

December 5, 2014

Ministry of Transportation and Infrastructure
Suite 310 – 1500 Woolridge Street
Coquitlam, BC V3K 0B8

ISSUED FOR USE
FILE: V23203143-01
Via Email: Terence.Lai@gov.bc.ca

Attention: Mr. Terence Lai, M.Sc.
Assistant Regional Gravel Manager

Dear Mr. Lai:

Subject: July/August 2014 Water Monitoring Program
Strong Pit, Abbotsford, BC

1.0 INTRODUCTION

The British Columbia Ministry of Transportation and Infrastructure (MOTI) retained Tetra Tech EBA Inc. (Tetra Tech EBA) to complete a biannual water monitoring program for the Strong Pit site (herein referred to as "Strong Pit") in Abbotsford, BC and four residential properties located at the following addresses in Abbotsford, BC:^{s.21} The location of Strong Pit is shown on Figure 1, while monitoring well and private water well locations are presented on Figure 2.

The objective of the biannual water monitoring program is to determine groundwater quality at Strong Pit and nearby residential properties, and to assess compliance of Potential Contaminants of Concern (PCOCs) with applicable British Columbia (BC) Contaminated Sites Regulation (CSR) Drinking Water (DW) standards, Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ), and BC Approved and Working Water Quality Guidelines (BCWQG).

The PCOCs that are associated with the Strong Pit operations are dissolved and/or total metals, general parameters, total coliforms, and Escherichia Coli (E. Coli) (SNC-Lavalin 2013¹).

2.0 SCOPE OF WORK

During the July/August 2014 water monitoring event, Tetra Tech EBA has completed the following tasks:

- Completed a site-specific health and safety plan;
- Contacted the residential well owners and Strong Pit operator to discuss their availability and arrange for well access;
- Shock chlorinated groundwater monitoring wells W10-17B and W11-4 prior to groundwater sampling;
- Replaced the broken Wattera tubing in groundwater monitoring well W09-13B;
- Recorded groundwater levels, purged, and collected groundwater samples from seven groundwater monitoring wells in Strong Pit;

¹ SNC-Lavalin Inc. Environment Division. January 31, 2013. December 2012 Groundwater Monitoring and Sampling Program Results, Strong Pit, Abbotsford, BC. Project No. 510006.

- Measured field parameters (turbidity, electrical conductivity, pH, and temperature) during purging of the groundwater monitoring wells;
- Submitted the groundwater samples collected from the seven groundwater monitoring wells to ALS Environmental (ALS) for the following laboratory analysis: hardness, turbidity, total dissolved solids, colour, electrical conductivity, pH, major anions (chloride, fluoride and sulphate), nutrients (nitrate and nitrite), dissolved metals, E. Coli, and total coliforms;
- Collected tap water samples from four private water wells located on the nearby residential properties and submitted these samples for laboratory analysis of hardness, turbidity, total dissolved solids, colour, electrical conductivity, pH, major anions (chloride, fluoride and sulphate), nutrients (nitrate and nitrite), E. Coli, total coliform, dissolved metals, and total metals;
- Measured field parameters (turbidity, electrical conductivity, pH, and temperature) before groundwater sample collection from the private wells;
- Collected and submitted one duplicate groundwater sample and one duplicate tap water sample to ALS for laboratory analysis for the same parameters listed above, as part of Tetra Tech EBA's Quality Assurance / Quality Control (QA/QC) program to assess the integrity of the sampling methodology and analytical testing;
- Collected and submitted one trip blank and one equipment blank to ALS for E. Coli and total coliform analysis, as part of Tetra Tech EBA's QA/QC program to assess the integrity of the sample bottles and sampling methodology;
- Tabulated the results of the field variable measurements and laboratory analysis collected during this monitoring event, and compared the results to the applicable standards and guidelines; and
- Prepared this report outlining the investigation findings along with short break-out reports to be sent to the four private well owners.

The scope of work completed for this monitoring event was conducted in general accordance to Tetra Tech EBA's proposal dated April 12, 2013.

3.0 BACKGROUND

Strong Pit is currently operating as a gravel pit by Kiewit/Flatiron for the Port Mann/Highway 1 Project.

Various groundwater monitoring and sampling programs have been conducted between July 2009 and September 2011 by Tetra Tech EBA, Trow Associates Inc. (Trow), and Levelton Consultants Ltd (Levelton). In 2012, the wells located in Strong Pit and on the four residential sites were monitored and sampled on a quarterly basis by SNC-Lavalin Inc., Environment Division (SLE). Tetra Tech EBA has been conducting a biannual water monitoring program since June 2013.

The June and December 2013 analytical results are included in Table 1A and Table 1B of this report for reference. SLE's 2012 analytical results are summarized in Table 3 and Table 4 of this report.

3.1 2012 Results

Results of the groundwater monitoring and sampling by SLE may be summarized as follows:

- Dissolved metal analytical results for all monitoring wells were less than the applicable CSR DW and/or GCDWQ, with the exception of:
 - Arsenic at W11-2, which exceeded both the CSR DW standard and GCDWQ; and
 - Manganese beneath Strong Pit and the residential property located at ^{s.21} in Abbotsford, BC, which exceeded the GCDWQ aesthetic guidelines.
- The E. Coli count was below the laboratory method detection limit (MDL) and in compliance with the GCDWQ at all locations; and
- Total coliforms were detected at five of seven monitoring wells in Strong Pit, and on one residential property located at ^{s.21} in Abbotsford, BC.

3.2 2013 Results

The June and December 2013 analytical results, in general, were consistent with historical data.

Dissolved arsenic in groundwater in monitoring well W11-2 historically exceeded the GCDWQ value (10 µg/L) during all 2012 previous sampling events and also exceeded the GCDWQ value in December 2013. When sampled in June 2013, dissolved arsenic (9.2 µg/L) in W11-2 was marginally below the GCDWQ value. The higher arsenic concentrations observed in W11-2 were suspected to be attributed to higher sample turbidity. Arsenic concentrations measured at monitoring well W11-2 during the 2012 and 2013 monitoring events were similar to slightly elevated than arsenic levels measured at monitoring well W09-1, which is located hydraulically up-gradient from Strong Pit. Groundwater monitoring well W11-2 is located down-gradient from Strong Pit operation area.

Dissolved manganese in a number of groundwater monitoring wells (W09-1, W11-2, and W11-5), which historically exceeded the GCDWQ value during at least one previous sampling event, also exceeded the GCDWQ guideline in 2013.

Total coliforms were detected at two monitoring wells (W10-17B and W11-4) in Strong Pit, and on one residential property located at ^{s.21} in Abbotsford, BC.

4.0 METHODOLOGY

4.1 Health and Safety

Tetra Tech EBA prepared a site-specific health and safety plan that was implemented during the fieldwork to ensure Tetra Tech EBA's standard safety procedures were followed.

4.2 Groundwater Monitoring and Sampling

Strong Pit Monitoring Wells

Due to the persistent presence of total coliform identified in W10-17B and W11-4 since 2012, shock chlorination was conducted on these two monitoring wells prior to the July/August 2014 sampling event. Shock chlorination was performed on W10-17B and W11-4 by Union Pumps on July 21, 2014 by placing approximately 100 grams of solid chlorine powder into each well through a funnel, rinsing the powder down the well casings with groundwater from within each well. To remove the chlorinated water, Union Pumps returned to the Strong Pit site on July 22, 2014 to pump approximately four well volumes of water from each well using a hydrolift provided by Tetra Tech EBA. Due to the limited well access, the chlorinated water that was pumped out of the wells was discharged directly onto the ground approximately 10 m from each well location in accordance with methods described in the BC Ministry of Environment (MoE) Water Well Disinfection Using the Simple Chlorination Method². Mr. Tyler Petersen, of Tetra Tech EBA, was on site to monitor the well pumping and confirmed that the water was free of chlorine smell after four well volumes of groundwater removal.

Tetra Tech EBA sampled the groundwater monitoring wells between July 31 and August 6, 2014, using standard Tetra Tech EBA procedures designed to generate samples that are representative of formation water near the well screen and reduce the potential for contaminating samples or wells. Prior to groundwater sampling, Tetra Tech EBA measured the depth to water and depth to well bottom in each well in order to estimate the well volume. Tetra Tech EBA disinfected the electronic water level indicator with a household bleach wetted cloth between sampling locations to avoid cross-contamination. Tetra Tech EBA positioned the tubing intake at the mid-point of the saturated section of the well screen. Tetra Tech EBA then sampled each well using a Waterra® inertial lift pump as follows:

- Tetra Tech EBA purged three well volumes of water, or purged until the electrical conductivity, pH, and temperature measured for a purged well volume were within 5% of the values measured for the previous purged well volume. During purging, the flow rate was set to be at approximately 3.5 L/min;
- During purging at the two shock chlorinated wells, a field chlorine detection device (Hach 890 Colorimeter) was used to ensure that any residual chlorine levels were negligible before purging was complete;
- Following purging, Tetra Tech EBA reduced the flow rate to approximately 0.8 L/min and collected the samples directly from the tubing string and poured the samples into new laboratory-supplied containers. The flow rate was reduced to lower the water turbidity. Groundwater samples collected for dissolved metals were field-filtered and preserved with nitric acid. Tetra Tech EBA collected a duplicate sample, field labelled as DUP #2, from W10-17B; and
- Tetra Tech EBA then placed the samples in coolers with ice for transport under Chain-of-Custody protocol to the laboratory.

Residential Water Wells

Tetra Tech EBA sampled the private water wells on July 31, 2014. Before sampling groundwater using a household tap, Tetra Tech EBA disinfected the tap by wiping the faucet with diluted household bleach solution, allowing it to air dry for two minutes, and allowing water to discharge from the tap for approximately five minutes to flush out the chlorinated water, and monitored water variables: pH, temperature, and electric conductivity.

² BC Ministry of Environment. Water Well Disinfection Using the Simple Chlorination Method.
http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells/factsheets/PFRA_simple_chlorification.pdf

Tetra Tech EBA collected water samples directly from each tap using laboratory-prepared containers appropriate for the required analyses, taking care not to touch the mouth of the containers or the inside of the caps. Tetra Tech EBA then placed the samples in coolers with ice for transport under Chain-of-Custody protocol to the laboratory. Tetra Tech EBA collected a duplicate sample, field labelled as DUP #1, from the water tap located at s.21 in Abbotsford, BC.

4.3 Quality Assurance / Quality Control Program

During the biannual water monitoring program, Tetra Tech EBA implemented a QA/QC program to assess the integrity of the sampling methodology and analytical testing. The QA/QC program adhered to Tetra Tech EBA's in-house Quality Management System, which was designed to generate representative samples, mitigate potential cross-contamination between sampling locations and samples, and reduce the potential for systematic bias.

The QA/QC protocol included:

- Reviewing applicable regulatory and internal work methods for field sampling to ensure they meet regulatory and industry standards;
- Recording monitoring and sampling of environmental media;
- Recording the results of field activities in the field concurrently with the activities;
- Use of clean, new sampling nitrile gloves at each sampling location;
- Placing samples into new and labelled laboratory-supplied containers, and when warranted, preserving the samples using laboratory-measured and -supplied preservatives;
- When appropriate, forming duplicate samples using industry accepted splitting methods;
- Collecting equipment blank water samples by rinsing the sampling equipment with de-ionized water and collecting the rinsed water into the pre-labelled lab containers;
- Collecting bottle blank water samples by pouring de-ionized water into the pre-labelled bottle blank container and recapping it;
- Transporting temperature-sensitive samples to the analytical laboratory in chilled coolers using chain-of-custody procedures and ensuring that maximum holding times were not exceeded;
- Using CALA-affiliated laboratories that are qualified to analyze the samples using MoE-approved procedures;
- Submitting duplicate samples to the laboratory as "blind" samples meaning that they are not identified as duplicate samples;
- Decontaminating sampling equipment between sample locations;
- Reviewing the results of QA/QC analyses, assessing the significance of the analytical results, and identifying this information in this report; and
- Reviewing of this report by a qualified senior Tetra Tech EBA professional to ensure that the report meets Tetra Tech EBA technical and reporting requirements.

Part of the QA/QC program involved calculating the relative percent difference (RPD) between sample concentrations of paired blind duplicates. Results were calculated as follows:

$$\text{RPD (\%)} = 2 \times 100 \times |X - Y| / (X + Y)$$

Where:

X = the measured concentration in the original sample; and

Y = the measured concentration in the duplicate sample.

RPDs should only be calculated and assessed when both the sample and the duplicate results are greater than five times the laboratory reported detection limit (RDL), referred to as the Practical Quantification Limit.

When evaluating the RPDs for the duplicate samples, Tetra Tech EBA adopted a screening threshold of 1.5 times the acceptable laboratory RPD for groundwater, as recommended by MoE. Should the RPD of a duplicate groundwater sample exceed the 30% threshold value, an explanation of the variation is required.

5.0 INVESTIGATION RESULTS

5.1 Groundwater Monitoring Results

The results of the July/August 2014 groundwater monitoring event can be summarized as follows:

- All seven groundwater monitoring wells were observed to be in generally good condition. However, comparison of the historical well depth measurements to those collected during the July/August 2014 monitoring program, suggests that silts have been accumulating and are blocking the screened intervals in almost all on-site wells.
- No evidence of sheen, or odour was noted during purging and sampling of the wells. More than five well volumes of groundwater were removed from W10-17B to allow the field parameters to stabilize prior to groundwater sampling.
- Water depths ranged from 1.1 m at W11-5, to 26.5 m at W09-13B (measured below the top of the well stick-up casing). Comparison of the historical water depth measurements to those collected during the July/August 2014 monitoring program suggests that the seasonal variation in groundwater level at Strong Pit is minimal.
- All groundwater monitoring wells recharged readily during purging and sampling.
- At the time of groundwater sampling, the Waterra tubing in groundwater monitoring well W09-13B was found to be broken at approximately 2 m below grade, and was replaced.

5.2 Groundwater Analytical Results

Tetra Tech EBA submitted a total of fifteen (15) groundwater samples, including two duplicates, one field blank, and one equipment blank to ALS for laboratory analysis of hardness, turbidity, total dissolved solids, colour, electrical conductivity, pH, major anions (chloride, fluoride and sulphate), nutrients (nitrate and nitrite), total and/or dissolved metals, E. Coli, and/or total coliforms.

The analytical results of the Strong Pit monitoring wells are evaluated against the GCDWQ, BCWQG, and CSR DW standards, and are presented in Table 1A. The analytical results of the domestic residential wells are evaluated against the GCDWQ, BCWQG, and CSR DW standards, and are presented in Table 1B. The groundwater monitoring wells and private well sampling locations are shown on Figure 2. Copies of the laboratory analytical reports provided by ALS are provided as Appendix B.

The following provides a summary of the groundwater analytical results as compared to the applicable standards.

Strong Pit Monitoring Wells

pH

When sampled on August 1, 2014, groundwater monitoring well W11-4 had a field pH of 6.16 which was below the lower pH threshold value (6.5) for BCWQG and GCDWQ. There is no CSR DW standard for pH.

Dissolved Metals

Reported concentrations of dissolved metals were less than the applicable CSR DW and GCDWQ values for the seven Strong Pit monitoring wells with the following exceptions:

- W11-2 – reported arsenic concentration (12.8 µg/L) was greater than the CSR DW standard and GCDWQ. Both the CSR DW standard and the GCDWQ for arsenic are 10 µg/L; and
- W11-5 – reported manganese concentration (60 µg/L) was greater than the GCDWQ aesthetic objective criterion of 50 µg/L for manganese.

Bacteriological Species

The following samples had total coliform bacteria counts greater than the applicable BCWQG and GCDWQ of <1 MPN/100 mL:

- W09-13B – total coliform count of 1 MPN/100 mL; and
- W11-5 – total coliform count of 13 MPN/100 mL.

Residential Water Wells

As discussed previously, four nearby residential wells or^{s.21} were sampled during this sampling event. These residential wells have been sampled for routine physical parameters, major anions, nutrients, bacteriological parameters, dissolved metals and total metals. In July 2014, Tetra Tech EBA also sampled these residential wells for dissolved metals to compare dissolved arsenic concentrations in the residential wells to that in the groundwater monitoring wells.

pH

When sampled on July 31, 2014, residential water wells located at^{s.21}
s.21

Total Metals

s.21

Bacteriological Species

s.21

5.3 Quality Assurance / Quality Control Program

Tetra Tech EBA implemented a QA/QC program to assess the integrity of the sampling methodology and analytical testing. When evaluating the RPDs for the duplicate samples, Tetra Tech EBA adopted a RPD screening threshold of 1.5 times the acceptable laboratory RPD for the same compound as recommended by the MoE.

The results of RPD calculations for water samples are provided in Table 2. As shown in Table 2, the calculated RPD values for two pairs of duplicate water samples were all within the screening threshold values. Thus, Tetra Tech EBA considers the analytical results accurately represent the field conditions.

As shown on laboratory certificates presented as Appendix B, trip and equipment blank results for E. Coli and total coliform were less than the appropriate RDLs indicating that bacteria was not inadvertently introduced during well sampling or laboratory analysis. The laboratory QA/QC program did not reveal bias or high imprecision of analytical testing.

6.0 DISCUSSION

Discussions on groundwater quality are based on review of available groundwater analytical data collected since 2012.

6.1 2014 Strong Pit Groundwater Quality

pH

Groundwater monitoring well W11-4 had a field pH of 6.16 that was below the lower pH threshold value (6.5) for BCWQG and GCDWQ. However, there is no CSR DW standard for pH which is the applicable standard for groundwater sampled from monitoring wells.

Dissolved Manganese

When sampled during the July/August 2014 sampling event, dissolved manganese concentration (60 µg/L) in groundwater monitoring well W11-5 exceeded the GCDWQ value (50 µg/L); however, the reported concentration was below the CSR DW standard (550 µg/L), which is protective of human health. Manganese is one of the more abundant metals in the earth's crust and dissolved manganese in groundwater under oxygen-poor condition can reach an elevated level. In addition, the GCDWQ value for manganese is an aesthetic criterion only and is not toxicologically based for human health protection.

When sampled in July/August 2014, the dissolved manganese concentrations in monitoring wells W09-1 (47 µg/L) and W11-2 (46 µg/L) were marginally below the GCDWQ value. Dissolved manganese at concentrations greater than the GCDWQ value was previously identified in both W09-1 and W11-2.

The July/August 2014 analytical results, in general, were consistent with the June 2013 and December 2013 results, and the observed seasonal variation in dissolved manganese concentrations in the on-site wells is insignificant and is within the same order of magnitude.

Dissolved Arsenic

Groundwater is inferred to flow southeast at the Pit (see Figure 3); thus, W09-1 is considered to be representative of background condition. Groundwater monitoring well W11-2 is located down-gradient of the Strong Pit operation area whereas monitoring well W09-1 is located up-gradient of the Pit.

The dissolved arsenic concentration measured in W11-2 in December 2013 was 13 µg/L. When sampled in December 2013, the groundwater turbidity value (355 NTU) in the W11-2 water sample was significantly higher than the recommended turbidity value (1.0 NTU) established for water entering the distribution system or system where filter is not required to meet pathogen removal goals (Health Canada 2012b). Because arsenic has a tendency to absorb onto fine particles in groundwater, it was suspected that the high arsenic level in well W11-2 was attributed to the high turbidity level in the sample.

Thus, during the July/August 2014 sampling event, Tetra Tech EBA sampled the wells at low flow rates (0.8 L/min) in an attempt to minimize the presence of fine particles in the water samples and reduce the water turbidity. Tetra Tech EBA field staff reported that the water samples collected from W11-2 were still turbid at the time of groundwater sampling.

Water sample collected from W11-2 In July/August 2014 had a lower turbidity value (51.7 NTU) but still contained a dissolved arsenic concentration (12.8 µg/L) greater than the applicable CSR DW standard and GCDWQ value (10 µg/L). The CSR DW standard and the GCDWQ were established for the protection of human health. Dissolved arsenic concentration (9.1 µg/L) in W09-1, considered representative of background conditions, at a turbidity value of 0.25 NTU, was marginally below the CSR DW standard and GCDWQ. Comparison of measured arsenic concentrations to the water turbidity values measured during the 2013/2014 sampling event suggests that arsenic in W11-2 or W09-1 did not appear to be influenced by the presence of turbidity and/or suspended solids. Dissolved arsenic found in groundwater monitoring wells W11-2 and W09-1 is likely to be naturally occurring, and not related to the operation activities at Strong Pit.

Comparison of July/August 2014 groundwater analytical data to 2012 and 2013 historical data shows that seasonal variations in dissolved arsenic in groundwater in W11-2 and W09-1 are minimal. Arsenic levels in W11-2 (9.2 µg/L to 13.2 µg/L) have been similar to slightly elevated than arsenic levels in well W09-1 (9.0 µg/L to 9.77 µg/L).

Bacteriological Species

Elevated total coliform bacteria were previously identified in groundwater monitoring wells W10-17B and W11-4. The presence of total coliform bacteria in W10-17B appeared to be persistent as positive total coliform counts were identified in this particular well during the previous two sampling events.

To assess if the positive total coliform counts in groundwater from the Strong Pit well(s) are related to the activities and operations at Strong Pit, monitoring wells W10-17B and W11-4 were disinfected thoroughly by shock chlorination prior to the July/August 2014 sampling event. During the recent sampling event, total coliform bacteria and E. Coli were non-detect in these two wells.

However, total coliform count of 1 MPN/100 mL and 13 MPN/100 mL were identified in W09-13B and W11-5, respectively. Total coliform bacteria counts were detected in W09-13B in December 2012, but were not detected previously in W11-5. Total coliforms are naturally found in both faecal and non-faecal environments (Health Canada 2012b).

6.2 Residential Water Wells

pH

Water with a pH value below 6.5 may cause pipe corrosion (Health Canada 2012b).

s.21

Between 1992 and 1993, BC Ministry of Environment, Lands and Parks (now BC MoE) conducted a two-phase evaluation of the groundwater quality in more than 470 wells in the Fraser Valley. The evaluation included, but was not limited to, the collection and analysis of well water samples for a comprehensive suite of inorganic and organic constituents including pesticides and volatile organic compounds. During Phase 1 and Phase 2, 239 wells and 240 wells were sampled, respectively. Of the 240 wells sampled during Phase 2 work, 46 were community wells.

The evaluation results showed that, in Phase 1, 23% of the wells, or 54 wells, sampled, exceeded the GCDWQ manganese guideline, and in Phase 2, 24% of the well, or 59 wells, sampled exceeded the GCDWQ guideline (BC MoE 1995). The mean values for total manganese for the entire study area in Phase 1 and Phase 2 were 77 µg/L and 81 µg/L, respectively (BC MoE 1995). Based on the results, MoE concluded that occurrence of manganese is not limited to any one area, or any particular aquifers in the Fraser Valley, and there does not appear to be any link between wells with high manganese values and well depth, construction type or the aquifer into which the well is completed.

s.21

s.21

7.0 CONCLUSIONS

Based on the results of the July/August 2014 groundwater sampling event, Tetra Tech EBA concluded the following:

- The July/August 2014 analytical results, in general, were consistent with historical data. The observed seasonal variations in dissolved manganese and arsenic are minimal.
- Since 2012, dissolved manganese concentrations in monitoring well W11-5 have exceeded the GCDWQ guideline. In July/August 2014, dissolved manganese concentrations in monitoring wells W09-1 and W11-2 were marginally below the GCDWQ value, but historically, dissolved manganese concentrations in these two wells exceeded the GCDWQ during at least one previous sampling event. Dissolved manganese in groundwater under oxygen-poor conditions can reach an elevated level, and as was indicated in the MoE groundwater quality assessment, does not positively indicate an impact from the operations at Strong Pit.
- Since 2012, dissolved arsenic concentrations in groundwater in monitoring well W11-2 have been close to or exceeded the GCDWQ value. Arsenic concentrations measured at monitoring well W11-2 during the 2012 and 2013 monitoring events were similar to slightly elevated than arsenic levels measured at the up-gradient monitoring well W09-1. The arsenic levels measured in W11-2 or W09-1 did not appear to be influenced by the presence of turbidity and/or suspended solids. This suggests that arsenic is likely to be naturally occurring in groundwater.
- Positive total coliform bacteria counts were identified in W11-5 and W09-13B during the July/August 2014 sampling event. Total coliform bacteria counts were detected in W09-13B in December 2012 but were not detected previously in W11-5. Total coliforms are naturally found in both faecal and non-faecal environments. Further discussion and conclusions regarding the detectable total coliform in the samples collected from the groundwater monitoring wells and the residential well at s.21, will be provided at the completion of the 2014 monitoring program.

▪ s.21

▪

8.0 RECOMMENDATIONS

Based on the 2013 and July/August 2014 groundwater analytical data, Tetra Tech EBA proposes the following for the next (December 2014) groundwater monitoring and sampling event:

December 2014 Groundwater Monitoring and Sampling Event

	On-site Groundwater Monitoring Wells (W09-1, W09-6, W09-13B, W10-17B, W11-2 and W11-5)	The Four Residential Wells	Equipment Blank	Field Blank
Depth to Water Level	√			
Laboratory Analytical Program				
Physical parameters (hardness, turbidity, total dissolved solids)	√	√		
Other physical parameters (colour, electrical conductivity, and pH)	√	√		
Major anions (chloride, fluoride and sulphate)	√	√		
Nutrients (nitrate and nitrite)	√	√		
Dissolved metals	√			
Total metals		√		
E. Coli and total coliform bacteria	√	√	√	√

- Continue to monitor and sample the Strong Pit monitoring wells to assess annual changes in on-site groundwater quality during the next proposed sampling event in December 2014 for the following laboratory analyses: hardness, turbidity, total dissolved solids, colour, electrical conductivity, pH, major anions (chloride, fluoride and sulphate), nutrients (nitrate and nitrite), dissolved metals, and pathogen indicator parameters such as E. Coli, and total coliform bacteria. It is our opinion that positive detections of the total coliform bacteria are not likely to be related to the operations at Strong Pit, but Tetra Tech EBA will conduct another round of bacterial sampling in December 2014 to assess the annual variation of bacterial production in the on-site monitoring wells.
- Continue to sample the four nearby residential wells to assess annual changes in groundwater quality in December 2014 for the following laboratory analysis: physical parameters, total dissolved solids, major anions (chloride, fluoride and sulphate), nutrients (nitrate and nitrite), total metals and pathogen indicator parameters such as E. Coli, and total coliform bacteria. Tetra Tech EBA recommends removing dissolved metals from the December 2014 residential well laboratory analytical program since total and dissolved metal concentrations during the July/August 2014 monitoring event were comparable.

9.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of British Columbia Ministry of Transportation and Infrastructure and their agents. Tetra Tech EBA Inc. (Tetra Tech EBA) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than BC Ministry of Transportation and Infrastructure, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech EBA's Services Agreement. Tetra Tech EBA's General Conditions are provided in Appendix A of this report.

10.0 CLOSURE

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

Respectfully submitted,
Tetra Tech EBA Inc.



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Attachments: Tables (5)
Figures (3)
Appendix A – Tetra Tech EBA's Geoenvironmental Report – General Conditions
Appendix B – Laboratory Analytical Reports (July/August 2014)

REFERENCES

- Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment. August 2012. Guidelines for Canadian Drinking Water Quality (2012b).
- Health Canada. April 2012. Guidance Document for Determining Ground Water at Risk of Containing Pathogens (GARP) Including Ground Water Under Direct Influence of Surface Water (GWUDI) (2012a).
- Ministry of Environment. Last updated January 2014. BC Contaminated Sites Regulation (BC Reg. 375/96, includes amendments up to B.C. Reg. 4/2014, January 31, 2014 - Schedules 6 and 10).
- Ministry of Environment. Last updated August 2001. Approved and Working Water Quality Guidelines.
- Ministry of Health, Ministry of Environment, Lands and Parks, Ministry of Agriculture, Fisheries and Food. 1995. Final Report – Fraser Valley Groundwater Monitoring Program.
- SNC-Lavalin Inc. May 2012. March 2012 Groundwater Monitoring and Sampling Program Results, Strong Pit, Abbotsford, BC. Project Number 510006.
- SNC-Lavalin Inc. August 2012. June 2012 Groundwater Monitoring and Sampling Program Results, Strong Pit, Abbotsford, BC. Project Number 510006.
- SNC-Lavalin Inc. November 2012. September 2012 Groundwater Monitoring and Sampling Program Results, Strong Pit, Abbotsford, BC. Project Number 510006.
- SNC-Lavalin Inc. January 2013. December 2012 Groundwater Monitoring and Sampling Program Results, Strong Pit, Abbotsford, BC. Project Number 510006.
- EBA Engineering Consultants Ltd., operating as EBA, A Tetra Tech Company. August 2013. July 2013 Water Monitoring Program, Strong Pit, Abbotsford, BC. File Number V23203143.
- Tetra Tech EBA Inc. May 2014. December 2013 Water Monitoring Program, Strong Pit, Abbotsford, BC. File Number V23203143.

TABLES

Table 1A	Groundwater Analytical Results – 2013 and 2014 Groundwater Monitoring Events, Strong Pit Wells
Table 1B	Groundwater Analytical Results – 2013 and 2014 Groundwater Monitoring Events ^{s.21} Residential Wells
Table 2	Quality Assurance/Quality Control – July/August 2014 Groundwater Analytical Results
Table 3	Historical Groundwater Analytical Results by SNC Lavalin 2012: Summary of Analytical Results for Dissolved Inorganics in Groundwater
Table 4	Historical Groundwater Analytical Results by SNC Lavalin 2012: Summary of Analytical Results for Total Metals and Bacteriological Parameters in Groundwater

Table 1A: Groundwater Analytical Results - 2013 and 2014 Groundwater Monitoring Events, Strong Pit Wells

						Field ID		W09-1*			W09-6*			W09-13B*				W10-17B*				
															DUP 1 (duplicate of W09-13B)					W10-97B * (duplicate of W10-17B)		DUP #2 (duplicate of W10-17B)
						Date Sampled	05-Jun-13	05-Dec-13	31-Jul-14	05-Jun-13	05-Dec-13	31-Jul-14	06-Jun-13	06-Jun-13	05-Dec-13	06-Aug-14	07-Jun-13	04-Dec-13	04-Dec-13	06-Aug-14	06-Aug-14	
Sample Code	L1312210-4	L1400400-1	L1495841-2	L1312210-3	L1400400-4	L1495841-1	L1312951-4	L1312951-7	L1400400-2	L1498052-1	L1313281-2	L1399821-2	L1399821-3	L1498052-2	L1498052-3							
Chemical Group	Parameter	Unit	RDL	BCWQG	CSR Schedule 6 - DW																	
Field Parameter	pH (field)	pH units	0.01	6.5 to 8.5	-	6.5 to 8.5	8.04	8.62	8.06	7.03	7.35	7.12	7.25	7.25	7.56	7.16	6.82	7.05	-	7.00	-	
Physical Tests	Turbidity	NTU	0.1	-	-	-	0.3	0.19	0.25	1.59	10.2	1.45	0.49	0.92	18.4	0.8	26	914	636	921	792	
	TDS (Filtered)	mg/L	10	-	-	500	138	127	138	176	178	177	190	186	157	178	163	171	170	245	240	
	Hardness as CaCO3	mg/L	0.5	-	-	-	86.7	86.0	85.0	136	141	137	106	107	106	105	109	124	123	159	158	
	Colour, True	CU	5.0	<15	-	<15	-	<5.0	<5.0	-	<5.0	<5.0	-	-	<5.0	<5.0	-	<5.0	<5.0	<5.0	<5.0	
	Conductivity	µS/cm	2.0	-	-	-	-	221	215	-	288	277	-	-	253	244	-	253	256	354	353	
	pH	pH	0.1	6.5 to 8.5	-	6.5 to 8.5	-	8.33	8.26	-	7.96	7.83	-	-	7.98	7.70	-	7.53	7.73	7.46	7.45	
Anions and Nutrients	Alkalinity, Total (as CaCO3)	µg/L	2000	-	-	-	-	103000	-	-	101000	-	-	-	68600	-	-	95800	97100	-	-	
	Bromide (Br)	µg/L	50	-	-	-	-	<50	<50	-	<50	<50	-	-	<50	<50	-	51	57	<50	<50	
	Chloride (Cl)	µg/L	500	250,000	250,000	250,000	-	1430	1410	-	6530	6080	-	-	10900	10100	-	4970	4850	19300	19300	
	Fluoride (F)	µg/L	20	1,500	1,500	1,500	-	98	103	-	45	54	-	-	34	36	-	27	27	40	41	
	Nitrate (as N)	µg/L	5.0	10,000	10,000	10,000	-	<5.0	32.7	-	5820	3560	-	-	7200	6440	-	2770	2760	2910	2900	
	Nitrite (as N)	µg/L	1.0	1,000	3,200	1,000	-	<1.0	<1.0	-	48.6	39.3	-	-	<1.0	<1.0	-	<1.0	<1.0	<1.0	<1.0	
	Sulfate (SO4)	µg/L	500	218000 to 309000	500,000	500,000	-	10300	10100	-	17200	19000	-	-	15600	15800	-	18000	17900	18200	18100	
Bacteriological Tests	E. coli	MPN/100mL	1	0 per 100 mL	-	0 per 100 mL	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
	Coliform Bacteria - Total	MPN/100mL	1	0 per 100 mL	-	0 per 100 mL	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	>201	291	21	<1	<1	
Dissolved Metals	Aluminum (Filtered)	µg/L	10	200	9500	100 ^{#2}	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	
	Antimony (Filtered)	µg/L	0.5	-	6	6	<0.5	<0.50	<0.50	<0.5	<0.50	<0.50	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
	Arsenic (Filtered)	µg/L	1	-	10	10	9.7	9.5	9.4	<1	<1.0	<1.0	1.4	1.5	1.4	1.6	<1	<1.0	<1.0	<1.0	<1.0	
	Barium (Filtered)	µg/L	20	-	1000	1000	41	40	40	23	22	22	<20	<20	<20	<20	<20	<20	<20	<20	<20	
	Beryllium (Filtered)	µg/L	5	-	-	-	<5	<5.0	<5.0	<5	<5.0	<5.0	<5	<5.0	<5.0	<5.0	<5	<5.0	<5.0	<5.0	<5.0	
	Boron (Filtered)	µg/L	100	-	5000	5000	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	
	Cadmium (Filtered)	µg/L	0.05	-	5	5	<0.05	<0.050	<0.050	<0.05	<0.050	<0.050	<0.05	<0.050	<0.050	<0.050	<0.050	0.203	0.079	<0.050	<0.050	
	Calcium (Filtered)	µg/L	100	-	-	-	21,000	20700	20600	34,900	36100	35000	24,600	25,000	24600	24800	25,800	30300	30300	42800	42700	
	Chromium (III+VI) (Filtered)	µg/L	0.5	-	50	50	<0.5	<0.50	<0.50	<0.5	<0.50	<0.50	2.71	2.73	3.16	2.92	2.23	2.61	2.69	7.33	7.37	
	Cobalt (Filtered)	µg/L	0.5	-	-	-	<0.5	<0.50	<0.50	<0.5	<0.50	<0.50	<0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
	Copper (Filtered)	µg/L	1	-	1000 ^{#1}	1000	<1	<1.0	<1.0	<1	<1.0	<1.0	<1	<1.0	<1.0	<1.0	<1	<1.0	<1.0	<1.0	<1.0	
	Iron (Filtered)	µg/L	30	-	6500 ^{#1#3}	300	58	56	43	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	
	Lead (Filtered)	µg/L	1	-	10	10	<1	<1.0	<1.0	<1	<1.0	<1.0	<1	<1.0	<1.0	<1.0	<1	<1.0	<1.0	<1.0	<1.0	
	Lithium (Filtered)	µg/L	50	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	
	Magnesium (Filtered)	µg/L	100	-	100000 ^{#1}	-	8,330	8330	8160	11,900	12400	12100	10,800	11,000	10700	10500	10,800	11800	11600	12600	12600	
	Manganese (Filtered)	µg/L	10	-	550 ^{#1#3}	50	55	53	47	27	28	28	<10	<10	<10	<10	<10	<10	<10	<10	<10	
	Mercury (Filtered)	µg/L	0.2	-	1	1	<0.2	<0.20	<0.20	<0.2	<0.20	<0.20	<0.2	<0.20	<0.20	<0.20	<0.2	<0.20	<0.20	<0.20	<0.20	
	Molybdenum (Filtered)	µg/L	1	-	250	-	2.1	2.1	2.2	<1	<1.0	<1.0	<1	<1.0	<1.0	<1.0	<1	<1.0	<1.0	<1.0	<1.0	
	Nickel (Filtered)	µg/L	5	-	-	-	<5	<5.0	<5.0	<5	<5.0	<5.0	<5	<5.0	<5.0	<5.0	<5	<5.0	<5.0	<5.0	<5.0	
	Selenium (Filtered)	µg/L	1	-	10	10	<1	<1.0	<1.0	1.4	1.4	1.3	<1	<1.0	<1.0	<1.0	<1	<1.0	<1.0	<1.0	<1.0	
	Silver (Filtered)	µg/L	0.05	-	-	-	<0.05	<0.050	<0.050	<0.05	<0.050	<0.050	<0.05	<0.050	<0.050	<0.050	<0.05	<0.050	<0.050	0.066	0.145	
	Sodium (Filtered)	µg/L	2000	-	200000 ^{#1}	200000	13,300	12700	12900	5,600	5500	5800	7,800	8,000	7500	8100	7,200	6500	6100	10100	10100	
	Thallium (Filtered)	µg/L	0.2	-	-	-	<0.2	<0.20	<0.20	<0.2	<0.20	<0.20	<0.2	<0.20	<0.20	<0.20	<0.2	<0.20	<0.20	<0.20	<0.20	
	Titanium (Filtered)	µg/L	50	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	
	Uranium (Filtered)	µg/L	0.2	-	20	20	<0.2	<0.20	<0.20	<0.2	<0.20	<0.20	<0.2	<0.20	<0.20	<0.20	<0.2	<0.20	<0.20	<0.20	<0.20	
	Vanadium (Filtered)	µg/L	30	-	-	-	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	
	Zinc (Filtered)	µg/L	5	-	5000 ^{#1}	5000	<5	<5.0	5.4	<5	<5.0	<5.0	<5	<5.0	<5.0	<5.0	<5.0	6.8	<5.0	<5.0	<5.0	

NOTES:

- 1Concentrations are in µg/L unless otherwise noted.
- 2Standard is specific to protection of human health.
- 3Standard is for conventional treatment (200 µg/L for other treatments)
- 3Standard is no longer applicable based on the CSR Stage 8 Amendments. Results were compared for due diligence purposes.
- Not analyzed or no applicable CSR standard.
- <Concentration is less than the laboratory detection limit indicated.
- GCDWQGuideline for Canadian Drinking Water Quality (last updated August 2012)
- CSRBC Contaminated Sites Regulation (BC Reg. 375/96, includes amendments up to B.C. Reg. 4/2014, January 31, 2014 - Schedules 6 and 10).
- CSR - DWCSR groundwater standards for the protection of groundwater used as drinking water.
- BCWQGBC Working Quality Guidelines - Working and Approved
- RDLReported Detection Limit
- *Reported with prefix "MW" in place of "W" on laboratory analytical reports.
- **Laboratory RDL is greater than the applicable working BCWQG.
- Bold**Bold and shaded indicates an exceedance of the Guidelines for Canadian Drinking Water Quality.

Table 1A: Groundwater Analytical Results - 2013 and 2014 Groundwater Monitoring Events, Strong Pit Wells

						Field ID				W11-2*			W11-4*			W11-5*			TRIP BLANK	EQUIPMENT BLANK	FIELD BLANK		
						Date Sampled		07-Jun-13	05-Dec-13	31-Jul-14	06-Jun-13	04-Dec-13	01-Aug-14	05-Jun-13	05-Dec-13	31-Jul-14	05-Dec-13	31-Jul-14	05-Dec-13	13-Jul-14			
Sample Code		L1313281-1	L1400400-5	L1495841-3	L1312951-5	L1399821-1	L1496418-1	L1312210-2	L1400400-3	L1495841-4	L1400400-10	L1495841-5	L1400400-11	L1495841-6									
Chemical Group	Parameter	Unit	RDL	BCWQG	CSR Schedule 6 - DW	GCDWQ																	
Field Parameter	pH (field)	pH units	0.01	6.5 to 8.5	-	6.5 to 8.5				8.1	8.72	8.45	6.53	6.69	6.16	8.09	8.51	8.03	-	-	-	-	
Physical Tests	Turbidity	NTU	0.1	-	-	-				33.7	355	51.7	55.1	30.3	5.96	27.6	13.0	2.96	-	-	-	-	
	TDS (Filtered)	mg/L	10	-	-	500				160	143	140	137	177	152	210	203	215	-	-	-	-	
	Hardness as CaCO3	mg/L	0.5	-	-	-				49.0	39.5	39.9	84.6	124	93.1	171	169	174	-	-	-	-	
	Colour, True	CU	5.0	<15	-	<15				-	<5.0	<5.0	-	<5.0	<5.0	-	<5.0	<5.0	-	-	-	-	
	Conductivity	µS/cm	2.0	-	-	-				-	218	209	-	262	213	-	343	352	-	-	-	-	
	pH	pH	0.1	6.5 to 8.5	-	6.5 to 8.5				-	8.35	8.34	-	7.52	7.49	-	8.29	8.28	-	-	-	-	
Anions and Nutrients	Alkalinity, Total (as CaCO3)	µg/L	2000	-	-	-				-	95900	-	-	103000	-	-	125000	-	-	-	-	-	
	Bromide (Br)	µg/L	50	-	-	-				-	<50	<50	-	84	168	-	<50	<50	-	-	-	-	
	Chloride (Cl)	µg/L	500	250,000	250,000	250,000				-	2900	1420	-	5620	5600	-	7340	7340	-	-	-	-	
	Fluoride (F)	µg/L	20	1,500	1,500	1,500				-	108	113	-	<20	<20	-	41	44	-	-	-	-	
	Nitrate (as N)	µg/L	5.0	10,000	10,000	10,000				-	<5.0	<5.0	-	1930	568	-	2890	3140	-	-	-	-	
	Nitrite (as N)	µg/L	1.0	1,000	3,200	1,000				-	<1.0	<1.0	-	<1.0	<1.0	-	595	665	-	-	-	-	
	Sulfate (SO4)	µg/L	500	218000 to 309000	500,000	500,000				-	13000	12000	-	16600	13900	-	35000	35100	-	-	-	-	
Bacteriological Tests	E. coli	MPN/100mL	1	0 per 100 mL	-	0 per 100 mL				<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
	Coliform Bacteria - Total	MPN/100mL	1	0 per 100 mL	-	0 per 100 mL				<1	<1	<1	2	<1	<1	<1	<1	13	<1	<1	<1	<1	
Dissolved Metals	Aluminum (Filtered)	µg/L	10	200	9500	100 ^{#2}				<10	<10	<10	<10	<10	<10	<10	<10	<10	-	-	-	-	
	Antimony (Filtered)	µg/L	0.5	-	6	6				<0.5	<0.50	<0.50	<0.5	<0.50	<0.50	1.51	1.39	1.53	-	-	-	-	
	Arsenic (Filtered)	µg/L	1	-	10	10				9.2	13.0	12.8	<1	<1.0	<1.0	2.7	2.7	2.4	-	-	-	-	
	Barium (Filtered)	µg/L	20	-	1000	1000				<20	<20	<20	<20	<20	<20	94	88	99	-	-	-	-	
	Beryllium (Filtered)	µg/L	5	-	-	-				<5	<5.0	<5.0	<5	<5.0	<5.0	<5	<5.0	<5.0	-	-	-	-	
	Boron (Filtered)	µg/L	100	-	5000	5000				<100	<100	<100	<100	<100	<100	<100	<100	<100	-	-	-	-	
	Cadmium (Filtered)	µg/L	0.05	-	5	5				<0.05	<0.050	<0.050	<0.05	<0.050	<0.050	0.108	<0.050	<0.050	-	-	-	-	
	Calcium (Filtered)	µg/L	100	-	-	-				12,100	9170	9030	21,500	32700	24800	46,700	46500	47300	-	-	-	-	
	Chromium (III+VI) (Filtered)	µg/L	0.5	-	50	50				<0.5	<0.50	<0.50	<0.5	0.62	<0.50	<0.5	<0.50	<0.50	-	-	-	-	
	Cobalt (Filtered)	µg/L	0.5	-	-	-				<0.5	<0.50	<0.50	<0.5	<0.50	<0.50	<0.5	<0.50	<0.50	-	-	-	-	
	Copper (Filtered)	µg/L	1	-	1000 ^{#1}	1000				<1	<1.0	<1.0	<1	<1.0	<1.0	<1	<1.0	<1.0	-	-	-	-	
	Iron (Filtered)	µg/L	30	-	6500 ^{#1#3}	300				<30	<30	<30	<30	<30	<30	<30	<30	<30	-	-	-	-	
	Lead (Filtered)	µg/L	1	-	10	10				<1	<1.0	<1.0	<1	<1.0	<1.0	<1	<1.0	<1.0	-	-	-	-	
	Lithium (Filtered)	µg/L	50	-	-	-				<50	<50	<50	<50	<50	<50	<50	<50	<50	-	-	-	-	
	Magnesium (Filtered)	µg/L	100	-	100000 ^{#1}	-				4,570	4020	4220	7,500	10200	07560	13,200	13000	13700	-	-	-	-	
	Manganese (Filtered)	µg/L	10	-	550 ^{#1#3}	50				74	75	46	<10	<10	<10	58	60	60	-	-	-	-	
	Mercury (Filtered)	µg/L	0.2	-	1	1				<0.2	<0.20	<0.20	<0.2	<0.20	<0.20	<0.2	<0.20	<0.20	-	-	-	-	
	Molybdenum (Filtered)	µg/L	1	-	250	-				4.4	3.4	3.1	<1	<1.0	<1.0	1.2	1.1	1.1	-	-	-	-	
	Nickel (Filtered)	µg/L	5	-	-	-				<5	<5.0	<5.0	<5	<5.0	<5.0	<5	<5.0	<5.0	-	-	-	-	
	Selenium (Filtered)	µg/L	1	-	10	10				<1	<1.0	<1.0	<1	<1.0	<1.0	<1	<1.0	<1.0	-	-	-	-	
	Silver (Filtered)	µg/L	0.05	-	-	-				<0.05	<0.050	<0.050	<0.05	<0.050	<0.050	<0.05	<0.050	<0.050	-	-	-	-	
	Sodium (Filtered)	µg/L	2000	-	200000 ^{#1}	200000				32,200	29800	29500	5,900	6300	5800	6,700	6100	6500	-	-	-	-	
	Thallium (Filtered)	µg/L	0.2	-	-	-				<0.2	<0.20	<0.20	<0.2	<0.20	<0.20	<0.2	<0.20	<0.20	-	-	-	-	
	Titanium (Filtered)	µg/L	50	-	-	-				<50	<50	<50	<50	<50	<50	<50	<50	<50	-	-	-	-	
	Uranium (Filtered)	µg/L	0.2	-	20	20				0.34	<0.20	<0.20	<0.2	<0.20	<0.20	1.38	1.25	1.26	-	-	-	-	
	Vanadium (Filtered)	µg/L	30	-	-	-				<30	<30	<30	<30	<30	<30	<30	<30	<30	-	-	-	-	
	Zinc (Filtered)	µg/L	5	-	5000 ^{#1}	5000				<5	<5.0	<5.0	7.3	<5.0	<5.0	<5	<5.0	<5.0	-	-	-	-	

NOTES:

1	Concentrations are in µg/L unless otherwise noted.
2	Standard is specific to protection of human health.
3	Standard is for conventional treatment (200 µg/L for other treatments)
-	Standard is no longer applicable based on the CSR Stage 8 Amendments. Results were compared for due diligence purposes.
<	Not analyzed or no applicable CSR standard.
GCDWQ	Concentration is less than the laboratory detection limit indicated.
CSR	Guideline for Canadian Drinking Water Quality (last updated August 2012)
CSR - DW	BC Contaminated Sites Regulation (BC Reg. 375/96, includes amendments up to B.C. Reg. 4/2014, January 31, 2014 - Schedules 6 and 10).
BCWQG	CSR groundwater standards for the protection of groundwater used as drinking water.
RDL	BC Working Quality Guidelines - Working and Approved
*	Reported Detection Limit
**	Reported with prefix "MW" in place of "W" on laboratory analytical reports.
Bold	Reported RDL is greater than the applicable working BCWQG.
	Bold and shaded indicates an exceedance of the Guidelines for Canadian Drinking Water Quality.

Table 1B. Groundwater Analytical Results - 2013 and 2014 Groundwater Monitoring Events ^{s.21} Residential Wells ^{s.21}

			Field ID			
			Date Sampled			
			Sample Code			
Chemical Group	Parameter	Unit	RDL	BCWQG	CSR Schedule 6 - DW	GCDWQ
Field Parameter	pH (field)	pH units	s.21			
Physical Tests	Turbidity	NTU				
	TDS (Filtered)	mg/L				
	Hardness as CaCO3	mg/L				
	Colour, True	CU				
	Conductivity	µS/cm				
	pH	pH				
Anions and Nutrients	Alkalinity, Total (as CaCO3)	µg/L				
	Bromide (Br)	µg/L				
	Chloride (Cl)	µg/L				
	Fluoride (F)	µg/L				
	Nitrate (as N)	µg/L				
	Nitrite (as N)	µg/L				
Bacteriological Tests	Sulfate (SO4)	µg/L				
	E. coli	MPN/100mL				
Total Metals	Coliform Bacteria - Total	MPN/100mL				
	Aluminum	µg/L				
	Antimony	µg/L				
	Arsenic	µg/L				
	Barium	µg/L				
	Beryllium	µg/L				
	Boron	µg/L				
	Cadmium	µg/L				
	Calcium	µg/L				
	Chromium (III+VI)	µg/L				
	Cobalt	µg/L				
	Copper	µg/L				
	Iron	µg/L				
	Lead	µg/L				
	Lithium	µg/L				
	Magnesium	µg/L				
	Manganese	µg/L				
	Mercury	µg/L				
	Molybdenum	µg/L				
	Nickel	µg/L				
	Potassium	µg/L				
	Selenium	µg/L				
	Silver	µg/L				
	Sodium	µg/L				
	Thallium	µg/L				
	Titanium	µg/L				
	Uranium	µg/L				
	Vanadium	µg/L				
	Zinc	µg/L				
Dissolved Metals	Aluminum (Filtered)	µg/L				
	Antimony (Filtered)	µg/L				
	Arsenic (Filtered)	µg/L				
	Barium (Filtered)	µg/L				
	Beryllium (Filtered)	µg/L				
	Boron (Filtered)	µg/L				
	Cadmium (Filtered)	µg/L				
	Calcium (Filtered)	µg/L				
	Chromium (III+VI) (Filtered)	µg/L				
	Cobalt (Filtered)	µg/L				
	Copper (Filtered)	µg/L				
	Iron (Filtered)	µg/L				
	Lead (Filtered)	µg/L				
	Lithium (Filtered)	µg/L				
	Magnesium (Filtered)	µg/L				
	Manganese (Filtered)	µg/L				
	Mercury (Filtered)	µg/L				
	Molybdenum (Filtered)	µg/L				
	Nickel (Filtered)	µg/L				
	Selenium (Filtered)	µg/L				
	Silver (Filtered)	µg/L				
	Sodium (Filtered)	µg/L				
	Thallium (Filtered)	µg/L				
	Titanium (Filtered)	µg/L				
	Uranium (Filtered)	µg/L				
	Vanadium (Filtered)	µg/L				
	Zinc (Filtered)	µg/L				

NOTES:

Concentrations are in µg/L unless otherwise noted.

1 Standard is specific to protection of human health

2 Standard is for conventional treatment (200 µg/L for other treatments)

- Not analyzed or no applicable CSR standard.

< Concentration is less than the laboratory detection limit indicated.

GCDWQ Guideline for Canadian Drinking Water Quality (last updated August 2012)

CSR BC Contaminated Sites Regulation (BC Reg. 375/96, includes amendments up to B.C. Reg. 4/2014, January 31, 2014 - Schedules 6 and 10).

CSR - DW CSR groundwater standards for the protection of groundwater used as drinking water.

BCWQG BC Working Quality Guidelines - Working and Approved

RDL Reported Detection Limit

** Laboratory RDL is greater than the applicable working BCWQG.

Bold Bold and shaded indicates an exceedance of the Guidelines for Canadian Drinking Water Quality.

Table 2: Quality Assurance/Quality Control - July and August 2014 Groundwater Analytical Results

			Field ID	S.21	RPD	W10-17B	DUP #2 (Dup of W10-17B)	RPD
			Date Sampled	31-Jul-14	31-Jul-14	06-Aug-14	06-Aug-14	
			Sample Code	S.21		L1498052-2	L1498052-3	
Chemical Group	Parameter	Unit	RDL					
Physical Tests	Turbidity	NTU	S.21			921	792	15.1%
	TDS (Filtered)	mg/L				245	240	2.1%
	Hardness as CaCO3	mg/L				159	158	0.6%
	Colour, True	CU				<5.0	<5.0	-
	Conductivity	µS/cm				354	353	0.3%
	pH	pH				7.46	7.45	0.1%
Anions and Nutrients	Alkalinity, Total (as CaCO3)	µg/L				-	-	-
	Bromide (Br)	µg/L				<50	<50	-
	Chloride (Cl)	µg/L				19300	19300	-
	Fluoride (F)	µg/L				40	41	2.5%
	Nitrate (as N)	µg/L				2910	2900	0.3%
	Nitrite (as N)	µg/L				<1.0	<1.0	-
Bacteriological Tests	Sulfate (SO4)	µg/L				18200	18100	0.6%
	E. coli	MPN/100mL				<1	<1	-
Total Metals	Coliform Bacteria - Total	MPN/100mL				<1	<1	-
	Aluminum	µg/L				-	-	-
	Antimony	µg/L				-	-	-
	Arsenic	µg/L				-	-	-
	Barium	µg/L				-	-	-
	Beryllium	µg/L				-	-	-
	Boron	µg/L				-	-	-
	Cadmium	µg/L				-	-	-
	Calcium	µg/L				-	-	-
	Chromium (III+VI)	µg/L				-	-	-
	Cobalt	µg/L				-	-	-
	Copper	µg/L				-	-	-
	Iron	µg/L				-	-	-
	Lead	µg/L				-	-	-
	Lithium	µg/L				-	-	-
	Magnesium	µg/L				-	-	-
	Manganese	µg/L				-	-	-
	Mercury	µg/L				-	-	-
	Molybdenum	µg/L				-	-	-
	Nickel	µg/L				-	-	-
	Selenium	µg/L				-	-	-
	Silver	µg/L				-	-	-
	Sodium	µg/L				-	-	-
	Thallium	µg/L				-	-	-
	Titanium	µg/L				-	-	-
	Uranium	µg/L				-	-	-
	Vanadium	µg/L				-	-	-
	Zinc	µg/L				-	-	-
Dissolved Metals	Aluminium (Filtered)	µg/L				<10	<10	-
	Antimony (Filtered)	µg/L				<0.50	<0.50	-
	Arsenic (Filtered)	µg/L				<1.0	<1.0	-
	Barium (Filtered)	µg/L				<20	<20	-
	Beryllium (Filtered)	µg/L				<5.0	<5.0	-
	Boron (Filtered)	µg/L				<100	<100	-
	Cadmium (Filtered)	µg/L				<0.050	<0.050	-
	Calcium (Filtered)	µg/L				42800	42700	0.2%
	Chromium (III+VI) (Filtered)	µg/L				7.33	7.37	0.5%
	Cobalt (Filtered)	µg/L				<0.50	<0.50	-
	Copper (Filtered)	µg/L				<1.0	<1.0	-
	Iron (Filtered)	µg/L				<30	41	-
	Lead (Filtered)	µg/L				<1.0	<1.0	-
	Lithium (Filtered)	µg/L				<50	<50	-
	Magnesium (Filtered)	µg/L				12600	12600	0.0%
	Manganese (Filtered)	µg/L				<10	<10	-
	Mercury (Filtered)	µg/L				<0.20	<0.20	-
	Molybdenum (Filtered)	µg/L				<1.0	<1.0	-
	Nickel (Filtered)	µg/L				<5.0	<5.0	-
	Selenium (Filtered)	µg/L				<1.0	<1.0	-
	Silver (Filtered)	µg/L				0.066	0.145	-
	Sodium (Filtered)	µg/L				10100	10100	-
	Thallium (Filtered)	µg/L				<0.20	<0.20	-
	Titanium (Filtered)	µg/L				<50	<50	-
	Uranium (Filtered)	µg/L				<0.20	<0.20	-
	Vanadium (Filtered)	µg/L				<30	<30	-
	Zinc (Filtered)	µg/L				<5.0	<5.0	-

NOTES:

RPD Relative Percent Difference [%]

RDL Reported Detection Limit

- RPD not calculated

< Concentration is less than the laboratory detection limit indicated.

* RPD is Relative Percentage Difference calculated as $RPD = \frac{C2 - C1}{[(C1 + C2)/2]}$ where C1, C2 = concentrations of parameters in 1st and 2nd sample respectively.

RPDs have only been considered where both concentrations are greater than 5 times the RDL.

High RPDs are in **bold** (acceptable RPD is 30% for inorganics in water, as recommended by BC Ministry of Environment Q&A, and BC Field Sampling Manual).

Table 3: Historical Groundwater Analytical Results by SNC Lavalin 2012: Summary of Analytical Results for Dissolved Inorganics in Groundwater

Sample Location		MW09-1				MW09-6												BC Standards	
Sample ID	Sample Date (yyyy mm dd)	W09-1-120328 2012 03 28	W09-1-120628 2012 06 28	MW09-1-120927 2012 09 27	MW09-1-121213 2012 12 13	W09-6-120328 2012 03 28	W12-A-120328 Duplicate of W09-6-120328	QA/QC RPD %	W09-6-120628 2012 06 28	W12-A-120628 Duplicate of W09-6-120628	QA/QC RPD %	MW09-6-120927 2012 09 27	MW12-A-120927 Duplicate of MW09-6-120927	QA/QC RPD %	MW09-6-121213 2012 12 13	MW12-A-121213 Duplicate of MW09-6-121213	QA/QC RPD %	CSR Drinking Water (DW)	Canadian Drinking Water Quality (DW)
Parameter	Units	Analytical Results																	
Physical Parameters																			
Hardness	µg/L	78,900	79,300	83,500	85,600	109,000	108,000	< 1	105,000	107,000	2	117,000	117,000	0	126,000	124,000	2	n/a	n/a
pH (field)	pH	8.54	7.82	8.5	8.38	7.49	7.49	0	7.63	7.63	0	7.49	7.49	0	7.19	7.19	0	n/a	n/a
Turbidity	NTU	0.46	4.09	1.39	0.13	3.87	5.16	29	2.52	2.3	9	0.55	0.44	*	18	12.5	36	n/a	n/a
Total Dissolved Solids	µg/L	122,000	118,000	114,000	124,000	146,000	142,000	3	138,000	140,000	1	134,000	148,000	10	136,000	172,000	23	n/a	500,000
Dissolved Inorganics																			
Nitrate Nitrogen	µg/L	< 20	< 20	< 20	< 20	4,560	4,400	4	4,160	4,100	2	4,320	4,250	2	5,130	5,230	2	10,000	45,000
Nitrite Nitrogen	µg/L	< 5	< 5	< 5	< 5	17	20	*	7	9.6	*	20.5	20.9	*	41.6	41.2	< 1	3,200	3,200
Nitrate+Nitrite Nitrogen	µg/L	< 20	< 20	< 20	< 20	4,580	4,420	4	4,170	4,110	1	4,340	4,270	2	5,170	5,270	2	10,000	n/a
Sulphate	µg/L	9,630	8,980	10,000	9,260	14,800	15,800	7	14,800	14,700	< 1	16,500	16,600	< 1	15,800	15,400	3	500,000	500,000 (AO)
Total Alkalinity (as CaCO3)	µg/L	102,000	103,000	102,000	102,000	87,900	88,800	1	87,600	88,100	< 1	91,700	92,200	< 1	96,000	95,100	< 1	n/a	n/a
Alkalinity, Phenolphthalein (as CaCO3)	µg/L	< 500	< 500	< 500	< 500	< 500	< 500	*	< 500	< 500	*	< 500	< 500	*	< 500	< 500	*	n/a	n/a
Bicarbonate HCO3	µg/L	124,000	126,000	125,000	125,000	107,000	108,000	< 1	107,000	107,000	0	112,000	113,000	< 1	117,000	116,000	< 1	n/a	n/a
Carbonate CO3	µg/L	< 500	< 500	< 500	< 500	< 500	< 500	*	< 500	< 500	*	< 500	< 500	*	< 500	< 500	*	n/a	n/a
Hydroxide	µg/L	< 500	< 500	< 500	< 500	< 500	< 500	*	< 500	< 500	*	< 500	< 500	*	< 500	< 500	*	n/a	n/a
Geochemical Indicators																			
Dissolved Aluminum	µg/L	10.6	4.5	4.4	6.1	< 3	< 3	*	< 3	< 3	*	< 3	< 3	*	< 3	< 3	*	9,500	100 (AO)
Dissolved Calcium	µg/L	19,100	19,100	20,100	20,500	26,900	26,700	< 1	25,600	25,800	< 1	28,800	28,800	0	31,300	30,600	2	n/a	n/a
Dissolved Iron	µg/L	73	62.3	61.5	64.8	< 5	< 5	*	< 5	< 5	*	< 5	< 5	*	8.5	< 5	*	n/a ^a	300 (AO)
Dissolved Magnesium	µg/L	7,590	7,680	8,070	8,340	10,100	10,100	0	10,000	10,300	3	10,800	11,000	2	11,700	11,500	2	100,000	n/a
Dissolved Manganese	µg/L	58.3	42	49.7	49.7	11.1	11.2	< 1	5	5.1	2	22.1	21.7	2	26.3	26.6	1	n/a ^a	50 (AO)
Dissolved Potassium	µg/L	2,850	2,950	3,130	3,010	1,290	1,290	0	1,260	1,300	3	1,420	1,430	< 1	1,500	1,490	< 1	n/a	n/a
Dissolved Sodium	µg/L	12,000	12,200	12,700	13,000	4,970	5,030	1	5,030	5,110	2	5,290	5,330	< 1	5,660	5,750	2	200,000	200,000 (AO)
Dissolved Metals																			
Antimony	µg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	*	< 0.5	< 0.5	*	< 0.5	< 0.5	*	6	6
Arsenic	µg/L	9	9.21	9.77	9.32	0.44	0.42	*	0.42	0.42	*	0.54	0.54	0	0.59	0.56	5	10	10
Barium	µg/L	37.7	38.5	40.3	40.1	16.1	16.6	3	15.8	15.9	< 1	20.3	20.3	0	22	22.3	1	1,000	1,000
Beryllium	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	*	< 0.1	< 0.1	*	< 0.1	< 0.1	*	< 0.1	< 0.1	*	n/a	n/a
Boron	µg/L	< 50	< 50	< 50	< 50	< 50	< 50	*	< 50	< 50	*	< 50	< 50	*	< 50	< 50	*	5,000	5,000
Cadmium	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	0.033	0.031	*	0.035	0.044	*	0.026	0.023	*	0.019	0.022	*	5	5
Chromium	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	*	< 1	< 1	*	50	50
Cobalt	µg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	*	< 0.5	< 0.5	*	< 0.5	< 0.5	*	n/a	n/a
Copper	µg/L	44.6	< 0.2	< 0.2	< 0.2	0.25	< 0.2	*	0.21	< 0.2	*	0.32	0.23	*	< 0.2	< 0.2	*	1,000	1,000 (AO)
Lead	µg/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	*	< 0.2	< 0.2	*	< 0.2	< 0.2	*	< 0.2	< 0.2	*	10	10
Lithium	µg/L	< 5	< 5	< 5	< 5	< 5	< 5	*	< 5	< 5	*	< 5	< 5	*	< 5	< 5	*	730	n/a
Mercury	µg/L	< 0.01	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	*	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	< 0.05	*	1	1
Molybdenum	µg/L	2.1	2.2	2.2	2.2	< 1	< 1	*	< 1	< 1	*	< 1	< 1	*	< 1	< 1	*	250	n/a
Nickel	µg/L	< 1	< 1	< 1	< 1	2.8	2.8	*	2.2	2.3	*	3.1	3	*	3	3.1	*	n/a	n/a
Selenium	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	0.87	0.91	5	0.75	0.87	15	1.09	1.1	< 1	1.22	1.21	< 1	10	10
Silver	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	*	< 0.02	< 0.02	*	< 0.02	< 0.02	*	< 0.02	< 0.02	*	n/a	n/a
Thallium	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	< 0.05	*	n/a	n/a
Titanium	µg/L	< 5	< 5	< 5	< 5	< 5	< 5	*	< 5	< 5	*	< 5	< 5	*	< 5	< 5	*	n/a	n/a
Uranium	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	*	< 0.1	< 0.1	*	< 0.1	< 0.1	*	0.12	0.12	*	20	20
Vanadium	µg/L	< 5	< 5	< 5	< 5	< 5	< 5	*	< 5	< 5	*	< 5	< 5	*	< 5	< 5	*	n/a	n/a
Zinc	µg/L	< 5	< 5	< 5	< 5	< 5	< 5	*	< 5	< 5	*	< 5	< 5	*	< 5	< 5	*	5,000	5,000

Associated Maxxam file: B225817, B255954, B255959, B286622, B287204, B287205, B2B3121, B2B3568.

All terms defined within the body of SLE's report.

< Denotes concentration less than indicated detection limit or RPD less than indicated value.

- Denotes analysis not conducted.

n/a Denotes no applicable standard.

* RPDs are not normally calculated where one or more concentrations are less than five times MDL.

AO Denotes aesthetic objective.

BOLD	Concentration greater than CSR Drinking Water (DW) standard.
SHADOW	Concentration greater than or equal to Canadian Drinking Water Quality Drinking Water (DW) guideline.

^a As per Stage 8 amendments to the CSR (January 25, 2013).

TABLE 3 (Cont'd): Historical Groundwater Analytical Results by SNC Lavalin 2012: Summary of Analytical Results for Dissolved Inorganics in Groundwater

Sample Location		MW09-13B			MW10-17B				MW10-11	MW11-2			BC Standards	
Sample ID Sample Date (yyyy mm dd)		W09-13B-120628 2012 06 28	MW09-13B-120926 2012 09 26	MW09-13B-121213 2012 12 13	W10-17B-120328 2012 03 28	W10-17B-120628 2012 06 28	MW10-17B-120926 2012 09 26/27	MW10-17B-121213 2012 12 13/14	W10-11-120328 2012 03 28	W11-2-120628 2012 06 28	MW11-2-120926 2012 09 26	MW11-2-121213 2012 12 13/14	CSR Drinking Water (DW)	Canadian Drinking Water Quality (DW)
Parameter	Units	Analytical Results												
Physical Parameters														
Hardness	µg/L	100,000	104,000	109,000	103,000	101,000	107,000	110,000	41,500	39,700	40,600	42,000	n/a	n/a
pH (field)	pH	7.64	7.75	7.21	9.28	7.51	7.22	7.07	8.44	7.92	7.92	8.07	n/a	n/a
Turbidity	NTU	3.96	1.93	1.73	30.7	61.9	20.7	40.4	234	461	162	74.6	n/a	n/a
Total Dissolved Solids	µg/L	166,000	104,000	156,000	138,000	140,000	146,000	134,000	214,000	206,000	195,000	172,000	n/a	500,000
Dissolved Inorganics														
Nitrate Nitrogen	µg/L	7,720	7,690	8,060	2,380	2,540	2,620	2,620	162	35	< 20	123	10,000	45,000
Nitrite Nitrogen	µg/L	< 5	< 5	< 5	26	< 5	< 5	< 5	< 5	58.6	< 5	< 5	3,200	3,200
Nitrate+Nitrite Nitrogen	µg/L	7,720	7,690	8,060	2,410	2,540	2,620	2,620	162	94	< 20	123	10,000	n/a
Sulphate	µg/L	13,900	14,100	14,000	15,700	15,900	16,900	16,200	35,300	29,000	18,800	16,600	500,000	500,000 (AO)
Total Alkalinity (as CaCO3)	µg/L	66,000	67,300	68,900	92,700	88,400	90,300	98,600	133,000	112,000	101,000	103,000	n/a	n/a
Alkalinity, Phenolphthalein (as CaCO3)	µg/L	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	n/a	n/a
Bicarbonate HCO3	µg/L	80,500	82,100	84,100	113,000	108,000	110,000	120,000	163,000	137,000	124,000	125,000	n/a	n/a
Carbonate CO3	µg/L	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	n/a	n/a
Hydroxide	µg/L	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	< 500	n/a	n/a
Geochemical Indicators														
Dissolved Aluminum	µg/L	5.5	< 3	< 3	20	19.5	3.7	4.1	11.8	7.7	12.4	9.2	9,500	100 (AO)
Dissolved Calcium	µg/L	23,400	24,400	25,200	25,100	24,200	25,500	26,200	10,300	9,710	9,750	9,860	n/a	n/a
Dissolved Iron	µg/L	< 5	< 5	< 5	148	193	40.8	29.7	< 5	37.8	12	< 5	n/a ^a	300 (AO)
Dissolved Magnesium	µg/L	10,100	10,500	11,100	9,820	9,950	10,400	10,900	3,810	3,740	3,950	4,220	100,000	n/a
Dissolved Manganese	µg/L	< 1	< 1	< 1	300	61.9	28.4	10.1	195	189	105	110	n/a ^a	50 (AO)
Dissolved Potassium	µg/L	1,510	1,620	1,690	1,340	1,220	1,210	1,200	6,300	5,960	6,440	6,330	n/a	n/a
Dissolved Sodium	µg/L	6,950	7,610	8,030	5,990	5,620	5,890	6,140	32,300	29,900	40,800	35,100	200,000	200,000 (AO)
Dissolved Metals														
Antimony	µg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	6	6
Arsenic	µg/L	1.19	1.36	1.49	1.34	0.59	0.16	0.16	9.74	10.5	12.5	13.2	10	10
Barium	µg/L	10.2	11.2	11.4	20	16.9	18.4	16.2	14.6	13.1	13.9	12.9	1,000	1,000
Beryllium	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	n/a	n/a
Boron	µg/L	< 50	< 50	< 50	< 50	< 50	< 50	< 50	58	61	62	68	5,000	5,000
Cadmium	µg/L	< 0.01	< 0.01	< 0.01	0.028	0.034	0.043	0.037	0.019	< 0.01	< 0.01	< 0.01	5	5
Chromium	µg/L	2.6	2.9	2.9	< 1	< 1	2.1	2.3	< 1	< 1	< 1	< 1	50	50
Cobalt	µg/L	< 0.5	< 0.5	< 0.5	2.47	0.63	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	n/a	n/a
Copper	µg/L	0.26	0.22	0.21	0.55	< 0.2	0.32	< 0.2	0.4	< 0.2	0.49	< 0.2	1,000	1,000 (AO)
Lead	µg/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	10	10
Lithium	µg/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	730	n/a
Mercury	µg/L	< 0.05	< 0.05	< 0.05	< 0.01	< 0.05	< 0.05	< 0.05	< 0.01	< 0.05	< 0.05	< 0.05	1	1
Molybdenum	µg/L	< 1	< 1	< 1	1.5	< 1	< 1	< 1	4.8	4.5	4.3	4.3	250	n/a
Nickel	µg/L	< 1	< 1	< 1	3.9	1.8	1.8	1.5	1.4	< 1	< 1	< 1	n/a	n/a
Selenium	µg/L	0.18	0.22	0.23	0.23	0.22	0.26	0.19	< 0.1	< 0.1	0.16	< 0.1	10	10
Silver	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	n/a	n/a
Thallium	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	n/a	n/a
Titanium	µg/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	n/a	n/a
Uranium	µg/L	< 0.1	< 0.1	0.12	0.12	< 0.1	< 0.1	< 0.1	0.31	0.2	0.27	0.19	20	20
Vanadium	µg/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	n/a	n/a
Zinc	µg/L	< 5	< 5	< 5	6.5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5,000	5,000

Associated Maxxam file: B225817, B255954, B255959, B286622, B287204, B287205, B2B3121, B2B3568.

All terms defined within the body of SLE's report.

< Denotes concentration less than indicated detection limit or RPD less than indicated value.

- Denotes analysis not conducted.

n/a Denotes no applicable standard.

* RPDs are not normally calculated where one or more concentrations are less than five times MDL.

AO Denotes aesthetic objective.

BOLD	Concentration greater than CSR Drinking Water (DW) standard.
SHADOW	Concentration greater than or equal to Canadian Drinking Water Quality Drinking Water (DW) guideline.

^a As per Stage 8 amendments to the CSR (January 25, 2013).

TABLE 3 (Cont'd): Historical Groundwater Analytical Results by SNC Lavalin 2012: Summary of Analytical Results for Dissolved Inorganics in Groundwater

Sample Location		MW11-4			MW11-5			
Sample ID	Sample Date (yyyy mm dd)	W11-4-120628	MW11-4-120926	MW11-4-121213	W11-5-120328	W11-5-120628	MW11-5-120926	MW11-5-121213
		2012 06 28	2012 09 26	2012 12 13/14	2012 03 28	2012 06 28	2012 09 26	2012 12 13
Parameter	Units	Analytical Results						
Physical Parameters								
Hardness	µg/L	120,000	135,000	146,000	143,000	153,000	153,000	160,000
pH (field)	pH	6.7	7.24	6.86	8.58	8.09	8.98	8.05
Turbidity	NTU	52.4	129	0.56	17.1	6.94	162	10.1
Total Dissolved Solids	µg/L	154,000	134,000	48,000	194,000	192,000	178,000	176,000
Dissolved Inorganics								
Nitrate Nitrogen	µg/L	4,070	3,200	< 20	992	< 20	2,420	2,270
Nitrite Nitrogen	µg/L	22.9	< 5	< 5	19	< 5	650	704
Nitrate+Nitrite Nitrogen	µg/L	4,090	3,200	< 20	1,010	< 20	3,070	2,970
Sulphate	µg/L	14,900	12,000	2,950	45,900	36,600	31,900	32,700
Total Alkalinity (as CaCO3)	µg/L	102,000	127,000	37,500	112,000	99,800	120,000	117,000
Alkalinity, Phenolphthalein (as CaCO3)	µg/L	< 500	< 500	< 500	< 500	< 500	< 500	< 500
Bicarbonate HCO3	µg/L	124,000	155,000	45,700	136,000	122,000	147,000	142,000
Carbonate CO3	µg/L	< 500	< 500	< 500	< 500	< 500	< 500	< 500
Hydroxide	µg/L	< 500	< 500	< 500	< 500	< 500	< 500	< 500
Geochemical Indicators								
Dissolved Aluminum	µg/L	< 3	< 3	< 3	5.9	5.5	4.4	5.7
Dissolved Calcium	µg/L	30,300	33,800	36,300	38,300	40,900	41,000	42,600
Dissolved Iron	µg/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Dissolved Magnesium	µg/L	10,700	12,400	13,500	11,400	12,300	12,400	13,000
Dissolved Manganese	µg/L	< 1	< 1	< 1	63.7	53.7	58.2	55.9
Dissolved Potassium	µg/L	1,860	1,940	2,040	3,980	4,340	4,270	4,370
Dissolved Sodium	µg/L	6,220	6,810	7,470	7,230	6,310	6,340	6,630
Dissolved Metals								
Antimony	µg/L	< 0.5	< 0.5	< 0.5	1.76	1.99	1.51	1.65
Arsenic	µg/L	0.27	0.25	0.26	2.55	2.47	2.76	2.73
Barium	µg/L	9.9	10.5	11.7	74.2	90.6	92.4	94.3
Beryllium	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron	µg/L	< 50	< 50	< 50	< 50	< 50	< 50	< 50
Cadmium	µg/L	0.014	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chromium	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cobalt	µg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Copper	µg/L	< 0.2	0.37	< 0.2	0.23	0.38	0.71	0.33
Lead	µg/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Lithium	µg/L	< 5	< 5	< 5	5.6	6	5.8	5.7
Mercury	µg/L	< 0.05	< 0.05	< 0.05	< 0.01	< 0.05	< 0.05	< 0.05
Molybdenum	µg/L	< 1	< 1	< 1	1.9	1.2	1.2	1.2
Nickel	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Selenium	µg/L	0.34	0.27	0.69	0.58	0.66	0.69	0.71
Silver	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Thallium	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Titanium	µg/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Uranium	µg/L	0.12	0.14	0.16	1.55	1.5	1.4	1.44
Vanadium	µg/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Zinc	µg/L	< 5	< 5	< 5	< 5	< 5	< 5	< 5

Associated Maxxam file: B225817, B255954, B255959, B286622, B287204, B287205, B2B3121, B2B3568.

All terms defined within the body of SLE's report.

< Denotes concentration less than indicated detection limit or RPD less than indicated value.

- Denotes analysis not conducted.

n/a Denotes no applicable standard.

* RPDs are not normally calculated where one or more concentrations are less than five times MDL.

AO Denotes aesthetic objective.

BOLD	Concentration greater than CSR Drinking Water (DW) standard.
SHADOW	Concentration greater than or equal to Canadian Drinking Water Quality Drinking Water (DW) guideline.

^a As per Stage 8 amendments to the CSR (January 25, 2013).

SS12	BC Standards	
SS12-1-120927 2012 09 27 (DW)	CSR Drinking Water (DW)	Canadian Drinking Water Quality (DW)
109,000	n/a	n/a
-	n/a	n/a
2.56	n/a	n/a
140,000	n/a	500,000
2,540	10,000	45,000
66	3,200	3,200
2,610	10,000	n/a
27,300	500,000	500,000 (AO)
90,000	n/a	n/a
< 500	n/a	n/a
110,000	n/a	n/a
< 500	n/a	n/a
< 500	n/a	n/a
-	9,500	100 (AO)
-	n/a	n/a
-	n/a ^a	300 (AO)
-	100,000	n/a
-	n/a ^a	50 (AO)
-	n/a	n/a
-	200,000	200,000 (AO)
-	6	6
-	10	10
-	1,000	1,000
-	n/a	n/a
-	5,000	5,000
-	5	5
-	50	50
-	n/a	n/a
-	1,000	1,000 (AO)
-	10	10
-	730	n/a
-	1	1
-	250	n/a
-	n/a	n/a
-	10	10
-	n/a	n/a
-	n/a	n/a
-	n/a	n/a
-	n/a	n/a
-	20	20
-	n/a	n/a
-	5,000	5,000

Table 4: Historical Groundwater Analytical Results by SNC Lavalin 2012: Summary of Analytical Results for Total Metals and Bacteriological Parameters in Groundwater

Sample Location		MW09-1				MW09-6												BC Standards	
Sample ID		W09-1-120328	W09-1-120628	MW09-1-120927	MW09-1-121213	W09-6-120328	W12-A-120328	QA/QC	W09-6-120628	W12-A-120628	QA/QC	MW09-6-120927	MW12-A-120927	QA/QC	MW09-6-121213	MW12-A-121213	QA/QC	CSR Drinking Water (DW)	Canadian Drinking Water Quality (DW)
Sample Date (yyyy mm dd)		2012 03 28	2012 06 28	2012 09 27	2012 12 13	2012 03 28	Duplicate of W09-6-120328	RPD %	2012 06 28	Duplicate of W09-6-120628	RPD %	2012 09 27	Duplicate of MW09-6-120927	RPD %	2012 12 13	Duplicate of MW09-6-121213	RPD %		
Parameter	Units	Analytical Results																	
Physical Parameters																			
Hardness	µg/L	78,900	79,300	83,500	85,600	109,000	108,000	< 1	105,000	107,000	2	117,000	117,000	0	126,000	124,000	2	n/a	n/a
pH (field)	pH	8.54	7.82	8.5	8.38	7.49	7.49	0	7.63	7.63	0	7.49	7.49	0	7.19	7.19	0	n/a	n/a
Turbidity	NTU	0.46	4.09	1.39	0.13	3.87	5.16	29	2.52	2.3	9	0.55	0.44	*	18	12.5	36	n/a	n/a
Total Dissolved Solids	µg/L	122,000	118,000	114,000	124,000	146,000	142,000	3	138,000	140,000	1	134,000	148,000	10	136,000	172,000	23	n/a	500,000
Biochemical oxygen demand	mg/L	-	-	< 10	-	-	-	-	-	-	-	< 10	< 10	*	-	-	-	n/a	n/a
Chemical oxygen demand	mg/L	-	-	< 10	-	-	-	-	-	-	-	< 10	< 10	*	-	-	-	n/a	n/a
Total Metals																			
Aluminum	µg/L	6	-	-	-	114	125	9	-	-	-	-	-	-	-	-	-	9,500	100 (AO)
Antimony	µg/L	< 0.5	-	-	-	< 0.5	< 0.5	*	-	-	-	-	-	-	-	-	-	6	6
Arsenic	µg/L	8.7	-	-	-	0.6	0.5	18	-	-	-	-	-	-	-	-	-	10	10
Barium	µg/L	41	-	-	-	20	21	5	-	-	-	-	-	-	-	-	-	1,000	1,000
Beryllium	µg/L	< 0.1	-	-	-	< 0.1	< 0.1	*	-	-	-	-	-	-	-	-	-	n/a	n/a
Bismuth	µg/L	< 1	-	-	-	< 1	< 1	*	-	-	-	-	-	-	n/a	n/a	-	n/a	n/a
Boron	µg/L	< 50	-	-	-	< 50	< 50	*	-	-	-	-	-	-	-	-	-	5,000	5,000
Cadmium	µg/L	< 0.01	-	-	-	0.05	0.19	117	-	-	-	-	-	-	-	-	-	5	5
Calcium	µg/L	20,100	-	-	-	27,300	28,800	5	-	-	-	-	-	-	-	-	-	n/a	n/a
Chromium	µg/L	< 1	-	-	-	< 1	< 1	*	-	-	-	-	-	-	-	-	-	50	50
Cobalt	µg/L	< 0.5	-	-	-	< 0.5	< 0.5	*	-	-	-	-	-	-	-	-	-	n/a	n/a
Copper	µg/L	< 0.2	-	-	-	0.7	0.7	*	-	-	-	-	-	-	-	-	-	1,000	1,000 (AO)
Iron	µg/L	65	-	-	-	146	158	8	-	-	-	-	-	-	-	-	-	n/a ^c	300 (AO)
Lead	µg/L	< 0.2	-	-	-	< 0.2	< 0.2	*	-	-	-	-	-	-	-	-	-	10	10
Lithium	µg/L	< 5	-	-	-	< 5	< 5	*	-	-	-	-	-	-	-	-	-	730	n/a
Magnesium	µg/L	8,160	-	-	-	10,200	10,500	3	-	-	-	-	-	-	-	-	-	100,000	n/a
Manganese	µg/L	62	-	-	-	30	26	14	-	-	-	-	-	-	-	-	-	n/a ^c	50 (AO)
Mercury	µg/L	< 0.05	-	-	-	< 0.05	< 0.05	*	-	-	-	-	-	-	-	-	-	1	1
Molybdenum	µg/L	2	-	-	-	< 1	< 1	*	-	-	-	-	-	-	-	-	-	250	n/a
Nickel	µg/L	< 1	-	-	-	4	3	*	-	-	-	-	-	-	-	-	-	n/a	n/a
Potassium	µg/L	3,120	-	-	-	1,380	1,360	2	-	-	-	-	-	-	-	-	-	n/a	n/a
Selenium	µg/L	< 0.1	-	-	-	1	0.9	11	-	-	-	-	-	-	-	-	-	10	10
Silicon	µg/L	8,850	-	-	-	8,230	8,740	6	-	-	-	-	-	-	-	-	-	n/a	n/a
Silver	µg/L	< 0.02	-	-	-	< 0.02	< 0.02	*	-	-	-	-	-	-	-	-	-	n/a	n/a
Sodium	µg/L	12,900	-	-	-	5,370	5,250	2	-	-	-	-	-	-	-	-	-	200,000	200,000 (AO)
Strontium	µg/L	74	-	-	-	102	103	< 1	-	-	-	-	-	-	-	-	-	22,000	n/a
Sulphur	µg/L	3,700	-	-	-	3,700	< 3,000	*	-	-	-	-	-	-	-	-	-	n/a	n/a
Thallium	µg/L	< 0.05	-	-	-	< 0.05	< 0.05	*	-	-	-	-	-	-	-	-	-	n/a	n/a
Tin	µg/L	< 5	-	-	-	< 5	< 5	*	-	-	-	-	-	-	-	-	-	22,000	n/a
Titanium	µg/L	< 5	-	-	-	8	7	*	-	-	-	-	-	-	-	-	-	n/a	n/a
Uranium	µg/L	< 0.1	-	-	-	< 0.1	< 0.1	*	-	-	-	-	-	-	-	-	-	20	20
Vanadium	µg/L	< 5	-	-	-	< 5	< 5	*	-	-	-	-	-	-	-	-	-	n/a	n/a
Zinc	µg/L	< 5	-	-	-	< 5	< 5	*	-	-	-	-	-	-	-	-	-	5,000	5,000
Zirconium	µg/L	< 0.5	-	-	-	< 0.5	< 0.5	*	-	-	-	-	-	-	-	-	-	n/a	n/a
Bacteriological Parameters																			
Fecal Coliform	MPN/0.1L	-	-	-	< 1	-	-	-	-	-	-	-	-	-	< 1	< 1	*	n/a	0 per 100 mL
Total Coliform	MPN/0.1L	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	*	1	< 1	*	n/a	0 per 100 mL
E. Coli (MPN/100mL)	MPN/0.1L	< 1	< 1	< 1	-	< 1	< 1	*	< 1	< 1	*	< 1	< 1	*	-	-	-	n/a	0 per 100 mL

Associated Maxxam file: B225817, B255954, B255959, B286622, B287204, B287205, B2B3121, B2B3568.

All terms defined within the body of SLE's report.

< Denotes concentration less than indicated detection limit or RPD less than indicated value.

- Denotes analysis not conducted.

n/a Denotes no applicable standard.

* RPDs are not normally calculated where one or more concentrations are less than five times MDL.

AO Denotes aesthetic objective.

BOLD	Concentration greater than CSR Drinking Water (DW) standard.
SHADOW	Concentration greater than or equal to Canadian Drinking Water Quality Drinking Water (DW) guideline.

^a Minimum total coliform count due to high bacterial growth interference.

^b Laboratory detection limit exceeds regulatory standard.

^c As per Stage 8 amendments to the CSR (January 25, 2013).

TABLE 4 (Cont'd): Historical Groundwater Analytical Results by SNC Lavalin 2012: Summary of Analytical Results for Total Metals and Bacteriological Parameters in Groundwater

Sample Location		MW09-13B			MW10-11	MW10-17B				MW11-2			BC Standards		
Sample ID	Sample Date (yyyy mm dd)	W09-13B-120628 2012 06 28	MW09-13B-120926 2012 09 26/27	MW09-13B-121213 2012 12 13	W10-11-120328 2012 03 28	W10-17B-120328 2012 03 28	W10-17B-120628 2012 06 28	MW10-17B-120926 2012 09 26/27	MW10-17B-121213 2012 12 13/14	W11-2-120628 2012 06 28	MW11-2-120926 2012 09 26/27	MW11-2-121213 2012 12 13/14	CSR Drinking Water (DW)	Canadian Drinking Water Quality (DW)	
Parameter	Units	Analytical Results													
Physical Parameters															
Hardness	µg/L	100,000	104,000	109,000	41,500	103,000	101,000	107,000	110,000	39,700	40,600	42,000	n/a	n/a	
pH (field)	pH	7.64	7.75	7.21	8.44	9.28	7.51	7.22	7.07	7.92	7.92	8.07	n/a	n/a	
Turbidity	NTU	3.96	1.93	1.73	234	30.7	61.9	20.7	40.4	461	162	74.6	n/a	n/a	
Total Dissolved Solids	µg/L	166,000	104,000	156,000	214,000	138,000	140,000	146,000	134,000	206,000	195,000	172,000	n/a	500,000	
Biochemical oxygen demand	mg/L	-	< 10	-	-	-	-	< 10	-	-	-	-	n/a	n/a	
Chemical oxygen demand	mg/L	-	< 10	-	-	-	-	< 10	-	-	-	-	n/a	n/a	
Total Metals															
Aluminum	µg/L	-	-	-	8,150	1,550	-	-	-	-	-	-	9,500	100 (AO)	
Antimony	µg/L	-	-	-	< 0.5	< 0.5	-	-	-	-	-	-	6	6	
Arsenic	µg/L	-	-	-	7.4	1.2	-	-	-	-	-	-	10	10	
Barium	µg/L	-	-	-	90	39	-	-	-	-	-	-	1,000	1,000	
Beryllium	µg/L	-	-	-	0.6	< 0.1	-	-	-	-	-	-	n/a	n/a	
Bismuth	µg/L	-	-	-	< 1	< 1	-	-	-	-	-	-	n/a	n/a	
Boron	µg/L	-	-	-	57	< 50	-	-	-	-	-	-	5,000	5,000	
Cadmium	µg/L	-	-	-	0.23	0.13	-	-	-	-	-	-	5	5	
Calcium	µg/L	-	-	-	21,300	27,400	-	-	-	-	-	-	n/a	n/a	
Chromium	µg/L	-	-	-	13	4	-	-	-	-	-	-	50	50	
Cobalt	µg/L	-	-	-	4.9	1.9	-	-	-	-	-	-	n/a	n/a	
Copper	µg/L	-	-	-	13.5	3.8	-	-	-	-	-	-	1,000	1,000 (AO)	
Iron	µg/L	-	-	-	9,640	2,350	-	-	-	-	-	-	n/a ^c	300 (AO)	
Lead	µg/L	-	-	-	4.1	0.8	-	-	-	-	-	-	10	10	
Lithium	µg/L	-	-	-	8	< 5	-	-	-	-	-	-	730	n/a	
Magnesium	µg/L	-	-	-	10,000	10,900	-	-	-	-	-	-	100,000	n/a	
Manganese	µg/L	-	-	-	433	180	-	-	-	-	-	-	n/a ^c	50 (AO)	
Mercury	µg/L	-	-	-	< 0.05	< 0.05	-	-	-	-	-	-	1	1	
Molybdenum	µg/L	-	-	-	9	1	-	-	-	-	-	-	250	n/a	
Nickel	µg/L	-	-	-	15	6	-	-	-	-	-	-	n/a	n/a	
Potassium	µg/L	-	-	-	8,530	1,550	-	-	-	-	-	-	n/a	n/a	
Selenium	µg/L	-	-	-	0.2	0.3	-	-	-	-	-	-	10	10	
Silicon	µg/L	-	-	-	22,900	12,800	-	-	-	-	-	-	n/a	n/a	
Silver	µg/L	-	-	-	0.05	0.04	-	-	-	-	-	-	n/a	n/a	
Sodium	µg/L	-	-	-	44,700	6,720	-	-	-	-	-	-	200,000	200,000 (AO)	
Strontium	µg/L	-	-	-	169	133	-	-	-	-	-	-	22,000	n/a	
Sulphur	µg/L	-	-	-	10,700	< 3,000	-	-	-	-	-	-	n/a	n/a	
Thallium	µg/L	-	-	-	0.09	< 0.05	-	-	-	-	-	-	n/a	n/a	
Tin	µg/L	-	-	-	9	< 5	-	-	-	-	-	-	22,000	n/a	
Titanium	µg/L	-	-	-	334	72	-	-	-	-	-	-	n/a	n/a	
Uranium	µg/L	-	-	-	2.7	0.1	-	-	-	-	-	-	20	20	
Vanadium	µg/L	-	-	-	16	< 5	-	-	-	-	-	-	n/a	n/a	
Zinc	µg/L	-	-	-	29	14	-	-	-	-	-	-	5,000	5,000	
Zirconium	µg/L	-	-	-	3	< 0.5	-	-	-	-	-	-	n/a	n/a	
Bacteriological Parameters															
Fecal Coliform	MPN/0.1L	-	-	< 1	-	-	-	-	-	-	-	-	n/a	0 per 100 mL	
Total Coliform	MPN/0.1L	< 1	< 1	8	380 ^a	< 1	36	25	1,200	100	< 10 ^b	350	n/a	0 per 100 mL	
E. Coli (MPN/100mL)	MPN/0.1L	< 1	< 1	-	< 1	< 1	< 1	< 1	< 1	< 1	< 10 ^b	< 1	n/a	0 per 100 mL	

Associated Maxxam file: B225817, B255954, B255959, B286622, B287204, B287205, B2B3121, B2B3568.

All terms defined within the body of SLE's report.

< Denotes concentration less than indicated detection limit or RPD less than indicated value.

- Denotes analysis not conducted.

n/a Denotes no applicable standard.

* RPDs are not normally calculated where one or more concentrations are less than five times MDL.

AO Denotes aesthetic objective.

BOLD Concentration greater than CSR Drinking Water (DW) standard.

SHADOW Concentration greater than or equal to Canadian Drinking Water Quality Drinking Water (DW) guideline.

^a Minimum total coliform count due to high bacterial growth interference.

^b Laboratory detection limit exceeds regulatory standard.

^c As per Stage 8 amendments to the CSR (January 25, 2013).

TABLE 4 (Cont'd): Historical Groundwater Analytical Results by SNC Lavalin 2012: Summary of Analytical Results for Total Metals and Bacteriological Parameters in Groundwater

Sample Location		MW11-4			MW11-5				s.21	BC Standards	
Sample ID	Sample Date (yyyy mm dd)	W11-4-120628 2012 06 28	MW11-4-120926 2012 09 26/27	MW11-4-121213 2012 12 13/14	W11-5-120328 2012 03 28	W11-5-120628 2012 06 28	MW11-5-120926 2012 09 26/27	MW11-5-121213 2012 12 13		CSR Drinking Water (DW)	Canadian Drinking Water Quality (DW)
Parameter	Units	Anal									
Physical Parameters											
Hardness	µg/L	120,000	135,000	146,000	143,000	153,000	153,000	160,000			
pH (field)	pH	6.7	7.24	6.86	8.58	8.09	8.98	8.05			
Turbidity	NTU	52.4	129	0.56	17.1	6.94	162	10.1			
Total Dissolved Solids	µg/L	154,000	134,000	48,000	194,000	192,000	178,000	176,000			
Biochemical oxygen demand	mg/L	-	< 10	-	-	-	< 10	-			
Chemical oxygen demand	mg/L	-	12	-	-	-	< 10	-			
Total Metals											
Aluminum	µg/L	-	-	-	1,080	-	-	-			
Antimony	µg/L	-	-	-	1.6	-	-	-			
Arsenic	µg/L	-	-	-	3.3	-	-	-			
Barium	µg/L	-	-	-	79	-	-	-			
Beryllium	µg/L	-	-	-	< 0.1	-	-	-			
Bismuth	µg/L	-	-	-	< 1	-	-	-			
Boron	µg/L	-	-	-	< 50	-	-	-			
Cadmium	µg/L	-	-	-	0.03	-	-	-			
Calcium	µg/L	-	-	-	38,500	-	-	-			
Chromium	µg/L	-	-	-	2	-	-	-			
Cobalt	µg/L	-	-	-	0.7	-	-	-			
Copper	µg/L	-	-	-	3.5	-	-	-			
Iron	µg/L	-	-	-	1,250	-	-	-			
Lead	µg/L	-	-	-	0.6	-	-	-			
Lithium	µg/L	-	-	-	7	-	-	-			
Magnesium	µg/L	-	-	-	10,900	-	-	-			
Manganese	µg/L	-	-	-	55	-	-	-			
Mercury	µg/L	-	-	-	< 0.05	-	-	-			
Molybdenum	µg/L	-	-	-	5	-	-	-			
Nickel	µg/L	-	-	-	3	-	-	-			
Potassium	µg/L	-	-	-	4,450	-	-	-			
Selenium	µg/L	-	-	-	0.7	-	-	-			
Silicon	µg/L	-	-	-	6,270	-	-	-			
Silver	µg/L	-	-	-	< 0.02	-	-	-			
Sodium	µg/L	-	-	-	13,000	-	-	-			
Strontium	µg/L	-	-	-	183	-	-	-			
Sulphur	µg/L	-	-	-	13,300	-	-	-			
Thallium	µg/L	-	-	-	< 0.05	-	-	-			
Tin	µg/L	-	-	-	< 5	-	-	-			
Titanium	µg/L	-	-	-	51	-	-	-			
Uranium	µg/L	-	-	-	2.3	-	-	-			
Vanadium	µg/L	-	-	-	< 5	-	-	-			
Zinc	µg/L	-	-	-	7	-	-	-			
Zirconium	µg/L	-	-	-	0.6	-	-	-			
Bacteriological Parameters											
Fecal Coliform	MPN/0.1L	-	-	-	-	-	-	< 1			
Total Coliform	MPN/0.1L	64	< 10 ^b	48	< 1	< 1	< 10 ^b	< 1			
E. Coli (MPN/100mL)	MPN/0.1L	< 1	< 10 ^b	< 1	< 1	< 1	< 10 ^b	-			

Associated Maxxam file: B225817, B255954, B255959, B286622, B287204, B287205, B2B3121, B2B3568.

All terms defined within the body of SLE's report.

< Denotes concentration less than indicated detection limit or RPD less than indicated value.

- Denotes analysis not conducted.

n/a Denotes no applicable standard.

* RPDs are not normally calculated where one or more concentrations are less than five times MDL.

AO Denotes aesthetic objective.

BOLD Concentration greater than CSR Drinking Water (DW) standard.

SHADOW Concentration greater than or equal to Canadian Drinking Water Quality Drinking Water (DW) guideline.

^a Minimum total coliform count due to high bacterial growth interference.

^b Laboratory detection limit exceeds regulatory standard.

^c As per Stage 8 amendments to the CSR (January 25, 2013).

TABLE 4 (Cont'd): Historical Groundwater Analytical Results by SNC Lavalin 2012: Summary of Analytical Results for Total Metals and Bacteriological Parameters in Gro

Sample Location s.21	
Sample ID	
Sample Date (yyyy mm dd)	
Parameter	Units
Physical Parameters	
Hardness	µg/L
pH (field)	pH
Turbidity	NTU
Total Dissolved Solids	µg/L
Biochemical oxygen demand	mg/L
Chemical oxygen demand	mg/L
Total Metals	
Aluminum	µg/L
Antimony	µg/L
Arsenic	µg/L
Barium	µg/L
Beryllium	µg/L
Bismuth	µg/L
Boron	µg/L
Cadmium	µg/L
Calcium	µg/L
Chromium	µg/L
Cobalt	µg/L
Copper	µg/L
Iron	µg/L
Lead	µg/L
Lithium	µg/L
Magnesium	µg/L
Manganese	µg/L
Mercury	µg/L
Molybdenum	µg/L
Nickel	µg/L
Potassium	µg/L
Selenium	µg/L
Silicon	µg/L
Silver	µg/L
Sodium	µg/L
Strontium	µg/L
Sulphur	µg/L
Thallium	µg/L
Tin	µg/L
Titanium	µg/L
Uranium	µg/L
Vanadium	µg/L
Zinc	µg/L
Zirconium	µg/L
Bacteriological Parameters	
Fecal Coliform	MPN/0.1L
Total Coliform	MPN/0.1L
E. Coli (MPN/100mL)	MPN/0.1L

SS12	BC Standards	
SS12-1-120927 2012 09 27	CSR Drinking Water (DW)	Canadian Drinking Water Quality (DW)
109,000	n/a	n/a
-	n/a	n/a
2.56	n/a	n/a
140,000	n/a	500,000
< 10	n/a	n/a
< 10	n/a	n/a
208	9,500	100 (AO)
< 0.5	6	6
0.93	10	10
14.6	1,000	1,000
< 0.1	n/a	n/a
< 1	n/a	n/a
< 50	5,000	5,000
< 0.01	5	5
26,700	n/a	n/a
< 1	50	50
< 0.5	n/a	n/a
1.36	1,000	1,000 (AO)
209	n/a ^c	300 (AO)
< 0.2	10	10
< 5	730	n/a
10,300	100,000	n/a
14.1	n/a ^c	50 (AO)
< 0.05	1	1
< 1	250	n/a
< 1	n/a	n/a
1,640	n/a	n/a
0.3	10	10
4,510	n/a	n/a
< 0.02	n/a	n/a
8,920	200,000	200,000 (AO)
134	22,000	n/a
7,700	n/a	n/a
< 0.05	n/a	n/a
< 5	22,000	n/a
8.2	n/a	n/a
0.19	20	20
< 5	n/a	n/a
< 5	5,000	5,000
< 0.5	n/a	n/a
-	n/a	0 per 100 mL
1,000	n/a	0 per 100 mL
80	n/a	0 per 100 mL

Associated Maxxam file: B225817, B255954, B255959, B286622, B287204, B287205, B2B3121, B2B3568.

All terms defined within the body of SLE's report.

< Denotes concentration less than indicated detection limit or RPD less than indicated value.

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BOLD Concentration greater than CSR Drinking Water (DW) standard.

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^a Minimum total coliform count due to high bacterial growth interference.

^b Laboratory detection limit exceeds regulatory standard.

^c As per Stage 8 amendments to the CSR (January 25, 2013).

FIGURES

Figure 1	Site Location Plan
Figure 2	Site Plan
Figure 3	Groundwater Elevations

Q:\Vancouver\Drafting\Environmental\2321\23203143-01\23203143-01 Fig.1_R0.dwg [FIGURE 1] May 28, 2014 - 9:19:32 am (BY: BUCHAN, CAMERON)



LEGEND

--- Canada/USA Border

0 2 500
Scale: 1: 50 000 (metres)

CLIENT



Ministry of
Transportation
and Infrastructure



TETRA TECH EBA

**BIANNUAL WATER MONITORING PROGRAM
STRONG PIT - ABBOTSFORD, BC**

SITE LOCATION PLAN

PROJECT NO.
V23203143-01

DWN
CB

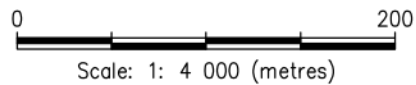
CKD
JS

REV
0

OFFICE
EBA-WHSE

DATE
July 10, 2013

Figure 1

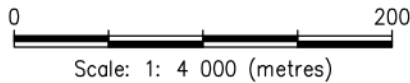


1. IN 2012, A NEW WELL (W10-17B) WAS DRILLED ADJACENT TO THE ORIGINAL WELL W10-17.
2. IN 2012, A NEW WELL (W11-2) WAS DRILLED TO REPLACE W10-2 DUE TO THE OBSTRUCTION IDENTIFIED IN THE WELL.

Ministry of
Transportation
and Infrastructure

PROJECT NO. V23203143-01	DWN CB	CKD JS	REV 0
OFFICE EBA-WHSE	DATE July 10, 2013		

Page 30 of 66 TRA-2015-51480



1. IN 2012, A NEW WELL (W10-17B) WAS DRILLED ADJACENT TO THE ORIGINAL WELL W10-17.
2. IN 2012, A NEW WELL (W11-2) WAS DRILLED TO REPLACE W10-2 DUE TO THE OBSTRUCTION IDENTIFIED IN THE WELL.

ISSUED FOR USE



BRITISH COLUMBIA
The Best Place on Earth

Ministry of
Transportation
and InfrastructureBIANNUAL WATER MONITORING PROGRAM
STRONG PIT - ABBOTSFORD, BC

GROUNDWATER ELEVATIONS

PROJECT NO. V23203143-01	DWN CB	CKD JS	REV 0	Figure 3
OFFICE EBA-WHSE	DATE July 10, 2013			

APPENDIX A

TETRA TECH EBA'S GEOENVIRONMENTAL REPORT - GENERAL CONDITIONS

GENERAL CONDITIONS

GEOENVIRONMENTAL REPORT

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

1.0 USE OF REPORT AND OWNERSHIP

This report pertains to a specific site, a specific development, and a specific scope of work. It 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 or proposed development would necessitate a supplementary investigation and assessment.

This report and the assessments and recommendations contained in it are intended for the sole use of Tetra Tech EBA's client. Tetra Tech EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than Tetra Tech EBA's Client unless otherwise authorized in writing by Tetra Tech EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of Tetra Tech EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where Tetra Tech EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed Tetra Tech EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by Tetra Tech EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of Tetra Tech EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except Tetra Tech EBA. The Client warrants that Tetra Tech EBA's instruments of professional service will be used only and exactly as submitted by Tetra Tech EBA.

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

3.0 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by Tetra Tech EBA in its reasonably exercised discretion.

4.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

During the performance of the work and the preparation of the report, Tetra Tech EBA may rely on information provided by persons other than the Client. While Tetra Tech EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

APPENDIX B

LABORATORY ANALYTICAL REPORTS (JULY/AUGUST 2014)



Tetra Tech EBA Inc.
ATTN: Jelena Sladojevic
Oceanic Plaza, 9th Floor
1066 West Hastings St.
Vancouver BC V6E 3X2

Date Received: 31-JUL-14
Report Date: 07-AUG-14 18:22 (MT)
Version: FINAL

Client Phone: 604-685-0275

Certificate of Analysis

Lab Work Order #: L1495841
Project P.O. #: NOT SUBMITTED
Job Reference: V23203143-01
C of C Numbers: 10-378879
Legal Site Desc:

Comments: ADDITIONAL 06-AUG-14 19:35

Brent Mack
Account Manager

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

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1495841-1 WATER 31-JUL-14 10:30 MW09-6	L1495841-2 WATER 31-JUL-14 11:45 MW09-1	L1495841-3 WATER 31-JUL-14 13:45 MW10-11	L1495841-4 WATER 31-JUL-14 15:30 MW11-5	L1495841-5 WATER 31-JUL-14 11:50 BLANK 1
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	<5.0	<5.0	<5.0	<5.0	
	Conductivity (uS/cm)	277	215	209	352	
	Hardness (as CaCO3) (ug/L)	137000	85000	39900	174000	
	pH (pH)	7.83	8.26	8.34	8.28	
	Total Dissolved Solids (ug/L)	177000	138000	140000	215000	
	Turbidity (NTU)	1.45	0.25	51.7	2.96	
Anions and Nutrients	Bromide (Br) (ug/L)	<50	<50	<50	<50	
	Chloride (Cl) (ug/L)	6080	1410	1420	7340	
	Fluoride (F) (ug/L)	54	103	113	44	
	Nitrate (as N) (ug/L)	3560	32.7	<5.0	3140	
	Nitrite (as N) (ug/L)	39.3	<1.0	<1.0	665	
	Sulfate (SO4) (ug/L)	19000	10100	12000	35100	
Bacteriological Tests	E. coli (MPN/100mL)	<1	<1	<1	<1	<1
	Coliform Bacteria - Total (MPN/100mL)	<1	<1	<1	13	<1
Total Metals	Aluminum (Al)-Total (ug/L)					
	Antimony (Sb)-Total (ug/L)					
	Arsenic (As)-Total (ug/L)					
	Barium (Ba)-Total (ug/L)					
	Beryllium (Be)-Total (ug/L)					
	Boron (B)-Total (ug/L)					
	Cadmium (Cd)-Total (ug/L)					
	Calcium (Ca)-Total (ug/L)					
	Chromium (Cr)-Total (ug/L)					
	Cobalt (Co)-Total (ug/L)					
	Copper (Cu)-Total (ug/L)					
	Iron (Fe)-Total (ug/L)					
	Lead (Pb)-Total (ug/L)					
	Lithium (Li)-Total (ug/L)					
	Magnesium (Mg)-Total (ug/L)					
	Manganese (Mn)-Total (ug/L)					
	Mercury (Hg)-Total (ug/L)					
	Molybdenum (Mo)-Total (ug/L)					
	Nickel (Ni)-Total (ug/L)					
	Selenium (Se)-Total (ug/L)					
	Silver (Ag)-Total (ug/L)					
	Sodium (Na)-Total (ug/L)					

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		s.21	WATER 31-JUL-14 11:53 BLANK 2	WATER 31-JUL-14 13:25 s.21	WATER 31-JUL-14 14:00	WATER 31-JUL-14 14:40	WATER 31-JUL-14 15:40
Grouping	Analyte						
WATER				s.21			
Physical Tests	Colour, True (CU)						
	Conductivity (uS/cm)						
	Hardness (as CaCO3) (ug/L)						
	pH (pH)						
	Total Dissolved Solids (ug/L)						
	Turbidity (NTU)						
Anions and Nutrients	Bromide (Br) (ug/L)						
	Chloride (Cl) (ug/L)						
	Fluoride (F) (ug/L)						
	Nitrate (as N) (ug/L)						
	Nitrite (as N) (ug/L)						
	Sulfate (SO4) (ug/L)						
Bacteriological Tests	E. coli (MPN/100mL)	<1					
	Coliform Bacteria - Total (MPN/100mL)	<1					
Total Metals	Aluminum (Al)-Total (ug/L)						
	Antimony (Sb)-Total (ug/L)						
	Arsenic (As)-Total (ug/L)						
	Barium (Ba)-Total (ug/L)						
	Beryllium (Be)-Total (ug/L)						
	Boron (B)-Total (ug/L)						
	Cadmium (Cd)-Total (ug/L)						
	Calcium (Ca)-Total (ug/L)						
	Chromium (Cr)-Total (ug/L)						
	Cobalt (Co)-Total (ug/L)						
	Copper (Cu)-Total (ug/L)						
	Iron (Fe)-Total (ug/L)						
	Lead (Pb)-Total (ug/L)						
	Lithium (Li)-Total (ug/L)						
	Magnesium (Mg)-Total (ug/L)						
	Manganese (Mn)-Total (ug/L)						
	Mercury (Hg)-Total (ug/L)						
	Molybdenum (Mo)-Total (ug/L)						
	Nickel (Ni)-Total (ug/L)						
	Selenium (Se)-Total (ug/L)						
	Silver (Ag)-Total (ug/L)						
	Sodium (Na)-Total (ug/L)						

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	s.21				
		Description	WATER				
		Sampled Date	31-JUL-14				
		Sampled Time					
		Client ID	s.21				
Grouping	Analyte						
WATER		s.21					
Physical Tests	Colour, True (CU)						
	Conductivity (uS/cm)						
	Hardness (as CaCO3) (ug/L)						
	pH (pH)						
	Total Dissolved Solids (ug/L)						
	Turbidity (NTU)						
Anions and Nutrients	Bromide (Br) (ug/L)						
	Chloride (Cl) (ug/L)						
	Fluoride (F) (ug/L)						
	Nitrate (as N) (ug/L)						
	Nitrite (as N) (ug/L)						
	Sulfate (SO4) (ug/L)						
Bacteriological Tests	E. coli (MPN/100mL)						
	Coliform Bacteria - Total (MPN/100mL)						
Total Metals	Aluminum (Al)-Total (ug/L)						
	Antimony (Sb)-Total (ug/L)						
	Arsenic (As)-Total (ug/L)						
	Barium (Ba)-Total (ug/L)						
	Beryllium (Be)-Total (ug/L)						
	Boron (B)-Total (ug/L)						
	Cadmium (Cd)-Total (ug/L)						
	Calcium (Ca)-Total (ug/L)						
	Chromium (Cr)-Total (ug/L)						
	Cobalt (Co)-Total (ug/L)						
	Copper (Cu)-Total (ug/L)						
	Iron (Fe)-Total (ug/L)						
	Lead (Pb)-Total (ug/L)						
	Lithium (Li)-Total (ug/L)						
	Magnesium (Mg)-Total (ug/L)						
	Manganese (Mn)-Total (ug/L)						
	Mercury (Hg)-Total (ug/L)						
	Molybdenum (Mo)-Total (ug/L)						
	Nickel (Ni)-Total (ug/L)						
	Selenium (Se)-Total (ug/L)						
	Silver (Ag)-Total (ug/L)						
	Sodium (Na)-Total (ug/L)						

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1495841-1 WATER 31-JUL-14 10:30 MW09-6	L1495841-2 WATER 31-JUL-14 11:45 MW09-1	L1495841-3 WATER 31-JUL-14 13:45 MW10-11	L1495841-4 WATER 31-JUL-14 15:30 MW11-5	L1495841-5 WATER 31-JUL-14 11:50 BLANK 1
Grouping	Analyte					
WATER						
Total Metals	Thallium (Tl)-Total (ug/L)					
	Titanium (Ti)-Total (ug/L)					
	Uranium (U)-Total (ug/L)					
	Vanadium (V)-Total (ug/L)					
	Zinc (Zn)-Total (ug/L)					
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Aluminum (Al)-Dissolved (ug/L)	<10	<10	<10	<10	
	Antimony (Sb)-Dissolved (ug/L)	<0.50	<0.50	<0.50	1.53	
	Arsenic (As)-Dissolved (ug/L)	<1.0	9.4	12.8	2.4	
	Barium (Ba)-Dissolved (ug/L)	22	40	<20	99	
	Beryllium (Be)-Dissolved (ug/L)	<5.0	<5.0	<5.0	<5.0	
	Boron (B)-Dissolved (ug/L)	<100	<100	<100	<100	
	Cadmium (Cd)-Dissolved (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Calcium (Ca)-Dissolved (ug/L)	35000	20600	9030	47300	
	Chromium (Cr)-Dissolved (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Cobalt (Co)-Dissolved (ug/L)	<0.50	<0.50	<0.50	<0.50	
	Copper (Cu)-Dissolved (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Iron (Fe)-Dissolved (ug/L)	<30	43	<30	<30	
	Lead (Pb)-Dissolved (ug/L)	<1.0	<1.0	<1.0	<1.0	
	Lithium (Li)-Dissolved (ug/L)	<50	<50	<50	<50	
	Magnesium (Mg)-Dissolved (ug/L)	12100	8160	4220	13700	
	Manganese (Mn)-Dissolved (ug/L)	28	47	46	60	
	Mercury (Hg)-Dissolved (ug/L)	<0.20	<0.20	<0.20	<0.20	
	Molybdenum (Mo)-Dissolved (ug/L)	<1.0	2.2	3.1	1.1	
	Nickel (Ni)-Dissolved (ug/L)	<5.0	<5.0	<5.0	<5.0	
	Selenium (Se)-Dissolved (ug/L)	1.3	<1.0	<1.0	<1.0	
	Silver (Ag)-Dissolved (ug/L)	<0.050	<0.050	<0.050	<0.050	
	Sodium (Na)-Dissolved (ug/L)	5800	12900	29500	6500	
	Thallium (Tl)-Dissolved (ug/L)	<0.20	<0.20	<0.20	<0.20	
	Titanium (Ti)-Dissolved (ug/L)	<50	<50	<50	<50	
	Uranium (U)-Dissolved (ug/L)	<0.20	<0.20	<0.20	1.26	
	Vanadium (V)-Dissolved (ug/L)	<30	<30	<30	<30	
	Zinc (Zn)-Dissolved (ug/L)	<5.0	5.4	<5.0	<5.0	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		s.21 WATER 31-JUL-14 11:53 BLANK 2	WATER 31-JUL-14 13:25 s.21	WATER 31-JUL-14 14:00	WATER 31-JUL-14 14:40	WATER 31-JUL-14 15:40
Grouping	Analyte					
WATER			s.21			
Total Metals	Thallium (Tl)-Total (ug/L)					
	Titanium (Ti)-Total (ug/L)					
	Uranium (U)-Total (ug/L)					
	Vanadium (V)-Total (ug/L)					
	Zinc (Zn)-Total (ug/L)					
Dissolved Metals	Dissolved Mercury Filtration Location					
	Dissolved Metals Filtration Location					
	Aluminum (Al)-Dissolved (ug/L)					
	Antimony (Sb)-Dissolved (ug/L)					
	Arsenic (As)-Dissolved (ug/L)					
	Barium (Ba)-Dissolved (ug/L)					
	Beryllium (Be)-Dissolved (ug/L)					
	Boron (B)-Dissolved (ug/L)					
	Cadmium (Cd)-Dissolved (ug/L)					
	Calcium (Ca)-Dissolved (ug/L)					
	Chromium (Cr)-Dissolved (ug/L)					
	Cobalt (Co)-Dissolved (ug/L)					
	Copper (Cu)-Dissolved (ug/L)					
	Iron (Fe)-Dissolved (ug/L)					
	Lead (Pb)-Dissolved (ug/L)					
	Lithium (Li)-Dissolved (ug/L)					
	Magnesium (Mg)-Dissolved (ug/L)					
	Manganese (Mn)-Dissolved (ug/L)					
	Mercury (Hg)-Dissolved (ug/L)					
	Molybdenum (Mo)-Dissolved (ug/L)					
	Nickel (Ni)-Dissolved (ug/L)					
	Selenium (Se)-Dissolved (ug/L)					
	Silver (Ag)-Dissolved (ug/L)					
	Sodium (Na)-Dissolved (ug/L)					
	Thallium (Tl)-Dissolved (ug/L)					
	Titanium (Ti)-Dissolved (ug/L)					
	Uranium (U)-Dissolved (ug/L)					
	Vanadium (V)-Dissolved (ug/L)					
	Zinc (Zn)-Dissolved (ug/L)					

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	s.21 WATER 31-JUL-14 s.21				
Grouping	Analyte						
WATER		s.21					
Total Metals	Thallium (Tl)-Total (ug/L)						
	Titanium (Ti)-Total (ug/L)						
	Uranium (U)-Total (ug/L)						
	Vanadium (V)-Total (ug/L)						
	Zinc (Zn)-Total (ug/L)						
Dissolved Metals	Dissolved Mercury Filtration Location						
	Dissolved Metals Filtration Location						
	Aluminum (Al)-Dissolved (ug/L)						
	Antimony (Sb)-Dissolved (ug/L)						
	Arsenic (As)-Dissolved (ug/L)						
	Barium (Ba)-Dissolved (ug/L)						
	Beryllium (Be)-Dissolved (ug/L)						
	Boron (B)-Dissolved (ug/L)						
	Cadmium (Cd)-Dissolved (ug/L)						
	Calcium (Ca)-Dissolved (ug/L)						
	Chromium (Cr)-Dissolved (ug/L)						
	Cobalt (Co)-Dissolved (ug/L)						
	Copper (Cu)-Dissolved (ug/L)						
	Iron (Fe)-Dissolved (ug/L)						
	Lead (Pb)-Dissolved (ug/L)						
	Lithium (Li)-Dissolved (ug/L)						
	Magnesium (Mg)-Dissolved (ug/L)						
	Manganese (Mn)-Dissolved (ug/L)						
	Mercury (Hg)-Dissolved (ug/L)						
	Molybdenum (Mo)-Dissolved (ug/L)						
	Nickel (Ni)-Dissolved (ug/L)						
	Selenium (Se)-Dissolved (ug/L)						
	Silver (Ag)-Dissolved (ug/L)						
	Sodium (Na)-Dissolved (ug/L)						
	Thallium (Tl)-Dissolved (ug/L)						
	Titanium (Ti)-Dissolved (ug/L)						
	Uranium (U)-Dissolved (ug/L)						
	Vanadium (V)-Dissolved (ug/L)						
	Zinc (Zn)-Dissolved (ug/L)						

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Chromium (Cr)-Dissolved	DLA	L1495841-1, -10, -11, -2, -3, -4, -7, -8, -9
Duplicate	Selenium (Se)-Dissolved	DLA	L1495841-1, -10, -11, -2, -3, -4, -7, -8, -9
Duplicate	Silver (Ag)-Dissolved	DLA	L1495841-1, -10, -11, -2, -3, -4, -7, -8, -9
Duplicate	Thallium (Tl)-Dissolved	DLA	L1495841-1, -10, -11, -2, -3, -4, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1495841-1, -10, -11, -2, -3, -4, -7, -8, -9
Matrix Spike	Copper (Cu)-Total	MS-B	L1495841-10, -11, -7, -8, -9
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1495841-1, -10, -11, -2, -3, -4, -7, -8, -9
Matrix Spike	Copper (Cu)-Dissolved	MS-B	L1495841-1, -10, -11, -2, -3, -4, -7, -8, -9
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1495841-1, -10, -11, -2, -3, -4, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DTC	Dissolved concentration exceeds total. Results were confirmed by re-analysis.
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**
ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-NO2-IC-VA	Water	Nitrite in Water by Ion Chromatography	EPA 300.0
This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.			
ANIONS-NO3-IC-VA	Water	Nitrate in Water by Ion Chromatography	EPA 300.0
This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.			
ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
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. Apparent Colour is determined without prior sample filtration. Colour is pH dependent. Unless otherwise indicated, reported colour results pertain to the pH of the sample as received, to within +/- 1 pH unit.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
ECOLI-COLI-HLTH-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.			
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-DIS-CVAFS-VA	Water	Dissolved Mercury in Water by CVAFS	EPA SW-846 3005A & EPA 245.7
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 filtration (EPA Method 3005A) and			

Reference Information

involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-CVAFS-VA Water Total Mercury in Water by CVAFS EPA 245.7

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 a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

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-DIS-LOW-MS-VA Water Dissolved Metals in Water by ICPMS(Low) EPA SW-846 3005A/6020A

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 preliminary sample treatment by filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

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).

MET-TOT-LOW-MS-VA Water Total Metals in Water by ICPMS(Low) EPA SW-846 3005A/6020A

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, or filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

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.

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

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

TDS-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.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 "Turbidity"

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

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

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

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

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

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

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

Chain of Custody Numbers:

10-378879

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 ww - 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.



L1495841-COFC

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

10-378879

Page ____ of ____

Report To		Report Format / Distribution		Service Request (Rush subject to availability - Contact ALS to confirm TAT)						
Company: <u>Tetra Tech EISA</u>		Standard: <u>/</u> Other (specify): <u>/</u>		Regular (Standard Turnaround Times - Business Days)						
Contact: <u>1066 W. Hastings</u> <u>Selena Stadojevic</u>		Select: <u>PDF</u> / Excel / Digital / Fax		Priority (2-4 Business Days)-50% surcharge - Contact ALS to confirm TAT						
Address: <u>1066 W. Hastings</u>		Email 1: <u>Selena.Stadojevic@tetratech.com</u>		Emergency (1-2 Business Days)-100% Surcharge - Contact ALS to confirm TAT						
Phone: <u>604 685 0012</u> Fax: <u>/</u>		Email 2: <u>Taylor Petersen@tetratech.com</u>		Same Day or Weekend Emergency - Contact ALS to confirm TAT						
Invoice To Same as Report? (circle) <u>(Yes)</u> or No (If No, provide details)		Client / Project Information		Analysis Request						
Copy of Invoice with Report? (circle) <u>(Yes)</u> or No		Job #: <u>V232-03143-01</u>		(Indicate Filtered or Preserved, F/P)						
Company: <u>/</u>		PO / AFE: <u>/</u>		F/P						
Contact: <u>/</u>		LSD: <u>/</u>		F/P						
Address: <u>/</u>		Quote #: <u>/</u>		F/P						
Phone: <u>/</u> Fax: <u>/</u>		ALS Contact: <u>/</u>		F/P						
Lab Work Order # (lab use only)		Sampler: <u>Taylor Petersen</u>		F/P						
Sample #	Sample Identification (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	E. Coli	Total Coliform	Dissolved Metals	Total Metals	Dissolved As	Number of Containers
1066-01	<u>MW09-6</u>	<u>31-JUL-14</u>	<u>10:30</u>	<u>Water</u>	X	X	X	X	X	4
	<u>MW09-1</u>		<u>11:45</u>		X	X	X	X	X	4
	<u>MW10-11</u>		<u>1:45</u>		X	X	X	X	X	5
	<u>MW11-5</u>		<u>3:30</u>		X	X	X	X	X	4
	<u>Blank 1</u>		<u>11:50</u>		X	X	X	X	X	1
	<u>Blank 2</u>		<u>11:53</u>		X	X	X	X	X	1
	<u>s.21</u>		<u>1:25</u>		X	X	X	X	X	6
			<u>2:00</u>							6
			<u>2:40</u>							6
			<u>3:40</u>							6
										1
Special Instructions / Regulation with water or land use (CCME- Freshwater Aquatic Life/BC CSR-Commercial/AB Tier 1-Natural/ETC) / Hazardous Details										
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.										
SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)			SHIPMENT VERIFICATION (lab use only)				
Released by:	Date:	Time:	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations:
<u>Matt Hosford</u>	<u>July 31/14</u>	<u>6:00pm</u>	<u>Shafar</u>	<u>July 31</u>	<u>18:00</u>	<u>14 °C</u>				Yes / No ? If Yes add SIF

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY

YELLOW - CLIENT COPY

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Tetra Tech EBA Inc.
ATTN: Jelena Sladojevic
Oceanic Plaza, 9th Floor
1066 West Hastings St.
Vancouver BC V6E 3X2

Date Received: 01-AUG-14
Report Date: 07-AUG-14 11:08 (MT)
Version: FINAL

Client Phone: 604-685-0275

Certificate of Analysis

Lab Work Order #: L1496418
Project P.O. #: NOT SUBMITTED
Job Reference: V23203143-01
C of C Numbers: 10-380679
Legal Site Desc:

Brent Mack
Account Manager

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

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L1496418-1 Water 01-AUG-14 12:00 MW11-4				
Grouping	Analyte						
WATER							
Physical Tests	Colour, True (CU)	<5.0					
	Conductivity (uS/cm)	213					
	Hardness (as CaCO3) (ug/L)	93100					
	pH (pH)	7.49					
	Total Dissolved Solids (ug/L)	152000					
	Turbidity (NTU)	5.96					
Anions and Nutrients	Bromide (Br) (ug/L)	168					
	Chloride (Cl) (ug/L)	5600					
	Fluoride (F) (ug/L)	<20					
	Nitrate (as N) (ug/L)	568					
	Nitrite (as N) (ug/L)	<1.0					
	Sulfate (SO4) (ug/L)	13900					
Bacteriological Tests	E. coli (MPN/100mL)	<1					
	Coliform Bacteria - Total (MPN/100mL)	<1					
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD					
	Dissolved Metals Filtration Location	FIELD					
	Aluminum (Al)-Dissolved (ug/L)	<10					
	Antimony (Sb)-Dissolved (ug/L)	<0.50					
	Arsenic (As)-Dissolved (ug/L)	<1.0					
	Barium (Ba)-Dissolved (ug/L)	<20					
	Beryllium (Be)-Dissolved (ug/L)	<5.0					
	Boron (B)-Dissolved (ug/L)	<100					
	Cadmium (Cd)-Dissolved (ug/L)	<0.050					
	Calcium (Ca)-Dissolved (ug/L)	24800					
	Chromium (Cr)-Dissolved (ug/L)	<0.50					
	Cobalt (Co)-Dissolved (ug/L)	<0.50					
	Copper (Cu)-Dissolved (ug/L)	<1.0					
	Iron (Fe)-Dissolved (ug/L)	<30					
	Lead (Pb)-Dissolved (ug/L)	<1.0					
	Lithium (Li)-Dissolved (ug/L)	<50					
	Magnesium (Mg)-Dissolved (ug/L)	7560					
	Manganese (Mn)-Dissolved (ug/L)	<10					
	Mercury (Hg)-Dissolved (ug/L)	<0.20					
	Molybdenum (Mo)-Dissolved (ug/L)	<1.0					
	Nickel (Ni)-Dissolved (ug/L)	<5.0					
	Selenium (Se)-Dissolved (ug/L)	<1.0					

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID Description Sampled Date Sampled Time Client ID	L1496418-1 Water 01-AUG-14 12:00 MW11-4				
Grouping	Analyte						
WATER							
Dissolved Metals	Silver (Ag)-Dissolved (ug/L)	<0.050					
	Sodium (Na)-Dissolved (ug/L)	5800					
	Thallium (Tl)-Dissolved (ug/L)	<0.20					
	Titanium (Ti)-Dissolved (ug/L)	<50					
	Uranium (U)-Dissolved (ug/L)	<0.20					
	Vanadium (V)-Dissolved (ug/L)	<30					
	Zinc (Zn)-Dissolved (ug/L)	<5.0					

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Chromium (Cr)-Dissolved	DLA	L1496418-1
Duplicate	Selenium (Se)-Dissolved	DLA	L1496418-1
Duplicate	Silver (Ag)-Dissolved	DLA	L1496418-1
Duplicate	Thallium (Tl)-Dissolved	DLA	L1496418-1
Duplicate	Bromide (Br)	DLM	L1496418-1
Matrix Spike	Nitrate (as N)	MS-B	L1496418-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLM	Detection Limit Adjusted due to sample matrix effects.
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**
ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-NO2-IC-VA	Water	Nitrite in Water by Ion Chromatography	EPA 300.0
This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.			
ANIONS-NO3-IC-VA	Water	Nitrate in Water by Ion Chromatography	EPA 300.0
This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.			
ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
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. Apparent Colour is determined without prior sample filtration. Colour is pH dependent. Unless otherwise indicated, reported colour results pertain to the pH of the sample as received, to within +/- 1 pH unit.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
ECOLI-COLI-HLTH-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.			
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-DIS-CVAFS-VA	Water	Dissolved Mercury in Water by CVAFS	EPA SW-846 3005A & EPA 245.7
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 filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).			
MET-DIS-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA SW-846 3005A/6010B

Reference Information

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-DIS-LOW-MS-VA Water Dissolved Metals in Water by ICPMS(Low) EPA SW-846 3005A/6020A

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 preliminary sample treatment by filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

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.

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

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

TDS-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.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 "Turbidity"

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

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

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

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

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

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

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

Chain of Custody Numbers:

10-380679

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.



L1496418-COFC

Chain of Custody / Analytical Request Form
Canada Toll Free: 1-800-668-9878
www.alsglobal.com

10-380679

Page 1 of 1

Report To			Report Format / Distribution			Service Request (Rush subject to availability - Contact ALS to confirm TAT)																																																										
Company: <u>Tetra Tech EBA</u>			Standard: <input checked="" type="checkbox"/> Other (specify):			<input checked="" type="checkbox"/> Regular (Standard Turnaround Times - Business Days)																																																										
Contact: <u>Telena Slabjevic</u>			Select: PDF <input checked="" type="checkbox"/> Excel <input checked="" type="checkbox"/> Digital <input checked="" type="checkbox"/> Fax			Priority (2-4 Business Days)-50% surcharge - Contact ALS to confirm TAT																																																										
Address: <u>10100 W Hastings St. 9th Floor</u>			Email 1: <u>jsladojevic@eba.ca</u>			Emergency (1-2 Business Days)-100% Surcharge - Contact ALS to confirm TAT																																																										
Phone: <u>604.685.6275</u> Fax: <u>604.684-6241</u>			Email 2:			Same Day or Weekend Emergency - Contact ALS to confirm TAT																																																										
Invoice To Same as Report? (circle) Yes or No (if No, provide details)			Client / Project Information			Analysis Request																																																										
Copy of Invoice with Report? (circle) Yes or No			Job #: <u>V23203143-01</u>			(Indicate Filtered or Preserved, F/P)																																																										
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Contact:			LSD:																																																													
Address:			Quote #: <u>Q40075</u>																																																													
Phone:			Fax:																																																													
Lab Work Order # (lab use only)			ALS Contact: <u>Brent Mack</u>			Sampler: <u>Tyler Rebsen</u>																																																										
Sample #	Sample Identification (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type																																																												
	<u>MW11-4</u>	<u>01-Aug-14</u>	<u>12:00</u>	<u>water</u>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>							<input checked="" type="checkbox"/>																																															
	MW10-13B				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>																																																						
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Special Instructions / Regulation with water or land use (CCME- Freshwater Aquatic Life/BC CSR-Commercial/AB Tier 1-Natural/ETC) / Hazardous Details																																																																
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.																																																																
SHIPMENT RELEASE (client use)					SHIPMENT RECEPTION (lab use only)					SHIPMENT VERIFICATION (lab use only)																																																						
Released by: <u>[Signature]</u>	Date: <u>01-Aug-2014</u>	Time: <u>16:25 hrs</u>	Received by: <u>[Signature]</u>	Date: <u>Aug 1</u>	Time: <u>16:30</u>	Temperature: <u>9.8 °C</u>	Verified by:	Date:	Time:	Observations: Yes / No ?	If Yes add SIF																																																					

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY

YELLOW - CLIENT COPY

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Tetra Tech EBA Inc.
ATTN: Jelena Sladojevic
Oceanic Plaza, 9th Floor
1066 West Hastings St.
Vancouver BC V6E 3X2

Date Received: 06-AUG-14
Report Date: 13-AUG-14 14:56 (MT)
Version: FINAL

Client Phone: 604-685-0275

Certificate of Analysis

Lab Work Order #: L1498052
Project P.O. #: NOT SUBMITTED
Job Reference: V23203143-01
C of C Numbers: 10-385171
Legal Site Desc:

Brent Mack
Account Manager

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

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1498052-1 WATER 06-AUG-14 10:00 MW09-13B	L1498052-2 WATER 06-AUG-14 12:00 MW10-17B	L1498052-3 WATER 06-AUG-14 12:00 DUP#2		
Grouping	Analyte					
WATER						
Physical Tests	Colour, True (CU)	<5.0	<5.0	<5.0		
	Conductivity (uS/cm)	244	354	353		
	Hardness (as CaCO3) (ug/L)	105000	159000	158000		
	pH (pH)	7.70	7.46	7.45		
	Total Dissolved Solids (ug/L)	178000	245000	240000		
	Turbidity (NTU)	0.80	921	792		
Anions and Nutrients	Bromide (Br) (ug/L)	<50	<50	<50		
	Chloride (Cl) (ug/L)	10100	19300	19300		
	Fluoride (F) (ug/L)	36	40	41		
	Nitrate (as N) (ug/L)	6440	2910	2900		
	Nitrite (as N) (ug/L)	<1.0	<1.0	<1.0		
	Sulfate (SO4) (ug/L)	15800	18200	18100		
Bacteriological Tests	E. coli (MPN/100mL)	<1	<1	<1		
	Coliform Bacteria - Total (MPN/100mL)	1	<1	<1		
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD		
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		
	Aluminum (Al)-Dissolved (ug/L)	<10	<10	<10		
	Antimony (Sb)-Dissolved (ug/L)	<0.50	<0.50	<0.50		
	Arsenic (As)-Dissolved (ug/L)	1.6	<1.0	<1.0		
	Barium (Ba)-Dissolved (ug/L)	<20	<20	<20		
	Beryllium (Be)-Dissolved (ug/L)	<5.0	<5.0	<5.0		
	Boron (B)-Dissolved (ug/L)	<100	<100	<100		
	Cadmium (Cd)-Dissolved (ug/L)	<0.050	<0.050	<0.050		
	Calcium (Ca)-Dissolved (ug/L)	24800	42800	42700		
	Chromium (Cr)-Dissolved (ug/L)	2.92	7.33	7.37		
	Cobalt (Co)-Dissolved (ug/L)	<0.50	<0.50	<0.50		
	Copper (Cu)-Dissolved (ug/L)	<1.0	<1.0	<1.0		
	Iron (Fe)-Dissolved (ug/L)	<30	<30	41		
	Lead (Pb)-Dissolved (ug/L)	<1.0	<1.0	<1.0		
	Lithium (Li)-Dissolved (ug/L)	<50	<50	<50		
	Magnesium (Mg)-Dissolved (ug/L)	10500	12600	12600		
	Manganese (Mn)-Dissolved (ug/L)	<10	<10	<10		
	Mercury (Hg)-Dissolved (ug/L)	<0.20	<0.20	<0.20		
	Molybdenum (Mo)-Dissolved (ug/L)	<1.0	<1.0	<1.0		
	Nickel (Ni)-Dissolved (ug/L)	<5.0	<5.0	<5.0		
	Selenium (Se)-Dissolved (ug/L)	<1.0	<1.0	<1.0		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID				
		Description				
		Sampled Date				
		Sampled Time				
		Client ID				
Grouping	Analyte					
WATER						
Dissolved Metals	Silver (Ag)-Dissolved (ug/L)	<0.050	0.066	0.145		
	Sodium (Na)-Dissolved (ug/L)	8100	10100	10100		
	Thallium (Tl)-Dissolved (ug/L)	<0.20	<0.20	<0.20		
	Titanium (Ti)-Dissolved (ug/L)	<50	<50	<50		
	Uranium (U)-Dissolved (ug/L)	<0.20	<0.20	<0.20		
	Vanadium (V)-Dissolved (ug/L)	<30	<30	<30		
	Zinc (Zn)-Dissolved (ug/L)	<5.0	<5.0	<5.0		

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Bromide (Br)	DLM	L1498052-1, -2, -3
Duplicate	Nitrate (as N)	DLM	L1498052-1, -2, -3
Duplicate	Nitrite (as N)	DLM	L1498052-1, -2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1498052-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1498052-1, -2, -3
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1498052-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1498052-1, -2, -3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects.
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**
ANIONS-BR-IC-VA	Water	Bromide by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-F-IC-VA	Water	Fluoride by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-NO2-IC-VA	Water	Nitrite in Water by Ion Chromatography	EPA 300.0
This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrite is detected by UV absorbance.			
ANIONS-NO3-IC-VA	Water	Nitrate in Water by Ion Chromatography	EPA 300.0
This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography". Nitrate is detected by UV absorbance.			
ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
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. Apparent Colour is determined without prior sample filtration. Colour is pH dependent. Unless otherwise indicated, reported colour results pertain to the pH of the sample as received, to within +/- 1 pH unit.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
ECOLI-COLI-HLTH-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.			
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-DIS-CVAFS-VA	Water	Dissolved Mercury in Water by CVAFS	EPA SW-846 3005A & EPA 245.7
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 filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).			
MET-DIS-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA SW-846 3005A/6010B

Reference Information

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-DIS-LOW-MS-VA Water Dissolved Metals in Water by ICPMS(Low) EPA SW-846 3005A/6020A

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 preliminary sample treatment by filtration (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).

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.

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

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

TDS-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.

TURBIDITY-VA Water Turbidity by Meter APHA 2130 "Turbidity"

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

TURBIDITY-VA Water Turbidity by Meter APHA 2130 Turbidity

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

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

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

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

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

Chain of Custody Numbers:

10-385171

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.

[illegible]



December 8, 2014

Ministry of Transportation & Infrastructure
South Coast Region
310 – 1500 Woolridge Street
Coquitlam, BC V3K 0B8

ISSUED FOR USE
FILE: 704-V23203143-01
Via Email: Terence.Lai@gov.bc.ca

Attention: Terence Lai, MSc.
Assistant Regional Gravel Manager

Subject: Desktop Study on Naturally-Occurring Arsenic in Groundwater, Strong Pit Area
Abbotsford, BC

1.0 INTRODUCTION

Tetra Tech EBA Inc. (Tetra Tech EBA) was retained by the BC Ministry of Transportation & Infrastructure to conduct a desktop study to assess the potential origin of elevated arsenic concentrations observed in groundwater samples collected in the area of the Strong Pit near Abbotsford, BC.

Tetra Tech EBA has previously been collecting groundwater samples in the area of the Strong Pit. The objective of the water monitoring program was to determine groundwater quality at Strong Pit and nearby residential properties, and assess compliance of potential contaminants of concern (PCOCs) with applicable federal and British Columbia water quality standards and guidelines.

Several of the monitoring wells and water wells in the area of the Strong Pit contain arsenic concentrations near the Guidelines for Canadian Drinking Water Quality (GCDWQ) value of 0.01 mg/L. The purpose of this letter report is to present our opinion of whether the observed elevated arsenic concentrations may be naturally-occurring.

2.0 GEOCHEMISTRY OF ARSENIC

Arsenic (As) is ubiquitous in nature and distributed throughout the atmosphere, hydrosphere, and lithosphere. In aqueous form, As occurs as negatively charged ions or neutral species. The main inorganic As ionic species in natural waters are arsenite [As(III)] and arsenate [As(V)] (Watt and Le, 2003). The speciation of As is a function not only of groundwater electrochemical conditions and acidity (e.g., redox potential and pH), but also of other geochemical processes such as kinetic reaction rates, the sorption potential of solids in contact with the water, and biologically mediated reactions. Due to these complicating factors, thermodynamic equilibrium is rarely achieved in many natural, low-temperature systems. As a result, As(III) and As(V) may coexist in groundwater, both in oxygen-rich (oxic) and oxygen-poor (anoxic) environments.

Arsenic is a component of several rock and soil-forming minerals in the earth's crust, and enters groundwater through the erosion and weathering of minerals and soils. The most common sources of arsenic in the natural environment are volcanic rocks, marine sedimentary rocks, hydrothermal ore deposits (and associated geothermal waters) and fossil fuels. Arsenopyrite (FeAsS) is the most important mineral containing As; other less common As-bearing minerals include realgar (AsS) and orpiment (As₂S₃). The geochemical oxidation of exposed sulphide minerals that contain As will release the As into surface and groundwater. The dissolution of Fe(III) oxides and hydroxides under reducing conditions can also lead to high arsenic concentrations in anoxic groundwater.

As may adsorb onto charged surfaces in soils and sediments, such as clay, hydroxides and oxyhydroxides of iron, aluminum and manganese. However, with increasing pH these charged surfaces lose some of their attractive charge and can re-release adsorbed As. Arsenic is therefore found to be more soluble and mobile in water at high pH values (upwards of 8.5) in oxidizing conditions.

Due to a range of toxic effects of As exposure, standards and guidelines have been developed for the maximum allowable concentrations (MAC) of As in drinking water. The World Health Organisation (WHO) has published a recommended maximum for As in drinking water of 0.01 mg/L which has been adopted by Health Canada and resulted in a reduction of the GCDWQ MAC for As from 0.025 mg/L to the current value of 0.01 mg/L in 2006.

3.0 NATURALLY-OCCURRING ARSENIC IN GROUNDWATER IN THE FRASER RIVER DELTA

Groundwater in the Fraser River Delta in the lower mainland of British Columbia is known to contain naturally-occurring As in concentrations exceeding the GCDWQ value for As of 0.01 mg/L (Wilson et al. 2008). That study found 43% of all privately owned groundwater wells in the Langley-Surrey-White Rock area had total As concentrations above the MAC of 0.010 mg/L. A further 40% were between 0.0003 mg/L and 0.010 mg/L which is considered of possible health concern if associated with long-term exposure. The maximum observed arsenic concentration in this lower mainland area was about 0.06 mg/L.

Arsenic in this region is primarily found in groundwater wells completed in or near marine and glaciomarine surficial materials. Wells in or near glacial-fluvial deposits showed the lowest levels of arsenic. Most of the high arsenic concentrations were found in wells completed in clay-dominated materials. There was also a significant positive correlation of the arsenic concentration with well depth.

4.0 ARSENIC IN GROUNDWATER IN THE STRONG PIT AREA

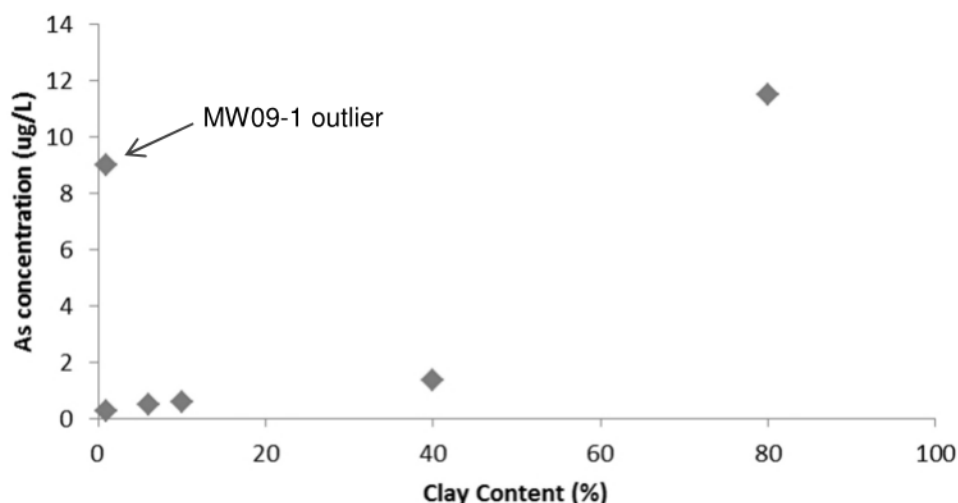
Observed As concentrations in the area of the Strong Pit ranged from less than the laboratory detection limit of 0.001 mg/L to just above the guideline value of 0.01 mg/L (at monitoring well MW11-2 with a maximum observed concentration of 0.0132 mg/L in 2012). Figure 1 shows the average As concentrations observed in the monitoring wells and residential water wells in the Strong Pit area in 2012. Arsenic concentrations observed in 2013 were very similar and in good agreement with the distribution of concentrations measured in 2012 (EBA 2013).

All monitoring wells were completed to a similar depth of about 30 m below grade with the exception of MW10-11 which was completed at about 20 m depth. The depths of the residential water wells are unknown. A positive correlation of As concentration with well depth was not observed at the Strong Pit, but this may be due to the overall similar depth range for the monitoring wells.

As mentioned above, most of the high As concentrations found in the Fraser River Delta were associated with wells completed in clay-dominated profiles. A similar observation was made for the monitoring wells at Strong Pit. Table 1 and Figure 2 show the correlation of As concentration with the clay content within the screened zone of the monitoring wells in the Strong Pit area. With the exception of one location (MW09-1), the data show a positive correlation with clay content which is in agreement with naturally-occurring As in groundwater in other areas of the Fraser River Delta. There is, however, a clay layer about 1 m above the top of the well screen in MW09-1.

Table 1: Clay Content and As Concentrations in Monitoring Wells

Well ID	Clay Content (%)	Average As Concentration in 2012 (ug/L)
MW09-1	1	9
MW09-6	6	0.5
MW11-5	no well log	2.63
MW10-11	80	11.49
MW10-17	10	0.56
MW11-4	1	0.26
MW09-13B	40	1.35

**Figure 2: As Concentrations vs. Clay Content in Monitoring Wells at Strong Pit**

5.0 CONCLUSIONS

Based on the known occurrence of naturally-derived As in groundwater in the Fraser River Delta, it is very likely that the As concentrations observed in the monitoring wells and by inference the ^{s.21} in the area of the Strong Pit are naturally-occurring and not the result of anthropogenic activity.

The positive correlation of As concentrations with well depth observed in other areas of the Fraser River Delta was used by Wilson et al. (2008) as one of the strongest arguments for a natural source of the As in groundwater. This correlation was not observed in the data from the Strong Pit area. However, this may simply due to the fact that all monitoring wells are completed at a similar depth and since the depths of the ^{s.21} are unknown.

The positive correlation of the As concentrations in the Strong Pit area with clay content is in agreement with observations made by Wilson et al. (2008) in the Surrey-Langley area. This correlation indicates that As concentrations may be related to the aquifer materials or in situ geochemical conditions within clay-rich aquifers. This also suggests a natural source of As rather than an anthropogenic source.

6.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the BC Ministry of Transportation & Infrastructure and their agents. Tetra Tech EBA Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than BC Ministry of Transportation & Infrastructure, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech EBA's Services Agreement. Tetra Tech EBA's General Conditions are provided in Appendix A of this report.

7.0 CLOSURE

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

Respectfully submitted,
Tetra Tech EBA Inc.



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Attachments: Figure 1 - Site Plan
Appendix A - Tetra Tech EBA's General Conditions

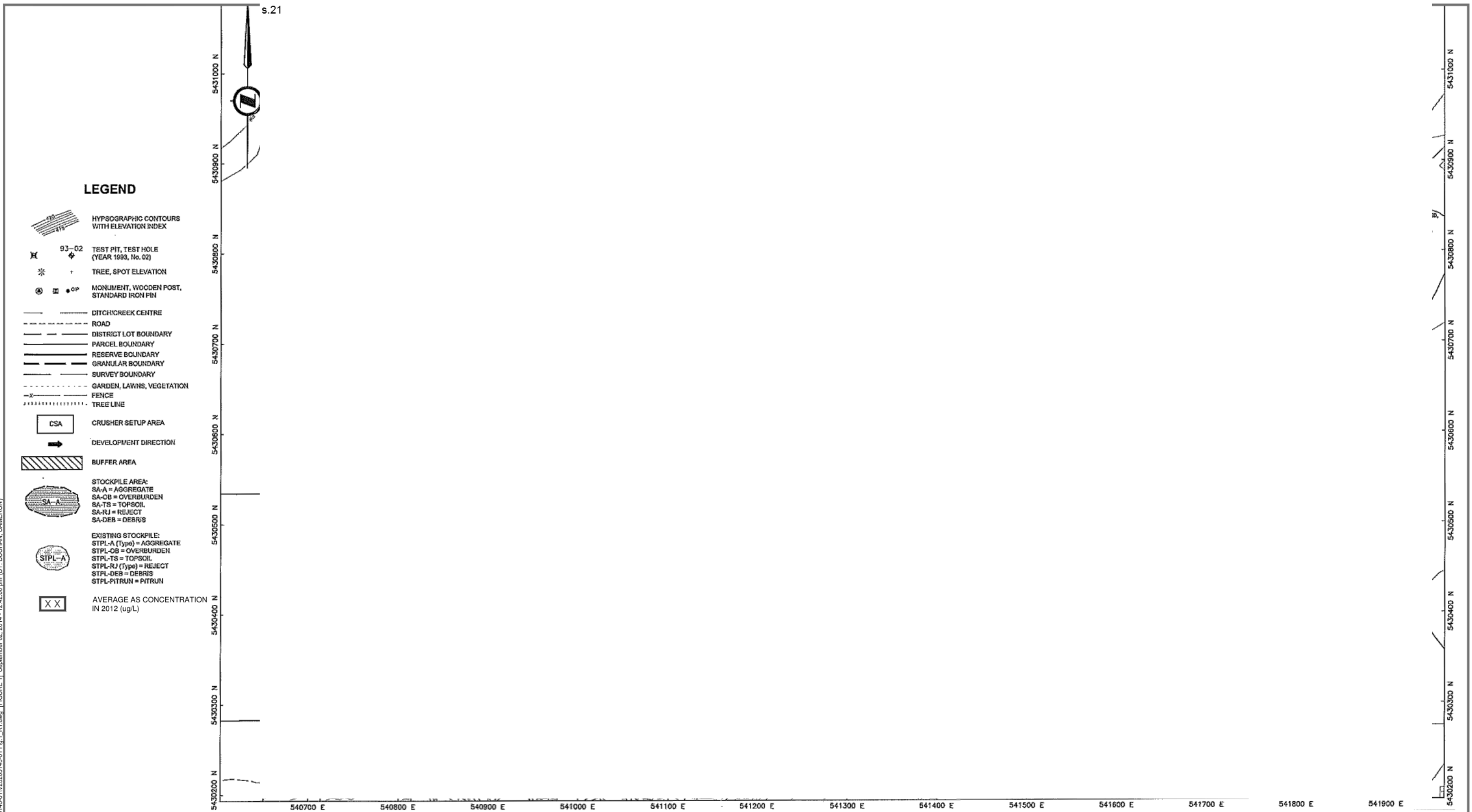
REFERENCES

- EBA, A Tetra Tech Company, 2013, June 2013 Water Monitoring Program, Strong Pit, Abbotsford, BC. Report prepared for Ministry of Transportation and Infrastructure (EBA File: V23203143).
- Watt, C. and Le, X.C., 2003, Arsenic speciation in natural waters. *Biogeochemistry of environmentally important trace elements*. O.C. Braids. Washington, DC, American Chemical Society, 835: 11-32.
- Wilson, J., Schreier, H., and Brown, S., 2008, *Arsenic in Groundwater in the Surrey-Langley Area*. Institute for Resources & Environment, University of British Columbia.

FIGURES


Figure 1 Site Plan

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Scale: 1: 4 000 (metres)

ISSUED FOR USE

CLIENT		DESKTOP STUDY ON NATURALLY-OCCURRING ARSENIC IN GROUNDWATER STRONG PIT - ABBOTSFORD, BC			
 BRITISH COLUMBIA The Best Place on Earth		Ministry of Transportation and Infrastructure			
TETRA TECH EBA		SITE PLAN			
PROJECT NO. V23203143-01	DWN CB	CKD JS	REV 0	Figure 1	
OFFICE EBA-WHSE	DATE December 2014				

APPENDIX A

TETRA TECH EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOENVIRONMENTAL REPORT

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

1.0 USE OF REPORT AND OWNERSHIP

This report pertains to a specific site, a specific development, and a specific scope of work. It 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 or proposed development would necessitate a supplementary investigation and assessment.

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