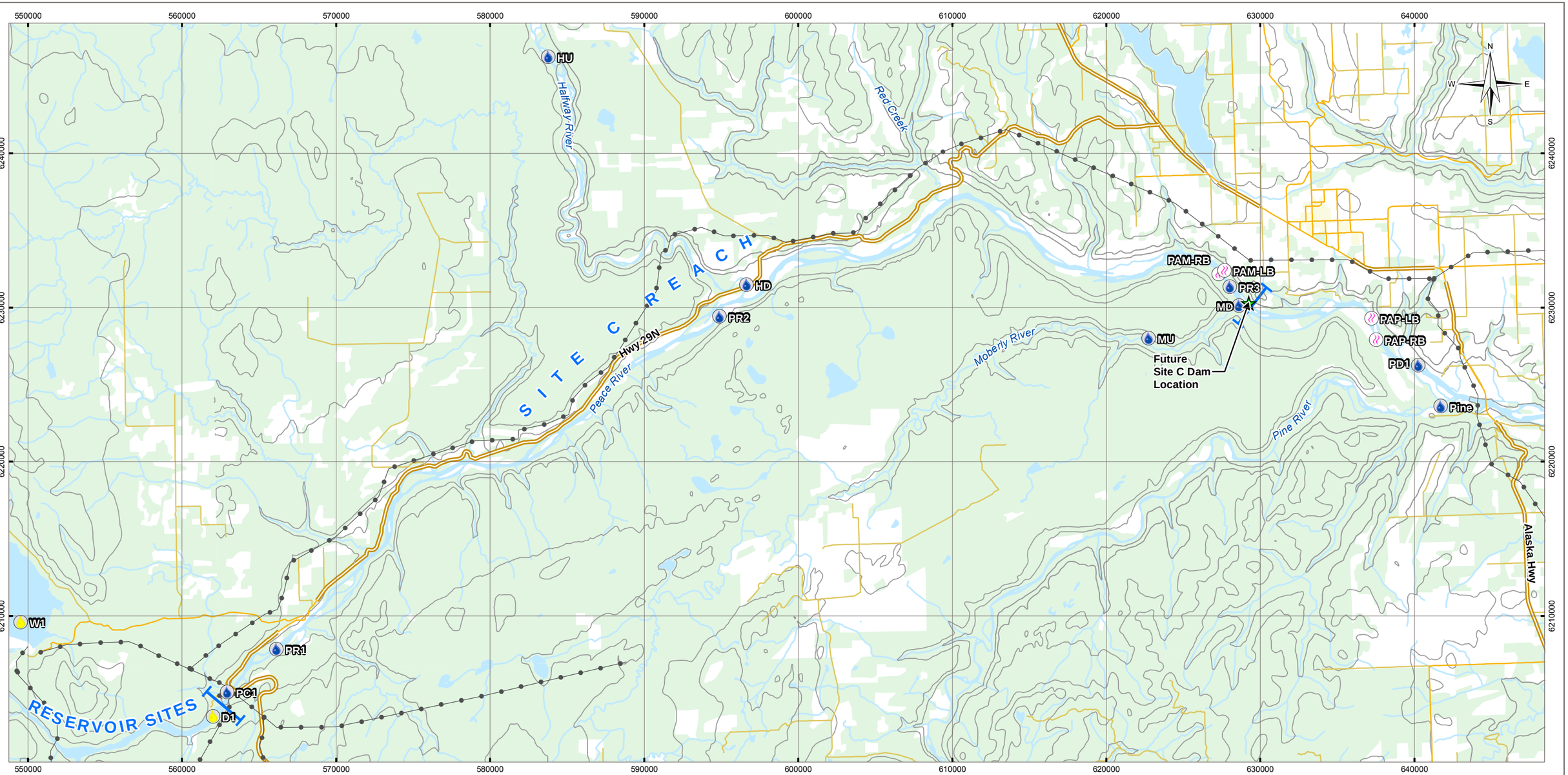


LEGEND

- Surface Water Monitoring Station
- Surface Water Monitoring Station/ Sediment Sample Location
- Turbidity Monitoring Station
- Reach Break
- Future Site C Dam Location
- 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

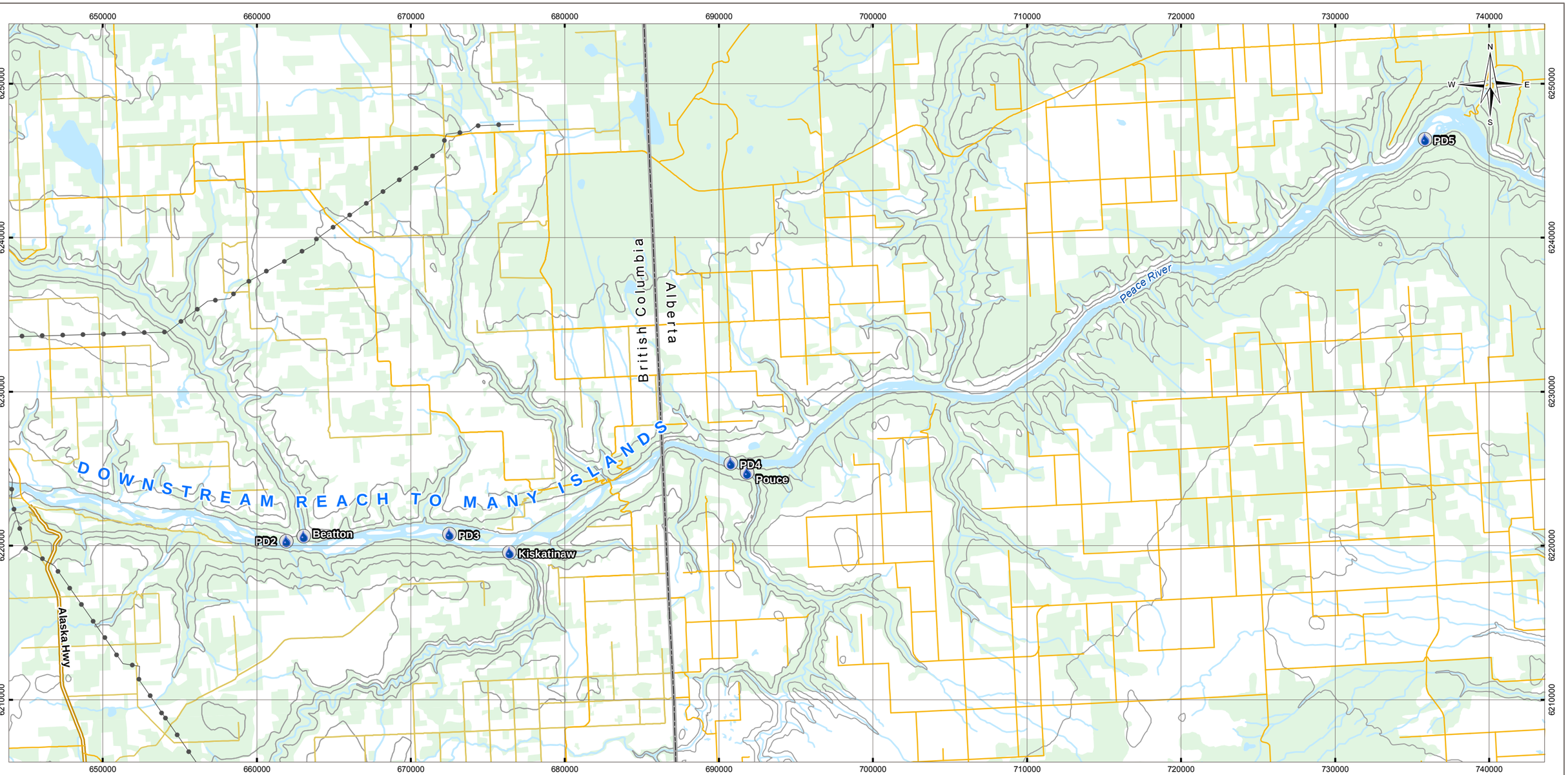
STATUS
ISSUED FOR USE

WATER AND SEDIMENT QUALITY MONITORING PROGRAMS SITE C, FORT ST. JOHN, BC

Water Quality Monitoring Station Location Plan

PROJECTION: UTM Zone 10	DATUM: NAD83			CLIENT: BC hydro
Scale: 1:250,000 (5 2.5 0 5 Kilometres)				TETRA TECH
FILE NO.: VENV03118-01_Figure02_WQMon.mxd				
OFFICE: Tt-VANC	DWN: MEZ	CKD: SL	APVD: DM	REV: 0
DATE: March 20, 2017	PROJECT NO.: ENV.VENV03118-01			Figure2a

W:\Projects\WAN\1449420\VENV03118-01\GIS\Maps\VENV03118-01_Figure02_WQMon.mxd modified 3/20/2017 by morgan.zondervan



LEGEND

- Surface Water Monitoring Station
- Surface Water Monitoring Station/ Sediment Sample Location
- Turbidity Monitoring Station
- Reach Break
- Future Site C Dam Location
- 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

STATUS
ISSUED FOR USE

WATER AND SEDIMENT QUALITY MONITORING PROGRAMS SITE C, FORT ST. JOHN, BC

Water Quality Monitoring Station Location Plan

PROJECTION UTM Zone 10		**DATUM** NAD83			**CLIENT** BC hydro
Scale: 1:250,000 5 2.5 0 5 Kilometres					TETRA TECH
FILE NO. VENV03118-01_Figure02_WQMon.mxd					
OFFICE Tt-VANC	**DWN** MEZ	**CKD** SL	**APVD** DM	**REV** 0	**Figure2b**
DATE March 20, 2017	**PROJECT NO.** ENV.VENV03118-01				

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APPENDIX A
LABORATORY REPORTS

Tetra Tech EBA Inc.
ATTN: Danielle MacDonald
1 - 4376 Boban Drive
Nanaimo BC V9T 6A7

Date Received: 29-MAY-16
Report Date: 10-JUN-16 15:32 (MT)
Version: FINAL

Client Phone: 250-756-2256

Certificate of Analysis

Lab Work Order #: L1775119

Project P.O. #: NOT SUBMITTED
Job Reference: VENV03118-01
C of C Numbers: 14-487052
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1775119-1	L1775119-2			
	Description	WATER	WATER			
	Sampled Date	29-MAY-16	29-MAY-16			
	Sampled Time	11:00	13:15			
	Client ID	(D1) DINOSAUR RESERVOIR	(W1) WILLISTON RESERVOIR			
Grouping	**Analyte**					
WATER						
Physical Tests	Colour, True (CU)	10.3	8.6			
	Conductivity (umhos/cm)	179	179			
	Hardness (as CaCO3) (ug/L)	99500	99100			
	pH (pH units)	7.78	7.80			
	Total Suspended Solids (ug/L)	<3000	<3000			
	Total Dissolved Solids (ug/L)	105000	112000			
Anions and Nutrients	Alkalinity, Total (as CaCO3) (ug/L)	77300	78800			
	Ammonia, Total (as N) (ug/L)	<5.0	<5.0			
	Nitrate and Nitrite (as N) (ug/L)	75.8	72.8			
	Nitrate (as N) (ug/L)	75.8	72.8			
	Nitrite (as N) (ug/L)	<1.0	<1.0			
	Total Kjeldahl Nitrogen (ug/L)	115	107			
	Total Nitrogen (ug/L)	140	136			
	Orthophosphate-Dissolved (as P) (ug/L)	<1.0	<1.0			
	Phosphorus (P)-Total Dissolved (ug/L)	<2.0	<2.0			
	Phosphorus (P)-Total (ug/L)	4.1	3.4			
Organic / Inorganic Carbon	Dissolved Organic Carbon (ug/L)	2630	2420			
	Total Organic Carbon (ug/L)	3630	3400			
Total Metals	Aluminum (Al)-Total (ug/L)	26.5	27.0			
	Antimony (Sb)-Total (ug/L)	<0.50	<0.50			
	Arsenic (As)-Total (ug/L)	<0.50	<0.50			
	Barium (Ba)-Total (ug/L)	33	32			
	Beryllium (Be)-Total (ug/L)	<1.0	<1.0			
	Bismuth (Bi)-Total (ug/L)	<200	<200			
	Boron (B)-Total (ug/L)	<100	<100			
	Cadmium (Cd)-Total (ug/L)	0.0180	0.0146			
	Calcium (Ca)-Total (ug/L)	29500	30000			
	Chromium (Cr)-Total (ug/L)	<1.0	<1.0			
	Cobalt (Co)-Total (ug/L)	<0.30	<0.30			
	Copper (Cu)-Total (ug/L)	<1.0	<1.0			
	Iron (Fe)-Total (ug/L)	40	32			
	Lead (Pb)-Total (ug/L)	<0.50	<0.50			
	Lithium (Li)-Total (ug/L)	<1.0	<1.0			
	Magnesium (Mg)-Total (ug/L)	6060	6180			
	Manganese (Mn)-Total (ug/L)	2.28	1.89			
	Mercury (Hg)-Total (ug/L)	<0.0050	<0.0050			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1775119-1	L1775119-2			
	Description	WATER	WATER			
	Sampled Date	29-MAY-16	29-MAY-16			
	Sampled Time	11:00	13:15			
	Client ID	(D1) DINOSAUR RESERVOIR	(W1) WILLISTON RESERVOIR			
Grouping	**Analyte**					
WATER						
Total Metals	Molybdenum (Mo)-Total (ug/L)	<1.0	<1.0			
	Nickel (Ni)-Total (ug/L)	<1.0	<1.0			
	Phosphorus (P)-Total (ug/L)	<300	<300			
	Potassium (K)-Total (ug/L)	<2000	<2000			
	Selenium (Se)-Total (ug/L)	0.249	0.230			
	Silicon (Si)-Total (ug/L)	2180	2230			
	Silver (Ag)-Total (ug/L)	<0.020	<0.020			
	Sodium (Na)-Total (ug/L)	<2000	<2000			
	Strontium (Sr)-Total (ug/L)	108	111			
	Thallium (Tl)-Total (ug/L)	<0.20	<0.20			
	Tin (Sn)-Total (ug/L)	<0.50	<0.50			
	Titanium (Ti)-Total (ug/L)	<10	<10			
	Uranium (U)-Total (ug/L)	0.46	0.48			
	Vanadium (V)-Total (ug/L)	<0.50	<0.50			
	Zinc (Zn)-Total (ug/L)	<5.0	<5.0			
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD			
	Dissolved Metals Filtration Location	FIELD	FIELD			
	Aluminum (Al)-Dissolved (ug/L)	<5.0	<5.0			
	Antimony (Sb)-Dissolved (ug/L)	<0.50	<0.50			
	Arsenic (As)-Dissolved (ug/L)	<0.50	<0.50			
	Barium (Ba)-Dissolved (ug/L)	32	31			
	Beryllium (Be)-Dissolved (ug/L)	<1.0	<1.0			
	Bismuth (Bi)-Dissolved (ug/L)	<200	<200			
	Boron (B)-Dissolved (ug/L)	<100	<100			
	Cadmium (Cd)-Dissolved (ug/L)	0.0104	0.0088			
	Calcium (Ca)-Dissolved (ug/L)	29800	29800			
	Chromium (Cr)-Dissolved (ug/L)	<1.0	<1.0			
	Cobalt (Co)-Dissolved (ug/L)	<0.30	<0.30			
	Copper (Cu)-Dissolved (ug/L)	<1.0	<1.0			
	Iron (Fe)-Dissolved (ug/L)	<30	<30			
	Lead (Pb)-Dissolved (ug/L)	<0.50	<0.50			
	Lithium (Li)-Dissolved (ug/L)	<1.0	<1.0			
	Magnesium (Mg)-Dissolved (ug/L)	6070	5990			
	Manganese (Mn)-Dissolved (ug/L)	0.84	0.65			
	Mercury (Hg)-Dissolved (ug/L)	0.0062	<0.0050			
	Molybdenum (Mo)-Dissolved (ug/L)	<1.0	<1.0			
	Nickel (Ni)-Dissolved (ug/L)	<1.0	<1.0			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1775119-1	L1775119-2			
	Description	WATER	WATER			
	Sampled Date	29-MAY-16	29-MAY-16			
	Sampled Time	11:00	13:15			
	Client ID	(D1) DINOSAUR RESERVOIR	(W1) WILLISTON RESERVOIR			
Grouping	**Analyte**					
WATER						
Dissolved Metals	Phosphorus (P)-Dissolved (ug/L)	<300	<300			
	Potassium (K)-Dissolved (ug/L)	<2000	<2000			
	Selenium (Se)-Dissolved (ug/L)	0.258	0.253			
	Silicon (Si)-Dissolved (ug/L)	2140	2160			
	Silver (Ag)-Dissolved (ug/L)	<0.020	<0.020			
	Sodium (Na)-Dissolved (ug/L)	<2000	<2000			
	Strontium (Sr)-Dissolved (ug/L)	107	107			
	Thallium (Tl)-Dissolved (ug/L)	<0.20	<0.20			
	Tin (Sn)-Dissolved (ug/L)	<0.50	<0.50			
	Titanium (Ti)-Dissolved (ug/L)	<10	<10			
	Uranium (U)-Dissolved (ug/L)	0.41	0.41			
	Vanadium (V)-Dissolved (ug/L)	<0.50	<0.50			
	Zinc (Zn)-Dissolved (ug/L)	<5.0	6.5			
Plant Pigments	Chlorophyll a (ug/L)	0.308	0.533			

* 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	L1775119-1, -2
Method Blank	Alkalinity, Total (as CaCO3)	B	L1775119-1, -2
Duplicate	Aluminum (Al)-Dissolved	DLA	L1775119-1, -2
Duplicate	Antimony (Sb)-Dissolved	DLA	L1775119-1, -2
Duplicate	Beryllium (Be)-Dissolved	DLA	L1775119-1, -2
Duplicate	Chromium (Cr)-Dissolved	DLA	L1775119-1, -2
Duplicate	Lead (Pb)-Dissolved	DLA	L1775119-1, -2
Duplicate	Selenium (Se)-Dissolved	DLA	L1775119-1, -2
Duplicate	Silver (Ag)-Dissolved	DLA	L1775119-1, -2
Duplicate	Thallium (Tl)-Dissolved	DLA	L1775119-1, -2
Duplicate	Tin (Sn)-Dissolved	DLA	L1775119-1, -2
Duplicate	Vanadium (V)-Dissolved	DLA	L1775119-1, -2
Duplicate	Aluminum (Al)-Dissolved	DLA	L1775119-1, -2
Duplicate	Beryllium (Be)-Dissolved	DLA	L1775119-1, -2
Duplicate	Chromium (Cr)-Dissolved	DLA	L1775119-1, -2
Duplicate	Cobalt (Co)-Dissolved	DLA	L1775119-1, -2
Duplicate	Copper (Cu)-Dissolved	DLA	L1775119-1, -2
Duplicate	Lead (Pb)-Dissolved	DLA	L1775119-1, -2
Duplicate	Molybdenum (Mo)-Dissolved	DLA	L1775119-1, -2
Duplicate	Nickel (Ni)-Dissolved	DLA	L1775119-1, -2
Duplicate	Silver (Ag)-Dissolved	DLA	L1775119-1, -2
Duplicate	Tin (Sn)-Dissolved	DLA	L1775119-1, -2
Duplicate	Vanadium (V)-Dissolved	DLA	L1775119-1, -2
Duplicate	Nitrite (as N)	DLDS	L1775119-1, -2
Duplicate	Cadmium (Cd)-Dissolved	DLM	L1775119-1, -2
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Iron (Fe)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Total Nitrogen	MS-B	L1775119-1, -2
Matrix Spike	Total Nitrogen	MS-B	L1775119-1, -2
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Silicon (Si)-Total	MS-B	L1775119-1, -2
Matrix Spike	Molybdenum (Mo)-Total	MS-B	L1775119-1, -2
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Antimony (Sb)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Arsenic (As)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1775119-1, -2
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1775119-1, -2

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. All associated sample results are at least 5 times greater than blank levels and are considered reliable.
DLA	Detection Limit adjusted for required dilution
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
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.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-WP	Water	Alkalinity, Total (as CaCO3)	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 HCO3- and H2CO3 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).

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)".

CHLOROA-F-VA	Water	Chlorophyll a by Fluorometer	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.

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-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.

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.

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-DIS-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA SW-846 3005A/6010B

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 "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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.

Reference Information

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

MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B

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 "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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	APHA 4500 NH3-NITROGEN (AMMONIA)

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.

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.

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.

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.

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.

** 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:

Reference Information

14-487052

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

L1775119-COFC

COC Number: 14 - 487052

Page ____ of ____

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	TETRA TECH EBA INC	Select Report Format:	☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3pm)
Contact:	DANIELLE MACDONALD	Quality Control (QC) Report with Report	☑ Yes ☐ No	P ☐ Priority (2-4 business days if received by 3pm)
Address:	14940-123 AVE EDMONTON AB	☑ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 business days if received by 3pm)
		Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Phone:	780 886 3055	Email 1 or Fax	danielle.macdonald@tetratech.com	Specify Date Required for E2,E or P:
		Email 2	dave.hunter@bchydro.com	

Invoice To		Invoice Distribution	
	Same as Report To ☑ Yes ☐ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☑ Yes ☐ No	Email 1 or Fax	same as email 1 + 2
Company:	same as above	Email 2	
Contact:			

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q55655	Approver ID:	Cost Center:
Job #:	VENV03118-01	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only)	L1775119	ALS Contact:	Sampler: D. MacDonald P. Gauthier

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

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	TDS, TSS, pH, EC, Colour, Alkalinity	Chlorophyll a	DOC (F/P)	TOC (P)	NH3, nitrate/nitrite	TKN, total N, P, Diss. P	Total Metals (CSR + ICP + Hardness + Hg)	Dissolved Metals (CSR + ICP + Hardness + Hg) F/P	Number of Containers
	(D1) DINOSAUR RESERVOIR	29-05-16	11:00AM	WATER	✓	✓	✓	✓	✓	✓	✓	✓	8
	(W1) WILLISTON RESERVOIR	29-05-16	13:15	WATER	✓	✓	✓	✓	✓	✓	✓	✓	8

*chlorophyll a → not filtered, collected in 250mL plastic bottle covered in foil

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	Email 3: sarahsimon@bchydro.com
Are samples for human drinking water use? ☐ Yes ☑ No	Email 4: pgauthier2014@hotmail.com
	Please refer to Q55655 for May Sampling Suite

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐	
Ice packs	Yes ☒	No ☐	Custody seal intact	Yes ☐	No ☐
Cooling Initiated	☒				

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
8					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Phyllis GAUTHIER	MAY 29/16	3:45pm	Geoff	May 29/16	15:45			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-TM-0325e 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.

Tetra Tech EBA Inc.
ATTN: Danielle MacDonald
1 - 4376 Boban Drive
Nanaimo BC V9T 6A7

Date Received: 30-MAY-16
Report Date: 08-JUN-16 10:19 (MT)
Version: FINAL

Client Phone: 250-756-2256

Certificate of Analysis

Lab Work Order #: L1775540

Project P.O. #: NOT SUBMITTED
Job Reference: VENV0309S-02.002
C of C Numbers: 14-487050
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L1775540-1	L1775540-2	L1775540-3		
Description	WATER (SURFA	WATER (SURFA	WATER (SURFA		
Sampled Date	30-MAY-16	30-MAY-16	30-MAY-16		
Sampled Time	10:40	12:10	12:40		
Client ID	PEACE 1 (PR1)	PEACE 2 (PR2)	HALFWAY RIVER (HD-D)		
Grouping	**Analyte**				
WATER					
Bacteriological Tests	E. coli (MPN/100mL)	1	<1	32	
	HPC (CFU/1mL)	<1	<1	11	
	Coliform Bacteria - Total (MPN/100mL)	3	8	613	
Volatile Organic Compounds	Benzene (ug/L)	<0.50	<0.50	<0.50	
	Ethylbenzene (ug/L)	<0.50	<0.50	<0.50	
	Methyl t-butyl ether (MTBE) (ug/L)	<0.50	<0.50	<0.50	
	Styrene (ug/L)	<0.50	<0.50	<0.50	
	Toluene (ug/L)	<0.50	<0.50	<0.50	
	ortho-Xylene (ug/L)	<0.50	<0.50	<0.50	
	meta- & para-Xylene (ug/L)	<0.50	<0.50	<0.50	
	Xylenes (ug/L)	<0.75	<0.75	<0.75	
	Surrogate: 4-Bromofluorobenzene (SS) (%)	92.9	100.3	103.0	
	Surrogate: 1,4-Difluorobenzene (SS) (%)	94.5	97.0	98.1	
Organochlorine Pesticides	Aldrin (ug/L)	<0.050	<0.050	<0.050	
	alpha-BHC (ug/L)	<0.050	<0.050	<0.050	
	beta-BHC (ug/L)	<0.10	<0.10	<0.10	
	Lindane (gamma - BHC) (ug/L)	<0.010	<0.010	<0.010	
	delta-BHC (ug/L)	<0.050	<0.050	<0.050	
	cis-Chlordane (alpha) (ug/L)	<0.050	<0.050	<0.050	
	trans-Chlordane (gamma) (ug/L)	<0.050	<0.050	<0.050	
	2,4'-DDD (ug/L)	<0.0050	<0.0050	<0.0050	
	4,4'-DDD (ug/L)	<0.0050	<0.0050	<0.0050	
	2,4'-DDE (ug/L)	<0.0050	<0.0050	<0.0050	
	4,4'-DDE (ug/L)	<0.0050	<0.0050	<0.0050	
	2,4'-DDT (ug/L)	<0.0050	<0.0050	<0.0050	
	4,4'-DDT (ug/L)	<0.0050	<0.0050	<0.0050	
	Dieldrin (ug/L)	<0.050	<0.050	<0.050	
	Endosulfan I (ug/L)	<0.0020	<0.0020	<0.0020	
	Endosulfan II (ug/L)	<0.0020	<0.0020	<0.0020	
	Endosulfan Sulfate (ug/L)	<0.0020	<0.0020	<0.0020	
	Endrin (ug/L)	<0.020	<0.020	<0.020	
	Heptachlor (ug/L)	<0.10	<0.10	<0.10	
	Heptachlor Epoxide (ug/L)	<0.0030	<0.0030	<0.0030	
	Methoxychlor (ug/L)	<0.030	<0.030	<0.030	
	Mirex (ug/L)	<0.050	<0.050	<0.050	
	cis-Nonachlor (ug/L)	<0.050	<0.050	<0.050	

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1775540-1	L1775540-2	L1775540-3		
	Description	WATER (SURFA	WATER (SURFA	WATER (SURFA		
	Sampled Date	30-MAY-16	30-MAY-16	30-MAY-16		
	Sampled Time	10:40	12:10	12:40		
	Client ID	PEACE 1 (PR1)	PEACE 2 (PR2)	HALFWAY RIVER (HD-D)		
Grouping	**Analyte**					
WATER						
Organochlorine Pesticides	trans-Nonachlor (ug/L)	<0.050	<0.050	<0.050		
	Oxychlordane (ug/L)	<0.050	<0.050	<0.050		

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
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.

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.

OCP1-LL-SF-ECD-VA	Water	OCP-1 in Water by GCECD	EPA METHODS 3510, 3610, 3630, 3660, 8081

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Methods 3510, 3610, 3630, 3660 & 8081, published by the United States Environmental Protection Agency (EPA). The procedure involves extraction of the entire water sample with dichloromethane. The extract is then solvent exchanged to hexane followed by one or more of the following clean-up procedures (if required): alumina clean-up, silica gel clean-up and/or sulphur clean-up. The final extract is analysed by dual capillary column gas chromatography with electron capture detection (GC/ECD) and/or mass spectrometric detection (GC/MS).

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).

VOC7-HSMS-VA	Water	BTEX/MTBE/Styrene by Headspace GCMS	EPA 5021A/8260C

The water sample, with added reagents, is heated in a sealed vial to equilibrium. The headspace from the vial is transfered into a gas chromatograph. Target compound concentrations are measured using mass spectrometry detection.

VOC7/VOC-SURR-MS-VA	Water	VOC7 and/or VOC Surrogates for Waters	EPA 5035A/5021A/8260C
XYLENES-CALC-VA	Water	Sum of Xylene Isomer Concentrations	CALCULATION

Calculation of Total Xylenes

Total Xylenes is the sum of the concentrations of the ortho, meta, and para Xylene isomers. Results below detection limit (DL) are treated as zero. The DL for Total Xylenes is set to a value no less than the square root of the sum of the squares of the DLs of the individual Xylenes.

** 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

Chain of Custody Numbers:

14-487050

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

L1775540-COFC

COC Number: 14 - 487050

Page 1 of 1

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	Tetra Tech EBA Inc	Select Report Format:	☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3pm)
Contact:	Danielle MacDonald	Quality Control (QC) Report with Report	☑ Yes ☐ No	P ☐ Priority (2-4 business days if received by 3pm)
Address:	14940-123 AVE Edmonton AB	☑ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 business days if received by 3pm)
		Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Phone:	780 886 3055	Email 1 or Fax	danielle.macdonald@tetratech.com	Specify Date Required for E2,E or P:
		Email 2	sarah.simon@bchydro.com	

Invoice To		Invoice Distribution	
	Same as Report To ☑ Yes ☐ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☑ Yes ☐ No	Email 1 or Fax	Same as above
Company:		Email 2	
Contact:			

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	Q53931	Approver ID:	Cost Center:
Job #:	VENV03095-02.002	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L1775540	ALS Contact:	Sampler: D. MacDonald P. Gauthier

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

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	Total Coli, E. Coli, HPC P	Pesticides (OCP) P	BTEX P	Number of Containers
	Peace 1 (PR1)	30-05-16	10:40 am	Water	✓	✓	✓	5
	Peace 2 (PR2)	30-05-16	12:10 pm	(surface	✓	✓	✓	5
	Halfway River (HD-D)	30-05-16	12:40 pm	water)	✓	✓	✓	5

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No	Please add : email 3 : pgauthier@014@hotmail
Are samples for human drinking water use? ☐ Yes ☑ No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice packs Yes ☐ No ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
8					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Phyllis Gauthier	MAY 30-16	3:30 pm	Geoff	May 30/16	15:25			

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
1 - 4376 Boban Drive
Nanaimo BC V9T 6A7

Date Received: 30-MAY-16
Report Date: 28-FEB-17 16:09 (MT)
Version: FINAL REV. 2

Client Phone: 250-756-2256

Certificate of Analysis

Lab Work Order #: L1775541

Project P.O. #: NOT SUBMITTED
Job Reference: VENV03118-01
C of C Numbers: 14-487048
Legal Site Desc:

Comments:

28-FEB-2017 This report replaces the previous version and contains a Client Sample ID change, as requested.

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1775541-1 WATER 30-MAY-16 10:00 PEACE CANYON (PC1)	L1775541-2 WATER 30-MAY-16 10:40 UPPER SITE C RESERVOIR (PR1)	L1775541-3 WATER 30-MAY-16 12:40 HALFWAY RIVER-DOWNSTREAM (HD)	L1775541-4 WATER 30-MAY-16 12:00 MIDDLE SITE C RESERVOIR (PR2)	
WATER						
Physical Tests	Colour, True (CU)	6.4	6.5	28.3	6.7	
	Hardness (as CaCO3) (ug/L)	98700	100000	187000	101000	
	pH (pH)	7.99	8.00	8.18	8.04	
	Total Suspended Solids (ug/L)	<3000	<3000	226000	14500	
	Total Dissolved Solids (ug/L)	117000	108000	226000	119000	
Anions and Nutrients	Alkalinity, Total (as CaCO3) (ug/L)	82400	81800	147000	84100	
	Ammonia, Total (as N) (ug/L)	<5.0	<5.0	12.0	<5.0	
	Bromide (Br) (ug/L)	<50	<50	<50	<50	
	Chloride (Cl) (ug/L)	<500	<500	<500	<500	
	Fluoride (F) (ug/L)	40	40	93	41	
	Nitrate and Nitrite (as N) (ug/L)	75.6	75.3	24.1	71.7	
	Nitrate (as N) (ug/L)	75.6	75.3	24.1	71.7	
	Nitrite (as N) (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Total Kjeldahl Nitrogen (ug/L)	90	78	745	170	
	Total Nitrogen (ug/L)	137	156	387	141	
	Orthophosphate-Dissolved (as P) (ug/L)	<1.0	<1.0	4.4	<1.0	
	Phosphorus (P)-Total Dissolved (ug/L)	<2.0	<2.0	7.2	<2.0	
	Phosphorus (P)-Total (ug/L)	2.6	3.3	251 SFT	15.5	
	Silicate (as SiO2) (ug/L)	4570	4440	3570	4380	
	Sulfate (SO4) (ug/L)	13100	13100	37500	13300	
Organic / Inorganic Carbon	Dissolved Organic Carbon (ug/L)	2910	3450 RRV	7320	3480 RRV	
	Total Organic Carbon (ug/L)	2460	2690 RRV	7820	2790 RRV	
Total Metals	Aluminum (Al)-Total (ug/L)	31.2	42.5	3580	133	
	Antimony (Sb)-Total (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Arsenic (As)-Total (ug/L)	<0.50	<0.50	2.33	<0.50	
	Barium (Ba)-Total (ug/L)	32	33	187	36	
	Beryllium (Be)-Total (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Bismuth (Bi)-Total (ug/L)	<0.050	<0.050	0.102	<0.050	
	Boron (B)-Total (ug/L)	<100	<100	<100	<100	
	Cadmium (Cd)-Total (ug/L)	0.0194	0.0171	0.264	0.0384	
	Calcium (Ca)-Total (ug/L)	28900	28800	54900	28400	
	Chromium (Cr)-Total (ug/L)	<1.0	<1.0	6.5	<1.0	
	Cobalt (Co)-Total (ug/L)	<0.30	<0.30	2.14	<0.30	
	Copper (Cu)-Total (ug/L)	<1.0	<1.0	6.8	1.0	
	Iron (Fe)-Total (ug/L)	66	64	5140	277	
	Lead (Pb)-Total (ug/L)	<0.50	<0.50	2.67	<0.50	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1775541-1	L1775541-2	L1775541-3	L1775541-4	
	Description	WATER	WATER	WATER	WATER	
	Sampled Date	30-MAY-16	30-MAY-16	30-MAY-16	30-MAY-16	
	Sampled Time	10:00	10:40	12:40	12:00	
	Client ID	PEACE CANYON (PC1)	UPPER SITE C RESERVOIR (PR1)	HALFWAY RIVER-DOWNSTREAM (HD)	MIDDLE SITE C RESERVOIR (PR2)	
Grouping	**Analyte**					
WATER						
Total Metals	Lithium (Li)-Total (ug/L)	1.2	1.3	9.4	1.4	
	Magnesium (Mg)-Total (ug/L)	6020	6070	14700	6210	
	Manganese (Mn)-Total (ug/L)	2.41	2.59	73.1	6.49	
	Mercury (Hg)-Total (ug/L)	<0.0050	<0.0050	<0.025 DLM	<0.0050	
	Molybdenum (Mo)-Total (ug/L)	<1.0	<1.0	2.9	<1.0	
	Nickel (Ni)-Total (ug/L)	<1.0	<1.0	8.6	1.1	
	Phosphorus (P)-Total (ug/L)	<300	<300	<300	<300	
	Potassium (K)-Total (ug/L)	<2000	<2000	2200	<2000	
	Selenium (Se)-Total (ug/L)	0.248	0.231	1.44	0.246	
	Silicon (Si)-Total (ug/L)	2210	2220	9810	2390	
	Silver (Ag)-Total (ug/L)	<0.020	<0.020	0.072	<0.020	
	Sodium (Na)-Total (ug/L)	<2000	<2000	2900	<2000	
	Strontium (Sr)-Total (ug/L)	110	111	236	109	
	Thallium (Tl)-Total (ug/L)	<0.20	<0.20	<0.20	<0.20	
	Tin (Sn)-Total (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Titanium (Ti)-Total (ug/L)	<10	<10	97	<10	
	Uranium (U)-Total (ug/L)	0.46	0.47	0.89	0.47	
	Vanadium (V)-Total (ug/L)	<0.50	0.52	15.6	1.03	
	Zinc (Zn)-Total (ug/L)	<5.0	<5.0	29.3	<5.0	
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Aluminum (Al)-Dissolved (ug/L)	<5.0	<5.0	13.7	<5.0	
	Antimony (Sb)-Dissolved (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Arsenic (As)-Dissolved (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Barium (Ba)-Dissolved (ug/L)	31	31	66	32	
	Beryllium (Be)-Dissolved (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Bismuth (Bi)-Dissolved (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Boron (B)-Dissolved (ug/L)	<100	<100	<100	<100	
	Cadmium (Cd)-Dissolved (ug/L)	0.0078	0.0115	0.0182	0.0088	
	Calcium (Ca)-Dissolved (ug/L)	29800	30100	52400	30300	
	Chromium (Cr)-Dissolved (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Cobalt (Co)-Dissolved (ug/L)	<0.30	<0.30	<0.30	<0.30	
	Copper (Cu)-Dissolved (ug/L)	<1.0	<1.0	1.2	<1.0	
	Iron (Fe)-Dissolved (ug/L)	<30	<30	32	<30	
	Lead (Pb)-Dissolved (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Lithium (Li)-Dissolved (ug/L)	1.3	1.2	5.7	1.3	
	Magnesium (Mg)-Dissolved (ug/L)	5920	6050	13700	6040	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1775541-1	L1775541-2	L1775541-3	L1775541-4	
	Description	WATER	WATER	WATER	WATER	
	Sampled Date	30-MAY-16	30-MAY-16	30-MAY-16	30-MAY-16	
	Sampled Time	10:00	10:40	12:40	12:00	
	Client ID	PEACE CANYON (PC1)	UPPER SITE C RESERVOIR (PR1)	HALFWAY RIVER-DOWNSTREAM (HD)	MIDDLE SITE C RESERVOIR (PR2)	
Grouping	**Analyte**					
WATER						
Dissolved Metals	Manganese (Mn)-Dissolved (ug/L)	0.84	0.91	4.92	0.76	
	Mercury (Hg)-Dissolved (ug/L)	<0.0050	<0.0050	<0.0050	<0.0050	
	Molybdenum (Mo)-Dissolved (ug/L)	<1.0	<1.0	2.5	<1.0	
	Nickel (Ni)-Dissolved (ug/L)	<1.0	<1.0	1.9	<1.0	
	Phosphorus (P)-Dissolved (ug/L)	<300	<300	<300	<300	
	Potassium (K)-Dissolved (ug/L)	<2000	<2000	<2000	<2000	
	Selenium (Se)-Dissolved (ug/L)	0.239	0.268	1.26	0.268	
	Silicon (Si)-Dissolved (ug/L)	2160	2150	1760	2170	
	Silver (Ag)-Dissolved (ug/L)	<0.020	<0.020	<0.020	<0.020	
	Sodium (Na)-Dissolved (ug/L)	<2000	<2000	2900	<2000	
	Strontium (Sr)-Dissolved (ug/L)	108	108	227	108	
	Thallium (Tl)-Dissolved (ug/L)	<0.20	<0.20	<0.20	<0.20	
	Tin (Sn)-Dissolved (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Titanium (Ti)-Dissolved (ug/L)	<10	<10	<10	<10	
	Uranium (U)-Dissolved (ug/L)	0.43	0.40	0.59	0.41	
	Vanadium (V)-Dissolved (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Zinc (Zn)-Dissolved (ug/L)	<5.0	<5.0	<5.0	<5.0	
Plant Pigments	Chlorophyll a (ug/L)	0.622	0.614	2.41	1.72	

* 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	Iron (Fe)-Total	B	L1775541-3
Method Blank	Manganese (Mn)-Total	MB-LOR	L1775541-1, -2, -3, -4
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Aluminum (Al)-Total	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Copper (Cu)-Total	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Manganese (Mn)-Total	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Calcium (Ca)-Total	MS-B	L1775541-1, -2, -4
Matrix Spike	Phosphorus (P)-Total	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Silicon (Si)-Total	MS-B	L1775541-1, -2, -3, -4
Matrix Spike	Silicon (Si)-Total	MS-B	L1775541-1, -2, -4
Matrix Spike	Total Nitrogen	MS-B	L1775541-1, -2, -4
Matrix Spike	Total Nitrogen	MS-B	L1775541-1, -2, -4
Matrix Spike	Total Nitrogen	MS-B	L1775541-3
Matrix Spike	Total Nitrogen	MS-B	L1775541-3
Matrix Spike	Total Kjeldahl Nitrogen	MS-B	L1775541-3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. All associated sample results are at least 5 times greater than blank levels and are considered reliable.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
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
SFT	Sample was filtered due to turbidity interference. Result reflects soluble analyte concentration.

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)".

CHLOROA-F-VA	Water	Chlorophyll a by Fluorometer	EPA 445.0

Reference Information

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.

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-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.

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-DIS-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA SW-846 3005A/6010B

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 "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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.

MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B

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 "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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	APHA 4500 NH3-NITROGEN (AMMONIA)

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.

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.

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.

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.

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.

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.

** 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:

14-487048

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
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1775541-COFC

COC Number: 14 - 487048

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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 EBA Inc	Select Report Format:	☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3pm)
Contact:	DANIELLE MACDONALD	Quality Control (QC) Report with Report	☑ Yes ☐ No	P ☐ Priority (2-4 business days if received by 3pm)
Address:	14940-123 AVE EDMONTON AB	☑ Criteria on Report - provide details below if box checked		E ☐ Emergency (1-2 business days if received by 3pm)
		Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Phone:	780 886 3055	Email 1 or Fax	danielle.macdonald@tetratech.com	Specify Date Required for E2,E or P:
		Email 2	dave.hunter@bchydro.com	

Invoice To			Invoice Distribution	
	Same as Report To	☒ Yes ☐ No	Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report	☒ Yes ☐ No	Email 1 or Fax	same as above
Company:			Email 2	
Contact:				

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:	QSS655	Approver ID:	Cost Center:
Job #:	VENV03118-01	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L1775541	ALS Contact:	Sampler: D. MacDonald P. Gauthier

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

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	Routine as per quote	Chlorophyll A *	DOC as per quote (F/P)	TDC as per quote (F/P)	total metals + Hg (P)	dissolved metals + Hg (F/P)	as per quote	in addition to AnionsSQ in the QSS655	Silicate in addition to quote	Number of Containers
	Peace Canyon (PC1)	30-05-16	10:00 AM	water	✓	✓	✓	✓	✓	✓		✓	✓	8
	Upper Site C Reservoir (PR1)	30-05-16	10:40 AM		✓	✓	✓	✓	✓	✓		✓	✓	8
	~~Halfway River - Upstream (HD-U)~~													
	Halfway River - Downstream (HD-D)	30-05-16	12:40 PM		✓	✓	✓	✓	✓	✓		✓	✓	8
	Middle Site C Reservoir (PR2)		12:00 pm		✓	✓	✓	✓	✓	✓		✓	✓	8
	* HD-U = To be sampled May 31/2016 removed from this COC													

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? ☐ Yes ☑ No ~~Peace~~ River	Please add: email 3: sarah.simon@bchydro.com email 4: pgauthier2014@hotmail.com
Are samples for human drinking water use? ☐ Yes ☑ No Surface Water	* Chlorophyll A - unfiltered; stored in 500mL plastic and fil

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐
Ice packs	Yes ☐	No ☐	Custody seal intact	Yes ☐ No ☐
Cooling Initiated	☐			

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
8					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Phyllis Gauthier	MAY 30/16	3:25 pm	GeoF	May 30/16	15:25			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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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**.

APPENDIX B
SEES JV GENERAL CONDITIONS

GENERAL CONDITIONS

Natural Sciences

This report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORTS AND OWNERSHIP

This report pertains to a specific site, a specific development or activity, and/or a specific scope of work. The report may include plans, drawings, profiles and other supporting documents that collectively constitute the report (the "Report").

The Report is intended for the sole use of Saulteau EBA Environmental Services Joint Venture's (SEES JV) Client (the "Client") as specifically identified in the SEES JV Services Agreement or other Contract entered into with the Client (either of which is termed the "Services Agreement" herein). SEES JV does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Report when it is used or relied upon by any party other than the Client, unless authorized in writing by SEES JV.

Any unauthorized use of the Report is at the sole risk of the user. SEES JV accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Report.

Where SEES JV has expressly authorized the use of the Report by a third party (an "Authorized Party"), consideration for such authorization is the Authorized Party's acceptance of these General Conditions as well as any limitations on liability contained in the Services Agreement with the Client (all of which is collectively termed the "Limitations on Liability"). The Authorized Party should carefully review both these General Conditions and the Services Agreement prior to making any use of the Report. Any use made of the Report by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

The Report and any other form or type of data or documents generated by SEES JV during the performance of the work are SEES JV's professional work product and shall remain the copyright property of SEES JV.

The Report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of SEES JV. Additional copies of the Report, if required, may be obtained upon request.

2.0 ALTERNATIVE REPORT FORMAT

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

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

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

3.0 STANDARD OF CARE

Services performed by SEES JV for the Report have been conducted in accordance with the Services Agreement, 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 Report. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Report.

SEES JV professionals are bound by their ethical commitments to act within the bounds of all pertinent regulations. In certain instances, observations by SEES JV 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 SEES JV in its reasonably exercised discretion.

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 SEES JV.

4.0 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.

5.0 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with SEES JV 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 SEES JV to properly provide the services contracted for in the Services Agreement, SEES JV has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

6.0 INFORMATION PROVIDED TO SEES JV BY OTHERS

During the performance of the work and the preparation of this Report, SEES JV may have relied on information provided by persons other than the Client.

While SEES JV endeavours to verify the accuracy of such information, SEES JV 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.

7.0 GENERAL LIMITATIONS OF REPORT

This Report is based solely on the conditions present and the data available to SEES JV at the time the data were collected in the field or gathered from publically available databases.

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

The Report 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 at or the development proposed as of the date of the Report requires a supplementary investigation and assessment.

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.

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

8.0 JOB SITE SAFETY

SEES JV is only responsible for the activities of its employees on the job site and was not and will not be responsible for the supervision of any other persons whatsoever. The presence of SEES JV personnel on site shall not be construed in any way to relieve the Client or any other persons on site from their responsibility for job site safety.