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File: 1809191

December 5, 2018

CHZ International Investment Inc
7029 Cariboo Highway
Clinton BC
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Attention: CHZ International Investment Inc

Re: Assessments of Potential Recharge and Hydrochemical Characteristics of Aquifer 0921 at Clinton, British Columbia

As requested the following assessment has been completed of the potential recharge conditions for Aquifer 0921 at Clinton. In addition, available chemical analyses of groundwater and surface water in and about Aquifer 0921 were compiled and reviewed to assess the hydrochemical characteristics of the aquifer and relationships to adjacent surface water bodies.

Recharge was assessed through examination of available climate data for the region and a review of available hydrograph records for Observation Well 80 situated in the aquifer.

Hydrochemical characteristics of groundwater and surface water were assessed and interpreted utilizing graphical methods and chemical plots outlined by Stiff (1951) and others as outlined in Hem (1985). Findings of the assessments are outlined as follows:

Climate

Existing climate stations at Clinton do not provide a sufficient long-term record of historic trends in precipitation. The closest climate station with a sufficient long-term record and similar elevation to Clinton is situated at Red Lake, 58 km southeast of Clinton (Climate ID. 1166658). Some short-term precipitation data for Clinton (Climate ID. 1161661) is available for the 2003 to 2006 period. Clinton and Red Lake are both situated in the *Interior Douglas-fir* biogeoclimatic zone with Clinton being in a very dry warm subzone and Red Lake being in a very dry hot to dry cool subzone (Government of British Columbia, 2018a and 2018b). Monthly normal precipitation for the Red Lake station based on the 1981 to 2010 period is shown in Figure 1.

Based on the 1981-2010 period, the annual normal precipitation at Red Lake is 505.1 mm with 40 % falling as snow during the October to April period. The months of May, June and July are normally the wettest months. A comparison of the data for the stations at Clinton and Red Lake for period 2003 to 2007, indicates Clinton experienced 42 to 76 percent of the precipitation at Red Lake as shown in Appendix A, Table A1. Missing

monthly data, however, for Clinton during 2003 and 2004 suggests 67 to 76 percent of the annual precipitation recorded at Red Lake may be more representative.

Precipitation records for the Red Lake climate station (Climate ID. 1166658) are available from June 1985 to September 2018. A second station, Red Lake 2 (Climate ID. 166659) operated from November 1979 to May 1985. Figure 2 shows the combined long-term precipitation record for these two climate stations. Figure 3 compares annual precipitation for the 1980 to 2017 records to the annual normal, showing periods of near and below normal precipitation and periods of near and above precipitation.

Clinton Observation Well 80

Figure 4 shows the historic groundwater level trend for Provincial Observation Well 80, situated in Aquifer 0921, near Clinton from September 1971 to August 2018. Water level data between 1971 and November 2003 is reported monthly and thereafter hourly, from January 2004 to date (Ministry of Environment, 2018a). Figure 5 compares the observation well hydrograph with the cumulative monthly precipitation departure trend for the period 1985 to 2005. Use of the cumulative precipitation departure (CPD) method for analyzing groundwater level fluctuations in shallow aquifers in British Columbia has been described by Kohut *et al*., (1982). It involves plotting the cumulative difference between the average monthly precipitation determined from a lengthy period of time (e.g. years) and the recorded monthly precipitation. The method has also been widely used by researchers with the United States Geological Survey (USGS) to assess hydrologic effects of drought conditions, e.g. Weaver (2005). From Figure 5 it is observed that groundwater levels vary seasonally and begin to rise, reflecting recharge of the aquifer, in the *late summer-early fall months* generally peaking in early May of the following year and thereafter declining during the summer months. While generally following a regular pattern, rising groundwater levels during the fall and winter months do not coincide with months of higher precipitation or periods of melting snow. The seasonal observation well pattern may indicate a time lag of three to four months before groundwater levels respond to winter snowmelt and summer precipitation or to other factors described in the following sections.

Comparison of the observation well hydrograph with cumulative monthly precipitation departure data (Figure 5) indicates a general correlation between groundwater levels and long-term precipitation trends. Declining groundwater levels during the 1985-1989 period, for example, generally correspond with below average precipitation for the same period. Similarly, declining groundwater levels from 1999 to 2005, generally correspond with below average precipitation during this period. Annual seasonal fluctuations in the groundwater levels, however, do not show a strong correlation with variations in the cumulative monthly precipitation departure graph suggesting that recharge to the aquifer is not primarily due to infiltration of precipitation over the aquifer. Other sources of recharge, for example, may include infiltration of periodic surface streams flowing into the aquifer from adjacent upland areas. One unnamed stream draining the western upland, for example, is shown to disappear in the region upslope between Salt Lake and Duck Lake on the Clinton 1:50,000 topographic mapsheet (Natural Resources Canada, 2018).

EHD Consulting Ltd (2018) has identified a number of locations along the periphery of the aquifer where streams are observed to vanish underground.

Groundwater Recharge

Fluctuations in groundwater levels may be used to estimate recharge of an aquifer using the water-table fluctuation method (WTF) reported by Healy and Cook (2002) and Healy (2010). The WTF method is based on the premise that rises in groundwater levels in unconfined aquifers are due to recharge water arriving at the water table. Recharge is calculated as:

$$R = S_y \, \Delta h / \Delta t \qquad \text{(Equation 1)}$$

where S_y is specific yield, h is water-table height, and t is time as depicted in Figure 6.

The term Δh is determined by the difference between the peak of the rise and the low point of the extrapolated antecedent recession curve (dotted line) at the time of the peak.

The WTF method was subsequently applied in 24 cases as shown on Figure 7 to the historic monthly hydrograph record for Observation Well 80 during the 1971 to 2004 period to assess the magnitude of seasonal recharge occurring to Aquifer 0921. An additional 6 cases were also examined based on the hourly hydrograph data from 2008 to 2017 (Figure 8). Hourly hydrograph data indicates that Observation Well 80 has been affected by nearby wells since 2008. Pumping tests (Sarkor, 2015 and Lowen, 2015) conducted on the test well (WID 41015) and production well (WID 39845) in 2015 showed negligible affects on the observation well as shown in Figure 8c.

Δh data for all 30 cases was tested considering four sets of specific yield S_y values, ranging from 0.05 to 0.20. The lowest S_y value of 0.05 considered, was based on the storage coefficient value reported by Lowen (2015) following the testing of Production Well WID 39845. Higher specific yield values (0.10 to 0.20) that were considered are representative of fine sand to gravelly sand deposits reported by Healy and Cook (2002). Calculated recharge results of the WTF analyses are presented in Appendix B, Table B1.

From Table B1, net recharge of the aquifer on an annual basis is calculated to be in the range of 50,159 to 200,638 m^3/year, equivalent to a continuous average pumping rate of 25.2 to 100.8 USgpm depending upon the values of specific yield considered. Lowen (2018) estimated recharge from direct infiltration to be 143,500 m^3/year which falls in the range calculated using the WTF method. While these recharge volumes appear to be relatively small given the size of the aquifer, the magnitude of recharge may be related to significant groundwater inflow and outflow components due to the relatively high transmissivity of the aquifer. Inflow components likely include inflow from upland streams, and adjacent and underlying bedrock aquifers as *Mountain Block Recharge* (MBR), while outflow components include outflow to other down gradient aquifers, groundwater pumping and baseflow to streams such as Cutoff Valley Creek. Large inflow and outflow

components may be reflected in relatively small changes in aquifer storage and observation well levels.

A simplified water budget modified from Healy (2010) for the aquifer can be written as:

$$R = ET^{GW} + (Q^{GW}_{out} + Q^{GW}_{pump}) - (Q^{GW}_{in} + Q^{SW}_{in}) + \Delta S^{GW} \quad \text{(Equation 2)}$$

where R = groundwater recharge,

ET^{GW} = groundwater evapotranspiration,

Q^{GW}_{out} = groundwater outflow including baseflow to streams Q^{GW}_{bf},

Q^{GW}_{pump} = groundwater pumping,

Q^{GW}_{in} = groundwater inflow including Mountain Block Recharge,

Q^{SW}_{in} = surface water inflow (infiltration along boundaries of the aquifer, and

ΔS^{GW} = change in groundwater storage.

An indication of the magnitude of groundwater outflow Q^{GW}_{out} can be estimated by applying Darcy's Law to a cross-sectional area of the aquifer along the lower reaches (discharge zone) of the aquifer and normal to the estimated hydraulic gradient as depicted in Figure 9.

Table 1, summarizes potential annual groundwater outflow quantities through a cross section of the aquifer of varying width using Darcy's law, and a range of hydraulic gradient values normal to the discharge boundary. This can be expressed as:

$$Q^{GW}_{out} = T\, i \times L \quad \text{(Equation 3)}$$

where Q^{GW}_{out} = groundwater outflow,

T = transmissivity,
i = hydraulic gradient, and
L = length (aquifer width) where flow takes place.

From Table 1 it is evident that annual groundwater outflow quantities from the aquifer could be relatively large in the potential range of 2.97E+06 to 1.10E+07 m^3/year; equivalent to a continuous flow between 1493 and 5529 USgpm. Lowen (2018) estimated *Mountain Block Recharge* (MBR) to be 3.76E+06 m^3/year as an inflow component which falls in the range of the groundwater outflow calculations based on Darcy's Law. The greater part of this outflow likely occurs as groundwater discharge to an unclassified, unconsolidated alluvial aquifer occupying the Cutoff Valley Creek floodplain. Tipper (1971) indicates that the Cutoff Valley Creek – Clinton Creek floodplain was occupied by a major meltwater channel during recession of the last glaciation in the region. Several wells, ranging from 50 to 183 feet (15.24 to 55.78 m) in depth and

completed in unconsolidated materials including sand and gravel deposits are reported in the valley east of the Clinton townsite (Ministry of Environment, 2018b).

Table 1. Potential annual groundwater outflow quantities for a range of aquifer discharge widths and hydraulic gradient values.

Width (m)	***Hydraulic Gradient Range (i)*** *(*low to high)		***Transmissivity*** **(m^2/day)**	Q^{GW}_{out} **(m^3/year)** low est.	Q^{GW}_{out} **(m^3/year)** high est.	Q^{GW}_{out} **(USgpm)** low est.	Q^{GW}_{out} **(USgpm)** high est
2400	0.013	0.02	626	7.13E+06	1.10E+07	3584	5529
2000	0.013	0.02	626	5.94E+06	9.14E+06	2986	4594
1500	0.013	0.02	626	4.46E+06	6.85E+06	2242	3443
1000	0.013	0.02	626	2.97E+06	4.57E+06	1493	2297

* Transmissivity value from Lowen (2015).

Similar inflow and outflow quantities may be reflected in relatively small changes in aquifer storage and observation well levels as discussed previously. The relationship of these potential groundwater outflow quantities to surface water flows of Cutoff Valley Creek may warrant further investigation. From limited hydrometric records of Cutoff Valley Creek upstream of Clinton (Figure 10), minimum surface flow rates of about 0.05 m^3/s (793 USgpm) are reported during the period July to October (Government of Canada, 2018c). Groundwater levels also tend to be relatively low in July and August but as discussed previously, begin to rise, reflecting recharge of the aquifer, in the *late summer-early fall months* and generally peaking in early May of the following year.

An indication of surface water inflow (infiltration into the aquifer) from runoff can be obtained by examining potential moisture surpluses for the 15.7 km^2, upland watershed areas surrounding the aquifer. Applying the *Thornthwaite-type* analysis, adapted from Dingman (2001) that uses the Hamon (1963) method, to normal precipitation data for the Red Lake climate station, results in a moisture surplus of 130.1 mm available for runoff and groundwater infiltration (Appendix C). Assuming Clinton precipitation at 70 percent of the Red Lake normal, for example, would translate into a potential runoff volume of 1.43 E+06 m^3/year or equivalent to a flow of 718.7 USgpm. During a dry year (e.g. 1998) with only 63% of the normal precipitation, potential runoff is estimated at 9.00E+05 m^3/year, equivalent to a flow rate of 452.4 USgpm. These values are regarded as conservative as higher precipitation values would be expected at higher elevations in the surrounding upland areas of the watersheds.

Hydrochemical Assessment

All available water quality analyses for samples taken from wells and surface water sources in the area are summarized in Appendix D, Table D1. Figure 11 shows the location of the sampling sites on and in the vicinity of Aquifer 0921. Chemical characteristics of the various water sources are outlined in Table 2 and various hydrochemical plots are provided in Appendix E. Copies of available laboratory analyses

are provided in Appendix F. Water quality of the various sources are discussed as follows:

Groundwater Samples

As indicated in Table 2, water quality analyses are available for 6 well sites completed in Aquifer 0921 including:

Gainor Well WID 48288,
Domestic Well WID 48914,
Clinton Observation Well 80,
CHZ Test Well WID 41015,
CHZ Production Well WID 39845, and
CHZ Monitoring Well WID 39847.
One deep (48.77 m) bedrock well, WID 38346, likely completed in fractured basalt and situated close to and west of the Clinton Observation Well 80 was also sampled.

Based on the dominant percentages of cations and anions, groundwater at the Gainor well site is of the *calcium-magnesium-bicarbonate type,* low in chloride and moderately mineralized (TDS = 776 mg/L) with elevated concentrations of total iron. Groundwater at the CHZ sites ranges from the *magnesium-sulphate-bicarbonate type* and *magnesium-bicarbonate-sulphate type* to the *magnesium-chloride-sulphate-bicarbonate type*. Samples from the CHZ sites are moderately mineralized (TDS = 784 to 1180 mg/L) with elevated levels of total iron, total manganese and sulphate. Elevated levels of Metasilicic Acid (H_2Si0_3) are also reported in samples from the CHZ Production Well (WID 39845) and Monitoring Well (WID 39847). The Clinton Observation Well 80 is of the *magnesium-bicarbonate-sulphate type* with moderate mineralization
(TDS = 1200-1390 mg/L) with elevated levels of total iron and total manganese.

Water quality from the bedrock well is of the *magnesium-sulphate-bicarbonate type,* low in chloride, with a relatively high TDS of 2390 mg/L and elevated concentrations of total iron, total manganese and total arsenic.

Schoeller type plots (Appendix E, Figures E1 to E3) show similar cation and anion relationships among the CHZ sites and the Clinton Observation Well 80 with slight variations in the relationships among bicarbonate, sulphate and chloride concentrations. Anion concentration ratios (SO_4, HCO_3 and Cl) among the CHZ sites show some variability (Appendix E, Figure E2).

The Gainor well site is dominantly a *calcium-magnesium-bicarbonate type* with low chloride (Figure E3(a), while the Bedrock Well is a *magnesium- sulphate-bicarbonate type* with low chloride (Figure E3(b).

Stiff type patterns (Appendix E, Figures E5 and E6) show similar cation and anion relationships among the CHZ sites and the Clinton Observation Well 80 with the exception of the monitoring well which shows a lower bicarbonate concentration and higher chloride concentration. The *Stiff type* pattern, Figure E6(a), for the Gainor Well site shows that calcium and bicarbonate are the dominant cation and anion, respectively. The

Stiff type pattern for the Bedrock Well, Figure E6(c) shows that magnesium is the dominant cation while sulphate is the dominant anion.

Pie diagrams where cations and anions are shown as percentages (Appendix E, Figures E7 to E9) show similar relationships to the *Stiff type* relationships discussed above. Anion concentration ratios (SO_4, HCO_3 and Cl) among the CHZ sites, however, show some variability (Appendix E, Figure E9).

A Piper trilinear plot (Figure 12) of the groundwater samples showing cation and anion percentages indicate that all of the CHZ sites, the Clinton Observation Well and the bedrock well fall into a tight grouping suggesting a common source. The Gainor well sample plots in a separate grouping with the Gainor Lake and Cutoff Valley Creek samples suggesting a common source.

Surface Water Samples

As indicated in Table 2, water quality analyses are available for 4 surface sources including:

Gainor Lake,
Cutoff Valley Creek (6 sites),
Duck Lake, and
Salt Lake.

Based on the dominant percentages of cations and anions, samples from Gainor Lake and Cutoff Valley Creek are of the *calcium-magnesium-bicarbonate type*, low in chloride with relatively low mineralization (TDS = 287-425 mg/L). Duck Lake water quality is of the *magnesium-sodium-bicarbonate-sulphate type,* highly mineralized (TDS = 2470-2650 mg/L) with elevated sodium concentrations. Salt Lake water quality is of the *magnesium-sodium-sulphate type,* very highly mineralized (TDS= 109000-232000 mg/L) with total iron, total manganese, total arsenic, total uranium and sodium concentrations.

Schoeller type plots (Appendix E, Figure E4) show similar cation and anion relationships between Gainor Lake, Cutoff Valley Creek and the Gainor Well (Figure E3(a). Duck Lake and Salt Lake show similar cation-anion relationships with variations in sulphate and bicarbonate concentrations. Duck Lake is dominantly bicarbonate while Salt Lake is dominantly sulphate. Both show relatively low calcium and chloride concentrations. Duck Lake samples are 2 to 3 times more mineralized (e.g. TDS) than samples from the CHZ wells. If pumping of the CHZ wells were inducing flow from Duck Lake, increasing trends in the TDS of the CHZ wells would be anticipated during pumping. When pump tested in June 2015, CHZ Test Well (WID 41015), however, showed a decrease in conductivity during testing even though the groundwater level in the well was drawn below the surface water level of Duck Lake (Sarkor, 2015). Lowen (2015) reports that lake levels were monitored when WID 41015 was tested and no impact was measured. During pump testing of CHZ Production Well (WID 39845) in November 2015 when Duck Lake was frozen, the TDS of a well sample taken at the end of the test showed a TDS of 882 mg/L

(Lowen, 2015). A much higher TDS would have been anticipated if freeze-out brine from Duck Lake was being drawn towards the production well.

Table 2. Summary of chemical characteristics of well and surface water samples.

SITE	SOURCE	WATER QUALITY TYPE	TDS mg/l	ELEVATED PARAMETERS	CONCENTRATION mg/L	NUMBER OF SAMPLES
Gainor Well WID 48288	Shallow Groundwater (Unconsolidated Aquifer 0921)	Calcium-Magnesium-Bicarbonate	776	Iron (Tot.)	0.914	1
Domestic Well WID 48914	Shallow Groundwater (Unconsolidated Aquifer 0921)			Iron (Tot.) Manganese (Tot)	8.200 0.240	1
Bedrock Well WID 38346	Deep Groundwater (fractured	Magnesium-Sulphate-Bicarbonate	2390	Iron (Tot.) Arsenic (Tot.) Manganese (Tot)	1.500 0.057 0.167	1
Clinton Obs. Well	Shallow Groundwater (Unconsolidated Aquifer 0921)	Magnesium-Bicarbonate-Sulphate	1200-1390	Iron (Tot.) Manganese (Tot)	1.200-2.080 0.051-0.0563	5
Test Well WID 41015	Shallow Groundwater (Unconsolidated Aquifer 0921)	Magnesium-Sulphate-Bicarbonate	1000-1180	Sulphate Manganese (Tot)	425-511 0.536-0.558	2
Production Well WID 39845	Shallow Groundwater (Unconsolidated Aquifer 0921)	Magnesium-Bicarbonate-Sulphate	784-904	Manganese (Tot)	0.455-0.562	3
Monitoring Well WID 39847	Shallow Groundwater (Unconsolidated Aquifer 0921)	Magnesium-Chloride--Sulphate-Bicarbonate	799	Iron (Tot.) Manganese (Tot)	0.918 0.294	2
Gainor Lake	Surface Water	Calcium-Magnesium-Bicarbonate	384			1
Cutoff Valley Creek (various locations)	Surface Water	Calcium-Magnesium-Bicarbonate	287-425			6
Duck Lake	Surface Water	Magnesium-Sodium-Bicarbonate-Sulphate	2470-2650	Sodium (Tot.)	309-330	2
Salt Lake	Surface Water	Magnesium-Sodium-Sulphate	109000-232000	Iron (Tot.) Manganese (Tot) Arsenic (Tot.) Uranium (Tot.) Sodium (Tot.)	7.300 0.139-0.942 0.015-0.044 0.450 6620-18600	2

Stiff type patterns (Appendix E, Figure E6) show similar cation and anion relationships between Gainor Lake, Cutoff Valley Creek and the Gainor Well. The *Stiff type* pattern, Figure E6(a), for the Gainor Well site shows that calcium and bicarbonate are the dominant cations and anions, respectively. The *Stiff type* pattern for the Bedrock Well, Figure E6(c) shows that magnesium is the dominant cation while sulphate is the dominant anion.

Pie diagrams where cations and anions are shown as percentages (Appendix E, Figures E7 to E9) show similar relationships to the *Stiff type* relationships discussed above.

A Piper trilinear plot (Figure 12) of the surface water samples showing cation and anion percentages, indicate that the Gainor well, Gainor Lake and Cutoff Valley Creek samples plots in a tight grouping suggesting a common source. The Duck Lake and Salt Lake samples plot separately although the Duck Lake sample appears to be more aligned with the groundwater samples with respect to anion composition.

Interpretation

From the limited chemical analyses available for the region, all of the groundwater samples examined, with the exception of the Gainor Well, appear to originate from a common source that is likely related to groundwater discharging from bedrock formations underlying Aquifer 0921. These bedrock formations have been mapped by Campbell and Tipper (1971) and Schiarizza *et al*., (1994) as shown in Figure 13. The principle rock units underlying and adjacent to Aquifer 0921 include: the Chilcotin Group, of Miocene (Tertiary) age comprised of shale, sandstone, tuff, diatomite, conglomerate and breccia rocks, and the Cache Creek Complex of Permian to Triassic age comprised of marine sedimentary and volcanic rocks. Major north-south trending faults bounding the major rock units occur in the region.

The Gainor Well sample, which is more aligned with the water quality of Gainor Lake and Cutoff Valley Creek, is likely representative of shallow groundwater that is recharged from infiltration of precipitation and surface water runoff from adjacent upland area. Samples from Cutoff Valley Creek show no discernible evidence of groundwater discharge of highly mineralized groundwaters.

The highly mineralized groundwater at the southern portion of Aquifer 0921 may not be entirely representative of groundwater quality throughout the aquifer but a localized phenomenon due to highly mineralized groundwater discharging from bedrock formations and fault zones along the southern boundary of the aquifer.

Samples from Duck Lake likely represent a mixture of shallow groundwaters originating from infiltration of precipitation and surface water runoff, groundwater discharging from the underlying bedrock formations and the effects of evaporation. Duck Lake samples are 2 to 3 times more mineralized (e.g. TDS) than samples from the CHZ wells.

Salt Lake likely represents groundwater discharge from underlying bedrock formations into a closed lake basin subject to evaporation with little subsurface seepage losses. Campbell, and Tipper (1971) attribute the water quality of the lake, containing a deposit of epsomite (magnesium suphate), to surface water and springs percolating through basic lavas of the Cache Creek rocks. Cummings (1940) refers to Salt Lake as "Clinton Lake" as being a commercial source of epsomite from 1918 to 1920. Geologic mapping by Read (1989) indicates that the region south of Clinton towards Salt Lake was occupied by a Miocene (Tertiary) channel draining towards the north within Chilcotin Group rocks. This channel likely connects with the valley occupied by several lakes such as Three Mile Lake, and 4 Mile Lake, which are situated in a former glacial, lateral overflow channel in the region, as described by Tipper (1971).

Read (1989) reports an occurrence of diatomaceous earth at a location along this channel south of Clinton. Diatomaceous earth is a hydrated silica sedimentary rock, comprised primarily of the remains of silica skeletons of microscopic diatoms. It is possible that this rock could be the source of elevated Metasilicic Acid (H_2Si0_3) reported in samples from the CHZ Production Well (WID 39845) and Monitoring Well (WID 39847).

Renault (1994) describes Clinton Lake as a small ephemeral lake lying in a glacial paleomeltwater channel. Renault reports that the lake is a Mg-Na-$S0_4$ brine with permanent deposits of epsomite. The following description of the lake environs and source of water is provided by Renault (1994),

"There is no channelled inflow, and Clinton Lake is fed mainly by groundwater, direct precipitation, and diffuse runoff. About 120 m north of the lake, at slightly higher elevation, lies a small carbonate playa, called Clinton Pond. This is fed by a series of small springs and seepages. Other springs issue from the basin margins, but most seep into the ground or evaporate before reaching the lake. Shallow brine covers Clinton Lake during spring and early summer, but most of the surface is salt encrusted by late summer and autumn. Preliminary analyses of the basin waters and sediment mineralogy suggest that Clinton Lake may be fed by at least two distinct groundwater sources. The first type has a very high Na/Cl ratio (>15); the second type is less evolved, less saline, and has a lower Na/Cl ratio (<12). Both types of groundwaters have very high Mg/Ca ratios, resulting from contact with Mg-rich bedrock and early precipitation of calcite cements in soils. Aragonite and Mg-calcite are precipitated at the spring orifices, further depleting the waters in calcium. Some spring waters flow into Clinton Pond, where aragonite and hydromagnesite precipitate. Pond waters, augmented by other springs, may seep below hummocky carbonate mudflats toward Clinton Lake. At Clinton Lake, these waters mix with other shallow, dilute seepage and possibly, artesian groundwaters discharging through the lake floor."

Summary

As Clinton does not have a long-term climate station, precipitation data from the Red Lake climate station situated 58 km southeast of Clinton was utilized to assess the historic groundwater level fluctuations for Aquifer 0921 as recorded by provincial Observation Well 80. Limited short-term climate records available for Clinton suggest that annual precipitation may be about 70 percent of the annual precipitation recorded at Red Lake.

Groundwater levels are observed to vary seasonally and begin to rise, reflecting recharge of the aquifer, in the *late summer-early fall months* generally peaking in early May of the following year and thereafter declining during the summer months. While generally following a regular pattern, rising groundwater levels during the fall and winter months do not coincide with months of higher precipitation or periods of melting snow. The seasonal observation well pattern may indicate a time lag of three to four months before groundwater levels respond to winter snowmelt and summer precipitation or to other factors such as infiltrating surface water runoff. Comparison of the observation well levels with cumulative monthly precipitation departure data indicates a general correlation between groundwater levels and long-term precipitation trends. Annual seasonal fluctuations in the groundwater levels, however, do not show a strong correlation with variations in the cumulative monthly precipitation departure graph suggesting that recharge to the aquifer is not primarily due to infiltration of precipitation over the aquifer.

Based on the water table fluctuation (WTF) method, net recharge to the aquifer on an annual basis was determined to be in the range of 501,59 to 200,638 m^3/year, equivalent to a continuous average pumping rate of 25.2 to 100.8 USgpm depending upon the values of specific yield considered. While these recharge volumes appear to be relatively small given the size of the aquifer, the magnitude of recharge may be related to significant groundwater inflow and outflow components as a result of the relatively high transmissivity (626 m^2/day) of the aquifer. Inflow components likely include inflow from upland streams, and adjacent and underlying bedrock aquifers as *Mountain Block Recharge* (MBR), while outflow components include outflow to other down gradient aquifers, groundwater pumping and baseflow to streams such as Cutoff Valley Creek. Large inflow and outflow components may be reflected in relatively small changes in aquifer storage and observation well levels.

Annual groundwater outflow quantities from the aquifer could be relatively large in the potential range of 2.97E+06 to 1.10E+07 m^3/year; equivalent to a continuous flow between 1493 and 5529 USgpm. Part of this groundwater outflow may contribute to the baseflow of Cutoff Valley Creek. The bulk of this outflow likely discharges to an unclassified alluvial valley aquifer underlying the Cutoff Valley Creek – Clinton Creek drainage. The relationship of these potential groundwater outflow quantities to surface water flows of Cutoff Valley Creek may warrant further investigation. From limited hydrometric records of Cutoff Valley Creek upstream of Clinton, minimum surface flow rates of about 0.05 m^3/s (660 Igpm) are reported during the period July to October.

Groundwater levels also tend to be relatively low in July and August but begin to rise in the *late summer-early fall months;* generally peaking in early May of the following year.

An indication of surface water inflow (infiltration into the aquifer) from runoff was obtained by examining potential moisture surpluses for the 15.7 km^2, upland watershed areas surrounding the aquifer. Assuming Clinton precipitation at 70 percent of the Red Lake normal, for example, translates into a potential runoff volume of 1.43 E+06 m^3/year or equivalent to a flow of 718.7 USgpm. During a dry year (e.g. 1998) with only 63% of the normal precipitation, potential runoff was estimated at 9.00E+05 m^3/year, equivalent to a flow rate of 452.4 USgpm.

Based on the estimates made of the net recharge, groundwater inflow and groundwater outflow quantities presented above, it is considered that there is sufficient groundwater available on an annual basis to support CHZ well production in the range of 80 to 200 USgpm (1.59E+05 to 3.98E+05 m^3/year). With regard to potential effects on groundwater baseflow of Cutoff Valley Creek during low surface flow periods, significant flow impacts within the above pumping range above would not be anticipated due to the distance of the production well from the creek (1000 m), relatively high groundwater inflow and outflow estimates, rising groundwater levels during the low surface flow period and likelihood of there being a lateral component of groundwater flow along Cutoff Valley Creek contributing to the baseflow.

From the limited chemical analyses available for the region, all of the groundwater samples examined, with the exception of the Gainor Well, appear to originate from a common source that is likely related to groundwater discharging from bedrock formations underlying Aquifer 0921 principally rocks of the Cache Creek Complex and the Chilcotin Group.

Samples from Cutoff Valley Creek show no discernible evidence of groundwater discharge of highly mineralized groundwaters.

The highly mineralized groundwater at the southern portion of Aquifer 0921 may not be entirely representative of groundwater quality throughout the aquifer but a localized phenomenon due to highly mineralized groundwater discharging from bedrock formations and fault zones along the southern boundary of the aquifer.

Samples from Duck Lake likely represent a mixture of shallow groundwaters originating from infiltration of precipitation and surface water runoff, groundwater discharging from the underlying bedrock formations and effects of evaporation.

None of the hydrochemical results obtained indicate that water from Duck Lake was contributing significantly to CHZ well pumping during the well tests. Monitoring of Duck Lake in conjunction with production well pumping would be required to confirm any potential interference effects. In the event of a slow lake drawdown due to pumping it may be feasible to maintain lake levels by pumping groundwater into the lake. Given the higher dissolved mineralization of Duck Lake, inputting groundwater of lower TDS should

not be a detrimental to the water quality of the lake. This would need to be confirmed through periodic groundwater and surface water monitoring.

Salt Lake likely represents groundwater discharge from underlying bedrock formations into a closed lake basin subject to evaporation with little subsurface seepage losses.

Recommendations

The following recommendations are made for consideration:

1. Given some potential variability of the water quality among the CHZ wells, frequent monitoring (e.g. monthly) of the water quality should be considered during any production pumping.

2. Monitoring of water levels in all CHZ wells and Duck Lake during ice-free periods, utilizing pressure transducers should be undertaken to obtain a record of water level trends with time. This data would be particularly important for assessing when any well maintenance may be required to maintain the well efficiency of the production well.

3. Periodic monitoring of the water quality of Duck Lake should be undertaken in the event it becomes necessary to maintain lake levels by pumping groundwater into the lake.

Respectfully submitted,

Alan P. Kohut PEng
Principal and Senior Hydrogeologist

HY-GEO CONSULTING

Closure

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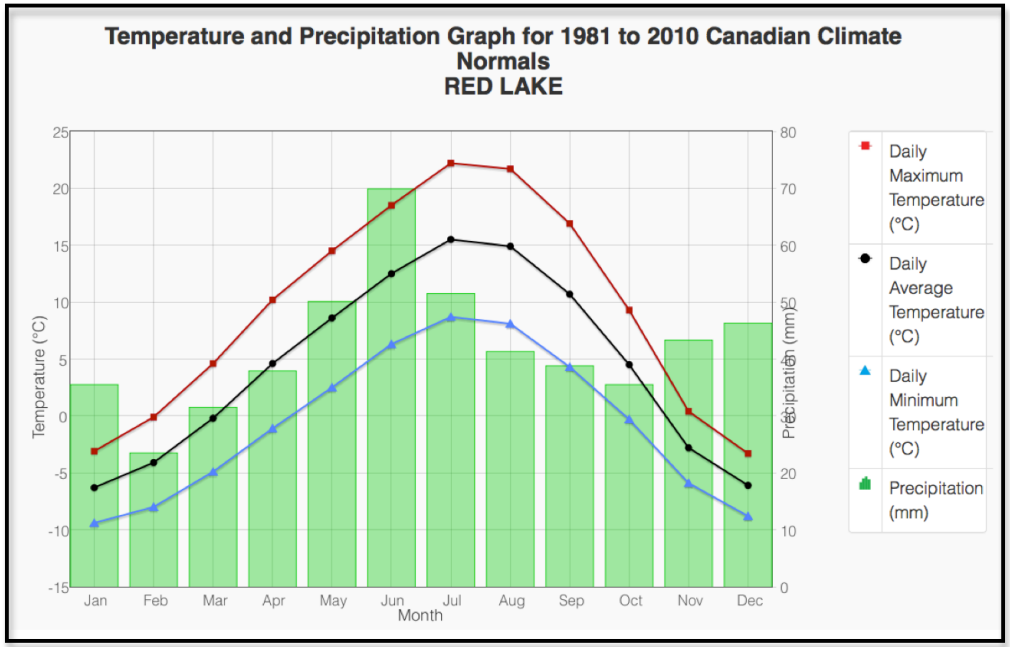

Figure 1. Graph of monthly normal precipitation for Red Lake climate station (Climate ID. 1166658). Graph from Government of Canada (2018a).

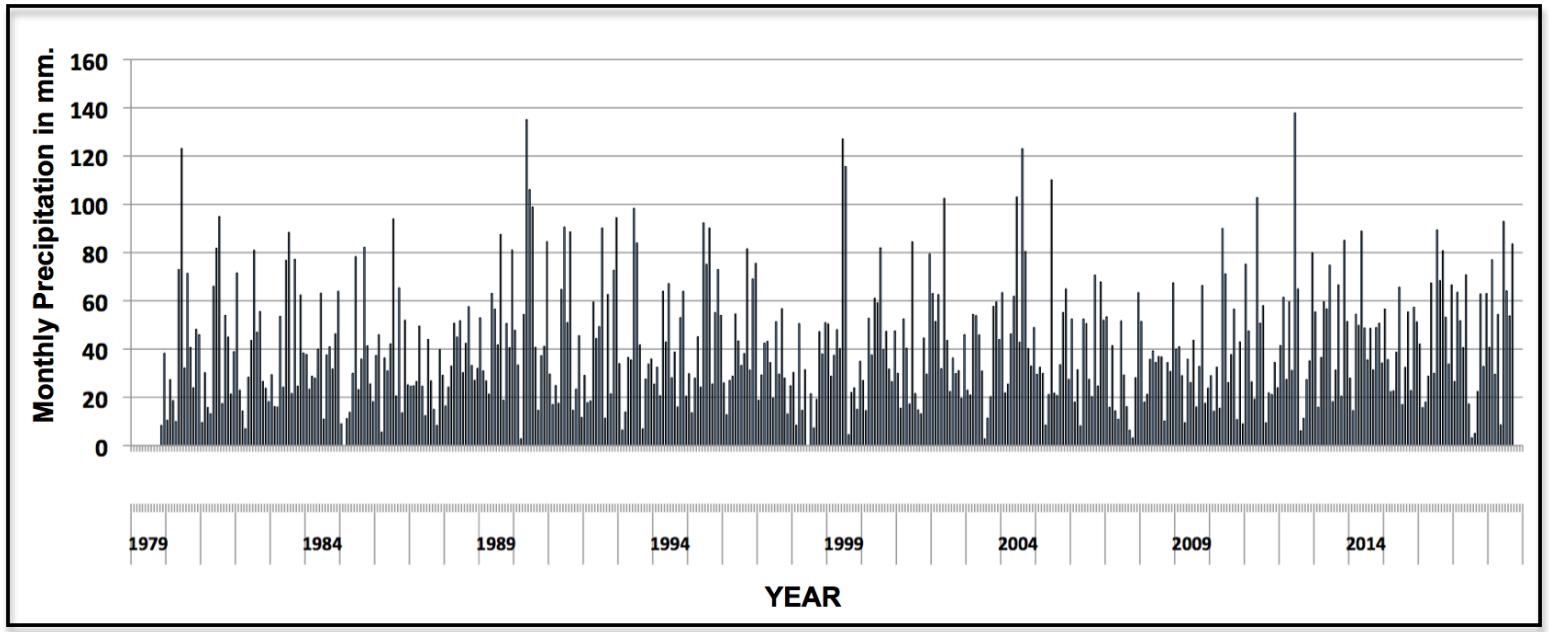

Figure 2. Monthly precipitation at Red Lake from June 1979 to September 2018. Data from Government of Canada (2018b).

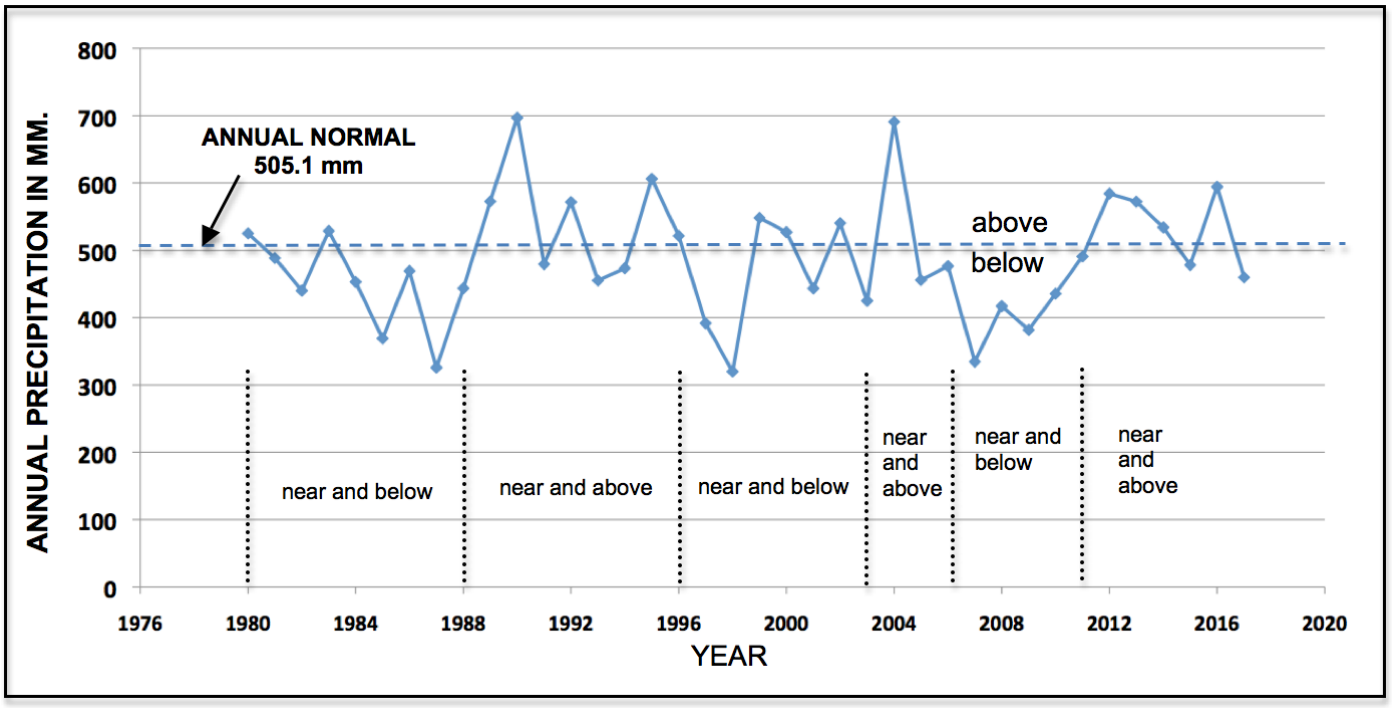

Figure 3. Annual precipitation at Red Lake in comparison to annual normal for 1980 to 2017. Data from Government of Canada (2018b).

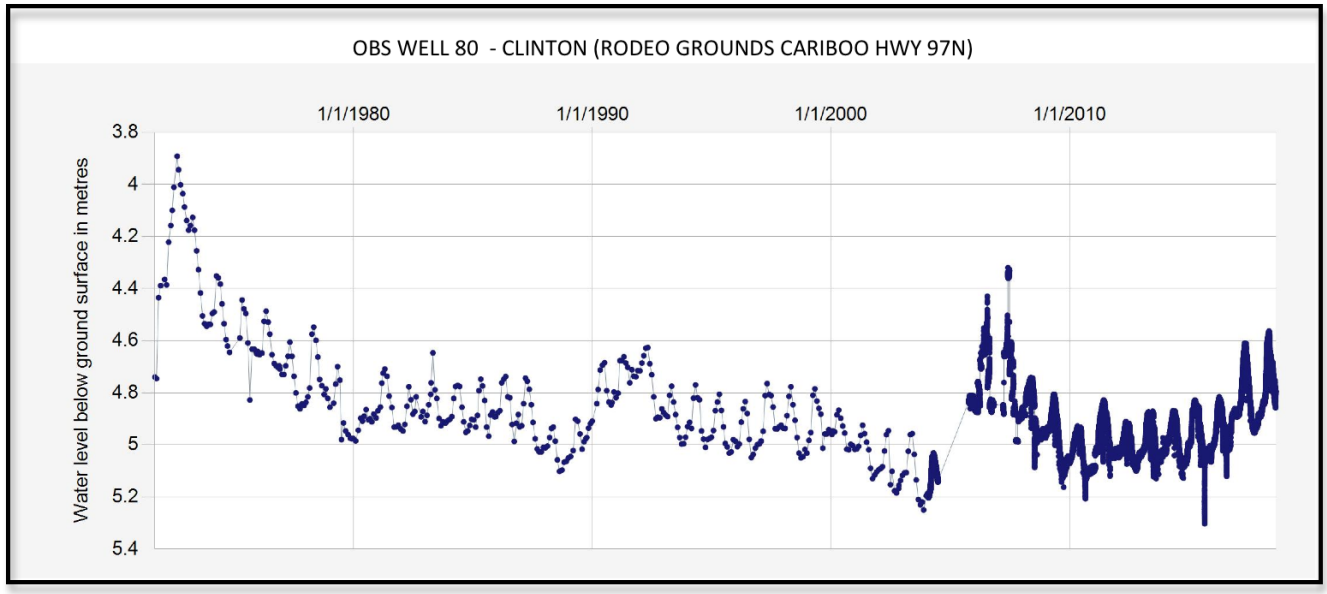

Figure 4. Historic groundwater level trend for Observation Well 80 at Clinton. From Ministry of Environment (2018a).

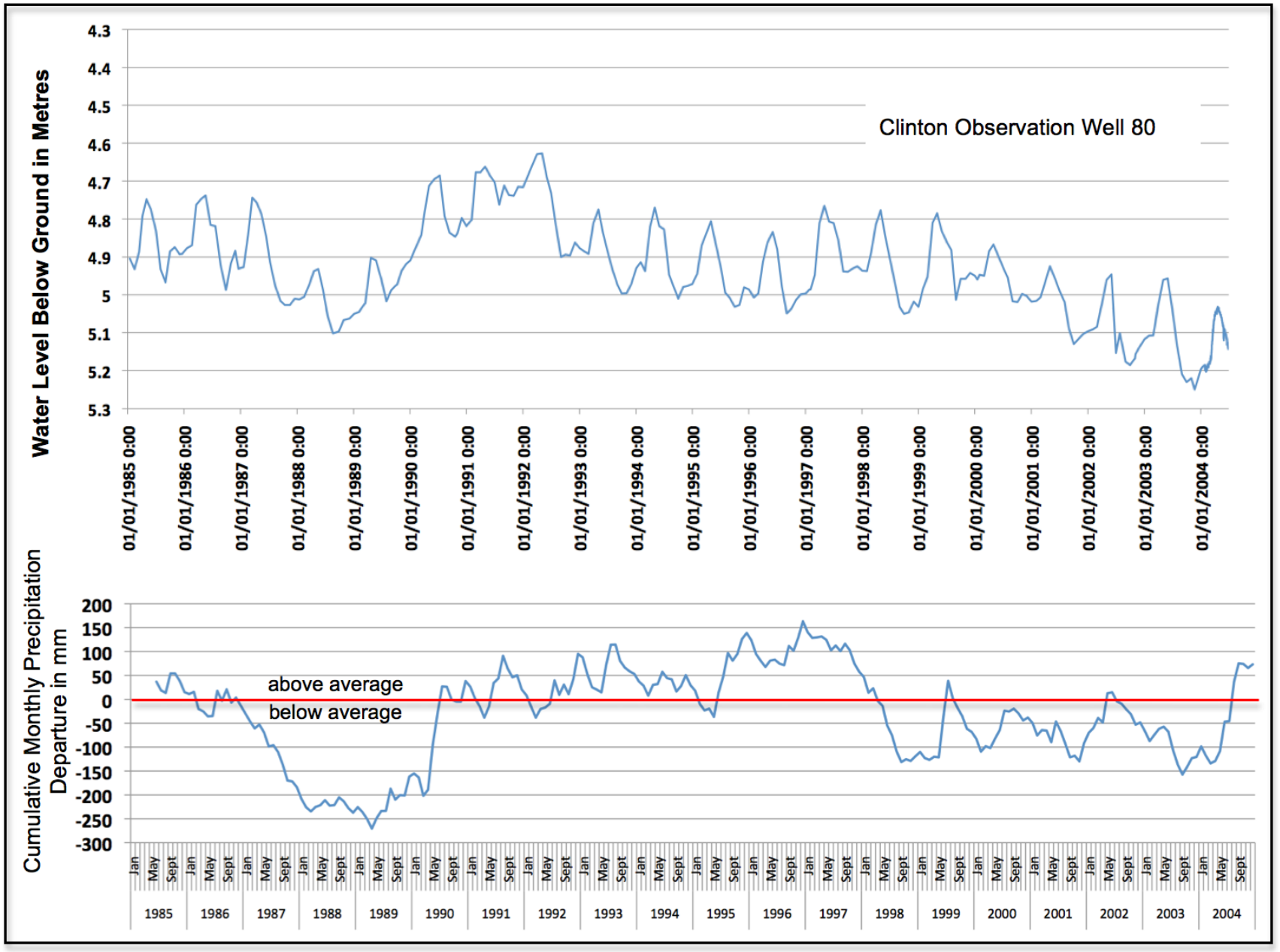

Figure 5. Comparison of observation well hydrograph with cumulative monthly precipitation departure for the period 1985 to 2005.

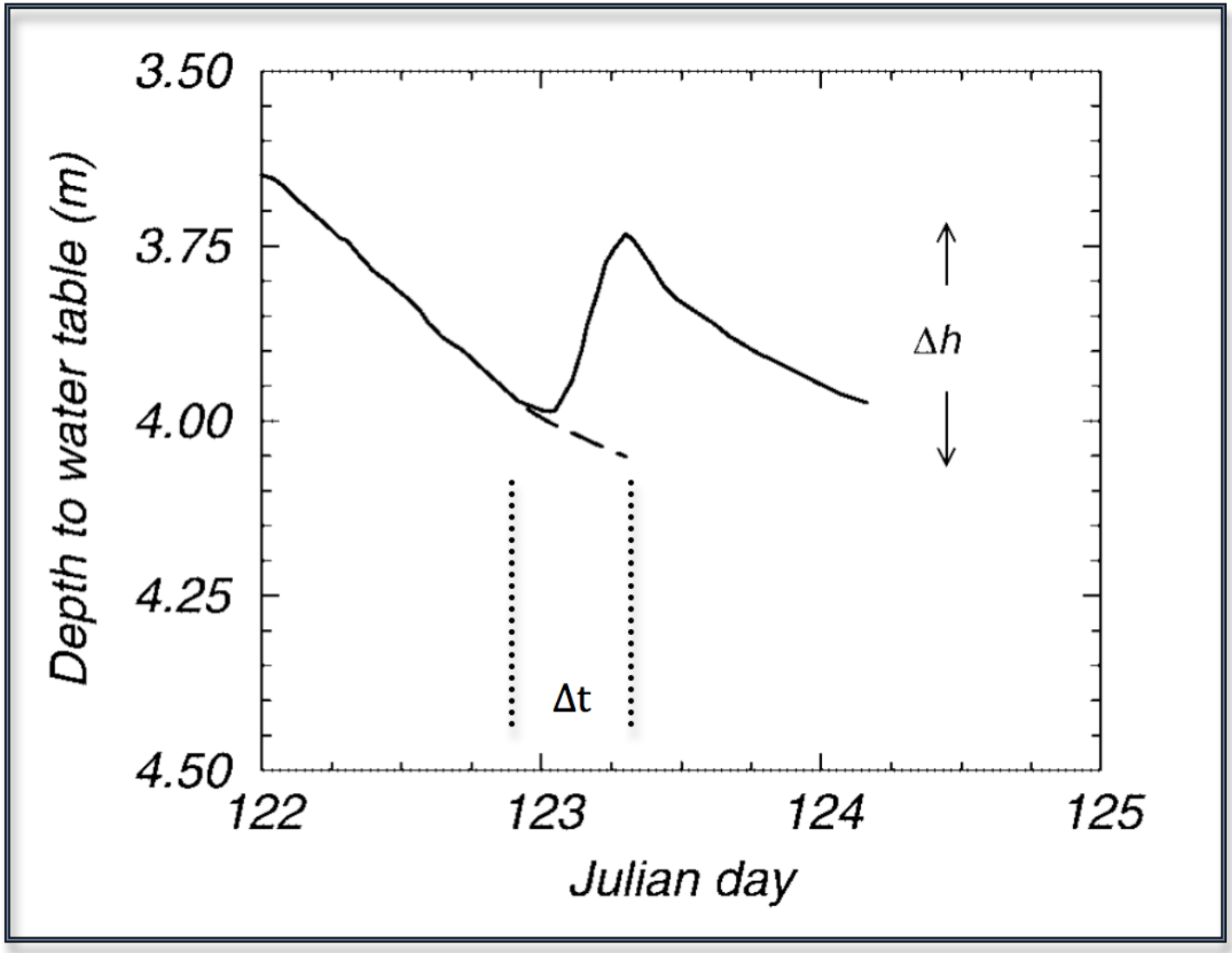

Figure 6. Hypothetical water-level rise in well reflecting recharge. Modified after Healy and Cook (2002).

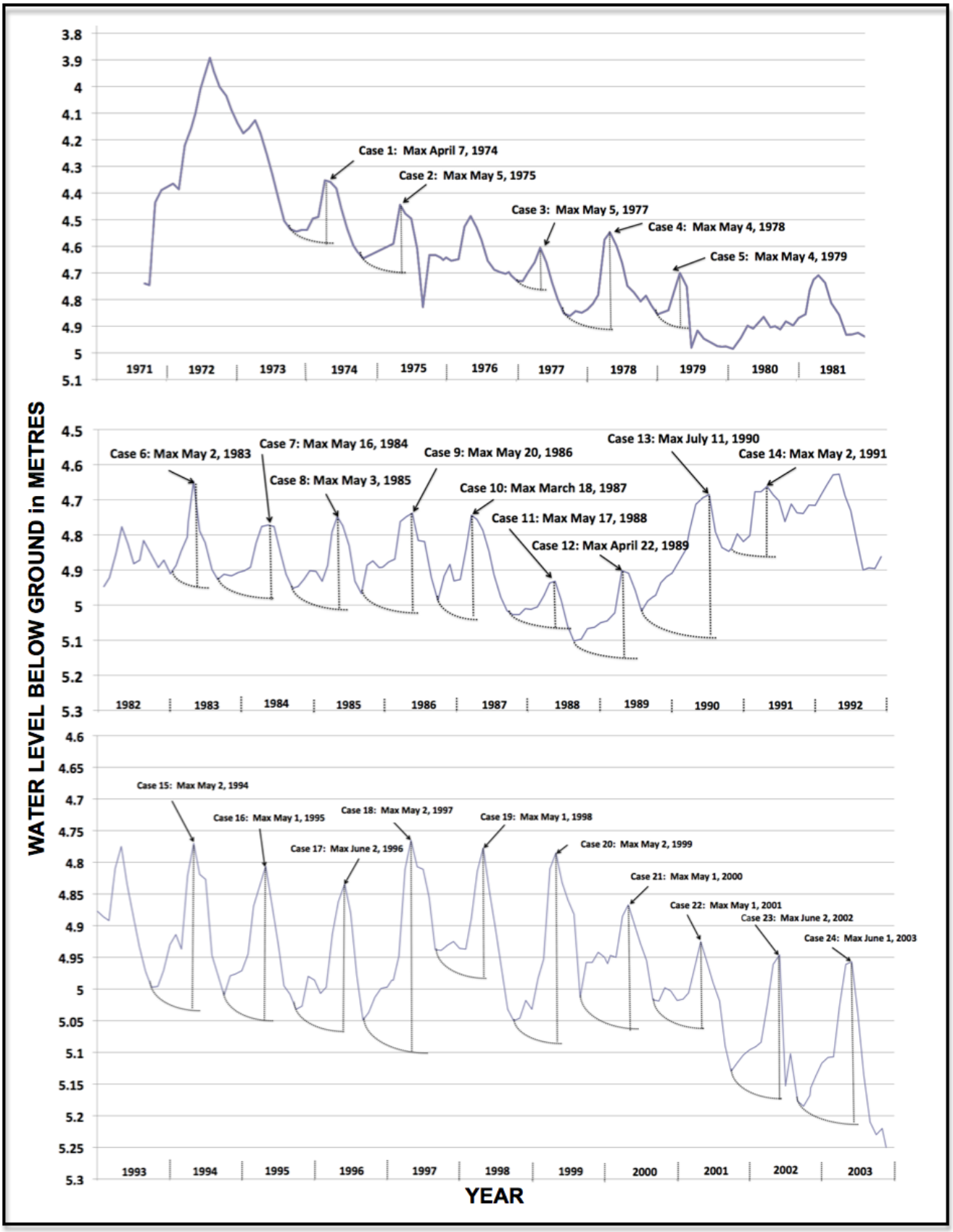

Figure 7. Graphical application of the WTF method in 24 cases to determine the seasonal water level rise in Observation Well 80 during the 1971 to 2004 period.

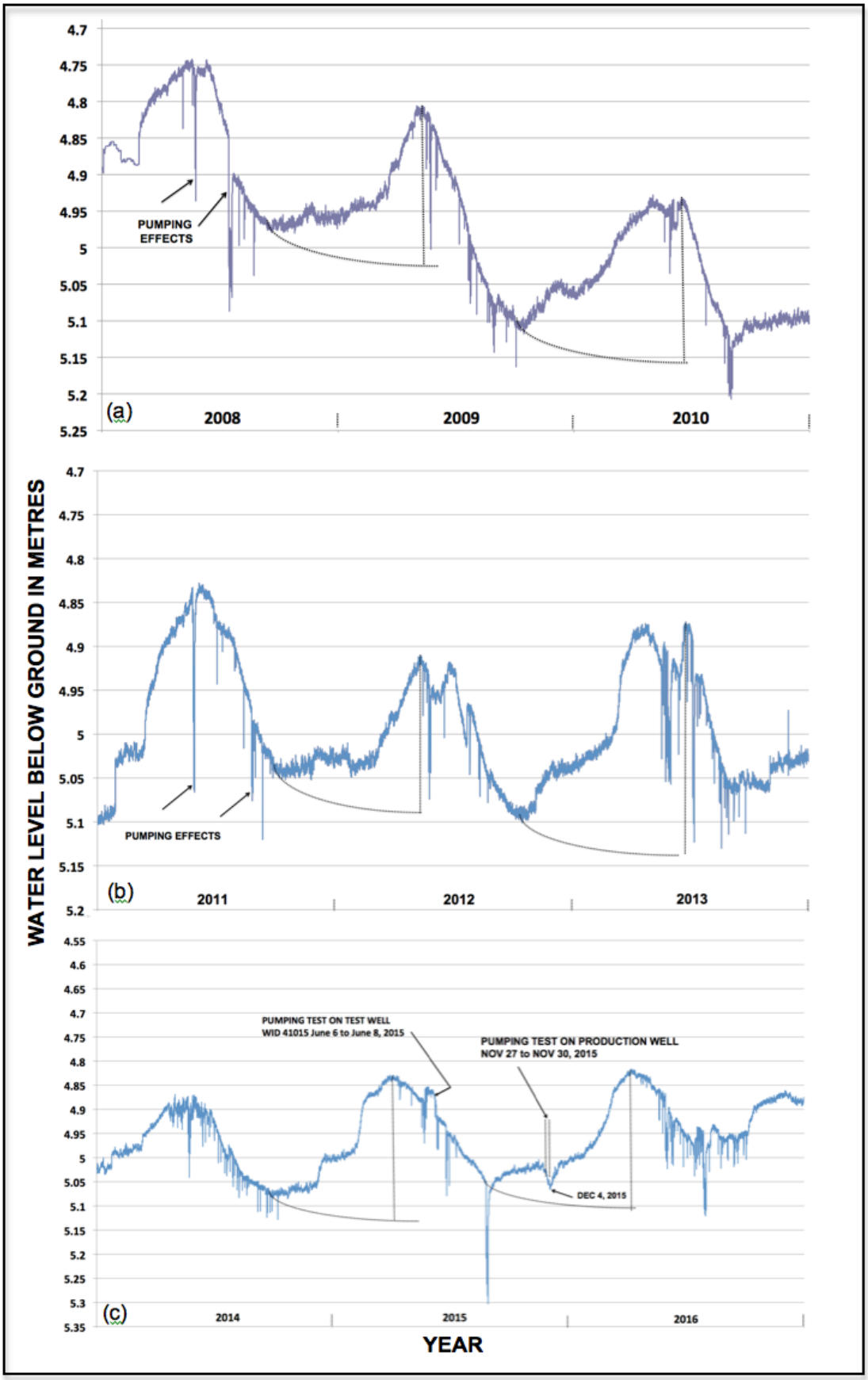

Figure 8. Graphical application of the WTF method in 6 cases to determine the the seasonal water level rise in Observation Well 80 during the 2008 to 2016 period.

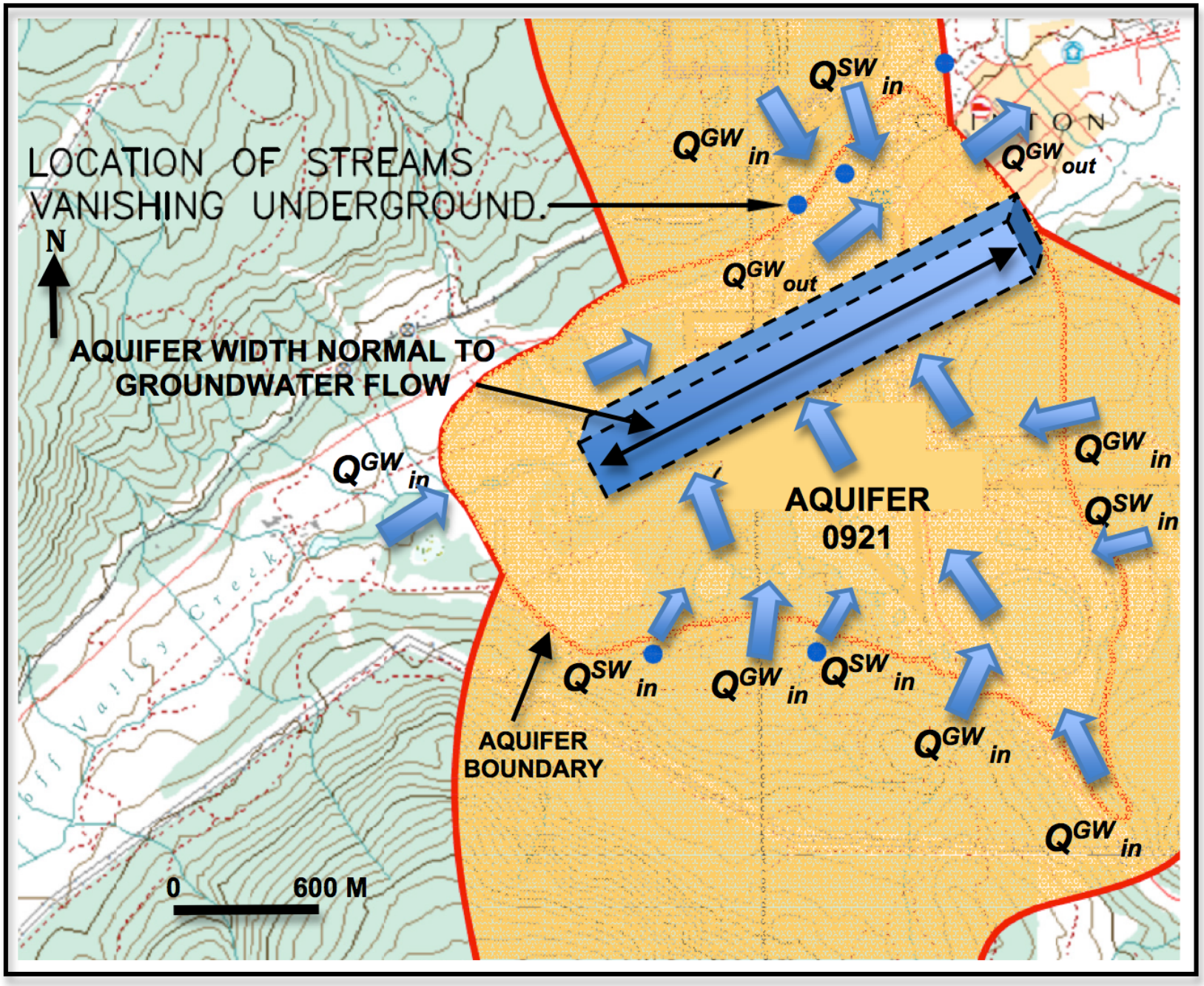

Figure 9. Application of Darcy's Law to estimate groundwater outflow component in lower reaches of aquifer showing inferred groundwater flow directions. Base drawing from EHD Consulting Ltd (2018).

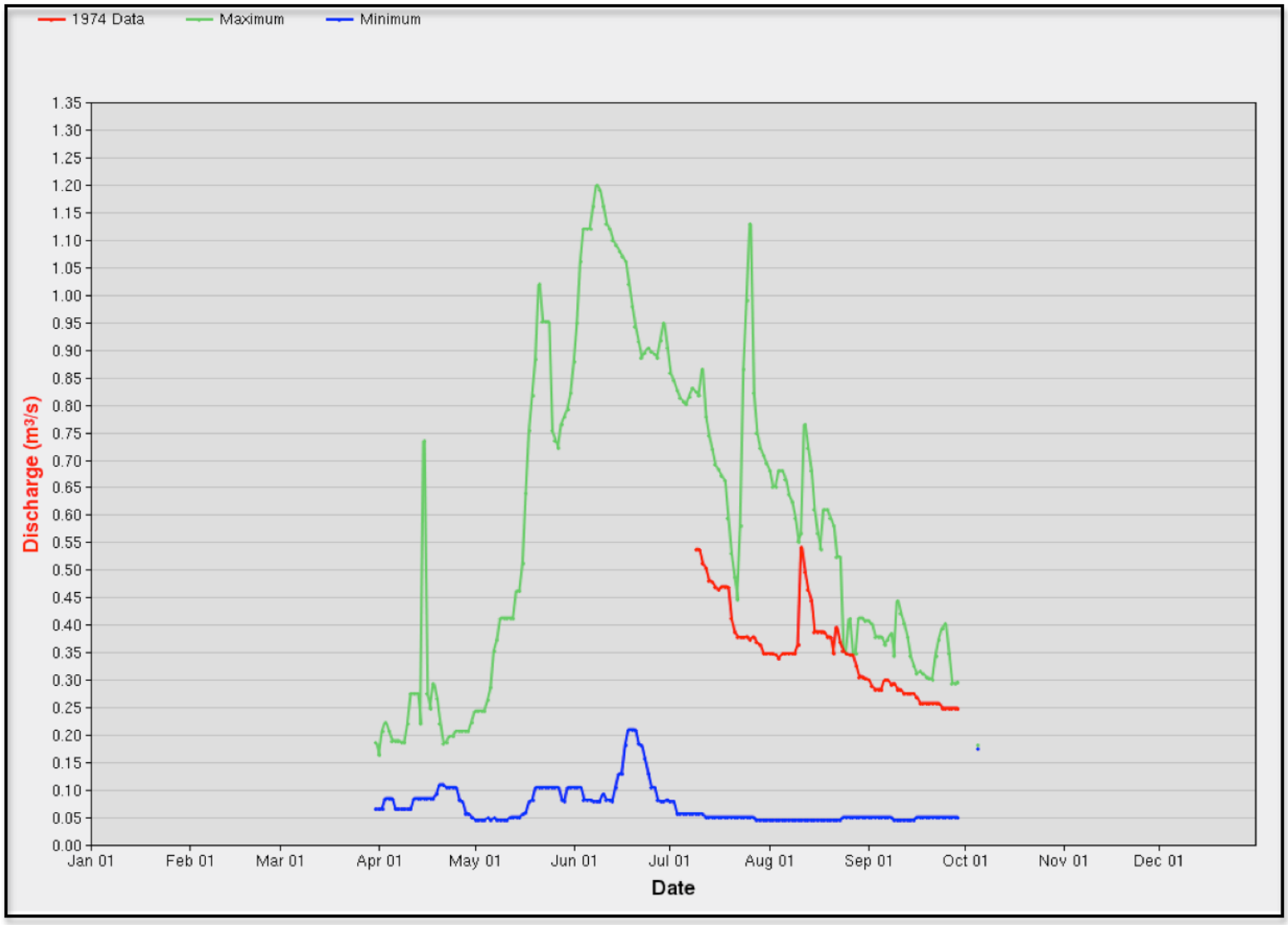

Figure 10. Daily discharge graph for Cutoff Valley Creek hydrometric station (08LF037) near Clinton. From Government of Canada (2018c).

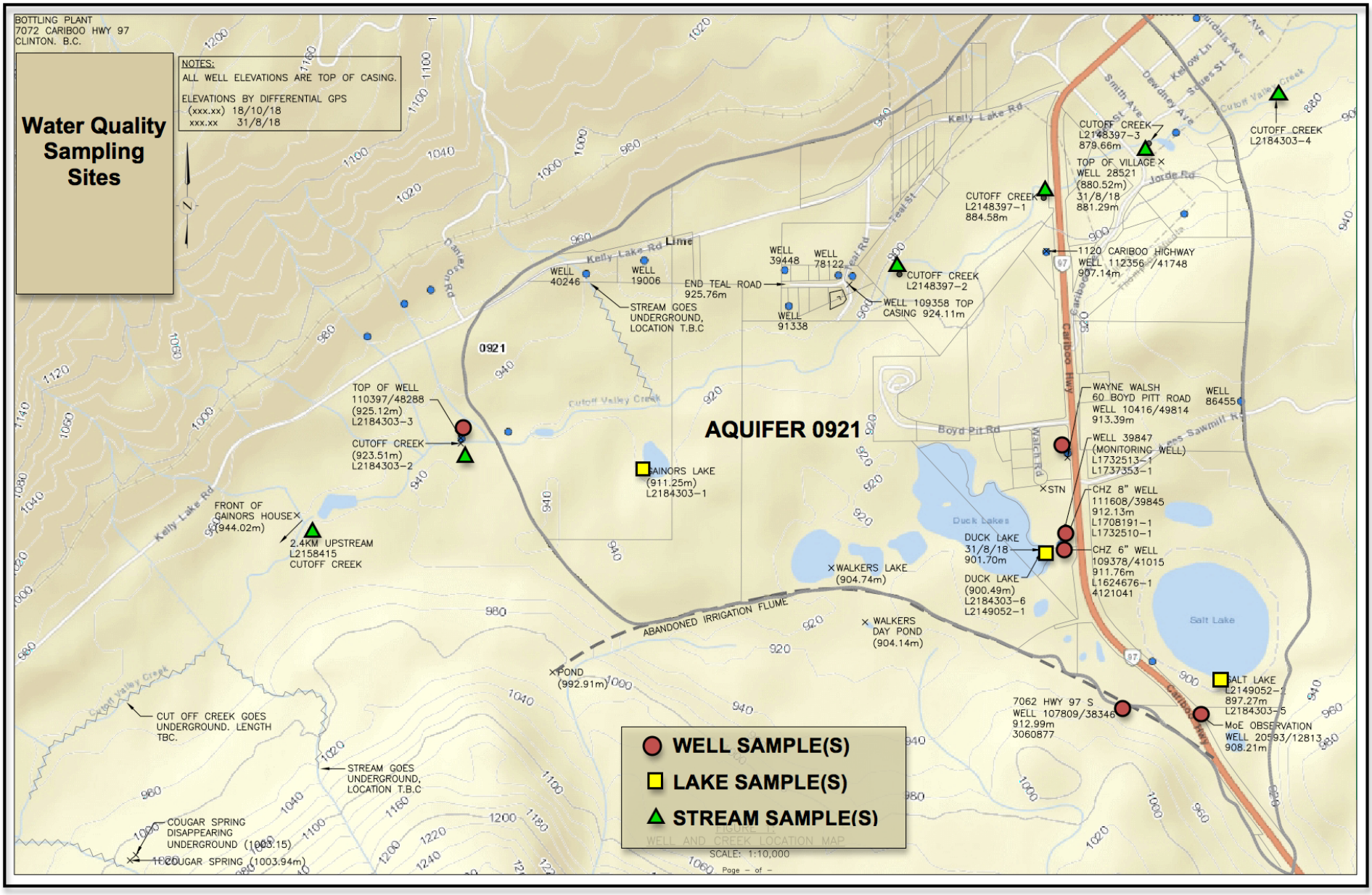

Figure 11. Location of water quality sampling sites.

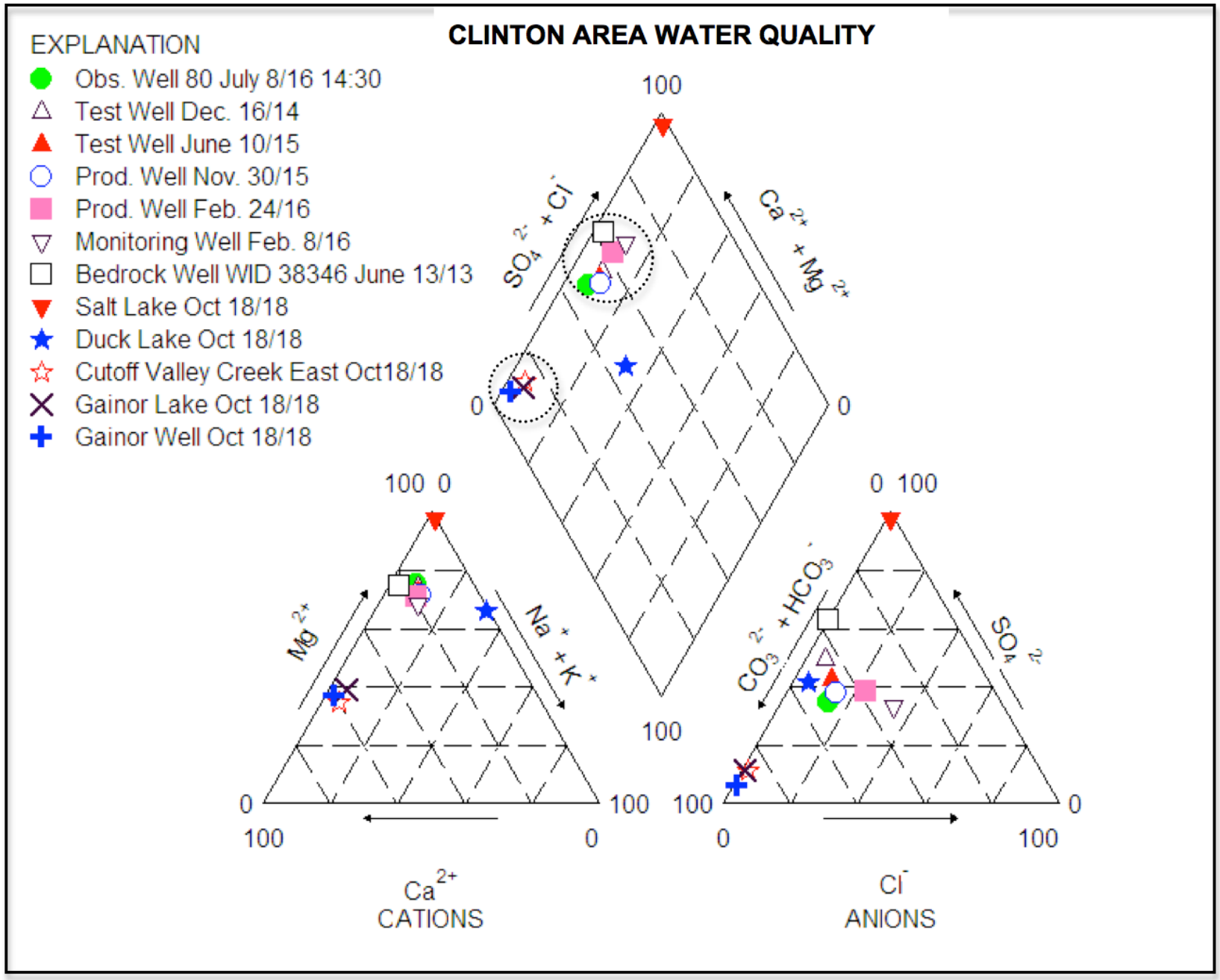

Figure 12. Piper trilinear diagram showing hydrochemical relationships among groundwater and surface water samples.

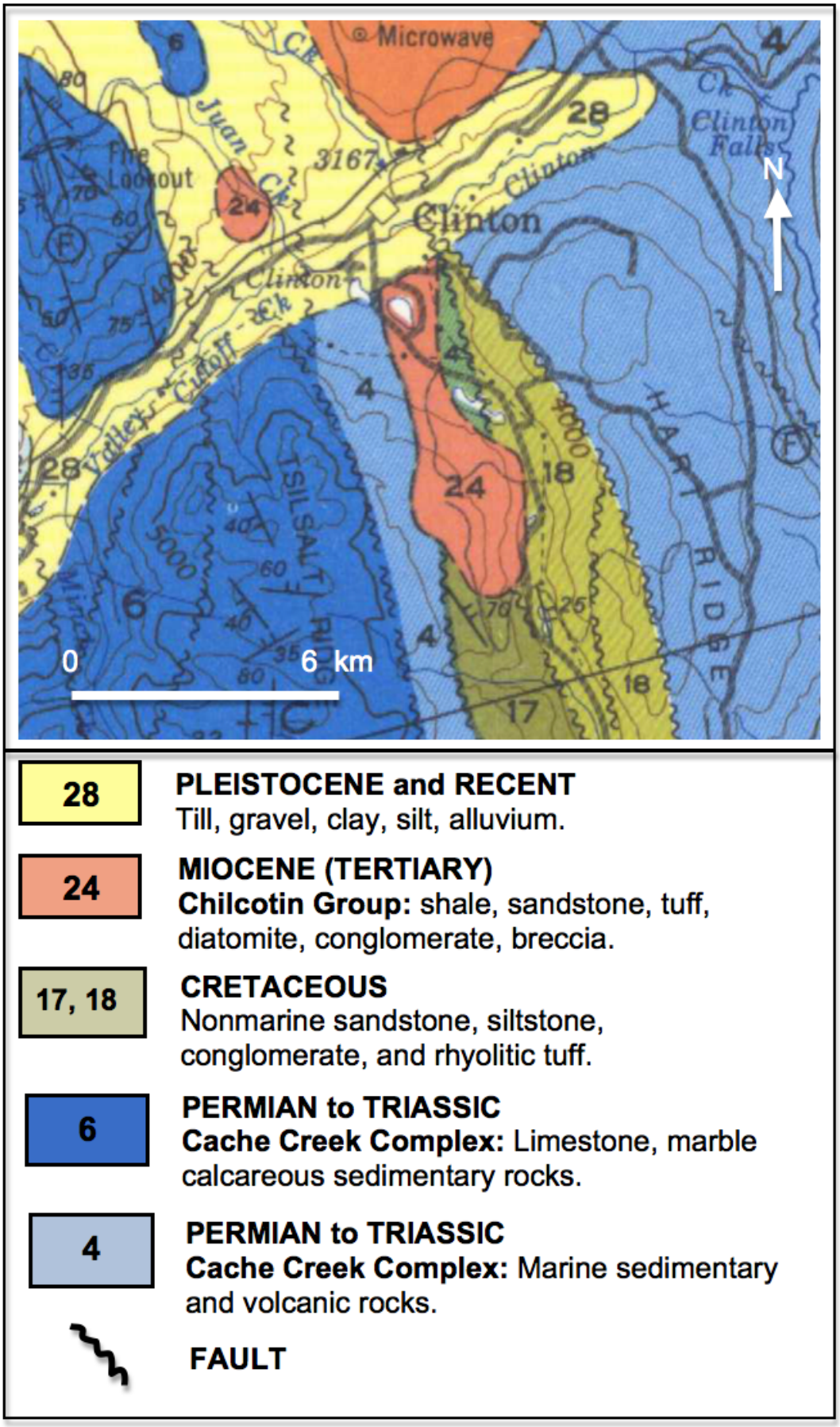

Figure 13. Bedrock geology. Basemap from Campbell and Tipper (1971). Legend modified after Schiarizza *et al*., (1994).

APPENDIX A

Table A1. Comparison of monthly and annual precipitation for climate stations at Clinton and Red Lake for the 2003 to 2007 period.

YEAR	MONTH	Total Precipitation Clinton AUT 1161661	Total Precipitation Red Lake 1166658	Difference	% Difference	Ratio Clinton/Red Lake
2003	January		23	-23	-100.00	0.00
	February	7	21	-14	-66.67	0.33
	March	19	54.4	-35.4	-65.07	0.35
	April		53.9	-53.9	-100.00	0.00
	May	22.5	45.9	-23.4	-50.98	0.49
	June	35.5	30.9	4.6	14.89	1.15
	July	3	2.8	0.2	7.14	1.07
	August	14	11.4	2.6	22.81	1.23
	September	14	20.4	-6.4	-31.37	0.69
	October	18	57.7	-39.7	-68.80	0.31
	November	36	59.5	-23.5	-39.50	0.61
	December	10	44	-34	-77.27	0.23
	Totals:	**179**	**424.9**	**-245.9**	**-57.87**	**0.42**
2004	January		63.5	-63.5	-100.00	0.00
	February		21.9	-21.9	-100.00	0.00
	March	7	25.5	-18.5	-72.55	0.27
	April	36.5	46.3	-9.8	-21.17	0.79
	May	43	61.9	-18.9	-30.53	0.69
	June	36	103	-67	-65.05	0.35
	July	12.5	42.9	-30.4	-70.86	0.29
	August	96.5	123.1	-26.6	-21.61	0.78
	September	57.5	80.5	-23	-28.57	0.71
	October	22	40.2	-18.2	-45.27	0.55
	November	45.1	33	12.1	36.67	1.37
	December	35	49	-14	-28.57	0.71
	Totals:	**391.1**	**690.8**	**-299.7**	**-43.38**	**0.57**
2005	January	21.5	29.6	-8.1	-27.36	0.73
	February	15.5	32.5	-17	-52.31	0.48
	March	21.6	30	-8.4	-28.00	0.72
	April	15	8.5	6.5	76.47	1.76
	May	39	21.2	17.8	83.96	1.84
	June	42.5	110.2	-67.7	-61.43	0.39
	July	5	21.8	-16.8	-77.06	0.23
	August	16	20.8	-4.8	-23.08	0.77
	September	72	33.5	38.5	114.93	2.15
	October	21.5	55.2	-33.7	-61.05	0.39
	November	21.5	65	-43.5	-66.92	0.33
	December	15.5	27.5	-12	-43.64	0.56
	Totals:	**306.6**	**455.8**	**-149.2**	**-32.73**	**0.67**
2006	January	24.5	52.5	-28	-53.33	0.47
	February	20.5	18	2.5	13.89	1.14
	March	13.5	31.5	-18	-57.14	0.43
	April	17.5	8.2	9.3	113.41	2.13
	May	55.5	52.5	3	5.71	1.06
	June	36.5	50.6	-14.1	-27.87	0.72
	July	14.5	27.5	-13	-47.27	0.53
	August	22.5	20.4	2.1	10.29	1.10
	September	80.5	70.7	9.8	13.86	1.14
	October	25.5	24.7	0.8	3.24	1.03
	November	37	67.9	-30.9	-45.51	0.54
	December	14.5	52	-37.5	-72.12	0.28
	Totals:	**362.5**	**476.5**	**-114**	**-23.92**	**0.76**

Data from Government of Canada (2018b).

APPENDIX B

Table B1. Summary of recharge calculations based on WTF analysis of hydrographs for Observation Well 80.

Case	Period	Δh (m)	Δt (days)	S_y = 0.05			S_y = 0.10			S_y = 0.15			S_y = 0.20		
				R (mm)	Volume (m^3)	Volume (USgpm)	R (mm)	Volume (m^3)	Volume (USgpm)	R (mm)	Volume (m^3)	Volume (USgpm)	R (mm)	Volume (m^3)	Volume (USgpm)
1	Nov 9/73 to Apr 7/74	0.2045	150	10.23	41923	*21.1*	20.45	83845	*42.1*	30.675	125768	*63.2*	40.9	167690	*84.3*
2	Oct 25/74 to May 5/75	0.256	192	12.8	52480	*26.4*	25.6	104960	*52.8*	38.4	157440	*79.1*	51.2	209920	*105.5*
3	Jan 5/77 to May 5/77	0.1445	121	7.225	29623	*14.9*	14.45	59245	*29.8*	21.675	88868	*44.7*	28.9	118490	*59.6*
4	Oct 7/77 to May 4/78	0.3724	210	18.62	76342	*38.4*	37.24	152684	*76.7*	55.86	229026	*115.1*	74.48	305368	*153.5*
5	Jan 7/79-May 4/79	0.18	118	9	36900	*18.5*	18	73800	*37.1*	27	110700	*55.6*	36	147600	*74.2*
6	Jan 3/83 to May 2/83	0.303	120	15.15	62115	*31.2*	30.3	124230	*62.4*	45.45	186345	*93.7*	60.6	248460	*124.9*
7	Sept 2/83 to May 16/84	0.208	258	10.4	42640	*21.4*	20.8	85280	*42.9*	31.2	127920	*64.3*	41.6	170560	*85.7*
8	Oct 15/84 to May 3/85	0.272	200	13.6	55760	*28.0*	27.2	111520	*56.1*	40.8	167280	*84.1*	54.4	223040	*112.1*
9	Sept 3/85 to May 20/86	0.282	260	14.1	57810	*29.1*	28.2	115620	*58.1*	42.3	173430	*87.2*	56.4	231240	*116.2*
10	Sept 28/86 to Mar 18/87	0.296	172	14.8	60680	*30.5*	29.6	121360	*61.0*	44.4	182040	*91.5*	59.2	242720	*122.0*
11	Oct 14/87 to May 17/88	0.143	217	7.15	29315	*14.7*	14.3	58630	*29.5*	21.45	87945	*44.2*	28.6	117260	*58.9*
12	Aug 20/88 to April 22/89	0.2	246	10	41000	*20.6*	20	82000	*41.2*	30	123000	*61.8*	40	164000	*82.4*
13	July 31/89 to July 11/90	0.405	346	20.25	83025	*41.7*	40.5	166050	*83.5*	60.75	249075	*125.2*	81	332100	*166.9*
14	Oct 19/90 to May 2/91	0.198	196	9.9	40590	*20.4*	19.8	81180	*40.8*	29.7	121770	*61.2*	39.6	162360	*81.6*
15	Oct 1/93 to May 2/94	0.27	214	13.5	55350	*27.8*	27	110700	*55.6*	40.5	166050	*83.5*	54	221400	*111.3*
16	Oct 2/94 to May 1/95	0.244	212	12.2	50020	*25.1*	24.4	100040	*50.3*	36.6	150060	*75.4*	48.8	200080	*100.6*
17	Oct 1/95 to June 2/96	0.236	246	11.8	48380	*24.3*	23.6	96760	*48.6*	35.4	145140	*72.9*	47.2	193520	*97.3*
18	Sept 2/96 to May 2/97	0.335	243	16.75	68675	*34.5*	33.5	137350	*69.0*	50.25	206025	*103.6*	67	274700	*138.1*
19	Sept 1/97 to May 1/98	0.203	243	10.15	41615	*20.9*	20.3	83230	*41.8*	30.45	124845	*62.7*	40.6	166460	*83.7*
20	Oct 1/98 to May 2/99	0.295	214	14.75	60475	*30.4*	29.5	120950	*60.8*	44.25	181425	*91.2*	59	241900	*121.6*
21	Sept 1/99 to May 1/00	0.193	244	9.65	39565	*19.9*	19.3	79130	*39.8*	28.95	118695	*59.7*	38.6	158260	*79.5*
22	Sept 2/00 to May 1/01	0.135	242	6.75	27675	*13.9*	13.5	55350	*27.8*	20.25	83025	*41.7*	27	110700	*55.6*
23	Oct 1/01 to June 2/02	0.229	255	11.45	46945	*23.6*	22.9	93890	*47.2*	34.35	140835	*70.8*	45.8	187780	*94.4*
24	Oct 1/02 to June 1/03	0.253	254	12.65	51865	*26.1*	25.3	103730	*52.1*	37.95	155595	*78.2*	50.6	207460	*104.3*
25	Sept 17/08 to May 10/09	0.223	236	11.15	45715	*23.0*	22.3	91430	*46.0*	33.45	137145	*68.9*	44.6	182860	*91.9*
26	Oct 15/09 to June 15/10	0.224	250	11.2	45920	*23.1*	22.4	91840	*46.2*	33.6	137760	*69.2*	44.8	183680	*92.3*
27	Oct 17/11 to May 10/12	0.177	207	8.85	36285	*18.2*	17.7	72570	*36.5*	26.55	108855	*54.7*	35.4	145140	*72.9*
28	Oct 13/12 to June 25/13	0.266	266	13.3	54530	*27.4*	26.6	109060	*54.8*	39.9	163590	*82.2*	53.2	218120	*109.6*
29	Sept 27/14 to April 5/15	0.301	191	15.05	61705	*31.0*	30.1	123410	*62.0*	45.15	185115	*93.0*	60.2	246820	*124.1*
30	Aug 25/15 to April 8/16	0.292	228	14.6	59860	*30.1*	29.2	119720	*60.2*	43.8	179580	*90.3*	58.4	239440	*120.3*
	Averages	0.245	218	12.23	50159	***25.2***	24.5	100319	***50.4***	36.702	150478	***75.6***	48.9	200638	***100.8***

Based on area of aquifer = 4.1 km^2

APPENDIX C

Table C1. Thornthwaite-type water balance for Red Lake Climate Station, normal year.

THORNTHWAITE-TYPE MONTHLY WATER-BALANCE MODEL - AQUIFER 0921 AT CLINTON

Location: Red Lake, BC **Lat. =** 51.0 degree 0.89 radians ***SOILmax =*** 100 mm

Declination (deg)	-21.3	-13.3	-2.0	9.8	18.9	23.3	21.3	13.7	3.0	-9.0	-18.6	-23.3
Declination (rad)	-0.37	-0.23	-0.03	0.17	0.33	0.41	0.37	0.24	0.05	-0.16	-0.32	-0.41
DayLength (D) (hr)*	8.2	9.7	11.7	13.6	15.3	16.3	15.8	14.3	12.5	10.5	8.7	7.7

MONTHLY WATER BALANCE DATA - Normal Year

Month:	J	F	M	A	M	J	J	A	S	O	N	D	Year
PRECIPITATION (P)	35.4	23.5	31.5	38.0	50.1	69.1	52.3	41.3	38.9	35.5	43.3	46.3	505.2
TEMPERATURE (T)	-6.3	-4.1	-0.2	4.6	8.6	12.5	15.5	14.9	10.7	4.5	-2.8	-6.1	
MELTFACTOR (F)	0.00	0.00	0.00	0.77	1.00	1.00	1.00	1.00	1.00	0.75	0.00	0.00	
RAIN	1.5	1.2	4.4	22.0	43.6	69.1	51.5	41.3	37.5	23.6	6.8	0.5	303.0
SNOW	34	22	27	16	7	0	1	0	1	12	37	46	202
PACK	127	151	182	45	0	0	0	0	0	2	46	92	
MELT	0	0	0	152	51	0	1	0	1	9	0	0	214
INPUT (W_m)	1.5	1.2	4.4	174.0	94.7	69.1	52.3	41.3	38.9	32.5	6.8	0.5	517.2
PET	0.0	0.0	0.0	38.5	56.3	76.5	89.4	78.1	52.4	29.4	0.0	0.0	420.6
W_m - PET	2	1	4	135	38	-7	-37	-37	-14	3	7	1	
SOIL	51	52	56	100	100	93	64	44	39	42	49	49	
ΔSOIL	2	1	4	44	0	-7	-29	-20	-6	3	7	1	
ET	0.0	0.0	0.0	38.5	56.3	76.2	81.1	61.0	44.5	29.4	0.0	0.0	387.1
SURP=W-ET-ΔSOIL	0.0	0.0	0.0	91.7	38.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	130.1
DEFIC=PET-ET	0.0	0.0	0.0	0.0	0.0	0.3	8.3	17.1	7.9	0.0	0.0	0.0	33.5

Notes:

Water balance modified from Dingman 2001: ex. 7-13, Box 7-3 using ET model of Hamon (1963),

Temperature are in °C, water balance terms in mm.

Input Data - monthly normal data recorded at Red Lake, BC (Climate I.D. 1166658)

Computed Values

m is the month

F_m is calculated assuming if T_m is less than or equal to 0°C, F_m=0, if 0°C is less than 6°C, F_m=0.167xT_m; and if T_m is greater than or equal to 6°C, F_m=1.

$PACK_m$ is calculated as $(1-F_m)^2 x P_m + (1-F_m) x PACK_{m-1}$.

Water Input (W_m) is calculated as $RAIN_m + MELT_m$.

PET is potential evapotranspiration and, when T_m is greater than 0°C, is calculated as $924Dx0.611xe[17.1*T_m/(T_m+237.3)]/(T_m+273.2)$

when T_m is less than 0°C, PET is 0.

SOIL is the soil moisture value and is calculated as $\min\{[(W_m-PET_m)+SOIL_{m-1}], SOIL_{max}\}$,

The change in soil moisture is calculated as $SOIL_{m-1}\{1-\exp[-(PET_m-W_m)/SOIL_{max}]\}$.

ET is evapotranspiration and if W_m is greater than PET, ET=PET, if W_m is less than PET, $ET=W_m+SOIL_{m-1}-SOIL_m$.

SURP is surplus water and is calculated by the equation shown above.

DEFIC is the soil moisture deficit, which expresses the loss of water from the soil to satisfy evapotranspiration demands and is limited by the maximum depth from which soil moisture may be drawn ($SOIL_{max}$). This will vary based on soil type and is assumed to be 100mm where not otherwise known.

APPENDIX D

Summary of Water Quality Analyses for Wells
and Surface Water Sources

Table D1. Summary of water quality analyses.

Parameters/Site and Sampling Date	Clinton Obs. Well 80 12:55 hr 06-Jun-05	Clinton Obs. Well 80 12:00 hr 03-Nov-05	Clinton Obs. Well 80 13:00 hr 03-Mar-10	Clinton Obs. Well 80 14:30 hr 08-Jul-15	Clinton Obs. Well 80 14:25 hr 08-Jul-15	Test Well WID 41015 13:20 hr 16-Dec-14	L1624676-1 Test Well WID 41015 10-Jun-15	L1708191-1 Production Well WID 39845 30-Nov-15	L1732510-1 Production Well 14:30 hr WID 39845 08-Feb-16	Production Well WID 39845 24-Feb-16	L1732513-1 Monitoring Well WID 39847 08-Feb-16	L1737353-1 Monitoring Well WID 39847 23-Feb-16	Domestic Well WID 48914 27-Nov-90	L2184303-3 Gainor Well WID 48288 16:00 hr 18-Oct-18	Bedrock Well WID 38346 13:55 hr 13-Jun-13	L2149052-1 Duck Lake 10:10 hr 17-Aug-18	L2184303-6 Duck Lake 12:00 hr 18-Oct-18
PHYSICAL TESTS																	
True Colour						<5	<5	<5.0	<5.0		<5			<5	<5		6.6
Conductivity	1660	1830	1860	1940	1940	1630	1550	1420	1430		1270		935	1190	2970	3220	3080
Total Hardness ($CaCO_3$)	1100	1100	1160	1040	1030	1000	812	770		648.68	629		487	801	2220	1680	1580
pH	8.3	8.1	8.0	7.95	8.01	7.89	8.50	8.04	8.08	7.20	8.10	7.82		7.88	7.46		9.13
Total Dissolved solids (TDS)	**1220**	**1260**	**1200**	**1390**	**1380**	**1180**	**1000**	**882**	**904**	**784.16**	**799**			**776**	**2390**	**2650**	**2470**
Turbidity	**17**	**1.0**		**13.4**	**13.8**	0.4	0.15	0.11	0.61	0.93	0.34		**65**	**10.6**	**8.0**		**1.29**
ANIONS and OTHER TESTS																	
Alkalinity (Total as $CaCO_3$)	635	628	630	628	622	480	480	390	386	410.63	215		268	667	771		1190
Alkalinity (PP as $CaCO_3$)	<0.5	<0.5		<2.0	<2.0	<1								<1.0	<1		389
Alkalinity (OH as $CaCO_3$)						<1								<1.0	<1		<1.0
Bicarbonate	775	766	770							500.68							
Carbonate	<0.5		<0.5							0.00							
Hydroxide	<0.5									0.00							
Chloride	108	104	99	123	120	42.8	81.0	86.6		88.07	163			6.5	3.47	73	75
Bromide	<0.1	<0.1	0.7					0.087			<0.25			0.25			<1.0
Fluoride	0.22	0.21	0.20	0.18	0.20	0.23	0. 24	0.23		1.0	0.19		0.17	<0.10	0.17		0.40
Nitrate (N)	<0.02	<0.002	0.004	<0.0030	<0.030	<0.010	0.332	0.309		0.113	0.113		0.02	0.608	<0.010		<0.10
Nitrite (N)	<0.002	0.003	<0.002	<0.0020	<0.010	<0.010	0.0170	0.0197		<0.45	0.0208		0.006	<0.0050	<0.010		<0.020
Total Organic Nitrogen (N)	0.14	0.03	0.04			0.090		0.103							0.248		
Diss. Organic Nitrogen (N)				<0.050	<0.050												
Total Ammonia (N)	<0.005	0.089	0.041		0.0385	0.054		0.0191		0.10		<0.0050			0.651		
Nitrate plus Nitrite (N)	0.004	0.002	0.004	<0.0036	<0.032	<0.020							0.02		<0.01		
Total Nitrogen (N)	0.14	0.12	0.08														
Total Diss. Nitrogen (N)				0.069	0.055												
Diss. Kjeldahl Nitrogen				0.069	0.055												
Total. Kjeldahl Nitrogen	0.14	0.12	0.08			0.14		0.122				0.081			0.90		
Cyanide, Total												<0.0050					
Total Organic Carbon (C)								1.55				0.82					
Total Phosphorus (P)	0.051 and <0.1	0.046 and 0.1	0.058			<0.2		0.0429	<0.30		<0.30	0.0333		0.053	0.3	<0.10	<0.10
Silicate (as Si02)									29.1	30.42	24.5			30.5		2.47	2.60
Total Diss. Phosphorus (P)	0.012 and <0.1	0.011	0.017	0.0083	0.0082	<0.2									<0.2		
Sulphate	360	357	340	406	398	**511**	425	300		200.00	214			41.9	1260		891
Sulphide								<0.20				<0.020					
Metasilicic Acid										39.55	31.9					3.21	
TOTAL METALS																	
Aluminum	4	<3	1.0			<50	<10	<10		0.00	<10			284	90	35.3	12.5
Antimony	0.03	<0.05	<0.02			<1	<0.50	<0.5		<2	<0.5			<0.10	25	0.59	0.58
Arsenic	2.6	4	3.55			5	1.07	1.06			1.3			0.60	**57**	5.95	5.88
Barium	20.5	21.2	21.4			<50	<20	17	<20	20	22		10	29.2	<50	4.61	3.60
Beryllium	<0.1	<0.2	<0.01			<1		<5	<5.0		<5			<0.10	<1	<0.20	<0.20
Bismuth	<0.1	<0.2	<0.005			<1		<200	<200		<200			<0.050	<1	<0.10	<0.10
Boron	30	28	<50			240	<100	<100	<100	37	<100		300	<10	100	427	427
Cadmium	<0.05	<0.1	<0.005			<0.2	<0.20	<0.2			0.110			0.166	<0.1	<0.010	0.150
Cesium														0.013			0.026
Chromium	1	<2	0.2			<5	<0.20	<2		<1	2.01		<10	2.08	<5	0.32	0.23
Cobalt	0.19	0.14	0.156			<0.5		<10		<1	<0.50			0.41	8.5	<0.20	<0.20
Copper	<0.3	<0.5	<0.05			<2	<1.0	1.9		2	5.8		10	2.18	<2	<1.0	4.4
Iron	**2080**	**1160**	**1200**			<100	<30	<30	204	50	**918**		**8200**	**914**	**1500**	51	<20
Lead	0.90	0.2	0.147			<1	<0.50	<0.5			<1.0			0.054	<1	<0.10	0.21
Lithium	14.0	13.9	15.4			13		<10	<50	11	<50			3.3	41	20.0	19.8
Manganese	**51**	49.9	**56.3**			**558**	**536**	**455**	**517**	**562**	**294**		**240**	10.6	**167**	9.75	14.7
Mercury						<0.2	<0.20	<0.2	<0.2	<0.1	<0.20			<0.0050	<0.2	<0.0050	<0.0050
Molybdenum	4.3	4.4	5.66			19		<30		1.5	9.3			3.61	26	11.7	11.6
Nickel	0.8	<0.5	0.64			<2		<50		1	<5.0			6.71	67	<1.0	<1.0
Rubidium														0.57		16.0	15.5
Selenium	<1	<2	<0.04			11	5.3	7.9			32.3			5.90	<5	0.30	0.33
Silicon						19000		14500	14400		12100			15300	28000	1530	1430
Silver	<0.1	<0.2	<0.005			<0.5		<10		<1	<0.050			<0.010	<0.5	<0.040	<0.020
Strontium	369	377	436			260		199	201	215	201			353	2720	12.9	9.62
Tellurium						<2								<0.20	<2	<0.40	<0.40
Thallium	<0.01	<0.3	<0.002			<0.2		<200			<0.20			<0.010	<0.02	<0.020	<0.020
Thorium						<1								<0.10	<1	<0.20	<0.20
Tin	<0.05	<0.1	0.01			<2		<30	<30		<30			<0.10	<2	<0.20	<0.20
Titanium	<3	<3	<0.5			<50		<10	<50		<50			14.1	<50	2.56	1.76
Tungsten														<0.10		<0.20	<0.20
Uranium	3.20	3.52	3.76			4.4	3.30	2.88			1.62			3.11	6.8	6.68	6.85
Vanadium	<0.3	1.8	<0.2			<10		<30	<30	<5	<30			2.89	<10	1.1	1.0
Zinc	<0.5	<1	0.4			<40	<50	10.4	<5.0		<5.0		50	3.0	<40	<6.0	7.9
Zirconium	<5	<5	<0.1			<1								0.262	<1	0.18	0.24
Calcium	75.6	75.3	86.4			76.9	64.2	60.4	61	55.60	56.5		30	199	203	7.27	6.64
Magnesium	222	223	230			197	158	150	154	123.80	118		100	74.0	417	403	379
Potassium	7	7	8.20			6.3	5.86	5.47	6.2	5.47	5.6			2.37	11.1	87.8	86.1
Sodium	38.0	37.9	40.5			42.8	38.0	42.1	41.7	28.86	35.9			10.50	32.8	**330**	**309**
Sulphur	120	120	166			170								18.6		351	376

Note: Parameters exceeeding Canadian Drinking Water Guideline (2017) shown in Red Font.

Table D1 (Cont). Summary of water quality analyses.

Parameters/Site and Sampling Date	L21149052-1 Salt Lake 10:45 hr 17-Aug-18	L2184303-5 Salt Lake 17:53 hr 18-Oct-18	L2184303-1 Gainor Lake 16:25 hr 18-Oct-18	L2148397-1 Cut Off Creek Hwy 1 West 14:10 hr 15-Aug-18	L2184303-2 Cut Off Creek Hwy 1 West 16:50 hr 18-Oct-18	L2148397-2 Cut Off Creek Gravel Pit Rd 14:00 hr 15-Aug-18	L2148397-3 Cut Off Creek Reg. Con. Pk. 13:30 hr 15-Aug-18	L2158415-1 Cut Off Creek Off Kelly Lk. Rd. 11:30 hr 04-Sep-18	L2184303-4 Cut Off Creek East 17:00 hr 18-Oct-18	Clinton Obs. Well 80 12:55 hr 06-Jun-05	Clinton Obs. Well 80 14:30 hr 08-Jul-15	Clinton Obs. Well 80 14:25 hr 08-Jul-15	Test Well WID 41015 13:20 hr 16-Dec-14	Bedrock Well WID 38346 13:55 hr 13-Jun-13	Canadian Drinking WAter Guideline 2017	Units
PHYSICAL TESTS																
True Colour		48.8	<5.0		5.4				6.8						< or =15	TCU
Conductivity	72100	53200	640	676	621	680	678	452	637							µS/cm
Total Hardness ($CaCO_3$)	150000	58700	363	351	357	355	366	226	362							mg/L
pH		8.45	8.25		8.31				8.48						7.0-10.5	pH units
Total Dissolved solids (TDS)	232000	109000	384	420	389	419	425	287	363						< or = 500	mg/L
Turbidity		18.9	0.63		1.07				1.42						<1.0	NTU
ANIONS and OTHER TESTS																
Alkalinity (Total as $CaCO_3$)		1170	324		312				327							mg/L
Alkalinity (PP as $CaCO_3$)		141	<1.0		5.0				21.0							mg/L
Alkalinity (OH as $CaCO_3$)		<1.0	<1.0		<1.0				<1.0							
Bicarbonate																mg/L
Carbonate																mg/L
Hydroxide																mg/L
Chloride	120	435	<2.5		2.99			1.87	4.8						< or = 250	mg/L
Bromide		<5.0	<0.25		<0.050				<0.25							
Fluoride		<2.0	0.10		0.107				<2.0						1.5	mg/L
Nitrate (N)		<0.50	0.187		0.0454				0.065						10	mg/L
Nitrite (N)		<0.10	<0.0050		0.0011				<0.0050						1	mg/L
Total Organic Nitrogen (N)																mg/L
Diss. Organic Nitrogen (N)																mg/L
Total Ammonia (N)																mg/L
Nitrate plus Nitrite (N)																mg/L
Total Nitrogen (N)																mg/L
Total Diss. Nitrogen (N)																mg/L
Diss. Kjeldahl Nitrogen																mg/L
Total. Kjeldahl Nitrogen																mg/L
Cyanide, Total																
Total Organic Carbon (C)																mg/L
Total Phosphorus (P)	13	<5.0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050							mg/L
Silicate (as Si02)	2.91	0.72	20.3	20.7	17.5	19.0	20.3	14.6	18.1							mg/L
Total Diss. Phosphorus (P)																mg/L
Sulphate		69700	40.3		41.5				40.8						< or =500	mg/L
Sulphide															< or = 0.05	mg/L
Metasilicic Acid	3.78			26.91		24.7	26.39	18.98								
TOTAL METALS										**DISSOLVED METALS**						
Aluminum	4180	<300	3.1	89.3	50.7	78.9	78.2	66.8	54.4	<2	<1.0	<1.0	<50	<50		µg/L
Antimony	<20	<10	0.13	<0.1	0.11	<0.1	<0.1	<0.1	<0.10	<0.03	<0.10	<0.10	<1	25	6	µg/L
Arsenic	44	15	0.68	0.75	0.53	0.73	0.76	0.53	0.60	1.90	3.67	3.65	<5	55	10	µg/L
Barium	100	22	26.9	50.5	54.4	51.8	50.6	51.0	49.2	17.6	21.1	20.8	<50	<50	1000	µg/L
Beryllium	<20	<10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<1	<1		µg/L
Bismuth	<10	<5.0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.1	<0.050	<0.050	<1	<1		µg/L
Boron	<2000	<1000	13	<10	<10	<10	<10	<10	<10	32	38	37	<40	70	5000	µg/L
Cadmium	<1.0	<0.50	0.0112	0.0092	0.0097	0.0088	0.0077	0.0138	0.0095	<0.05	<0.0050	<0.0050	0.1	<0.1	5	µg/L
Cesium		<1.0	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010							µg/L
Chromium	<20	<10	1.35	0.77	0.48	0.59	0.63	0.47	0.63	<1	<0.10	<0.10	<5	<5	50	µg/L
Cobalt	<20	<10	<0.10	0.13	<0.10	0.11	0.11	<0.10	0.10	0.17	0.13	0.12	<0.5	8.0		µg/L
Copper	<100	<50	<0.50	0.64	0.53	0.5	0.6	0.72	0.66	<0.3	<0.20	<0.20	<2	<2	< or =1000	µg/L
Iron	7300	<1000	<10	189	113	157	170	164	121	<5	906	902	<100	1100	< or = 300	µg/L
Lead	<10	<5.0	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.054	<0.05	<0.050	<0.050	<0.1	<1	10	µg/L
Lithium	<200	<100	1.9	2.1	2.1	2	2.2	2.0	2.1	13.4			<11	41		µg/L
Manganese	942	139	0.62	25.5	25.5	21.5	22.3	24.9	18.8	48.6	52.9	52.9	538	157	< or = 50	µg/L
Mercury	0.055	<0.025	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050				<0.2	0.2	1	µg/L
Molybdenum	88	33.3	4.20	2.03	1.99	2.99	2.20	1.73	2.20	3.8	4.76	4.84	13	26		µg/L
Nickel	<100	<50	<0.50	0.73	0.60	0.67	0.70	<0.50	0.63	0.6	<0.50	<0.50	<2	65		µg/L
Rubidium	145	53	0.63	0.69	0.77	0.67	0.68	9.00	0.60							µg/L
Selenium	<10	<5.0	0.914	0.786	0.628	0.792	0.808	0.418	0.683	<1	0.092	0.117	<5	<5	50	µg/L
Silicon	<20000	<10000	10600	9500	8420	9810	8250	7040	8850		20900	20500	19000	27000		µg/L
Silver	<2.0	<1.0	<0.010	<0.020	<0.010	<0.020	<0.020	<0.010	<0.010	<0.1	<0.010	<0.010	<0.5	<0.5		µg/L
Strontium	8640	3110	278	253	262	257	271	228	263		413	415	240	2690		µg/L
Tellurium	<40	<20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				<2	<2		µg/L
Thallium	<2.0	<1.0	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010		<0.010	<0.010	<0.2	<0.2		µg/L
Thorium	<20	<10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10				<1	<1		µg/L
Tin	<20	<10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10		<0.10	<0.10	<2	<2		µg/L
Titanium	190	<30	<0.30	4.85	2.17	4.12	4.29	3.50	3.06	<3	<0.30	<0.30	<50	<50		µg/L
Tungsten	<20	<10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10							µg/L
Uranium	450	16.0	1.57	0.926	0.922	0.913	0.976	0.462	1.03	2.83	3.42	3.42	4.3	6.6	20	µg/L
Vanadium	<100	<50	1.19	1.13	0.74	1.09	1.11	0.71	0.88	<0.3	<0.50	<0.50	<10	<10		µg/L
Zinc	<600	<300	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<0.5	<1.0	<1.0	<40	<40	< or = 5000	µg/L
Zirconium	<12	<6.0	<0.060	0.074	0.080	0.081	0.089	<0.060	0.068	<5			<1	<1		µg/L
Calcium	289	179	85.5	86.2	95.5	88.6	92.6	61.1	92.2	75.8	75.7	75.8	67.7	202		mg/L
Magnesium	36100	14200	36.4	32.8	28.9	32.4	32.7	17.9	32.0	227	206	205	179	410		mg/L
Potassium	1620	551	3	2.29	2.52	2.20	2.25	1.33	2.37	7	7.37	7.33	6.2	10.1		mg/L
Sodium	18600	6620	8.54	8.27	6.97	7.66	8.25	4.89	8.36	37.7	37.2	37.2	39.0	31.7	< or = 200	mg/L
Sulphur	69600	27100	15.3	12.2	15.1	12.3	12.4	9.79	15.60	120	141	137	167			mg/L

Note: Parameters exceeeding Canadian Drinking Water Guideline (2017) shown in Red Font.

APPENDIX E

Hydrochemical plots of wells and surface water sources.

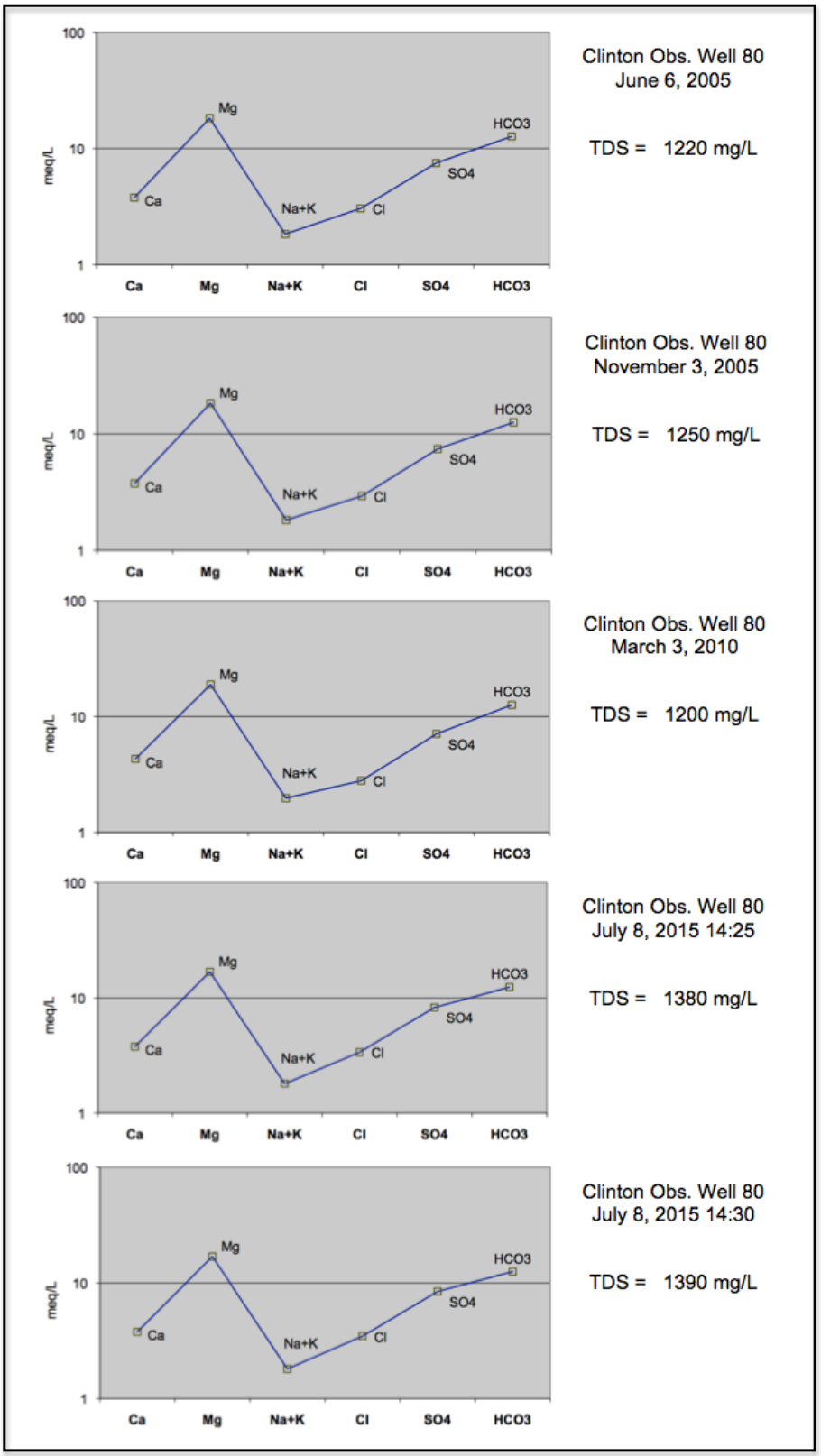

Figure E1. *Schoeller type* plots for samples from Clinton Observation Well 80.

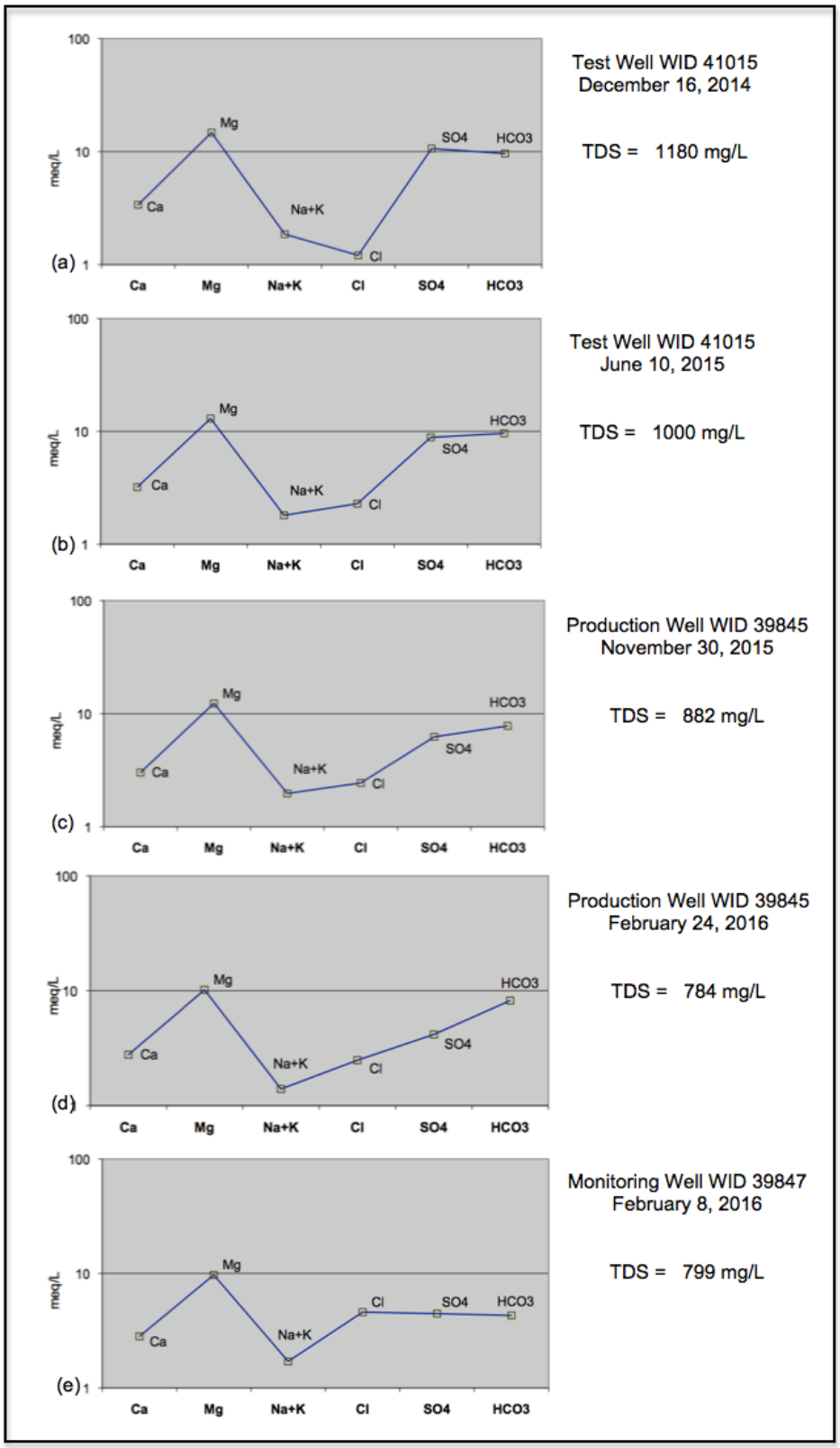

Figure E2. *Schoeller type* plots for water samples from production, test and monitoring wells.

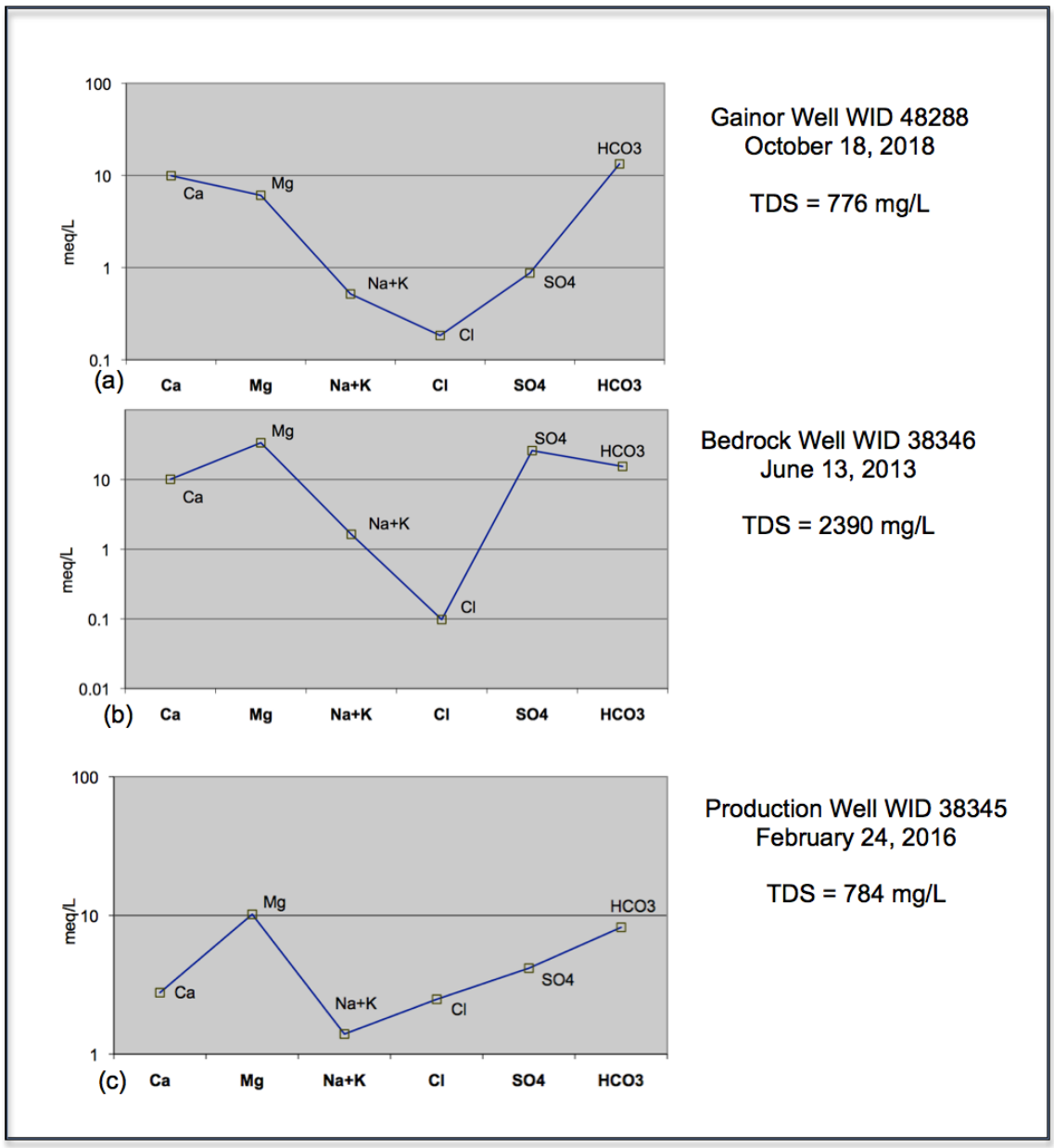

Figure E3. Comparison of *Schoeller type* plots for groundwater samples from various wells.

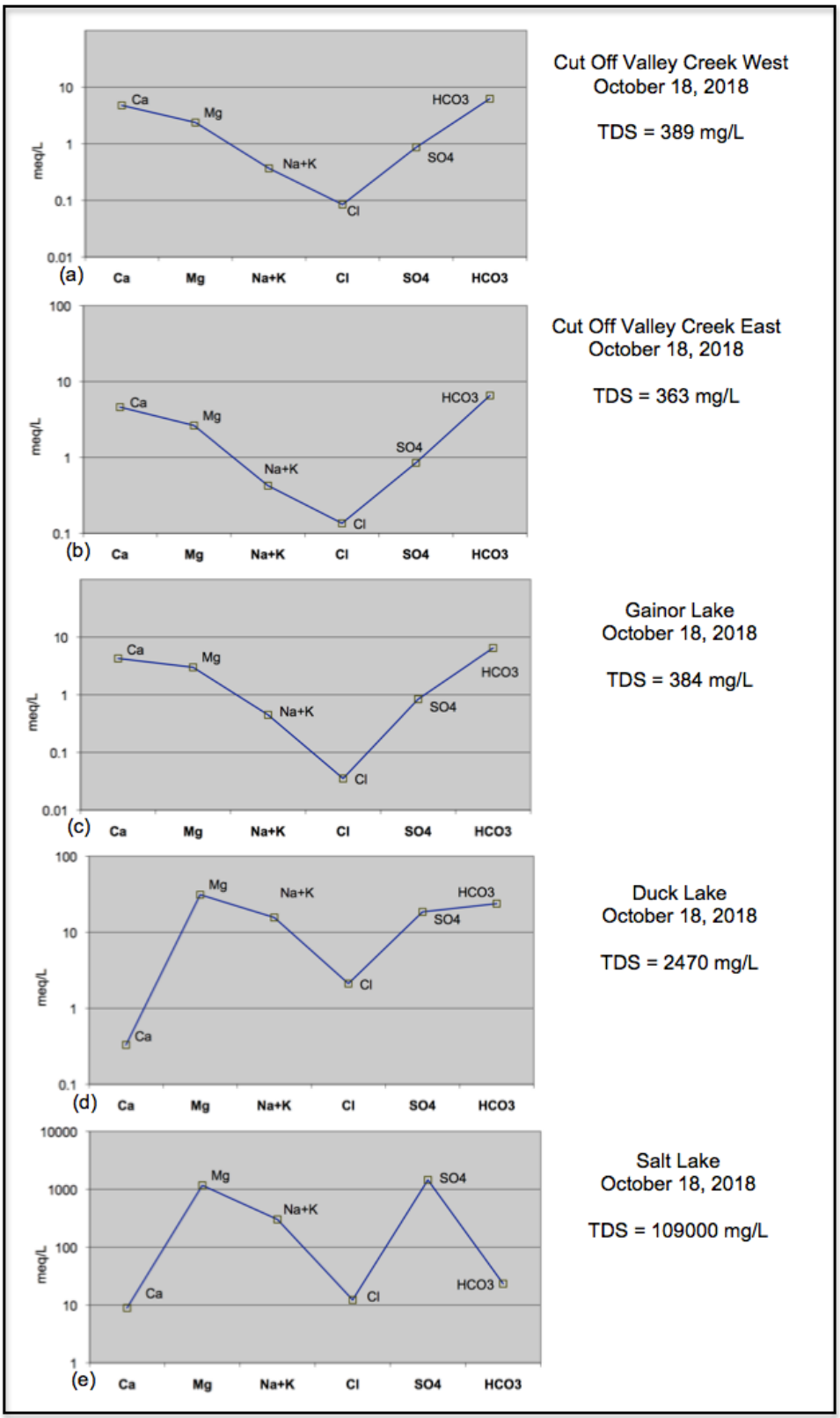

Figure E4. *Schoeller type* plots for surface water samples from Cut Off Valley Creek and various lakes.

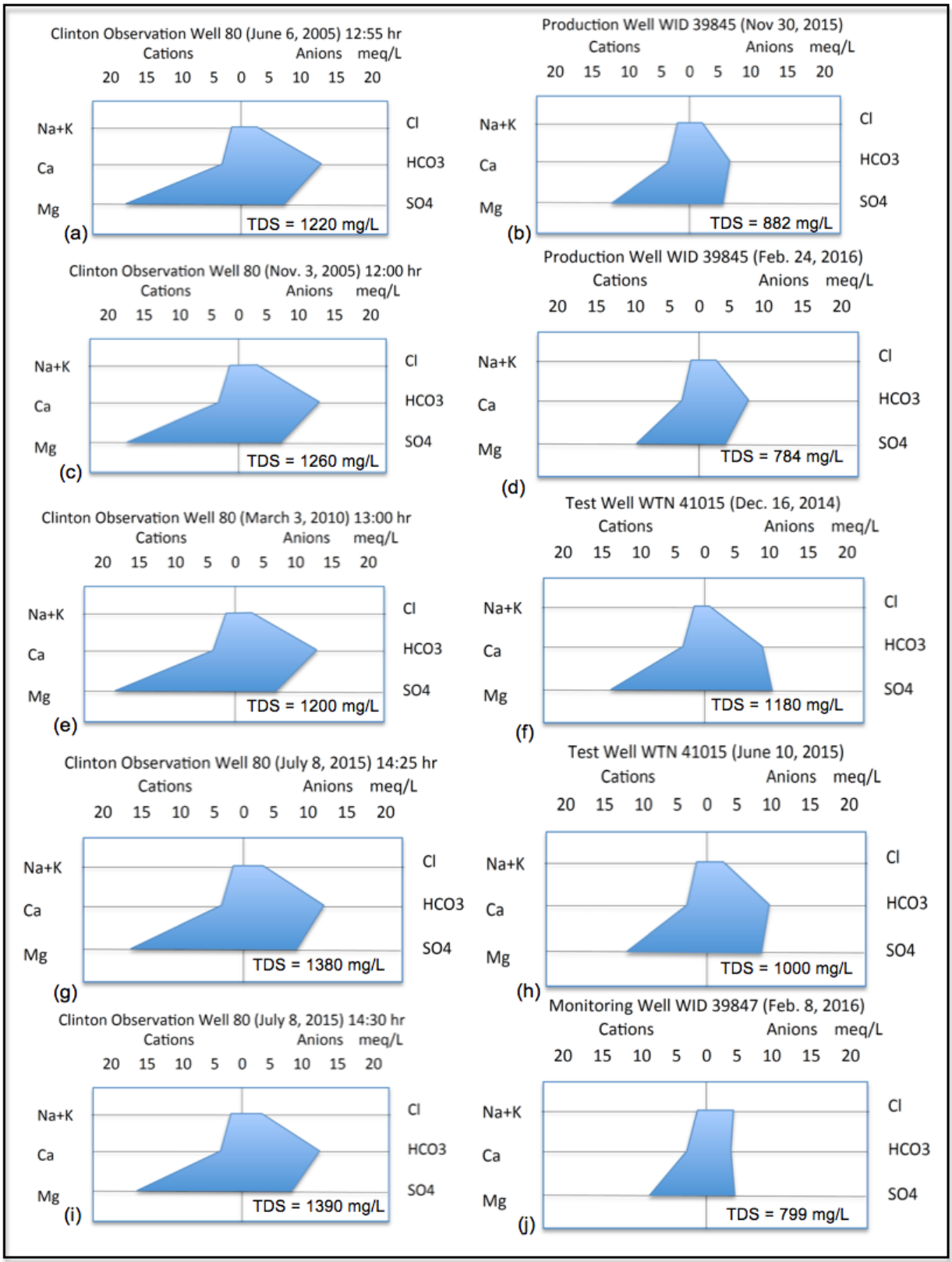

Figure E5. Comparison of *Stiff type* patterns of samples from Clinton Observation Well 80 and Crystal Clinton Bottling wells.

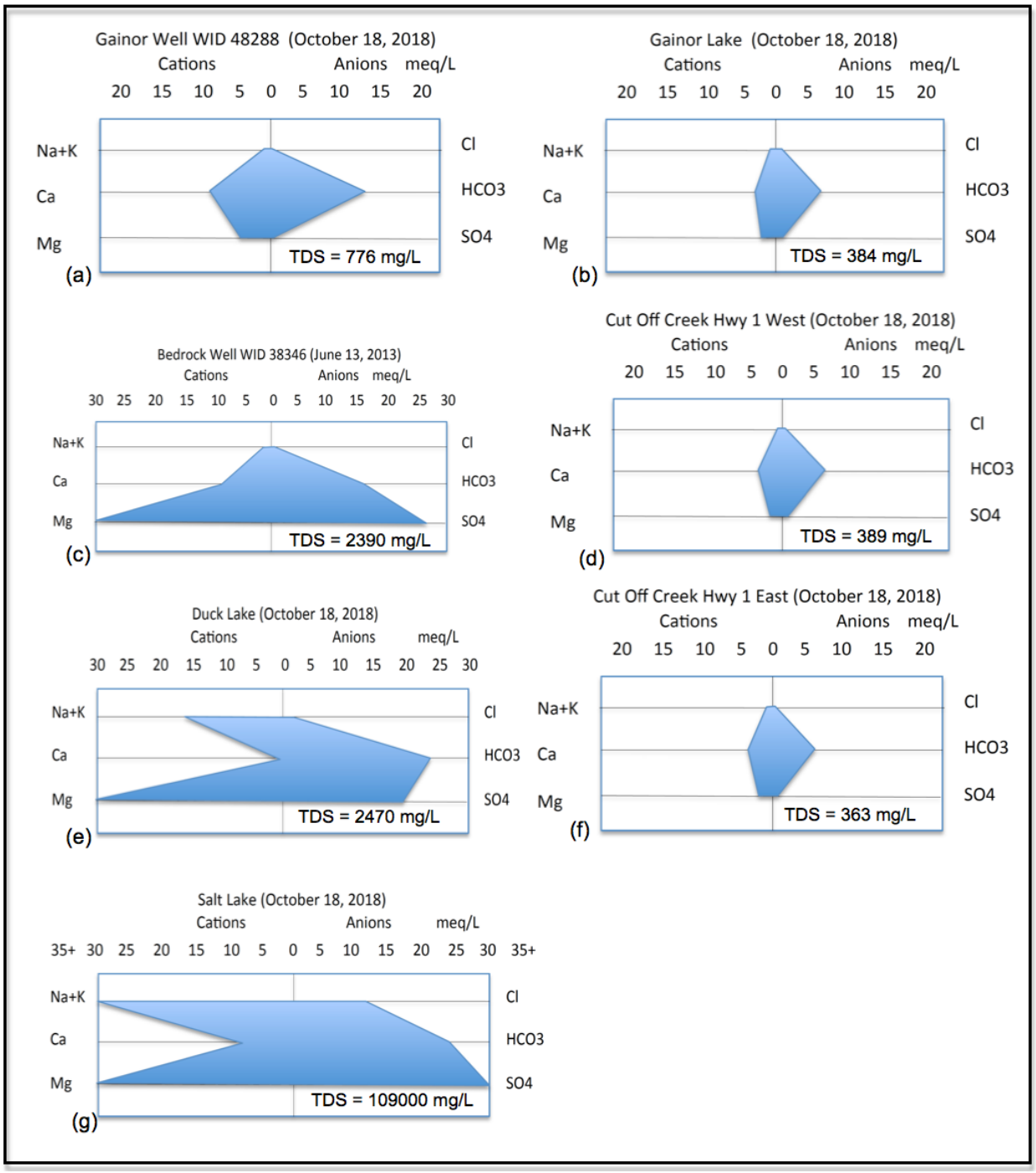

Figure E6. Comparison of *Stiff type* patterns among an unconsolidated shallow well, deep bedrock well and surface water sources.

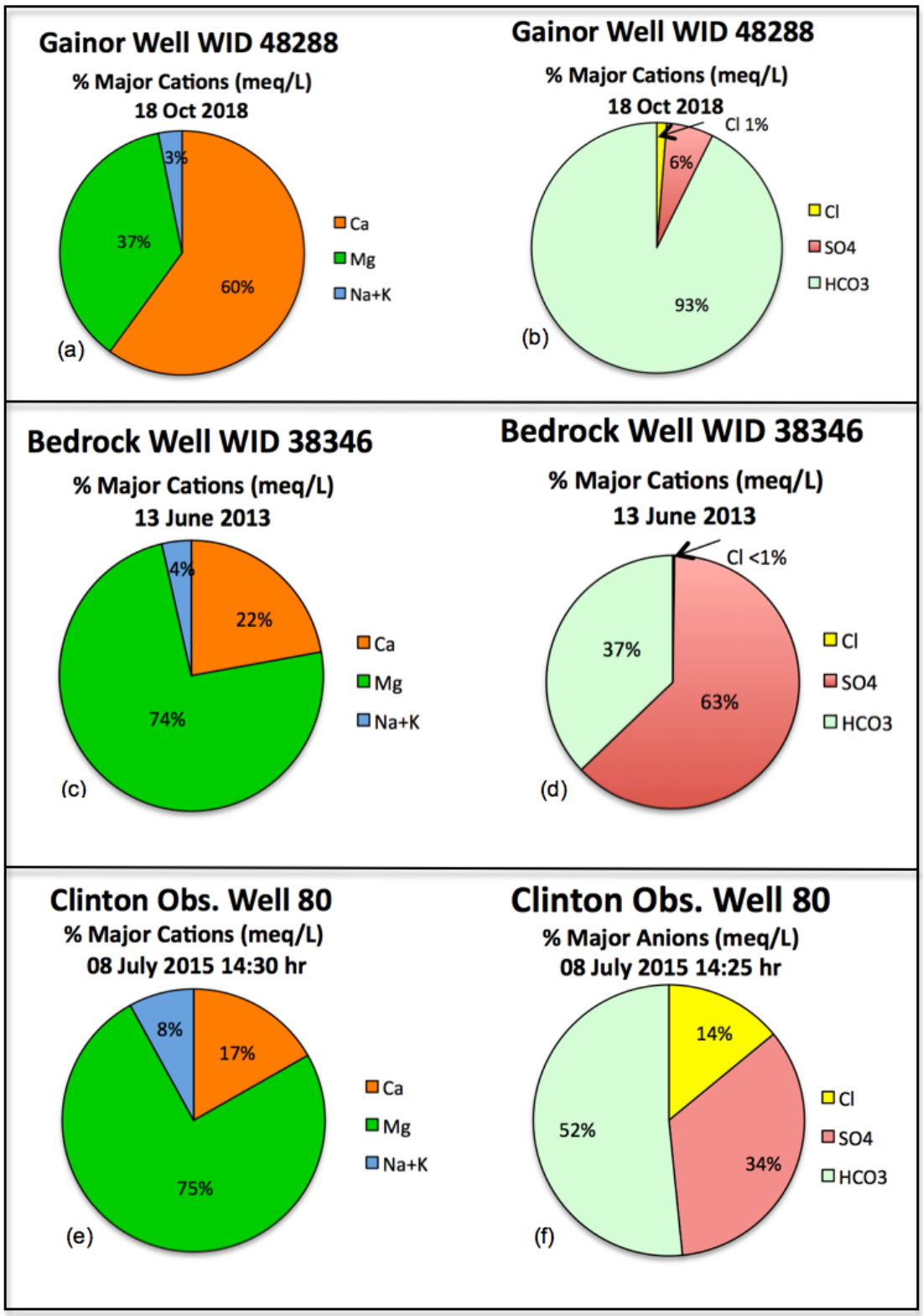

Figure E7. Comparison of cation and anion percentages for samples from various wells.

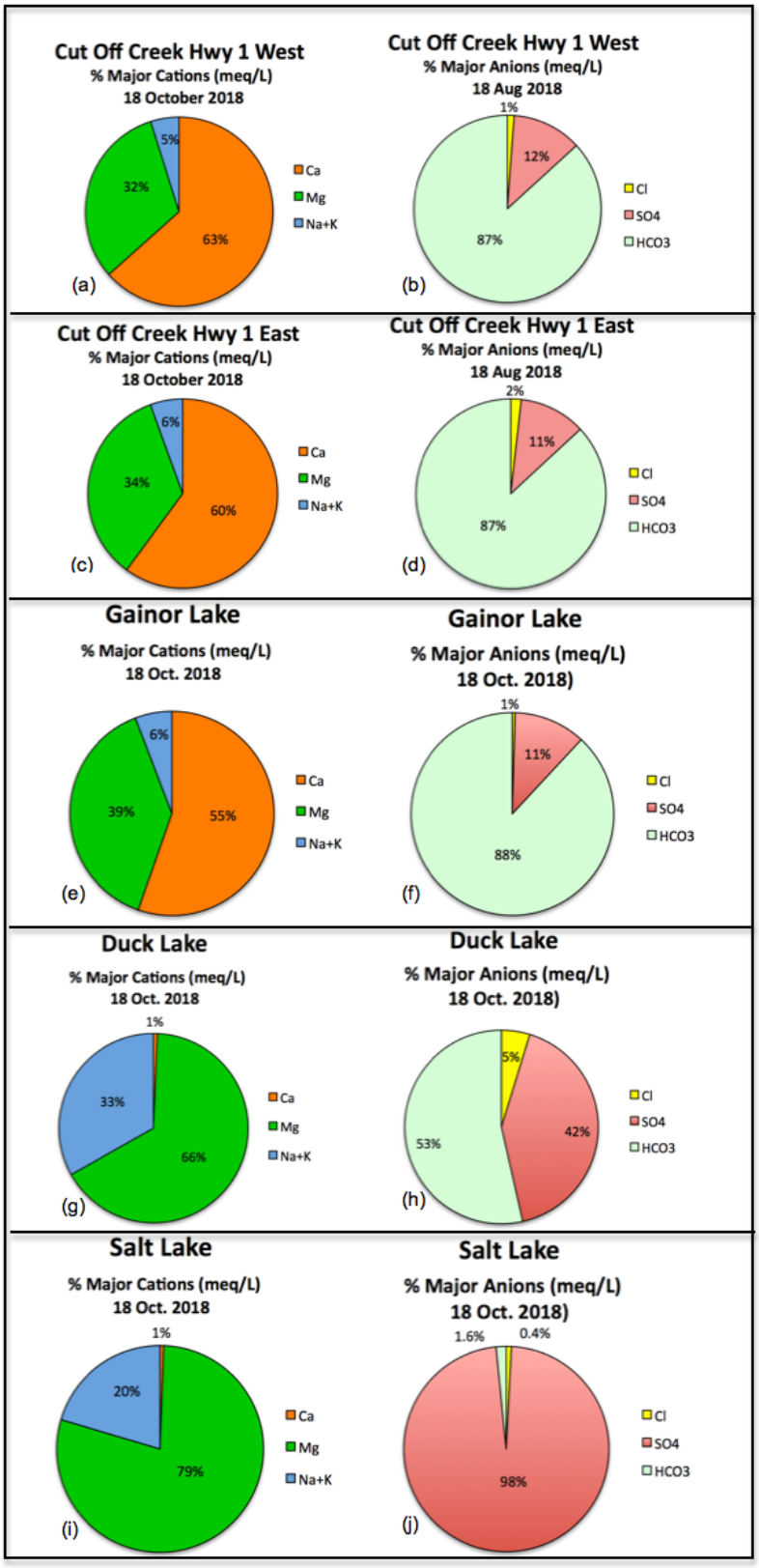

Figure E8. Comparison of cation and anion plots for samples from surface water sources.

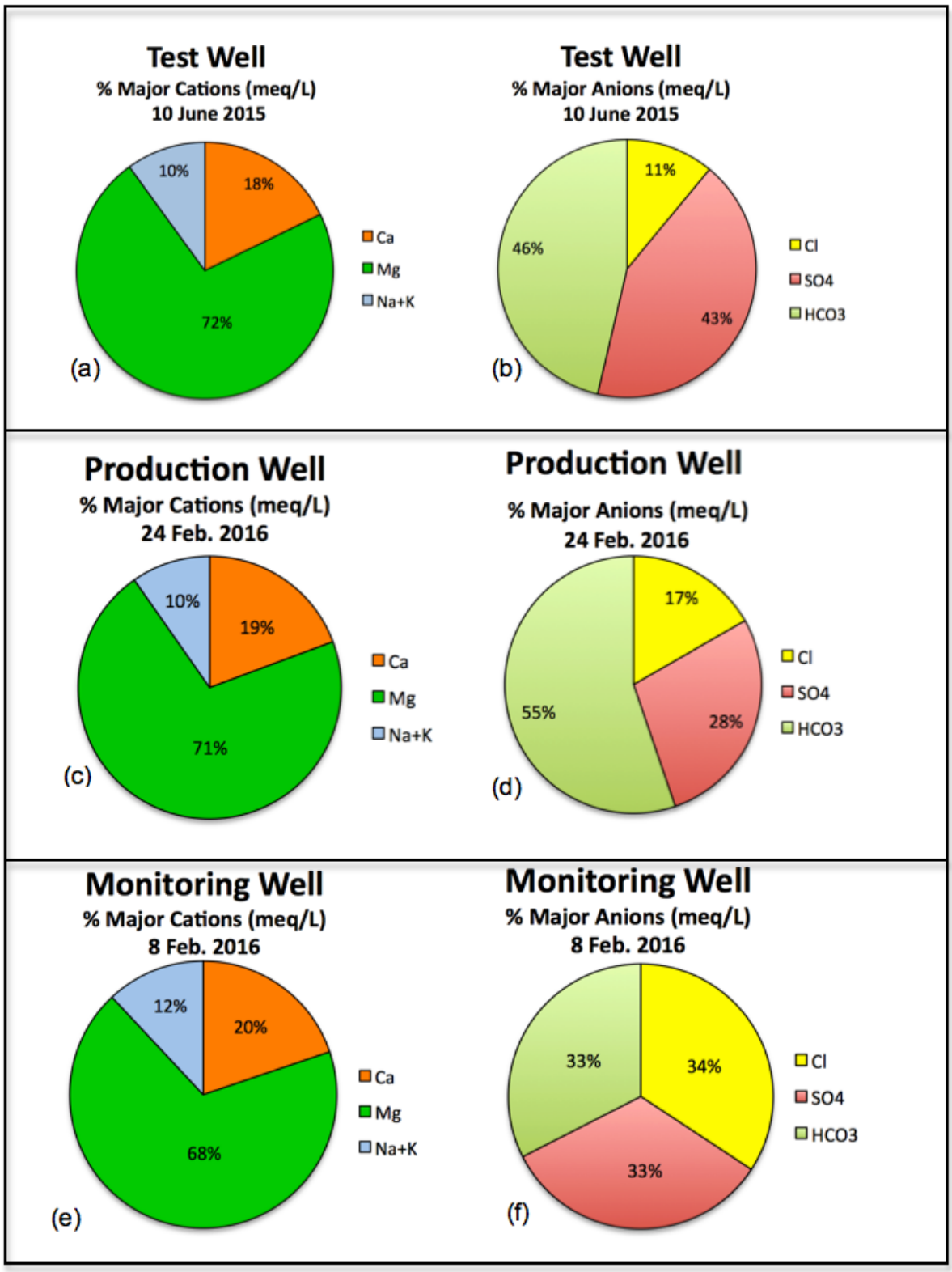

Figure E9. Comparison of cation and anion percentages for samples from production well and adjacent wells.

APPENDIX F

Chemical Analyses

Observation Well No. 80

Maxxam Analytics Inc

Maxxam Job #: A521982
Report Date: 2005/07/25

MINISTRY OF WATER, LAND AND AIR PROTECTION
Client Project #: OBWT
Site Reference: 1401070 OBSERVATION WELL # 80-
Your P.O. #: 50114414
Sampler Initials:

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		829963		
Sampling Date				
	Units	**REG/1**	**DL**	**QC Batch**
Field Parameters				
Sample End Date	N/A	20050615	0	806398
Sample End Time	N/A	12:55	0	806398
Sample Start Date	N/A	20050615	0	806398
Sample Start Time	N/A	12:55	0	806398
Temperature at Arrival	C	1.0	1	806377
Misc. Inorganics				
Bromide (Br)	mg/L	<0.1	0.1	810875
Fluoride (F)	mg/L	0.22	0.01	806940
Preparation				
Filter and HNO3 Preservation	N/A	YES	N/A	801392
Field-Vancouver				
Field Conductivity	uS/cm	1800	0.1	805281
Field Dissolved Oxygen	mg/L	1.8	0.1	805283
Field pH	pH Units	7.6	0.1	805280
Field Temperature	°C	8.1	0.1	805278
Field Turbidity	NTU	17	0.1	805282
Calculated Parameters				
Nitrate (N)	mg/L	<0.02	0.02	805021
Misc. Inorganics				
Dissolved Hardness (CaCO3)	mg/L	1100	0.5	806380
Alkalinity (Total as CaCO3)	mg/L	635	0.5	805807
Alkalinity (PP as CaCO3)	mg/L	<0.5	0.5	805807
Bicarbonate (HCO3)	mg/L	775	0.5	805807
Carbonate (CO3)	mg/L	<0.5	0.5	805807
Hydroxide (OH)	mg/L	<0.5	0.5	805807
Anions				
Dissolved Sulphate (SO4)	mg/L	360	0.5	810878
Dissolved Chloride (Cl)	mg/L	108	0.5	810871
Dissolved Metals by ICPMS				
Dissolved Aluminum (Al)	ug/L	<2	2	814716
Dissolved Antimony (Sb)	ug/L	<0.03	0.03	814716
Dissolved Arsenic (As)	ug/L	1.9	0.5	814716
Dissolved Barium (Ba)	ug/L	17.6	0.1	814716
Dissolved Beryllium (Be)	ug/L	<0.1	0.1	814716
Dissolved Bismuth (Bi)	ug/L	<0.1	0.1	814716
Dissolved Cadmium (Cd)	ug/L	<0.05	0.05	814716

Please check for attached comments

x } both elevated
x }

Maxxam Analytics Inc

Maxxam Job #: A521982
Report Date: 2005/07/25

MINISTRY OF WATER, LAND AND AIR PROTECTION
Client Project #: OBWT
Site Reference: 1401070 OBSERVATION WELL # 80-
Your P.O. #: 50114414
Sampler Initials:

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		829963		
Sampling Date				
	Units	REG/1	DL	QC Batch
Dissolved Chromium (Cr)	ug/L	<1	1	814716
Dissolved Cobalt (Co)	ug/L	0.17	0.03	814716
Dissolved Copper (Cu)	ug/L	<0.3	0.3	814716
Dissolved Lead (Pb)	ug/L	<0.05	0.05	814716
Dissolved Lithium (Li)	ug/L	13.4	0.3	814716
Dissolved Manganese (Mn)	ug/L	48.6	0.04	814716
Dissolved Molybdenum (Mo)	ug/L	3.8	0.3	814716
Dissolved Nickel (Ni)	ug/L	0.6	0.3	814716
Dissolved Selenium (Se)	ug/L	<1	1	814716
Dissolved Silver (Ag)	ug/L	<0.1	0.1	814716
Dissolved Strontium (Sr)	ug/L	369	0.03	814716
Dissolved Thallium (Tl)	ug/L	<0.01	0.01	814716
Dissolved Uranium (U)	ug/L	2.83	0.01	814716
Dissolved Vanadium (V)	ug/L	<0.3	0.3	814716
Dissolved Zinc (Zn)	ug/L	<0.5	0.5	814716
Leachable Metals				
Total Aluminum (Al)	ug/L	4	2	805309
Total Antimony (Sb)	ug/L	0.03	0.03	805309
Total Arsenic (As)	ug/L	2.6	0.5	805309
Total Barium (Ba)	ug/L	20.5	0.1	805309
Total Beryllium (Be)	ug/L	<0.1	0.1	805309
Total Bismuth (Bi)	ug/L	<0.1	0.1	805309
Total Cadmium (Cd)	ug/L	<0.05	0.05	805309
Total Chromium (Cr)	ug/L	1	1	805309
Total Cobalt (Co)	ug/L	0.19	0.03	805309
Total Copper (Cu)	ug/L	<0.3	0.3	805309
Total Lead (Pb)	ug/L	0.90	0.05	805309
Total Lithium (Li)	ug/L	14.0	0.3	805309
Total Manganese (Mn)	ug/L	51.0	0.04	805309
Total Molybdenum (Mo)	ug/L	4.3	0.3	805309
Total Nickel (Ni)	ug/L	0.8	0.3	805309
Total Selenium (Se)	ug/L	<1	1	805309
Total Silver (Ag)	ug/L	<0.1	0.1	805309
Total Strontium (Sr)	ug/L	369	0.03	805309
Total Thallium (Tl)	ug/L	<0.01	0.01	805309
Total Tin (Sn)	ug/L	<0.05	0.05	805309
Total Uranium (U)	ug/L	3.20	0.01	805309
Please check for attached comments				

Maxxam Analytics Inc

Maxxam Job #: A521982
Report Date: 2005/07/25

MINISTRY OF WATER, LAND AND AIR PROTECTION
Client Project #: OBWT
Site Reference: 1401070 OBSERVATION WELL # 80-
Your P.O. #: 50114414
Sampler Initials:

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		829963		
Sampling Date				
	Units	**REG/1**	**DL**	**QC Batch**
Total Vanadium (V)	ug/L	<0.3	0.3	805309
Total Zinc (Zn)	ug/L	<0.5	0.5	805309
Nutrients				
Total Kjeldahl Nitrogen (Calc)	mg/L	0.14	0.02	805019
Total Organic Nitrogen (N)	mg/L	0.14	0.02	805588
Dissolved Phosphorus (P)	mg/L	0.012	0.002	807757
Ammonia (N)	mg/L	<0.005	0.005	810856
Nitrate plus Nitrite (N)	mg/L	0.004	0.002	810861
Nitrite (N)	mg/L	<0.002	0.002	810860
Total Nitrogen (N)	mg/L	0.14	0.02	805582
Total Phosphorus (P)	mg/L	0.051	0.002	807761
Physical Properties				
Conductivity	uS/cm	1660	1	805806
pH	pH Units	8.3	0.1	805804
Physical Properties				
Total Dissolved Solids	mg/L	1220	10	809388
Please check for attached comments				

Maxxam Analytics Inc

Maxxam Job #: A521982
Report Date: 2005/07/25

MINISTRY OF WATER, LAND AND AIR PROTECTION
Client Project #: OBWT
Site Reference: 1401070 OBSERVATION WELL # 80-
Your P.O. #: 50114414
Sampler Initials:

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		829963		
Sampling Date				
	Units	**REG/1**	**DL**	**QC Batch**
Dissolved Metals by ICP				
Dissolved Boron (B)	mg/L	0.032	0.008	825902
Dissolved Calcium (Ca)	mg/L	75.8	0.05	825902
Dissolved Iron (Fe)	mg/L	<0.005	0.005	825902
Dissolved Magnesium (Mg)	mg/L	227	0.05	825902
Dissolved Phosphorus (P)	mg/L	<0.1	0.1	825902
Dissolved Potassium (K)	mg/L	7	1	825902
Dissolved Sodium (Na)	mg/L	37.7	0.05	825902
Dissolved Sulphur (S)	mg/L	120	0.1	825902
Dissolved Titanium (Ti)	mg/L	<0.003	0.003	825902
Dissolved Zirconium (Zr)	mg/L	<0.005	0.005	825902
Total Metals by ICP				
Total Boron (B)	mg/L	0.030	0.008	811985
Total Calcium (Ca)	mg/L	75.6	0.05	811985
Total Iron (Fe)	mg/L	2.08	0.005	811985
Total Magnesium (Mg)	mg/L	222	0.05	811985
Total Phosphorus (P)	mg/L	<0.1	0.1	811985
Total Potassium (K)	mg/L	7	1	811985
Total Sodium (Na)	mg/L	38.0	0.05	811985
Total Sulphur (S)	mg/L	120	0.1	811985
Total Titanium (Ti)	mg/L	<0.003	0.003	811985
Total Zirconium (Zr)	mg/L	<0.005	0.005	811985

Please check for attached comments

Maxxam Analytics Inc

Maxxam Job #: A546758
Report Date: 2005/11/18

MINISTRY OF WATER, LAND AND AIR PROTECTION
Client Project #: OBWT
Site Reference: 1401070 OBSERVATION WELL # 80-
Sampler Initials:

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		979253		
Sampling Date				
COC Number		50120065		
	Units	**REG/1**	**RDL**	**QC Batch**
Field Parameters				
Sample End Date	N/A	20051103	0	952829
Sample End Time	N/A	12:00	0	952829
Sample Start Date	N/A	20051103	0	952829
Sample Start Time	N/A	12:00	0	952829
Temperature at Arrival	C	1	1	952814
Misc. Inorganics				
Bromide (Br)	mg/L	<0.1	0.1	953966
Fluoride (F)	mg/L	0.21	0.01	962503
Field-Vancouver				
Field Conductivity	uS/cm	1900	0.1	ONSITE
Field Dissolved Oxygen	mg/L	4.3	0.1	ONSITE
Field pH	pH Units	7.7	0.1	ONSITE
Field Temperature	°C	7.6	0.1	ONSITE
Field Turbidity	NTU	1.0	0.1	ONSITE
Calculated Parameters				
Total Hardness (CaCO3)	mg/L	1100	0.5	952818
Nitrate (N)	mg/L	<0.002	0.002	952823
Demand Parameters				
Chemical Oxygen Demand	mg/L	<10	10	956311
Misc. Inorganics				
Alkalinity (Total as CaCO3)	mg/L	628	0.5	953715
Alkalinity (PP as CaCO3)	mg/L	<0.5	0.5	953715
Bicarbonate (HCO3)	mg/L	766	0.5	953715
Carbonate (CO3)	mg/L	<0.5	0.5	953715
Hydroxide (OH)	mg/L	<0.5	0.5	953715
Anions				
Dissolved Sulphate (SO4)	mg/L	357	0.5	953967
Dissolved Chloride (Cl)	mg/L	104	0.5	953963
Leachable Metals				
Total Aluminum (Al)	ug/L	<3	3	955798
Total Antimony (Sb)	ug/L	<0.05	0.05	955798
Total Arsenic (As)	ug/L	4	1	955798
Total Barium (Ba)	ug/L	21.2	0.2	955798

RDL = Reportable Detection Limit

Maxxam Analytics Inc

Maxxam Job #: A546758
Report Date: 2005/11/18

MINISTRY OF WATER, LAND AND AIR PROTECTION
Client Project #: OBWT
Site Reference: 1401070 OBSERVATION WELL # 80-
Sampler Initials:

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		979253		
Sampling Date				
COC Number		50120065		
	Units	**REG/1**	**RDL**	**QC Batch**
Total Beryllium (Be)	ug/L	<0.2	0.2	955798
Total Bismuth (Bi)	ug/L	<0.2	0.2	955798
Total Cadmium (Cd)	ug/L	<0.1	0.1	955798
Total Chromium (Cr)	ug/L	<2	2	955798
Total Cobalt (Co)	ug/L	0.14	0.05	955798
Total Copper (Cu)	ug/L	<0.5	0.5	955798
Total Lead (Pb)	ug/L	0.2	0.1	955798
Total Lithium (Li)	ug/L	13.9	0.5	955798
Total Manganese (Mn)	ug/L	49.9	0.08	955798
Total Molybdenum (Mo)	ug/L	4.4	0.5	955798
Total Nickel (Ni)	ug/L	<0.5	0.5	955798
Total Selenium (Se)	ug/L	<2	2	955798
Total Silver (Ag)	ug/L	<0.2	0.2	955798
Total Strontium (Sr)	ug/L	377	0.05	955798
Total Thallium (Tl)	ug/L	0.03	0.02	955798
Total Tin (Sn)	ug/L	<0.1	0.1	955798
Total Uranium (U)	ug/L	3.52	0.02	955798
Total Vanadium (V)	ug/L	1.8	0.6	955798
Total Zinc (Zn)	ug/L	<1	1	955798
Nutrients				
Total Kjeldahl Nitrogen (Calc)	mg/L	0.12	0.02	952834
Total Organic Nitrogen (N)	mg/L	0.03	0.02	952825
Dissolved Phosphorus (P)	mg/L	0.011	0.002	953954
Ammonia (N)	mg/L	0.089	0.005	953755
Nitrate plus Nitrite (N)	mg/L	0.002	0.002	953754
Nitrite (N)	mg/L	0.003	0.002	953756
Total Nitrogen (N)	mg/L	0.12	0.02	953598
Total Phosphorus (P)	mg/L	0.046	0.002	953950
Physical Properties				
Conductivity	uS/cm	1830	1	953714
pH	pH Units	8.1	0.1	953700
Physical Properties				
Total Dissolved Solids	mg/L	1260	10	956136

RDL = Reportable Detection Limit

Maxxam Analytics Inc

Maxxam Job #: A546758
Report Date: 2005/11/18

MINISTRY OF WATER, LAND AND AIR PROTECTION
Client Project #: OBWT
Site Reference: 1401070 OBSERVATION WELL # 80-
Sampler Initials:

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		979253		
Sampling Date				
COC Number		50120065		
	Units	**REG/1**	**RDL**	**QC Batch**
Total Metals by ICP				
Total Boron (B)	mg/L	0.028	0.008	953976
Total Calcium (Ca)	mg/L	75.3	0.05	953976
Total Iron (Fe)	mg/L	1.16	0.005	953976
Total Magnesium (Mg)	mg/L	223	0.05	953976
Total Phosphorus (P)	mg/L	0.1	0.1	953976
Total Potassium (K)	mg/L	7	1	953976
Total Sodium (Na)	mg/L	37.9	0.05	953976
Total Sulphur (S)	mg/L	120	0.1	953976
Total Titanium (Ti)	mg/L	<0.003	0.003	953976
Total Zirconium (Zr)	mg/L	<0.005	0.005	953976

RDL = Reportable Detection Limit

MINISTRY OF ENVIRONMENT

Maxxam Job #: B012621
Report Date: 2010/03/18

Client Project #: OBWT
Site Reference: 1401070 OBS WELL 80-CLINTON (RODEO GROUNDS CARIBOO HWY
Sampler Initials:

LOW LEVEL TOTAL METALS - WATER (WATER)

Maxxam ID		T07848		
Sampling Date		03/03/2010 13:00		
COC Number		50171334		
	Units	**REG/1**	**RDL**	**QC Batch**
Calculated Parameters				
Total Hardness (CaCO3)	mg/L	1160	0.5	3792139
Total Metals by ICPMS				
Total Aluminum (Al)	ug/L	1.0	0.2	3800310
Total Antimony (Sb)	ug/L	<0.02	0.02	3800310
Total Arsenic (As)	ug/L	3.55	0.02	3800310
Total Barium (Ba)	ug/L	21.4	0.02	3800310
Total Beryllium (Be)	ug/L	<0.01	0.01	3800310
Total Bismuth (Bi)	ug/L	<0.005	0.005	3800310
Total Boron (B)	ug/L	<50	50	3800310
Total Cadmium (Cd)	ug/L	<0.005	0.005	3800310
Total Chromium (Cr)	ug/L	0.2	0.1	3800310
Total Cobalt (Co)	ug/L	0.156	0.005	3800310
Total Copper (Cu)	ug/L	<0.05	0.05	3800310
Total Iron (Fe)	ug/L	1200	1	3800310
Total Lead (Pb)	ug/L	0.147	0.005	3800310
Total Lithium (Li)	ug/L	15.4	0.5	3800310
Total Manganese (Mn)	ug/L	56.3	0.05	3800310
Total Molybdenum (Mo)	ug/L	5.66	0.05	3800310
Total Nickel (Ni)	ug/L	0.64	0.02	3800310
Total Selenium (Se)	ug/L	<0.04	0.04	3800310
Total Silicon (Si)	ug/L	23100	100	3800310
Total Silver (Ag)	ug/L	<0.005	0.005	3800310
Total Strontium (Sr)	ug/L	436	0.05	3800310
Total Thallium (Tl)	ug/L	<0.002	0.002	3800310
Total Tin (Sn)	ug/L	0.01	0.01	3800310
Total Titanium (Ti)	ug/L	<0.5	0.5	3800310
Total Uranium (U)	ug/L	3.76	0.002	3800310
Total Vanadium (V)	ug/L	<0.2	0.2	3800310
Total Zinc (Zn)	ug/L	0.4	0.1	3800310
Total Zirconium (Zr)	ug/L	<0.1	0.1	3800310
Total Calcium (Ca)	mg/L	86.4	0.05	3803999
Total Magnesium (Mg)	mg/L	230	0.05	3803999
Total Potassium (K)	mg/L	8.20	0.05	3803999
Total Sodium (Na)	mg/L	40.5	0.05	3803999
Total Sulphur (S)	mg/L	166	3	3803999

RDL = Reportable Detection Limit
EDL = Estimated Detection Limit

Results relate only to the items tested.

MINISTRY OF ENVIRONMENT

Maxxam Job #: B012621
Report Date: 2010/03/18

Client Project #: OBWT
Site Reference: 1401070 OBS WELL 80-CLINTON (RODEO GROUNDS CARIBOO HWY
Sampler Initials:

LOW LEVEL TOTAL METALS - WATER (WATER)

Maxxam ID		T07848		
Sampling Date		03/03/2010 13:00		
COC Number		50171334		
	Units	**REG/1**	**RDL**	**QC Batch**
Calculated Parameters				
Total Hardness (CaCO3)	mg/L	1160	0.5	3792139
Total Metals by ICPMS				
Total Aluminum (Al)	ug/L	1.0	0.2	3800310
Total Antimony (Sb)	ug/L	<0.02	0.02	3800310
Total Arsenic (As)	ug/L	3.55	0.02	3800310
Total Barium (Ba)	ug/L	21.4	0.02	3800310
Total Beryllium (Be)	ug/L	<0.01	0.01	3800310
Total Bismuth (Bi)	ug/L	<0.005	0.005	3800310
Total Boron (B)	ug/L	<50	50	3800310
Total Cadmium (Cd)	ug/L	<0.005	0.005	3800310
Total Chromium (Cr)	ug/L	0.2	0.1	3800310
Total Cobalt (Co)	ug/L	0.156	0.005	3800310
Total Copper (Cu)	ug/L	<0.05	0.05	3800310
Total Iron (Fe)	ug/L	1200	1	3800310
Total Lead (Pb)	ug/L	0.147	0.005	3800310
Total Lithium (Li)	ug/L	15.4	0.5	3800310
Total Manganese (Mn)	ug/L	56.3	0.05	3800310
Total Molybdenum (Mo)	ug/L	5.66	0.05	3800310
Total Nickel (Ni)	ug/L	0.64	0.02	3800310
Total Selenium (Se)	ug/L	<0.04	0.04	3800310
Total Silicon (Si)	ug/L	23100	100	3800310
Total Silver (Ag)	ug/L	<0.005	0.005	3800310
Total Strontium (Sr)	ug/L	436	0.05	3800310
Total Thallium (Tl)	ug/L	<0.002	0.002	3800310
Total Tin (Sn)	ug/L	0.01	0.01	3800310
Total Titanium (Ti)	ug/L	<0.5	0.5	3800310
Total Uranium (U)	ug/L	3.76	0.002	3800310
Total Vanadium (V)	ug/L	<0.2	0.2	3800310
Total Zinc (Zn)	ug/L	0.4	0.1	3800310
Total Zirconium (Zr)	ug/L	<0.1	0.1	3800310
Total Calcium (Ca)	mg/L	86.4	0.05	3803999
Total Magnesium (Mg)	mg/L	230	0.05	3803999
Total Potassium (K)	mg/L	8.20	0.05	3803999
Total Sodium (Na)	mg/L	40.5	0.05	3803999
Total Sulphur (S)	mg/L	166	3	3803999

RDL = Reportable Detection Limit
EDL = Estimated Detection Limit

Results relate only to the items tested.

Results Summary L1640372

Job Reference	OBS WELL 80-CLINTON (RODEO GROUNDS CARIBOO HWY)
Report To	Laurie Lyons, BC MINISTRY OF ENVIRONMENT - Southern Interior - Kamloops
Date Received	9-Jul-2015 8:30
Report Date	20-Jul-2015 17:06
Report Revision	1

Parameter	Lowest Detection Limit	Units	1401070_REG 8-Jul-2015 14:25 L1640372-1 Water
Client Sample ID			
Date Sampled			
Time Sampled			
ALS Sample ID			
Field Tests (Water)			
EC, Client Supplied	2.0	uS/cm	1249
pH, Client Supplied	0.10	pH	6.94
Temperature, Client Supplied	-50	C	8.4
Physical Tests (Water)			
Conductivity	2.0	uS/cm	1940
Hardness (as CaCO3)	0.50	mg/L	1030
pH	0.10	pH	8.01
Total Dissolved Solids	20	mg/L	1380
Turbidity	0.10	NTU	13.8
Anions and Nutrients (Water)			
Alkalinity, Bicarbonate (as CaCO3)	1.0	mg/L	622
Alkalinity, Carbonate (as CaCO3)	1.0	mg/L	<1.0
Alkalinity, Hydroxide (as CaCO3)	1.0	mg/L	<1.0
Alkalinity, Phenolphthalein (as CaCO3)	2.0	mg/L	<2.0
Alkalinity, Total (as CaCO3)	1.0	mg/L	622
Ammonia, Total (as N)	0.0050	mg/L	0.0385
Chloride (Cl)	5.0	mg/L	120
Fluoride (F)	0.20	mg/L	<0.20
Nitrate and Nitrite (as N)	0.032	mg/L	<0.032
Nitrate (as N)	0.030	mg/L	<0.030
Nitrite (as N)	0.010	mg/L	<0.010
Dissolved Organic Nitrogen	0.050	mg/L	<0.050
Dissolved Kjeldahl Nitrogen	0.050	mg/L	0.055
Total Dissolved Nitrogen	0.030	mg/L	0.055
Phosphorus (P)-Total Dissolved	0.0020	mg/L	0.0082
Sulfate (SO4)	3.0	mg/L	398
Dissolved Metals (Water)			
Dissolved Metals Filtration Location		-	FIELD
Dissolved Metals Filtration Location		-	FIELD
Dissolved Metals Filtration Location		-	FIELD
Aluminum (Al)-Dissolved	0.0010	mg/L	<0.0010
Antimony (Sb)-Dissolved	0.00010	mg/L	<0.00010
Arsenic (As)-Dissolved	0.00010	mg/L	0.00365
Barium (Ba)-Dissolved	0.000050	mg/L	0.0208
Beryllium (Be)-Dissolved	0.00010	mg/L	<0.00010
Bismuth (Bi)-Dissolved	0.000050	mg/L	<0.000050
Boron (B)-Dissolved	0.010	mg/L	0.037
Cadmium (Cd)-Dissolved	0.0000050	mg/L	<0.0000050
Calcium (Ca)-Dissolved	0.050	mg/L	75.8
Chromium (Cr)-Dissolved	0.00010	mg/L	<0.00010
Cobalt (Co)-Dissolved	0.00010	mg/L	0.00012

Results Summary L1640372

Job Reference OBS WELL 80-CLINTON (RODEO GROUNDS CARIBOO HWY)
Report To Laurie Lyons, BC MINISTRY OF ENVIRONMENT - Southern Interior - Kamloops
Date Received 9-Jul-2015 8:30
Report Date 20-Jul-2015 17:06
Report Revision 1

Client Sample ID			1401070_REG
Date Sampled			8-Jul-2015
Time Sampled			14:25
ALS Sample ID			L1640372-1
Parameter	Lowest Detection Limit	Units	Water
Copper (Cu)-Dissolved	0.00020	mg/L	<0.00020
Iron (Fe)-Dissolved	0.0050	mg/L	0.902
Lead (Pb)-Dissolved	0.000050	mg/L	<0.000050
Magnesium (Mg)-Dissolved	0.0050	mg/L	205
Manganese (Mn)-Dissolved	0.00010	mg/L	0.0529
Molybdenum (Mo)-Dissolved	0.000050	mg/L	0.00484
Nickel (Ni)-Dissolved	0.00050	mg/L	<0.00050
Phosphorus (P)-Dissolved	0.010	mg/L	0.045
Potassium (K)-Dissolved	0.050	mg/L	7.33
Selenium (Se)-Dissolved	0.000050	mg/L	0.000117
Silicon (Si)-Dissolved	0.050	mg/L	20.5
Silver (Ag)-Dissolved	0.000010	mg/L	<0.000010
Sodium (Na)-Dissolved	0.050	mg/L	37.2
Strontium (Sr)-Dissolved	0.00020	mg/L	0.415
Sulfur (S)-Dissolved	0.50	mg/L	137
Thallium (Tl)-Dissolved	0.000010	mg/L	<0.000010
Tin (Sn)-Dissolved	0.00010	mg/L	<0.00010
Titanium (Ti)-Dissolved	0.00030	mg/L	<0.00030
Uranium (U)-Dissolved	0.000010	mg/L	0.00342
Vanadium (V)-Dissolved	0.00050	mg/L	<0.00050
Zinc (Zn)-Dissolved	0.0010	mg/L	<0.0010

Qualifier Legend

DLM	Detection Limit Adjusted due to sample matrix effects.

Results Summary L1640369

Job Reference OBS WELL 80-CLINTON (RODEO GROUNDS CARIBOO HWY)
Report To Laurie Lyons, BC MINISTRY OF ENVIRONMENT - Southern Interior - Kamloops
Date Received 9-Jul-2015 8:30
Report Date 22-Jul-2015 13:30
Report Revision 1

Client Sample ID			1401070_REG
Date Sampled			8-Jul-2015
Time Sampled			14:30
ALS Sample ID			L1640369-1
Parameter	Lowest Detection Limit	Units	Water
Field Tests (Water)			
EC, Client Supplied	2.0	uS/cm	1249
pH, Client Supplied	0.10	pH	6.94
Temperature, Client Supplied	-50	C	8.4
Physical Tests (Water)			
Conductivity	2.0	uS/cm	1940
Hardness (as CaCO3)	0.50	mg/L	1040
pH	0.10	pH	7.95
Total Dissolved Solids	20	mg/L	1390
Turbidity	0.10	NTU	13.4
Anions and Nutrients (Water)			
Alkalinity, Bicarbonate (as CaCO3)	1.0	mg/L	628
Alkalinity, Carbonate (as CaCO3)	1.0	mg/L	<1.0
Alkalinity, Hydroxide (as CaCO3)	1.0	mg/L	<1.0
Alkalinity, Phenolphthalein (as CaCO3)	2.0	mg/L	<2.0
Alkalinity, Total (as CaCO3)	1.0	mg/L	628
Ammonia, Total (as N)	0.0050	mg/L	0.0390
Chloride (Cl)	2.5	mg/L	123
Fluoride (F)	0.10	mg/L	0.18
Nitrate and Nitrite (as N)	0.0036	mg/L	<0.0036
Nitrate (as N)	0.0030	mg/L	<0.0030
Nitrite (as N)	0.0020	mg/L	<0.0020
Dissolved Organic Nitrogen	0.050	mg/L	<0.050
Dissolved Kjeldahl Nitrogen	0.050	mg/L	0.069
Total Dissolved Nitrogen	0.030	mg/L	0.069
Phosphorus (P)-Total Dissolved	0.0020	mg/L	0.0083
Sulfate (SO4)	1.5	mg/L	406
Dissolved Metals (Water)			
Dissolved Metals Filtration Location		-	FIELD
Dissolved Metals Filtration Location		-	FIELD
Dissolved Metals Filtration Location		-	FIELD
Aluminum (Al)-Dissolved	0.0010	mg/L	<0.0010
Antimony (Sb)-Dissolved	0.00010	mg/L	<0.00010
Arsenic (As)-Dissolved	0.00010	mg/L	0.00367
Barium (Ba)-Dissolved	0.000050	mg/L	0.0211
Beryllium (Be)-Dissolved	0.00010	mg/L	<0.00010
Bismuth (Bi)-Dissolved	0.000050	mg/L	<0.000050
Boron (B)-Dissolved	0.010	mg/L	0.038
Cadmium (Cd)-Dissolved	0.0000050	mg/L	<0.0000050
Calcium (Ca)-Dissolved	0.050	mg/L	75.7
Chromium (Cr)-Dissolved	0.00010	mg/L	<0.00010
Cobalt (Co)-Dissolved	0.00010	mg/L	0.00013

Results Summary L1640369

Job Reference OBS WELL 80-CLINTON (RODEO GROUNDS CARIBOO HWY)
Report To Laurie Lyons, BC MINISTRY OF ENVIRONMENT - Southern Interior - Kamloops
Date Received 9-Jul-2015 8:30
Report Date 22-Jul-2015 13:30
Report Revision 1

Client Sample ID			1401070_REG
Date Sampled			8-Jul-2015
Time Sampled			14:30
ALS Sample ID			L1640369-1
Parameter	Lowest Detection Limit	Units	Water
Copper (Cu)-Dissolved	0.00020	mg/L	<0.00020
Iron (Fe)-Dissolved	0.0050	mg/L	0.906
Lead (Pb)-Dissolved	0.000050	mg/L	<0.000050
Magnesium (Mg)-Dissolved	0.0050	mg/L	206
Manganese (Mn)-Dissolved	0.00010	mg/L	0.0529
Molybdenum (Mo)-Dissolved	0.000050	mg/L	0.00476
Nickel (Ni)-Dissolved	0.00050	mg/L	<0.00050
Phosphorus (P)-Dissolved	0.010	mg/L	0.046
Potassium (K)-Dissolved	0.050	mg/L	7.37
Selenium (Se)-Dissolved	0.000050	mg/L	0.000092
Silicon (Si)-Dissolved	0.050	mg/L	20.9
Silver (Ag)-Dissolved	0.000010	mg/L	<0.000010
Sodium (Na)-Dissolved	0.050	mg/L	37.2
Strontium (Sr)-Dissolved	0.00020	mg/L	0.413
Sulfur (S)-Dissolved	0.50	mg/L	141
Thallium (Tl)-Dissolved	0.000010	mg/L	<0.000010
Tin (Sn)-Dissolved	0.00010	mg/L	<0.00010
Titanium (Ti)-Dissolved	0.00030	mg/L	<0.00030
Uranium (U)-Dissolved	0.000010	mg/L	0.00342
Vanadium (V)-Dissolved	0.00050	mg/L	<0.00050
Zinc (Zn)-Dissolved	0.0010	mg/L	<0.0010

Qualifier Legend

DLM	Detection Limit Adjusted due to sample matrix effects.

WELL WATER ANALYSIS

WELL 107809 / 38346

1. WO 3060877

CARO
ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

REPORTED TO	Kala Geosciences Ltd. 1314 McGill Rd. Kamloops, BC V2C 6N6	**TEL** **FAX**	(250) 372-9194 (250) 372-9398
ATTENTION	Paul Blackett	**WORK ORDER**	3060877
PO NUMBER		**RECEIVED / TEMP**	Jun-14-13 13:35 / 9.0 °C
PROJECT	Kala Domestic Potability	**REPORTED**	Jun-21-13
PROJECT INFO	Barb Jones Polo Clinton BC 13048	**COC NUMBER**	B02159

General Comments:

CARO Analytical Services employs methods which are conducted according to procedures accepted by appropriate regulatory agencies, and/or are conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts, except where otherwise agreed to by the client.

The results in this report apply to the samples analyzed in accordance with the Chain of Custody or Sample Requisition document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

Issued By: **Jennifer Shanko, AScT**
Administration Coordinator, Kelowna

Please contact CARO if more information is needed or to provide feedback on our services.

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CARO ANALYTICAL SERVICES

ANALYSIS INFORMATION

REPORTED TO	Kala Geosciences Ltd.	**WORK ORDER**	3060877
PROJECT	Kala Domestic Potability	**REPORTED**	Jun-21-13

Analysis Description	Method Reference (* = modified from) Preparation	Analysis	Location
Alkalinity, speciated	N/A	APHA 2320 B	Kelowna
Alkalinity, total	N/A	APHA 2320 B	Kelowna
Ammonia-N, total colorimetric	N/A	APHA 4500-NH3 G	Kelowna
Chloride in Water by IC	N/A	APHA 4110 B	Kelowna
Colour, True at 410 nm	N/A	APHA 2120 C *	Kelowna
Conductivity in Water	N/A	APHA 2510 B	Kelowna
Dissolved Metals	APHA 3030 B	APHA 3125 B	Richmond
E. coli (by CCA)	N/A	APHA 9222 *	Kelowna
Fecal Coliforms (MF)	N/A	APHA 9222 D	Kelowna
Fluoride in Water by IC	N/A	APHA 4110 B	Kelowna
Hardness as CaCO3 (CALC)	N/A	APHA 2340 B	Richmond
Heterotrophic Plate Count	N/A	APHA 9215 D	Kelowna
Nitrate-N in Water by IC	N/A	APHA 4110 B	Kelowna
Nitrite-N in Water by IC	N/A	APHA 4110 B	Kelowna
pH in Water	N/A	APHA 4500-H+ B	Kelowna
Sulfate in Water by IC	N/A	APHA 4110 B	Kelowna
Total Coliforms (by CCA)	N/A	APHA 9222 *	Kelowna
Total Kjeldahl Nitrogen	N/A	EPA 351.2 (1993) *	Kelowna
Total Recoverable Metals	APHA 3030E *	APHA 3125 B	Richmond
Turbidity	N/A	APHA 2130 B	Kelowna

Note: The numbers in brackets represent the year that the method was published/approved

Method Reference Descriptions:

APHA	Standard Methods for the Examination of Water and Wastewater, American Public Health Association
EPA	United States Environmental Protection Agency Test Methods

Glossary of Terms:

MRL	Method Reporting Limit
<	Less than the Reported Detection Limit (RDL) - the RDL may be higher than the MRL due to various factors such as dilutions, limited sample volume, high moisture, or interferences
AO	Aesthetic objective
MAC	Maximum acceptable concentration (health-related guideline)
CFU/100mL	Colony Forming Units per 100 mL
CFU/mL	Colony Forming Units per millilitre
Color Unit	Colour referenced against a platinum cobalt standard
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
pH units	pH < 7 = acidic, ph > 7 = basic
uS/cm	Microsiemens per centimeter

CARO ANALYTICAL SERVICES

SAMPLE ANALYTICAL DATA

REPORTED TO Kala Geosciences Ltd.
PROJECT Kala Domestic Potability

WORK ORDER 3060877
REPORTED Jun-21-13

Analyte	Result / Recovery	Canadian DW Guideline	MRL / Limit	Units	Prepared	Analyzed	Notes
Anions							
Sample ID: WIN 38346 (3060877-01) [Water] Sampled: Jun-13-13 13:55							
Alkalinity, Total as CaCO3	**771**		1	mg/L	N/A	Jun-17-13	
Alkalinity, Phenolphthalein as CaCO3	< 1		1	mg/L	N/A	Jun-17-13	
Alkalinity, Carbonate as CaCO3	< 1		1	mg/L	N/A	Jun-17-13	
Alkalinity, Bicarbonate as CaCO3	**771**		1	mg/L	N/A	Jun-17-13	
Alkalinity, Hydroxide as CaCO3	< 1		1	mg/L	N/A	Jun-17-13	
Chloride	**3.47**	AO ≤ 250	0.10	mg/L	N/A	Jun-15-13	
Fluoride	**0.17**	MAC = 1.5	0.10	mg/L	N/A	Jun-15-13	
Nitrogen, Nitrate as N	< 0.010	MAC = 10	0.010	mg/L	N/A	Jun-15-13	
Nitrogen, Nitrite as N	< 0.010	MAC = 1	0.010	mg/L	N/A	Jun-15-13	
Sulfate	**1250**	AO ≤ 500	1.0	mg/L	N/A	Jun-15-13	
General Parameters							
Sample ID: WIN 38346 (3060877-01) [Water] Sampled: Jun-13-13 13:55							
Colour, True	< 5	AO ≤ 15	5	Color Unit	N/A	Jun-14-13	
Conductivity (EC)	**2970**		2	uS/cm	N/A	Jun-14-13	
Nitrogen, Ammonia as N, Total	**0.651**		0.020	mg/L	N/A	Jun-14-13	
Nitrogen, Total Kjeldahl	**0.90**		0.05	mg/L	N/A	Jun-14-13	
pH	**7.46**	AO = 6.5 - 8.5	0.01	pH units	N/A	Jun-14-13	
Turbidity	**8.0**	See Guidelines	0.1	NTU	N/A	Jun-14-13	
Calculated Parameters							
Sample ID: WIN 38346 (3060877-01) [Water] Sampled: Jun-13-13 13:55							
Hardness, Total (Total as CaCO3)	**2220**		5.0	mg/L	N/A	N/A	
Hardness, Total (Diss. as CaCO3)	**2190**		5.0	mg/L	N/A	N/A	
Nitrogen, Nitrate+Nitrite as N	< 0.01		0.01	mg/L	N/A	N/A	
Nitrogen, Organic	**0.248**		0.100	mg/L	N/A	N/A	
Solids, Total Dissolved	**2390**		100	mg/L	N/A	N/A	
Dissolved Metals							
Sample ID: WIN 38346 (3060877-01) [Water] Sampled: Jun-13-13 13:55							
Aluminum, dissolved	< 0.05		0.05	mg/L	N/A	Jun-19-13	
Antimony, dissolved	**0.025**		0.001	mg/L	N/A	Jun-19-13	
Arsenic, dissolved	**0.056**		0.005	mg/L	N/A	Jun-19-13	
Barium, dissolved	< 0.05		0.05	mg/L	N/A	Jun-19-13	
Beryllium, dissolved	< 0.001		0.001	mg/L	N/A	Jun-19-13	
Bismuth, dissolved	< 0.001		0.001	mg/L	N/A	Jun-19-13	
Boron, dissolved	**0.07**		0.04	mg/L	N/A	Jun-19-13	
Cadmium, dissolved	< 0.0001		0.0001	mg/L	N/A	Jun-19-13	
Calcium, dissolved	**202**		2	mg/L	N/A	Jun-19-13	
Chromium, dissolved	< 0.005		0.005	mg/L	N/A	Jun-19-13	
Cobalt, dissolved	**0.0080**		0.0005	mg/L	N/A	Jun-19-13	
Copper, dissolved	< 0.002		0.002	mg/L	N/A	Jun-19-13	

REPORTED TO Kala Geosciences Ltd.
PROJECT Kala Domestic Potability

WORK ORDER 3060877
REPORTED Jun-21-13

Analyte	Result / Recovery	Canadian DW Guideline	MRL / Limit	Units	Prepared	Analyzed	Notes
Dissolved Metals, Continued							
Sample ID: WIN 38346 (3060877-01) [Water] Sampled: Jun-13-13 13:55, Continued							
Iron, dissolved	1.1		0.1	mg/L	N/A	Jun-19-13	
Lead, dissolved	< 0.001		0.001	mg/L	N/A	Jun-19-13	
Lithium, dissolved	0.041		0.001	mg/L	N/A	Jun-19-13	
Magnesium, dissolved	410		0.1	mg/L	N/A	Jun-19-13	
Manganese, dissolved	0.157		0.002	mg/L	N/A	Jun-19-13	
Mercury, dissolved	0.0002		0.0002	mg/L	N/A	Jun-19-13	
Molybdenum, dissolved	0.026		0.001	mg/L	N/A	Jun-19-13	
Nickel, dissolved	0.065		0.002	mg/L	N/A	Jun-19-13	
Phosphorus, dissolved	< 0.2		0.2	mg/L	N/A	Jun-19-13	
Potassium, dissolved	10.1		0.2	mg/L	N/A	Jun-19-13	
Selenium, dissolved	< 0.005		0.005	mg/L	N/A	Jun-19-13	
Silicon, dissolved	27		5	mg/L	N/A	Jun-19-13	
Silver, dissolved	< 0.0005		0.0005	mg/L	N/A	Jun-19-13	
Sodium, dissolved	31.7		0.2	mg/L	N/A	Jun-19-13	
Strontium, dissolved	2.69		0.01	mg/L	N/A	Jun-19-13	
Tellurium, dissolved	< 0.002		0.002	mg/L	N/A	Jun-19-13	
Thallium, dissolved	< 0.0002		0.0002	mg/L	N/A	Jun-19-13	
Thorium, dissolved	< 0.001		0.001	mg/L	N/A	Jun-19-13	
Tin, dissolved	< 0.002		0.002	mg/L	N/A	Jun-19-13	
Titanium, dissolved	< 0.05		0.05	mg/L	N/A	Jun-19-13	
Uranium, dissolved	0.0066		0.0002	mg/L	N/A	Jun-19-13	
Vanadium, dissolved	< 0.01		0.01	mg/L	N/A	Jun-19-13	
Zinc, dissolved	< 0.04		0.04	mg/L	N/A	Jun-19-13	
Zirconium, dissolved	< 0.001		0.001	mg/L	N/A	Jun-19-13	
Total Recoverable Metals							
Sample ID: WIN 38346 (3060877-01) [Water] Sampled: Jun-13-13 13:55							
Aluminum, total	0.09	AO ≤ 0.1	0.05	mg/L	Jun-18-13	Jun-19-13	
Antimony, total	0.025	MAC = 0.006	0.001	mg/L	Jun-18-13	Jun-19-13	
Arsenic, total	0.057	MAC = 0.01	0.005	mg/L	Jun-18-13	Jun-19-13	
Barium, total	< 0.05	MAC = 1	0.05	mg/L	Jun-18-13	Jun-19-13	
Beryllium, total	< 0.001		0.001	mg/L	Jun-18-13	Jun-19-13	
Bismuth, total	< 0.001		0.001	mg/L	Jun-18-13	Jun-19-13	
Boron, total	0.10	MAC = 5	0.04	mg/L	Jun-18-13	Jun-19-13	
Cadmium, total	< 0.0001	MAC = 0.005	0.0001	mg/L	Jun-18-13	Jun-19-13	
Calcium, total	203		2	mg/L	Jun-18-13	Jun-19-13	
Chromium, total	< 0.005	MAC = 0.05	0.005	mg/L	Jun-18-13	Jun-19-13	
Cobalt, total	0.0085		0.0005	mg/L	Jun-18-13	Jun-19-13	
Copper, total	< 0.002	AO ≤ 1	0.002	mg/L	Jun-18-13	Jun-19-13	
Iron, total	1.5	AO ≤ 0.3	0.1	mg/L	Jun-18-13	Jun-19-13	
Lead, total	< 0.001	MAC = 0.01	0.001	mg/L	Jun-18-13	Jun-19-13	
Lithium, total	0.041		0.001	mg/L	Jun-18-13	Jun-19-13	
Magnesium, total	417		0.1	mg/L	Jun-18-13	Jun-19-13	
Manganese, total	0.167	AO ≤ 0.05	0.002	mg/L	Jun-18-13	Jun-19-13	

CARO ANALYTICAL SERVICES

SAMPLE ANALYTICAL DATA

REPORTED TO Kala Geosciences Ltd.
PROJECT Kala Domestic Potability

WORK ORDER 3060877
REPORTED Jun-21-13

Analyte	Result / *Recovery*	Canadian DW Guideline	MRL / *Limit*	Units	Prepared	Analyzed	Notes
Total Recoverable Metals, Continued							
Sample ID: WIN 38346 (3060877-01) [Water] Sampled: Jun-13-13 13:55, Continued							
Mercury, total	< 0.0002	MAC = 0.001	0.0002	mg/L	Jun-18-13	Jun-19-13	
Molybdenum, total	0.026		0.001	mg/L	Jun-18-13	Jun-19-13	
Nickel, total	0.067		0.002	mg/L	Jun-18-13	Jun-19-13	
Phosphorus, total	0.3		0.2	mg/L	Jun-18-13	Jun-19-13	
Potassium, total	11.1		0.2	mg/L	Jun-18-13	Jun-19-13	
Selenium total	< 0.005	MAC = 0.01	0.005	mg/L	Jun-18-13	Jun-19-13	
Silicon, total	28		5	mg/L	Jun-18-13	Jun-19-13	
Silver, total	< 0.0005		0.0005	mg/L	Jun-18-13	Jun-19-13	
Sodium, total	32.8	AO ≤ 200	0.2	mg/L	Jun-18-13	Jun-19-13	
Strontium, total	2.72		0.01	mg/L	Jun-18-13	Jun-19-13	
Tellurium, total	< 0.002		0.002	mg/L	Jun-18-13	Jun-19-13	
Thallium, total	< 0.0002		0.0002	mg/L	Jun-18-13	Jun-19-13	
Thorium, total	< 0.001		0.001	mg/L	Jun-18-13	Jun-19-13	
Tin, total	< 0.002		0.002	mg/L	Jun-18-13	Jun-19-13	
Titanium, total	< 0.05		0.05	mg/L	Jun-18-13	Jun-19-13	
Uranium, total	0.0068	MAC = 0.02	0.0002	mg/L	Jun-18-13	Jun-19-13	
Vanadium, total	< 0.01		0.01	mg/L	Jun-18-13	Jun-19-13	
Zinc, total	< 0.04	AO ≤ 5	0.04	mg/L	Jun-18-13	Jun-19-13	
Zirconium, total	< 0.001		0.001	mg/L	Jun-18-13	Jun-19-13	
Microbiological Parameters							
Sample ID: WIN 38346 (3060877-01) [Water] Sampled: Jun-13-13 13:55							
Coliforms, Total	< 1	MAC < 1	1	CFU/100mL	Jun-14-13	Jun-15-13	
Coliforms, Fecal	< 1		1	CFU/100mL	Jun-14-13	Jun-15-13	
Heterotrophic Plate Count	28		1	CFU/mL	Jun-14-13	Jun-17-13	HT
E. coli	< 1	MAC < 1	1	CFU/100mL	Jun-14-13	Jun-15-13	

Sample / Analysis Qualifiers:

HT Sample prepared / analyzed outside of the recommended holding time.

REPORTED TO	Kala Geosciences Ltd.	**WORK ORDER**	3060877
PROJECT	Kala Domestic Potability	**REPORTED**	Jun-21-13

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: Laboratory reagent water is carried through sample preparation and analysis steps. Method Blanks indicate that results are free from contamination, i.e. not biased high from sources such as the sample container or the laboratory environment.
- **Duplicate (Dup)**: Preparation and analysis of a replicate aliquot of a sample. Duplicates provide a measure of the analytical method's precision, i.e. how reproducible a result is. Duplicates are only reported if they are associated with your sample data.
- **Blank Spike (BS)**: A known amount of standard is carried through sample preparation and analysis steps. Blank Spikes, also known as laboratory control samples (LCS), are prepared from a different source of standard than used for the calibration. They ensure that the calibration is acceptable (i.e. not biased high or low) and also provide a measure of the analytical method's accuracy (i.e. closeness of the result to a target value).
- **Standard Reference Material (SRM)**: A material of similar matrix to the samples, externally certified for the parameter(s) listed. Standard Reference Materials ensure that the preparation steps in the method are adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	RPD	RPD Limit	Notes
Anions, Batch B3F0571										
Blank (B3F0571-BLK1)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrogen, Nitrate as N	< 0.010	0.010	mg/L							
Nitrogen, Nitrite as N	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
Blank (B3F0571-BLK2)				Prepared: Jun-15-13, Analyzed: Jun-15-13						
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrogen, Nitrate as N	< 0.010	0.010	mg/L							
Nitrogen, Nitrite as N	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
Blank (B3F0571-BLK3)				Prepared: Jun-15-13, Analyzed: Jun-15-13						
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrogen, Nitrate as N	< 0.010	0.010	mg/L							
Nitrogen, Nitrite as N	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
LCS (B3F0571-BS1)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Chloride	7.99	0.10	mg/L	8.00		100	85-115			
Fluoride	3.92	0.10	mg/L	4.00		98	85-115			
Nitrogen, Nitrate as N	3.95	0.010	mg/L	4.00		99	85-115			
Nitrogen, Nitrite as N	1.85	0.010	mg/L	2.00		92	85-115			
Sulfate	7.8	1.0	mg/L	8.00		98	85-115			
LCS (B3F0571-BS2)				Prepared: Jun-15-13, Analyzed: Jun-15-13						
Chloride	8.09	0.10	mg/L	8.00		101	85-115			
Fluoride	3.71	0.10	mg/L	4.00		93	85-115			
Nitrogen, Nitrate as N	3.94	0.010	mg/L	4.00		98	85-115			
Nitrogen, Nitrite as N	1.84	0.010	mg/L	2.00		92	85-115			
Sulfate	7.8	1.0	mg/L	8.00		97	85-115			

REPORTED TO Kala Geosciences Ltd.
PROJECT Kala Domestic Potability

WORK ORDER 3060877
REPORTED Jun-21-13

Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	RPD	RPD Limit	Notes
Anions, Batch B3F0571, Continued										
LCS (B3F0571-BS3)				Prepared: Jun-15-13, Analyzed: Jun-15-13						
Chloride	7 99	0 10	mg/L	8.00		100	85-115			
Fluoride	3.89	0.10	mg/L	4.00		97	85-115			
Nitrogen, Nitrate as N	3.91	0 010	mg/L	4.00		98	85-115			
Nitrogen, Nitrite as N	1.89	0 010	mg/L	2.00		94	85-115			
Sulfate	7 8	1 0	mg/L	8.00		98	85-115			
Anions, Batch B3F0629										
Blank (B3F0629-BLK1)				Prepared: Jun-17-13, Analyzed: Jun-17-13						
Alkalinity, Total as CaCO3	< 1	1	mg/L							
Alkalinity, Phenolphthalein as CaCO3	< 1	1	mg/L							
Alkalinity, Carbonate as CaCO3	< 1	1	mg/L							
Alkalinity, Bicarbonate as CaCO3	< 1	1	mg/L							
Alkalinity, Hydroxide as CaCO3	< 1	1	mg/L							
LCS (B3F0629-BS1)				Prepared: Jun-17-13, Analyzed: Jun-17-13						
Alkalinity, Total as CaCO3	107	1	mg/L	100		107	98-108			
Duplicate (B3F0629-DUP1)		Source: 3060877-01		Prepared: Jun-17-13, Analyzed: Jun-17-13						
Alkalinity, Total as CaCO3	774	1	mg/L		771			< 1	10	
Alkalinity, Phenolphthalein as CaCO3	< 1	1	mg/L		< 1				10	
Alkalinity, Carbonate as CaCO3	< 1	1	mg/L		< 1				10	
Alkalinity, Bicarbonate as CaCO3	774	1	mg/L		771			< 1	10	
Alkalinity, Hydroxide as CaCO3	< 1	1	mg/L		< 1				10	
Dissolved Metals, Batch B3F0658										
Blank (B3F0658-BLK1)				Prepared Jun-19-13, Analyzed Jun-19-13						
Aluminum, dissolved	< 0.05	0 05	mg/L							
Antimony, dissolved	< 0 001	0 001	mg/L							
Arsenic, dissolved	< 0 005	0 005	mg/L							
Barium, dissolved	< 0 05	0 05	mg/L							
Beryllium, dissolved	< 0 001	0 001	mg/L							
Bismuth, dissolved	< 0 001	0 001	mg/L							
Boron, dissolved	< 0 04	0.04	mg/L							
Cadmium, dissolved	< 0.0001	0 0001	mg/L							
Calcium, dissolved	< 2	2	mg/L							
Chromium, dissolved	< 0.005	0 005	mg/L							
Cobalt, dissolved	< 0 0005	0.0005	mg/L							
Copper, dissolved	< 0.002	0 002	mg/L							
Iron, dissolved	< 0 1	0 1	mg/L							
Lead, dissolved	< 0.001	0 001	mg/L							
Lithium, dissolved	< 0.001	0.001	mg/L							
Magnesium, dissolved	< 0 1	0.1	mg/L							
Manganese, dissolved	< 0.002	0 002	mg/L							
Mercury, dissolved	< 0 0002	0 0002	mg/L							
Molybdenum, dissolved	< 0 001	0.001	mg/L							
Nickel, dissolved	< 0 002	0.002	mg/L							
Phosphorus, dissolved	< 0 2	0 2	mg/L							
Potassium, dissolved	< 0 2	0 2	mg/L							
Selenium, dissolved	< 0 005	0 005	mg/L							
Silicon, dissolved	< 5	5	mg/L							
Silver, dissolved	< 0.0005	0 0005	mg/L							
Sodium, dissolved	< 0 2	0 2	mg/L							
Strontium, dissolved	< 0.01	0 01	mg/L							
Tellurium, dissolved	< 0 002	0 002	mg/L							

CARO ANALYTICAL SERVICES

QUALITY CONTROL DATA

REPORTED TO	Kala Geosciences Ltd.	**WORK ORDER**	3060877
PROJECT	Kala Domestic Potability	**REPORTED**	Jun-21-13

Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	RPD	RPD Limit	Notes
Dissolved Metals, Batch B3F0658, Continued										
Blank (B3F0658-BLK1), Continued				Prepared: Jun-19-13, Analyzed: Jun-19-13						
Thallium, dissolved	< 0.0002	0.0002	mg/L							
Thorium, dissolved	< 0.001	0.001	mg/L							
Tin, dissolved	< 0.002	0.002	mg/L							
Titanium, dissolved	< 0.05	0.05	mg/L							
Uranium, dissolved	< 0.0002	0.0002	mg/L							
Vanadium, dissolved	< 0.01	0.01	mg/L							
Zinc, dissolved	< 0.04	0.04	mg/L							
Zirconium, dissolved	< 0.001	0.001	mg/L							
Reference (B3F0658-SRM1)				Prepared Jun-19-13, Analyzed: Jun-19-13						
Aluminum, dissolved	0.24	0.05	mg/L	0.233		101	58-142			
Antimony, dissolved	0.052	0.001	mg/L	0.0430		120	75-125			
Arsenic, dissolved	0.478	0.005	mg/L	0.438		109	81-119			
Barium, dissolved	3.34	0.05	mg/L	3.35		100	83-117			
Beryllium, dissolved	0.209	0.001	mg/L	0.213		98	80-120			
Boron, dissolved	1.91	0.04	mg/L	1.74		110	74-117			
Cadmium, dissolved	0.220	0.0001	mg/L	0.224		98	83-117			
Calcium, dissolved	8	2	mg/L	7.69		104	76-124			
Chromium, dissolved	0.450	0.005	mg/L	0.437		103	81-119			
Cobalt, dissolved	0.135	0.0005	mg/L	0.128		105	76-124			
Copper, dissolved	0.901	0.002	mg/L	0.844		107	84-116			
Iron, dissolved	1.3	0.1	mg/L	1.29		103	74-126			
Lead, dissolved	0.110	0.001	mg/L	0.112		98	72-128			
Lithium, dissolved	0.096	0.001	mg/L	0.104		93	60-140			
Magnesium, dissolved	7.1	0.1	mg/L	6.92		103	81-119			
Manganese, dissolved	0.354	0.002	mg/L	0.345		103	84-116			
Molybdenum, dissolved	0.435	0.001	mg/L	0.426		102	83-117			
Nickel, dissolved	0.854	0.002	mg/L	0.840		102	74-126			
Phosphorus, dissolved	0.6	0.2	mg/L	0.495		124	68-132			
Potassium, dissolved	3.5	0.2	mg/L	3.19		109	74-126			
Selenium, dissolved	0.036	0.005	mg/L	0.0331		109	70-130			
Sodium, dissolved	19.6	0.2	mg/L	19.1		103	72-128			
Strontium, dissolved	0.93	0.01	mg/L	0.916		101	84-113			
Thallium, dissolved	0.0388	0.0002	mg/L	0.0393		99	57-143			
Uranium, dissolved	0.245	0.0002	mg/L	0.266		92	85-115			
Vanadium, dissolved	0.87	0.01	mg/L	0.869		100	87-113			
Zinc, dissolved	0.92	0.04	mg/L	0.881		105	72-128			
General Parameters, Batch B3F0570										
Blank (B3F0570-BLK1)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Conductivity (EC)	< 2	2	uS/cm							
Blank (B3F0570-BLK2)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Conductivity (EC)	< 2	2	uS/cm							
LCS (B3F0570-BS2)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Conductivity (EC)	1410	2	uS/cm	1410		100	93-104			
Duplicate (B3F0570-DUP2)		**Source: 3060877-01**		Prepared: Jun-14-13, Analyzed: Jun-14-13						
Conductivity (EC)	2960	2	uS/cm		2970			< 1	5	
pH	7.48	0.01	pH units		7.46			< 1	5	
Reference (B3F0570-SRM1)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
pH	7.00	0.01	pH units	7.00		100	98-102			
Reference (B3F0570-SRM2)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
pH	7.00	0.01	pH units	7.00		100	98-102			

CARO ANALYTICAL SERVICES

QUALITY CONTROL DATA

REPORTED TO	Kala Geosciences Ltd.	**WORK ORDER**	3060877
PROJECT	Kala Domestic Potability	**REPORTED**	Jun-21-13

Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	RPD	RPD Limit	Notes
General Parameters, Batch B3F0570, Continued										
General Parameters, Batch B3F0576										
Blank (B3F0576-BLK1)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Total Kjeldahl	< 0 05	0 05	mg/L							
Blank (B3F0576-BLK2)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Total Kjeldahl	< 0 05	0 05	mg/L							
LCS (B3F0576-BS1)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Total Kjeldahl	11 3	0 05	mg/L	10.0		113	89-116			
LCS (B3F0576-BS2)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Total Kjeldahl	11 2	0 05	mg/L	10.0		112	89-116			
Duplicate (B3F0576-DUP1)			**Source: 3060877-01**	Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Total Kjeldahl	0 91	0 05	mg/L		0 90			1	15	
General Parameters, Batch B3F0585										
Blank (B3F0585-BLK1)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Ammonia as N, Total	< 0 005	0.020	mg/L							
Blank (B3F0585-BLK2)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Ammonia as N, Total	< 0.005	0.020	mg/L							
Blank (B3F0585-BLK3)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Ammonia as N, Total	< 0 005	0.020	mg/L							
Blank (B3F0585-BLK4)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Ammonia as N, Total	< 0.005	0.020	mg/L							
Blank (B3F0585-BLK5)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Ammonia as N, Total	< 0.005	0.020	mg/L							
LCS (B3F0585-BS1)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Ammonia as N, Total	10 2	0 020	mg/L	10.0		102	86-111			
LCS (B3F0585-BS2)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Ammonia as N, Total	10 0	0 020	mg/L	10.0		100	86-111			
LCS (B3F0585-BS3)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Ammonia as N, Total	10 1	0 020	mg/L	10.0		101	86-111			
LCS (B3F0585-BS4)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Ammonia as N, Total	9 92	0 020	mg/L	10.0		99	86-111			
LCS (B3F0585-BS5)				Prepared: Jun-14-13, Analyzed: Jun-14-13						
Nitrogen, Ammonia as N, Total	10 0	0 020	mg/L	10.0		100	86-111			
General Parameters, Batch B3F0587										
Blank (B3F0587-BLK1)				Prepared: Jun-17-13, Analyzed: Jun-17-13						
Turbidity	< 0 1	0 1	NTU							
LCS (B3F0587-BS1)				Prepared: Jun-17-13, Analyzed: Jun-17-13						
Turbidity	40 9	0 1	NTU	40.0		102	85-115			
General Parameters, Batch B3F0637										

REPORTED TO Kala Geosciences Ltd.
PROJECT Kala Domestic Potability

WORK ORDER 3060877
REPORTED Jun-21-13

Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	RPD	RPD Limit	Notes
General Parameters, Batch B3F0637, Continued										
Blank (B3F0637-BLK1)				Prepared: Jun-17-13, Analyzed: Jun-17-13						
Colour, True	< 5	5	Color Unit							
LCS (B3F0637-BS1)				Prepared: Jun-17-13, Analyzed: Jun-17-13						
Colour, True	10	5	Color Unit	10.0		96	81-118			
Microbiological Parameters, Batch B3F0536										
Blank (B3F0536-BLK1)				Prepared: Jun-14-13, Analyzed: Jun-15-13						
Coliforms, Total	< 1	1	CFU/100mL							
E coli	< 1	1	CFU/100mL							
Blank (B3F0536-BLK2)				Prepared: Jun-14-13, Analyzed: Jun-15-13						
Coliforms, Total	< 1	1	CFU/100mL							
E coli	< 1	1	CFU/100mL							
Blank (B3F0536-BLK3)				Prepared: Jun-14-13, Analyzed: Jun-15-13						
Coliforms, Total	< 1	1	CFU/100mL							
E coli	< 1	1	CFU/100mL							
Blank (B3F0536-BLK4)				Prepared: Jun-14-13, Analyzed: Jun-15-13						
Coliforms, Total	< 1	1	CFU/100mL							
E. coli	< 1	1	CFU/100mL							
Microbiological Parameters, Batch B3F0537										
Blank (B3F0537-BLK2)				Prepared: Jun-14-13, Analyzed: Jun-15-13						
Coliforms, Fecal	< 1	1	CFU/100mL							
Microbiological Parameters, Batch B3F0569										
Blank (B3F0569-BLK1)				Prepared: Jun-14-13, Analyzed: Jun-17-13						
Heterotrophic Plate Count	< 1	1	CFU/mL							
Duplicate (B3F0569-DUP1)			Source: 3060877-01	Prepared: Jun-14-13, Analyzed: Jun-17-13						
Heterotrophic Plate Count	24	1	CFU/mL		28			15	63	
Total Recoverable Metals, Batch B3F0666										
Blank (B3F0666-BLK1)				Prepared: Jun-18-13, Analyzed: Jun-19-13						
Aluminum, total	< 0.05	0.05	mg/L							
Antimony, total	< 0.001	0.001	mg/L							
Arsenic, total	< 0.005	0.005	mg/L							
Barium, total	< 0.05	0.05	mg/L							
Beryllium, total	< 0.001	0.001	mg/L							
Bismuth, total	< 0.001	0.001	mg/L							
Boron, total	< 0.04	0.04	mg/L							
Cadmium, total	< 0.0001	0.0001	mg/L							
Calcium, total	< 2	2	mg/L							
Chromium, total	< 0.005	0.005	mg/L							
Cobalt, total	< 0.0005	0.0005	mg/L							
Copper, total	< 0.002	0.002	mg/L							
Iron, total	< 0.1	0.1	mg/L							
Lead, total	< 0.001	0.001	mg/L							
Lithium, total	< 0.001	0.001	mg/L							
Magnesium, total	< 0.1	0.1	mg/L							
Manganese, total	< 0.002	0.002	mg/L							

CARO ANALYTICAL SERVICES

QUALITY CONTROL DATA

REPORTED TO Kala Geosciences Ltd.
PROJECT Kala Domestic Potability

WORK ORDER 3060877
REPORTED Jun-21-13

Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	RPD	RPD Limit	Notes
Total Recoverable Metals, Batch B3F0666, Continued										
Blank (B3F0666-BLK1), Continued				Prepared: Jun-18-13, Analyzed: Jun-19-13						
Mercury, total	< 0 0002	0.0002	mg/L							
Molybdenum, total	< 0.001	0 001	mg/L							
Nickel, total	< 0.002	0 002	mg/L							
Phosphorus, total	< 0 2	0.2	mg/L							
Potassium, total	< 0 2	0.2	mg/L							
Selenium, total	< 0.005	0 005	mg/L							
Silicon, total	< 5	5	mg/L							
Silver, total	< 0 0005	0.0005	mg/L							
Sodium, total	< 0 2	0.2	mg/L							
Strontium, total	< 0 01	0 01	mg/L							
Tellurium, total	< 0.002	0 002	mg/L							
Thallium, total	< 0 0002	0 0002	mg/L							
Thorium, total	< 0.001	0 001	mg/L							
Tin, total	< 0.002	0 002	mg/L							
Titanium, total	< 0 05	0 05	mg/L							
Uranium, total	< 0 0002	0.0002	mg/L							
Vanadium, total	< 0 01	0 01	mg/L							
Zinc, total	< 0 04	0 04	mg/L							
Zirconium, total	< 0.001	0 001	mg/L							
Reference (B3F0666-SRM1)				Prepared: Jun-18-13, Analyzed: Jun-19-13						
Aluminum, total	0.28	0 05	mg/L	0 296		93	81-129			
Antimony, total	0.054	0 001	mg/L	0.0505		106	88-114			
Arsenic, total	0 113	0 005	mg/L	0 122		93	88-114			
Barium, total	0 73	0 05	mg/L	0 777		94	72-104			
Beryllium, total	0.045	0 001	mg/L	0.0488		92	78-131			
Boron, total	3.61	0 04	mg/L	3 40		106	75-121			
Cadmium, total	0 0483	0.0001	mg/L	0.0490		99	89-111			
Calcium, total	10	2	mg/L	10 2		98	86-121			
Chromium, total	0.238	0 005	mg/L	0 242		98	89-114			
Cobalt, total	0 0379	0.0005	mg/L	0.0366		104	91-113			
Copper, total	0.510	0 002	mg/L	0 487		105	91-115			
Iron, total	0 5	0.1	mg/L	0 469		101	77-124			
Lead, total	0 198	0 001	mg/L	0 193		102	92-113			
Lithium, total	0 385	0 001	mg/L	0 390		99	85-115			
Magnesium, total	3 3	0 1	mg/L	3 31		100	78-120			
Manganese, total	0 104	0.002	mg/L	0 109		95	90-114			
Mercury, total	0 0049	0.0002	mg/L	0 00456		108	50-150			
Molybdenum, total	0 200	0.001	mg/L	0 197		102	90-111			
Nickel, total	0 239	0.002	mg/L	0 242		99	90-111			
Phosphorus, total	0 2	0.2	mg/L	0 233		105	85-115			
Potassium, total	5 5	0.2	mg/L	5.93		93	84-113			
Selenium, total	0 111	0.005	mg/L	0.115		96	85-115			
Sodium, total	7 5	0.2	mg/L	7 64		98	82-123			
Strontium, total	0.35	0 01	mg/L	0 363		98	88-112			
Thallium, total	0 0807	0.0002	mg/L	0.0794		102	91-114			
Uranium, total	0 0188	0 0002	mg/L	0 0192		98	85-120			
Vanadium, total	0.35	0 01	mg/L	0 376		94	86-111			
Zinc, total	2.31	0 04	mg/L	2.42		95	85-111			

Pre-2018 CCB Well Samples

CERTIFICATE OF ANALYSIS

REPORTED TO	Kala Geosciences Ltd. 1314 McGill Rd. Kamloops, BC V2C 6N6	**TEL** **FAX**	(250) 372-9194 (250) 372-9398
ATTENTION	Paul Blackett	**WORK ORDER**	4121041
PO NUMBER	Clinton 14089	**RECEIVED / TEMP**	Dec-17-14 13:40 / 6°C
PROJECT	Kala Domestic Potability	**REPORTED**	Dec-24-14
PROJECT INFO	Clinton 14089	**COC NUMBER**	B 13390

General Comments:

CARO Analytical Services employs methods which are conducted according to procedures accepted by appropriate regulatory agencies, and/or are conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts, except where otherwise agreed to by the client.

The results in this report apply to the samples analyzed in accordance with the Chain of Custody or Sample Requisition document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

Work Order Comments:

Custody seals intact when received in Caro!

Issued By: **Karin Miyazaki For Jennifer Shanko, AScT**
Administration Coordinator

Please contact CARO if more information is needed or to provide feedback on our services.

Locations:

#110 4011 Viking Way
Richmond, BC V6V 2K9
Tel: 604-279-1499 Fax: 604-279-1599

#102 3677 Highway 97N
Kelowna, BC V1X 5C3
Tel: 250-765-9646 Fax: 250-765-3893

17225 109 Avenue
Edmonton, AB T5S 1H7
Tel: 780-489-9100 Fax: 780-489-9700

www.caro.ca

ALS Group USA, Corp.
dba ALS Environmental

Analytical Report

Client:	ALS Environmental - Canada	**Service Request:**	K1601428
Project:	L1732513	**Date Collected:**	02/8/16
Sample Matrix:	Water	**Date Received:**	02/12/16
Analysis Method:	300.1	**Units:**	ug/L
Prep Method:	None	**Basis:**	NA

Bromate

Sample Name	Lab Code	Result	MRL	Dil.	Date Analyzed	Q
L1732513-1	K1601428-001	ND U	5.0	1	02/16/16 18:32	
Method Blank	K1601428-MB	ND U	5.0	1	02/16/16 12:56	

ANALYSIS INFORMATION

REPORTED TO	Kala Geosciences Ltd.	**WORK ORDER**	4121041
PROJECT	Kala Domestic Potability	**REPORTED**	Dec-24-14

Analysis Description	Method Reference	Technique	Location
Alkalinity (Speciated)	APHA 2320 B	Titration with H2SO4 to pH 4.5	Kelowna
Anions in Water by IC	APHA 4110 B	Ion Chromatography with Chemical Suppression of Eluent Conductivity	Kelowna
Colour, True	APHA 2120 C *	Spectrophotometry (456 nm)	Kelowna
Conductivity in Water	APHA 2510 B	Conductivity Meter	Kelowna
Dissolved Metals	APHA 3030 B / APHA 3125 B	0.45 µm Filtration / Inductively Coupled Plasma Mass Spectrometry (ICP-MS)	Richmond
E. coli (CCA)	APHA 9222 *	Membrane Filtration	Kelowna
Fecal Coliforms (MF)	APHA 9222 D	Membrane Filtration	Kelowna
Hardness (as CaCO3)	APHA 2340 B	Calculation	N/A
HPC in Water (R2A Agar, 72 hrs @ 35 °C)	APHA 9215 D	Membrane Filtration	Kelowna
pH in Water	APHA 4500-H+ B	Electrometry	Kelowna
Total Ammonia-N in Water	APHA 4500-NH3 G	Automated Colorimetry (Phenate)	Kelowna
Total Coliforms (CCA)	APHA 9222 *	Membrane Filtration	Kelowna
Total Dissolved Solids (Gravimetric)	APHA 2540 C	Gravimetry (Dried at 103-105C)	Kelowna
Total Kjeldahl Nitrogen in Water	EPA 351.2 *	Sulfuric Acid Digestion, Automated Colorimetry	Kelowna
Total Recoverable Metals	APHA 3030E * / APHA 3125 B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma Mass Spectrometry (ICP-MS)	Richmond
Turbidity	APHA 2130 B	Nephelometry	Kelowna
VOC in Water	EPA 5030B/5021A / EPA 8260B	Purge&Trap or Headspace / GC-MS (SIM)	Richmond

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Method Reference Descriptions:

APHA	Standard Methods for the Examination of Water and Wastewater, 22nd Edition, American Public Health Association/American Water Works Association/Water Environment Federation
EPA	United States Environmental Protection Agency Test Methods

Glossary of Terms:

MRL	Method Reporting Limit
<	Less than the Reported Detection Limit (RDL) - the RDL may be higher than the MRL due to various factors such as dilutions, limited sample volume, high moisture, or interferences
AO	Aesthetic objective
MAC	Maximum acceptable concentration (health based)
OG	Operational guideline (treated water)
CFU/100 mL	Colony Forming Units per 100 millilitres
CFU/mL	Colony Forming Units per millilitre
CU	Colour Units (referenced against a platinum cobalt standard)
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
pH units	pH < 7 = acidic, ph > 7 = basic
µg/L	Micrograms per litre
µS/cm	Microsiemens per centimetre

REPORTED TO	Kala Geosciences Ltd.	**WORK ORDER**	4121041
PROJECT	Kala Domestic Potability	**REPORTED**	Dec-24-14

Analyte	Result / *Recovery*	Estimate of Uncertainty	MRL / *Limits*	Units	Prepared	Analyzed	Notes
Sample ID: WIN 41015 (4121041-01) [Water] Sampled: Dec-16-14 13:20							
Anions							
Chloride	**42.8**	± 1.5	0.10	mg/L	N/A	Dec-18-14	
Fluoride	**0.23**	± 0.03	0.10	mg/L	N/A	Dec-18-14	
Nitrate as N	< 0.010		0.010	mg/L	N/A	Dec-18-14	
Nitrite as N	< 0.010		0.010	mg/L	N/A	Dec-18-14	
Sulfate	**511**	± 65	1.0	mg/L	N/A	Dec-18-14	
General Parameters							
Alkalinity, Total as CaCO3	**480**	± 33	1	mg/L	N/A	Dec-17-14	
Alkalinity, Phenolphthalein as CaCO3	< 1		1	mg/L	N/A	Dec-17-14	
Alkalinity, Bicarbonate as CaCO3	**480**	± 36	1	mg/L	N/A	Dec-17-14	
Alkalinity, Carbonate as CaCO3	< 1		1	mg/L	N/A	Dec-17-14	
Alkalinity, Hydroxide as CaCO3	< 1		1	mg/L	N/A	Dec-17-14	
Colour, True	< 5		5	CU	N/A	Dec-18-14	
Conductivity (EC)	**1630**	± 60	2	µS/cm	N/A	Dec-17-14	
Ammonia as N, Total	**0.054**	± 0.009	0.020	mg/L	N/A	Dec-18-14	
Nitrogen, Total Kjeldahl	**0.14**	± 0.05	0.05	mg/L	Dec-19-14	Dec-22-14	
pH	**7.89**	± 0.01	0.01	pH units	N/A	Dec-17-14	
Solids, Total Dissolved	**1180**	± 111	10	mg/L	N/A	Dec-19-14	
Turbidity	**0.4**	± 0.1	0.1	NTU	N/A	Dec-19-14	
Calculated Parameters							
Hardness, Total (Total as CaCO3)	**1000**		5.0	mg/L	N/A	N/A	
Hardness, Total (Diss. as CaCO3)	**905**		5.0	mg/L	N/A	N/A	
Nitrate+Nitrite as N	< 0.020		0.020	mg/L	N/A	N/A	
Nitrogen, Organic	**0.090**		0.050	mg/L	N/A	N/A	
Dissolved Metals							
Aluminum, dissolved	< 0.05		0.05	mg/L	N/A	Dec-18-14	
Antimony, dissolved	**0.001**	± 0.001	0.001	mg/L	N/A	Dec-18-14	
Arsenic, dissolved	< 0.005		0.005	mg/L	N/A	Dec-18-14	
Barium, dissolved	< 0.05		0.05	mg/L	N/A	Dec-18-14	
Beryllium, dissolved	< 0.001		0.001	mg/L	N/A	Dec-18-14	
Bismuth, dissolved	< 0.001		0.001	mg/L	N/A	Dec-18-14	
Boron, dissolved	< 0.04		0.04	mg/L	N/A	Dec-18-14	
Cadmium, dissolved	**0.0001**	± 0.0001	0.0001	mg/L	N/A	Dec-18-14	
Calcium, dissolved	**67.7**	± 11.9	2.0	mg/L	N/A	Dec-18-14	
Chromium, dissolved	< 0.005		0.005	mg/L	N/A	Dec-18-14	
Cobalt, dissolved	< 0.0005		0.0005	mg/L	N/A	Dec-18-14	
Copper, dissolved	< 0.002		0.002	mg/L	N/A	Dec-18-14	
Iron, dissolved	< 0.10		0.10	mg/L	N/A	Dec-18-14	
Lead, dissolved	< 0.001		0.001	mg/L	N/A	Dec-18-14	
Lithium, dissolved	**0.011**	± 0.003	0.001	mg/L	N/A	Dec-18-14	
Magnesium, dissolved	**179**	± 30	0.1	mg/L	N/A	Dec-18-14	
Manganese, dissolved	**0.538**	± 0.061	0.002	mg/L	N/A	Dec-18-14	
Mercury, dissolved	< 0.0002		0.0002	mg/L	N/A	Dec-18-14	
Molybdenum, dissolved	**0.013**	± 0.001	0.001	mg/L	N/A	Dec-18-14	
Nickel, dissolved	< 0.002		0.002	mg/L	N/A	Dec-18-14	

REPORTED TO	Kala Geosciences Ltd.	**WORK ORDER**	4121041
PROJECT	Kala Domestic Potability	**REPORTED**	Dec-24-14

Analyte	Result / *Recovery*	Estimate of Uncertainty	MRL / *Limits*	Units	Prepared	Analyzed	Notes
Sample ID: WIN 41015 (4121041-01) [Water] Sampled: Dec-16-14 13:20, Continued							
Dissolved Metals, Continued							
Phosphorus, dissolved	< 0.2		0.2	mg/L	N/A	Dec-18-14	
Potassium, dissolved	**6.2**	± 0.8	0.2	mg/L	N/A	Dec-18-14	
Selenium, dissolved	< 0.005		0.005	mg/L	N/A	Dec-18-14	
Silicon, dissolved	**19**	± 9	5	mg/L	N/A	Dec-18-14	
Silver, dissolved	< 0.0005		0.0005	mg/L	N/A	Dec-18-14	
Sodium, dissolved	**39.0**	± 6.3	0.2	mg/L	N/A	Dec-18-14	
Strontium, dissolved	**0.24**	± 0.02	0.01	mg/L	N/A	Dec-18-14	
Sulfur, dissolved	**167**	± 62	10	mg/L	N/A	Dec-18-14	
Tellurium, dissolved	< 0.002		0.002	mg/L	N/A	Dec-18-14	
Thallium, dissolved	< 0.0002		0.0002	mg/L	N/A	Dec-18-14	
Thorium, dissolved	< 0.001		0.001	mg/L	N/A	Dec-18-14	
Tin, dissolved	< 0.002		0.002	mg/L	N/A	Dec-18-14	
Titanium, dissolved	< 0.05		0.05	mg/L	N/A	Dec-18-14	
Uranium, dissolved	**0.0043**	± 0.0006	0.0002	mg/L	N/A	Dec-18-14	
Vanadium, dissolved	< 0.01		0.01	mg/L	N/A	Dec-18-14	
Zinc, dissolved	< 0.04		0.04	mg/L	N/A	Dec-18-14	
Zirconium, dissolved	< 0.001		0.001	mg/L	N/A	Dec-18-14	
Total Recoverable Metals							
Aluminum, total	< 0.05		0.05	mg/L	Dec-18-14	Dec-19-14	
Antimony, total	< 0.001		0.001	mg/L	Dec-18-14	Dec-19-14	
Arsenic, total	**0.005**	± 0.001	0.005	mg/L	Dec-18-14	Dec-19-14	
Barium, total	< 0.05		0.05	mg/L	Dec-18-14	Dec-19-14	
Beryllium, total	< 0.001		0.001	mg/L	Dec-18-14	Dec-19-14	
Bismuth, total	< 0.001		0.001	mg/L	Dec-18-14	Dec-19-14	
Boron, total	**0.24**	± 0.05	0.04	mg/L	Dec-18-14	Dec-19-14	
Cadmium, total	**0.0002**		0.0001	mg/L	Dec-18-14	Dec-19-14	
Calcium, total	**76.9**	± 9.7	2.0	mg/L	Dec-18-14	Dec-19-14	
Chromium, total	< 0.005		0.005	mg/L	Dec-18-14	Dec-19-14	
Cobalt, total	< 0.0005		0.0005	mg/L	Dec-18-14	Dec-19-14	
Copper, total	< 0.002		0.002	mg/L	Dec-18-14	Dec-19-14	
Iron, total	< 0.10		0.10	mg/L	Dec-18-14	Dec-19-14	
Lead, total	< 0.001		0.001	mg/L	Dec-18-14	Dec-19-14	
Lithium, total	**0.013**	± 0.002	0.001	mg/L	Dec-18-14	Dec-19-14	
Magnesium, total	**197**	± 30	0.1	mg/L	Dec-18-14	Dec-19-14	
Manganese, total	**0.558**	± 0.051	0.002	mg/L	Dec-18-14	Dec-19-14	
Mercury, total	< 0.0002		0.0002	mg/L	Dec-18-14	Dec-19-14	
Molybdenum, total	**0.019**	± 0.002	0.001	mg/L	Dec-18-14	Dec-19-14	
Nickel, total	< 0.002		0.002	mg/L	Dec-18-14	Dec-19-14	
Phosphorus, total	< 0.2		0.2	mg/L	Dec-18-14	Dec-19-14	
Potassium, total	**6.3**	± 0.7	0.2	mg/L	Dec-18-14	Dec-19-14	
Selenium, total	**0.011**	± 0.002	0.005	mg/L	Dec-18-14	Dec-19-14	
Silicon, total	**19**	± 6	5	mg/L	Dec-18-14	Dec-19-14	
Silver, total	< 0.0005		0.0005	mg/L	Dec-18-14	Dec-19-14	
Sodium, total	**42.8**	± 6.3	0.2	mg/L	Dec-18-14	Dec-19-14	
Strontium, total	**0.26**	± 0.03	0.01	mg/L	Dec-18-14	Dec-19-14	

REPORTED TO	Kala Geosciences Ltd.	**WORK ORDER**	4121041
PROJECT	Kala Domestic Potability	**REPORTED**	Dec-24-14

Analyte	Result / *Recovery*	Estimate of Uncertainty	MRL / *Limits*	Units	Prepared	Analyzed	Notes
Sample ID: WIN 41015 (4121041-01) [Water] Sampled: Dec-16-14 13:20, Continued							
Total Recoverable Metals, Continued							
Sulfur, total	**170**	± 40	10	mg/L	Dec-18-14	Dec-19-14	
Tellurium, total	< 0.002		0.002	mg/L	Dec-18-14	Dec-19-14	
Thallium, total	< 0.0002		0.0002	mg/L	Dec-18-14	Dec-19-14	
Thorium, total	< 0.001		0.001	mg/L	Dec-18-14	Dec-19-14	
Tin, total	< 0.002		0.002	mg/L	Dec-18-14	Dec-19-14	
Titanium, total	< 0.05		0.05	mg/L	Dec-18-14	Dec-19-14	
Uranium, total	**0.0044**	± 0.0003	0.0002	mg/L	Dec-18-14	Dec-19-14	
Vanadium, total	< 0.01		0.01	mg/L	Dec-18-14	Dec-19-14	
Zinc, total	< 0.04		0.04	mg/L	Dec-18-14	Dec-19-14	
Zirconium, total	< 0.001		0.001	mg/L	Dec-18-14	Dec-19-14	
Microbiological Parameters							
Coliforms, Total	< 1		1	CFU/100 mL	Dec-17-14	Dec-18-14	
Coliforms, Fecal	< 1		1	CFU/100 mL	Dec-17-14	Dec-18-14	
Heterotrophic Plate Count	**62**		5	CFU/mL	Dec-17-14	Dec-20-14	HT
E. coli	< 1		1	CFU/100 mL	Dec-17-14	Dec-18-14	
Volatile Organic Compounds (VOC)							
Benzene	< 0.5		0.5	µg/L	N/A	Dec-19-14	
Bromodichloromethane	< 1.0		1.0	µg/L	N/A	Dec-19-14	
Bromoform	< 1.0		1.0	µg/L	N/A	Dec-19-14	
Carbon tetrachloride	< 1.0		1.0	µg/L	N/A	Dec-19-14	
Chlorobenzene	< 1.0		1.0	µg/L	N/A	Dec-19-14	
Chloroethane	< 2.0		2.0	µg/L	N/A	Dec-19-14	
Chloroform	< 1.0		1.0	µg/L	N/A	Dec-19-14	
Dibromochloromethane	< 1.0		1.0	µg/L	N/A	Dec-19-14	
1,2-Dibromoethane	< 0.3		0.3	µg/L	N/A	Dec-19-14	
Dibromomethane	< 1.0		1.0	µg/L	N/A	Dec-19-14	
1,2-Dichlorobenzene	< 0.5		0.5	µg/L	N/A	Dec-19-14	
1,3-Dichlorobenzene	< 1.0		1.0	µg/L	N/A	Dec-19-14	
1,4-Dichlorobenzene	< 1.0		1.0	µg/L	N/A	Dec-19-14	
1,1-Dichloroethane	< 1.0		1.0	µg/L	N/A	Dec-19-14	
1,2-Dichloroethane	< 1.0		1.0	µg/L	N/A	Dec-19-14	
1,1-Dichloroethene	< 1.0		1.0	µg/L	N/A	Dec-19-14	
cis-1,2-Dichloroethene	< 1.0		1.0	µg/L	N/A	Dec-19-14	
trans-1,2-Dichloroethene	< 1.0		1.0	µg/L	N/A	Dec-19-14	
1,2-Dichloropropane	< 1.0		1.0	µg/L	N/A	Dec-19-14	
cis-1,3-Dichloropropene	< 1.0		1.0	µg/L	N/A	Dec-19-14	
trans-1,3-Dichloropropene	< 1.0		1.0	µg/L	N/A	Dec-19-14	
Ethylbenzene	< 1.0		1.0	µg/L	N/A	Dec-19-14	
Methyl tert-butyl ether	< 1.0		1.0	µg/L	N/A	Dec-19-14	
Methylene chloride	< 3.0		3.0	µg/L	N/A	Dec-19-14	
Styrene	< 1.0		1.0	µg/L	N/A	Dec-19-14	
1,1,2,2-Tetrachloroethane	< 1.0		1.0	µg/L	N/A	Dec-19-14	
Tetrachloroethene	< 1.0		1.0	µg/L	N/A	Dec-19-14	
Toluene	< 1.0		1.0	µg/L	N/A	Dec-19-14	

REPORTED TO	Kala Geosciences Ltd.	**WORK ORDER**	4121041
PROJECT	Kala Domestic Potability	**REPORTED**	Dec-24-14

Analyte	Result / *Recovery*	Estimate of Uncertainty	MRL / *Limits*	Units	Prepared	Analyzed	Notes
Sample ID: WIN 41015 (4121041-01) [Water] Sampled: Dec-16-14 13:20, Continued							
Volatile Organic Compounds (VOC), Continued							
1,1,1-Trichloroethane	< 1.0		1.0	µg/L	N/A	Dec-19-14	
1,1,2-Trichloroethane	< 1.0		1.0	µg/L	N/A	Dec-19-14	
Trichloroethene	< 1.0		1.0	µg/L	N/A	Dec-19-14	
Trichlorofluoromethane	< 1.0		1.0	µg/L	N/A	Dec-19-14	
Vinyl chloride	< 2.0		2.0	µg/L	N/A	Dec-19-14	
Xylenes (total)	< 2.0		2.0	µg/L	N/A	Dec-19-14	
Surrogate: Toluene-d8	*87 %*		*70-130*		*N/A*	*Dec-19-14*	
Surrogate: 4-Bromofluorobenzene	*104 %*		*70-130*		*N/A*	*Dec-19-14*	
Surrogate: 1,4-Dichlorobenzene-d4	*92 %*		*70-130*		*N/A*	*Dec-19-14*	

Sample / Analysis Qualifiers:

HT The sample was prepared / analyzed past the recommended holding time.

Date: 22-JAN-16
PO No.:
WO No.: L1708191
Project Ref: CRYSTAL CLINTON BOTTLING LTD
Sample ID: CRYSTAL CLINTON BOTTLING LTD
Sampled By: Lloyd Ingram
Date Collected: 30-NOV-15
Lab Sample ID: L1708191-1
Matrix: Water

CASH CLIENT - KAMLOOPS
Ian Chadwick
Unit 204 1139 12th St
Kamloops BC V2B 7Z2
ATTN: EHD Consulting

Test Description	Result	Qualifier	Units of Measure	CDWQG MAC	Aesthetic Objective	Date Analyzed
Physical Tests						
Colour, True	<5.0		CU			01-DEC-15
Conductivity	1420		uS/cm			01-DEC-15
Hardness (as CaCO3)	770		mg/L		500	03-DEC-15
Langelier Index Temperature	8.3		C			03-DEC-15
Langelier Index	0.67		none			07-DEC-15
pH	8.04		pH		6.5-8.5	01-DEC-15
Total Dissolved Solids	882		mg/L		500	02-DEC-15
Transmittance, UV (254 nm)	95.7		% T			01-DEC-15
Turbidity	0.11		NTU			01-DEC-15
Anions and Nutrients						
Alkalinity, Bicarbonate (as CaCO3)	390		mg/L			01-DEC-15
Alkalinity, Carbonate (as CaCO3)	<1.0		mg/L			01-DEC-15
Alkalinity, Hydroxide (as CaCO3)	<1.0		mg/L			01-DEC-15
Alkalinity, Total (as CaCO3)	390		mg/L			01-DEC-15
Ammonia, Total (as N)	0.0191		mg/L			05-DEC-15
Bromide (Br)	0.087		mg/L			01-DEC-15
Chloride (Cl)	86.6		mg/L		250	01-DEC-15
Fluoride (F)	0.23		mg/L	1.5		01-DEC-15
Nitrate (as N)	0.309		mg/L	10		01-DEC-15
Nitrite (as N)	0.0197		mg/L	1		01-DEC-15
Total Kjeldahl Nitrogen	0.122		mg/L			03-DEC-15
Total Organic Nitrogen	0.103		mg/L			07-DEC-15
Phosphorus (P)-Total	0.0429		mg/L			02-DEC-15
Sulfate (SO4)	300		mg/L		500	01-DEC-15
Sulphide as S	<0.020		mg/L		0.05	01-DEC-15
Anion Sum	16.5		meq/L			07-DEC-15
Cation Sum	17.4		meq/L			07-DEC-15
Cation - Anion Balance	2.5		%			07-DEC-15
Cyanides						
Cyanide, Total	<0.0050		mg/L	0.2		02-DEC-15
Organic / Inorganic Carbon						
Total Organic Carbon	1.55		mg/L			01-DEC-15
Bacteriological Tests						
E. coli	<1		CFU/100mL	0		30-NOV-15
Background colonies	<1		CFU/100mL			30-NOV-15
Coliform Bacteria - Total	<1		CFU/100mL	0		30-NOV-15
Total Metals						
Aluminum (Al)-Total	<0.010		mg/L		0.1	02-DEC-15
Antimony (Sb)-Total	<0.00050		mg/L	0.006		02-DEC-15
Arsenic (As)-Total	0.00106		mg/L	0.01		02-DEC-15
Barium (Ba)-Total	0.017		mg/L	1		02-DEC-15
Beryllium (Be)-Total	<0.0050		mg/L			02-DEC-15

Date: 22-JAN-16
PO No.:
WO No.: L1708191
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Sample ID: CRYSTAL CLINTON BOTTLING LTD
Sampled By: Lloyd Ingram
Date Collected: 30-NOV-15
Lab Sample ID: L1708191-1
Matrix: Water

CASH CLIENT - KAMLOOPS
Ian Chadwick
Unit 204 1139 12th St
Kamloops BC V2B 7Z2
ATTN: EHD Consulting

Test Description	Result	Qualifier	Units of Measure	CDWQG MAC	Aesthetic Objective	Date Analyzed
Bismuth (Bi)-Total	<0.20		mg/L			02-DEC-15
Boron (B)-Total	<0.10		mg/L	5		02-DEC-15
Cadmium (Cd)-Total	<0.00020		mg/L	0.005		02-DEC-15
Calcium (Ca)-Total	60.4		mg/L			02-DEC-15
Chromium (Cr)-Total	<0.0020		mg/L	0.05		02-DEC-15
Cobalt (Co)-Total	<0.010		mg/L			02-DEC-15
Copper (Cu)-Total	0.0019		mg/L		1.0	02-DEC-15
Iron (Fe)-Total	<0.030		mg/L		0.3	02-DEC-15
Lead (Pb)-Total	<0.00050		mg/L	0.01		02-DEC-15
Lithium (Li)-Total	0.010		mg/L			02-DEC-15
Magnesium (Mg)-Total	150		mg/L			02-DEC-15
Manganese (Mn)-Total	0.455		mg/L		0.05	02-DEC-15
Mercury (Hg)-Total	<0.00020		mg/L	0.001		02-DEC-15
Molybdenum (Mo)-Total	<0.030		mg/L			02-DEC-15
Nickel (Ni)-Total	<0.050		mg/L			02-DEC-15
Phosphorus (P)-Total	<0.30		mg/L			02-DEC-15
Potassium (K)-Total	5.47		mg/L			02-DEC-15
Selenium (Se)-Total	0.0079		mg/L	0.05		02-DEC-15
Silicon (Si)-Total	14.5		mg/L			02-DEC-15
Silver (Ag)-Total	<0.010		mg/L			02-DEC-15
Sodium (Na)-Total	42.1		mg/L		200	02-DEC-15
Strontium (Sr)-Total	0.199		mg/L			02-DEC-15
Thallium (Tl)-Total	<0.20		mg/L			02-DEC-15
Tin (Sn)-Total	<0.030		mg/L			02-DEC-15
Titanium (Ti)-Total	<0.010		mg/L			02-DEC-15
Uranium (U)-Total	0.00288		mg/L	0.02		02-DEC-15
Vanadium (V)-Total	<0.030		mg/L			02-DEC-15
Zinc (Zn)-Total	0.0104		mg/L		5.0	02-DEC-15

CDWQG = Health Canada Guideline Limits updated DECEMBER 2015

* CDWQG for Nitrate+Nitrite-N is the limit for nitrate only. If present as Nitrate then the limit is 10mg/L < or N.D. = less than detection limit.
* Turbidity guideline based on membrane filtration. For guidelines on conventional treatment and slow sand or diatomaceous earth filtration please see Summary Table of Guidelines for Canadian Drinking Water Quality
- A blank entry designates no known limit.
- A shaded value in the Results column exceeds CDWQG MAC and/ or Aesthetic Objective.

Approved by

Amanda Lampreau
Account Manager

Guidelines & Objectives

Health Canada MAC Health Related Criteria Limits

Nitrate/Nitrite-N*	Criteria limit is 10 mg/L (1.0 mg/L if present as all Nitrite-N). High concentrations may contribute to blue baby syndrome in infants.
Lead*	A cumulative body poison, uncommon in naturally occurring hard waters.
Fluoride*	Present in fluoridated water supplies at 0.8 mg/L to reduce dental caries. Elevated levels causes fluorosis (mottling of teeth).
Total Coliforms*	Criteria is 0 CFU/100mL. Adverse health effects.
E. Coli*	Criteria is 0 CFU/100 mL. Certain E. Coli bacteria can be life threatening.

*Health Canada Canadian Drinking Water Quality Guidelines (MAC limit)

Aesthetic Objective Concentration Levels

Alkalinity	Acid neutralizing capacity. Usually a measure of carbonate and bicarbonates and calculated and reported as calcium carbonate.
Balance	Quality control parameter ratioing cations to anions
Bicarbonate	See Alkalinity. Report as the anion HCO3-1
Carbonate	See Alkalinity. Reported at the anion CO3-2
Calcium	See Hardness. Common major cation of water chemistry.
Chloride	Common major anion of water chemistry.
Conductance	Physical test measuring water salinity (dissolved ions or solids)
Hardness	Classical measure or capacity of water to precipitate soap (chiefly calcium and magnesium ions). Causes scaling tendency in water if carbonates/bicarbonates are present (if >200 mg/L). For drinking water purposes waters with results <200 mg/L are considered acceptable, results >200 mg/L are considered poor but can be tolerated. Results >500 mg/L are unacceptable.
Hydroxide	See alkalinity
Magnesium	See hardness. Common major cation of water chemistry. Elevated levels (>125 mg/L) may exert a cathartic or diuretic action.
pH	Measure of water acidity/alkalinity. Normal range is 7.0-8.5.
Potassium	Common major cation of water chemistry.
Sodium	Common major cation of water chemistry. Measure of salinity (saltiness).
Sulphate	Common major anion of water chemistry. Elevated levels may exert a cathartic or diuretic action.
Total Dissolved Solids	A measure of water salinity.
Iron	Causes staining to laundry and porcelain and astringent taste. Oxidizes to red-brown precipitate on exposure to air.
Manganese	Elevated levels may cause staining of laundry and porcelain.
Heterotrophic Plate Count	Criteria is 500 cfu/mL Measure of heterotrophic bacteria present.

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
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
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
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.

Date: 17-JUN-15
PO No.:
WO No.: L1624676
Project Ref: 908/15
Sample ID: 41015
Sampled By:
Date Collected: 10-JUN-15
Lab Sample ID: L1624676-1
Matrix: Water

CASH CLIENT - KAMLOOPS
EHD Consulting Ltd.
Unit 204-1139 12th Street
Kamloops BC V2B7Z2
ATTN: Matt Sarkor

Test Description	Result	Qualifier	Units of Measure	CDWQG MAC	Aesthetic Objective	Date Analyzed
Physical Tests						
Colour, True	<5.0		CU			12-JUN-15
Conductivity	1550		uS/cm			15-JUN-15
Hardness (as CaCO3)	812		mg/L		500	15-JUN-15
pH	8.50		pH		6.5-8.5	15-JUN-15
Total Suspended Solids	<3.0		mg/L			12-JUN-15
Total Dissolved Solids	1000		mg/L		500	15-JUN-15
Transmittance, UV (254 nm)	94.6		% T			12-JUN-15
Turbidity *	0.15		NTU	0.1		12-JUN-15
Anions and Nutrients						
Alkalinity, Total (as CaCO3)	480		mg/L			15-JUN-15
Chloride (Cl)	81.0		mg/L		250	12-JUN-15
Fluoride (F)	0.24		mg/L	1.5		12-JUN-15
Nitrate (as N)	0.332		mg/L	10		12-JUN-15
Nitrite (as N)	0.0170		mg/L	1		12-JUN-15
Sulfate (SO4)	425		mg/L		500	12-JUN-15
Bacteriological Tests						
E. coli	<1		CFU/100mL	0		10-JUN-15
Background colonies	<1		CFU/100mL			10-JUN-15
Coliform Bacteria - Total	<1		CFU/100mL	0		10-JUN-15
Total Metals						
Aluminum (Al)-Total	<0.010		mg/L		0.1	14-JUN-15
Antimony (Sb)-Total	<0.00050		mg/L	0.006		14-JUN-15
Arsenic (As)-Total	0.00107		mg/L	0.01		14-JUN-15
Barium (Ba)-Total	<0.020		mg/L	1		14-JUN-15
Boron (B)-Total	<0.10		mg/L	5		14-JUN-15
Cadmium (Cd)-Total	<0.00020		mg/L	0.005		14-JUN-15
Calcium (Ca)-Total	64.2		mg/L			14-JUN-15
Chromium (Cr)-Total	<0.0020		mg/L	0.05		14-JUN-15
Copper (Cu)-Total	<0.0010		mg/L		1.0	14-JUN-15
Iron (Fe)-Total	<0.030		mg/L		0.3	14-JUN-15
Lead (Pb)-Total	<0.00050		mg/L	0.01		14-JUN-15
Magnesium (Mg)-Total	158		mg/L			14-JUN-15
Manganese (Mn)-Total	0.536		mg/L		0.05	14-JUN-15
Mercury (Hg)-Total	<0.00020		mg/L	0.001		12-JUN-15
Potassium (K)-Total	5.86		mg/L			14-JUN-15
Selenium (Se)-Total	0.0053		mg/L	0.05		14-JUN-15
Sodium (Na)-Total	38.0		mg/L		200	14-JUN-15
Uranium (U)-Total	0.00330		mg/L	0.02		14-JUN-15
Zinc (Zn)-Total	<0.050		mg/L		5.0	14-JUN-15

Date: 17-JUN-15
PO No.:
WO No.: L1624676
Project Ref: 908/15
Sample ID: 41015
Sampled By:
Date Collected: 10-JUN-15
Lab Sample ID: L1624676-1
Matrix: Water

CASH CLIENT - KAMLOOPS
EHD Consulting Ltd.
Unit 204-1139 12th Street
Kamloops BC V2B7Z2
ATTN: Matt Sarkor

Test Description	Result	Qualifier	Units of Measure	CDWQG MAC	Aesthetic Objective	Date Analyzed

CDWQG = Health Canada Guideline Limits updated **OCTOBER 2014**

* CDWQG for Nitrate+Nitrite-N is the limit for nitrate only. If present as Nitrate then the limit is 10mg/L < or N.D. = less than detection limit.
* Turbidity guideline based on membrane filtration. For guidelines on conventional treatment and slow sand or diatomaceous earth filtration please see Summary Table of Guidelines for Canadian Drinking Water Quality
- A blank entry designates no known limit.
- A shaded value in the Results column exceeds CDWQG MAC and/ or Aesthetic Objective.
- In British Columbia the acceptable limits for drinking water refer to theGuidelines for Canadian Drinking Water Quality for all chemical, physical and radiological parameters. For microbiological parameters, the BC Drinking Water Protection Regulation has an immediate reporting standard of no detectable fecal coliform bacteria or Escherichia coli per 100 mL, which is represented on the report as a result of 0 or <1 MPN/100 mL of 0 or <1 CFU/100 mL.

Approved by

Amanda Lampreau
Account Manager

Guidelines & Objectives

Health Canada MAC Health Related Criteria Limits

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Chloride	Common major anion of water chemistry.
Conductance	Physical test measuring water salinity (dissolved ions or solids)
Hardness	Classical measure or capacity of water to precipitate soap (chiefly calcium and magnesium ions). Causes scaling tendency in water if carbonates/bicarbonates are present (if >200 mg/L). For drinking water purposes waters with results <200 mg/L are considered acceptable, results >200 mg/L are considered poor but can be tolerated. Results >500 mg/L are unacceptable.
Hydroxide	See alkalinity
Magnesium	See hardness. Common major cation of water chemistry. Elevated levels (>125 mg/L) may exert a cathartic or diuretic action.
pH	Measure of water acidity/alkalinity. Normal range is 7.0-8.5.
Potassium	Common major cation of water chemistry.
Sodium	Common major cation of water chemistry. Measure of salinity (saltiness).
Sulphate	Common major anion of water chemistry. Elevated levels may exert a cathartic or diuretic action.
Total Dissolved Solids	A measure of water salinity.
Iron	Causes staining to laundry and porcelain and astringent taste. Oxidizes to red-brown precipitate on exposure to air.
Manganese	Elevated levels may cause staining of laundry and porcelain.
Heterotrophic Plate Count	Criteria is 500 cfu/mL Measure of heterotrophic bacteria present.

GLOSSARY OF REPORT TERMS

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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
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 14 - 432431

Page 1 of 1

Report To		Report Format / Distribution	Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company:	EHD CONSULTING LTD.	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	R ☑ Regular (Standard TAT if received by 3pm)
Contact:	HATT SARKOR	Quality Control (QC) Report with Report ☑ Yes ☐ No	P ☐ Priority (2-4 business days if received by 3pm)
Address:	UNIT 204 - 1139 12TH ST KAMLOOPS, BC V2B 7Z2	☐ Criteria on Report - provide details below if box checked	E ☐ Emergency (1-2 business days if received by 3pm)
Phone:	250-996-1592	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	E2 ☐ Same day or weekend emergency if received by 10am – contact ALS for surcharge.
		Email 1 or Fax: sarkorma@gmail.com	Specify Date Required for E2,E or P:
		Email 2: ehdconsulting@shaw.ca	

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

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:		Approver ID:	Cost Center:
Job #:	908/15	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only): L1624676 | ALS Contact: AMBER | Sampler: LLOYD INGRAM

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

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	FULL POTABILITY	TSS	UVT	Number of Containers
	~~41015~~ 41015	10-JUN-15	08:30	WATER	F/P	F/P	F/P	3
	TSS	"	"	"				
	UVT	"	"	"				

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

SAMPLE CONDITION AS RECEIVED (lab use only)

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

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
9					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: LLOYD INGRAM	Date: 10-JUN-15	Time:	Received by: Amber M	Date: June 10	Time: 12:10	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326e v08 Front03 October 2013

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

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

EHD CONSULTING LTD
204-1139 12th Street

Kamloops BC V2B7Z2
ATTN: Ian Chadwick

Date: 01-MAR-16
PO No.:
WO No.: L1732513
Project Ref: CRYSTAL CLINTON BOTTLING LTD WELL TAG #39847
Sample ID: WELL TAG #39847
Sampled By:
Date Collected: 08-FEB-16
Lab Sample ID: L1732513-1
Matrix: Water

Test Description	Result	Qualifier	Units of Measure	CDWQG MAC	Aesthetic Objective	Date Analyzed
Physical Tests						
Colour, True	<5.0		CU			11-FEB-16
Conductivity	1270		uS/cm			11-FEB-16
Hardness (as CaCO3)	629		mg/L		500	19-FEB-16
Langelier Index Temperature	20		C			09-FEB-16
Langelier Index	0.65		none			26-FEB-16
pH	8.10		pH		6.5-8.5	10-FEB-16
Total Dissolved Solids	799		mg/L		500	12-FEB-16
Turbidity	0.34		NTU			11-FEB-16
Anions and Nutrients						
Acidity (as CaCO3)	1.8		mg/L			12-FEB-16
Alkalinity, Total (as CaCO3)	215		mg/L			10-FEB-16
Bromide (Br)	<0.25	DLDS	mg/L			11-FEB-16
Chloride (Cl)	163		mg/L		250	11-FEB-16
Fluoride (F)	0.19		mg/L	1.5		11-FEB-16
Nitrate (as N)	0.113		mg/L	10		11-FEB-16
Nitrite (as N)	0.0208		mg/L	1		11-FEB-16
Silicate (as SiO2)	24.5		mg/L			11-FEB-16
Sulfate (SO4)	214		mg/L		500	11-FEB-16
Bacteriological Tests						
E. coli	<1		MPN/100mL	0		09-FEB-16
Coliform Bacteria - Fecal	<1		CFU/100mL	0		09-FEB-16
Coliform Bacteria - Total	<1		MPN/100mL	0		09-FEB-16
Total Metals						
Aluminum (Al)-Total	<0.010		mg/L		0.1	18-FEB-16
Antimony (Sb)-Total	<0.00050		mg/L	0.006		18-FEB-16
Arsenic (As)-Total	0.0013		mg/L	0.01		18-FEB-16
Barium (Ba)-Total	0.022		mg/L	1		16-FEB-16
Beryllium (Be)-Total	<0.0050		mg/L			16-FEB-16
Bismuth (Bi)-Total	<0.20		mg/L			16-FEB-16
Boron (B)-Total	<0.10		mg/L	5		16-FEB-16
Cadmium (Cd)-Total	0.000110		mg/L	0.005		18-FEB-16
Calcium (Ca)-Total	56.5		mg/L			16-FEB-16
Chromium (Cr)-Total	0.00201		mg/L	0.05		18-FEB-16
Cobalt (Co)-Total	<0.00050		mg/L			18-FEB-16
Copper (Cu)-Total	0.0058		mg/L		1.0	18-FEB-16
Iron (Fe)-Total	0.918		mg/L		0.3	16-FEB-16
Lead (Pb)-Total	<0.0010		mg/L	0.01		18-FEB-16
Lithium (Li)-Total	<0.050		mg/L			16-FEB-16
Magnesium (Mg)-Total	118		mg/L			16-FEB-16
Manganese (Mn)-Total	0.294		mg/L		0.05	16-FEB-16
Mercury (Hg)-Total	<0.00020		mg/L	0.001		11-FEB-16
Molybdenum (Mo)-Total	0.0093		mg/L			18-FEB-16

EHD CONSULTING LTD
204-1139 12th Street

Kamloops BC V2B7Z2
ATTN: Ian Chadwick

Date: 01-MAR-16
PO No.:
WO No.: L1732513
Project Ref: CRYSTAL CLINTON BOTTLING LTD WELL TAG #39847
Sample ID: WELL TAG #39847
Sampled By:
Date Collected: 08-FEB-16
Lab Sample ID: L1732513-1
Matrix: Water

Test Description	Result	Qualifier	Units of Measure	CDWQG MAC	Aesthetic Objective	Date Analyzed
Nickel (Ni)-Total	<0.0050		mg/L			18-FEB-16
Phosphorus (P)-Total	<0.30		mg/L			16-FEB-16
Potassium (K)-Total	5.6		mg/L			16-FEB-16
Selenium (Se)-Total	0.0323		mg/L	0.05		18-FEB-16
Silicon (Si)-Total	12.1		mg/L			16-FEB-16
Silver (Ag)-Total	<0.000050		mg/L			18-FEB-16
Sodium (Na)-Total	35.9		mg/L		200	16-FEB-16
Strontium (Sr)-Total	0.201		mg/L			16-FEB-16
Thallium (Tl)-Total	<0.00020		mg/L			18-FEB-16
Tin (Sn)-Total	<0.030		mg/L			16-FEB-16
Titanium (Ti)-Total	<0.050		mg/L			16-FEB-16
Uranium (U)-Total	0.00162		mg/L	0.02		18-FEB-16
Vanadium (V)-Total	<0.030		mg/L			16-FEB-16
Zinc (Zn)-Total	<0.0050		mg/L		5.0	16-FEB-16
Aggregate Organics						
Mineral Oil & Grease	<1.0		mg/L			29-FEB-16
Phenols (4AAP)	<0.0010		mg/L			11-FEB-16
Permanent Gases						
Free Carbon Dioxide (as CO2)	<5.0		mg/L			11-FEB-16

CDWQG = Health Canada Guideline Limits updated DECEMBER 2015

* CDWQG for Nitrate+Nitrite-N is the limit for nitrate only. If present as Nitrate then the limit is 10mg/L < or N.D. = less than detection limit.
* Turbidity guideline based on membrane filtration. For guidelines on conventional treatment and slow sand or diatomaceous earth filtration please see Summary Table of Guidelines for Canadian Drinking Water Quality
- A blank entry designates no known limit.
- A shaded value in the Results column exceeds CDWQG MAC and/ or Aesthetic Objective.

Approved by

Amanda Lampreau
Account Manager

Metasilicic Acid =
(MW of Silicate/MW of Metasilicic Acid)x 24.5 mg/L SiO_2 = 31.9 mg/L

Guidelines & Objectives

Sample Parameter Qualifier key listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.

Health Canada MAC Health Related Criteria Limits

Nitrate/Nitrite-N*	Criteria limit is 10 mg/L (1.0 mg/L if present as all Nitrite-N). High concentrations may contribute to blue baby syndrome in infants.
Lead*	A cumulative body poison, uncommon in naturally occurring hard waters.
Fluoride*	Present in fluoridated water supplies at 0.8 mg/L to reduce dental caries. Elevated levels causes fluorosis (mottling of teeth).
Total Coliforms*	Criteria is 0 CFU/100mL. Adverse health effects.
E. Coli*	Criteria is 0 CFU/100 mL. Certain E. Coli bacteria can be life threatening.

*Health Canada Canadian Drinking Water Quality Guidelines (MAC limit)

Aesthetic Objective Concentration Levels

Alkalinity	Acid neutralizing capacity. Usually a measure of carbonate and bicarbonates and calculated and reported as calcium carbonate.
Balance	Quality control parameter ratioing cations to anions
Bicarbonate	See Alkalinity. Report as the anion HCO3-1
Carbonate	See Alkalinity. Reported at the anion CO3-2
Calcium	See Hardness. Common major cation of water chemistry.
Chloride	Common major anion of water chemistry.
Conductance	Physical test measuring water salinity (dissolved ions or solids)
Hardness	Classical measure or capacity of water to precipitate soap (chiefly calcium and magnesium ions). Causes scaling tendency in water if carbonates/bicarbonates are present (if >200 mg/L). For drinking water purposes waters with results <200 mg/L are considered acceptable, results >200 mg/L are considered poor but can be tolerated. Results >500 mg/L are unacceptable.
Hydroxide	See alkalinity
Magnesium	See hardness. Common major cation of water chemistry. Elevated levels (>125 mg/L) may exert a cathartic or diuretic action.
pH	Measure of water acidity/alkalinity. Normal range is 7.0-8.5.
Potassium	Common major cation of water chemistry.
Sodium	Common major cation of water chemistry. Measure of salinity (saltiness).
Sulphate	Common major anion of water chemistry. Elevated levels may exert a cathartic or diuretic action.
Total Dissolved Solids	A measure of water salinity.
Iron	Causes staining to laundry and porcelain and astringent taste. Oxidizes to red-brown precipitate on exposure to air.
Manganese	Elevated levels may cause staining of laundry and porcelain.
Heterotrophic Plate Count	Criteria is 500 cfu/mL Measure of heterotrophic bacteria present.

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
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
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
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.

CMA
150016042722

编号：C16027
Serial Number:

检 验 报 告

TESTING REPORT

委托单位：加拿大克林顿晶露矿泉水有限公司
Sumitted By Crystal Clinton Bottling Ltd

样品名称：地下水
Sample Name Underground Water

检验类别：委托检验
Kind Of Test Commisson Of Test

报告日期：2016年03月10日
Report Date Mar 10, 2016

国土资源部南昌矿产资源监督检测中心
（江西省地质调查研究院）
报告专用章

Nanchang Mineral Resources Supervision and Inspection Center
of National Land and Resources
(Jiangxi Geological Survey Research Institute)

注 意 事 项

Notices

1、检验报告无检测单位“报告专用章”无效。

1. No inspection Unit “Report Dedicated Seal”, the testing report is invalid.

2、检验报告无审核、批准人签字无效。

2. Without eramination and approval, the testing report is invalid.

3、报告涂改无效；复制检验报告未重新加盖“报告专用章”无效。

3. report is invalid with any alter; copy of the report in invalid without “Report Dedicated Seal”.

4、检验报告中的样品名称是送检单位声称的名称，非本单位检验认定/鉴定的样品名称。

4. Sample inspection report is the name of the inspection company to claim, Not my company.

5、送检单位对检验报告有异议，应于收到检验报告之日起15天内向检验单位综合技术部（电话0791-85230305）提出，逾期视为认可检测报告。

5. Inspection company has objections to the report, should be from the date of receiving the report with 15 day, overdue as a recognized inspection report (phone# 0791-85230305)

6、一般情况，委托检验仅对来样负责。

6. In general, commissioned the inspection Only to be responsible for the sample.

地　　址：江西省南昌市迎宾北大道938号

Address: 938 Yingbin North Road, Nanchang City, Jiangxi Province, China.

邮政编码：330030

Post Code :330030

电　　话：0791-85207494，85210581

Tel: (0791)85207494, 85210581

传　　真：0791-85207494

Fax: (0791)85207491

国土资源部南昌矿产资源监督检测中心
（江西省地质调查研究院）
Nanchang Mineral Resources Supervision and Inspection Center of National Land and Resources (Jiangxi Geological Survey Research Institute)

检验报告
Testing Report

检验批号 Test Lot C16027

样品名称 Sample Name	地下水 Under Water	样品数量 Sample Size	1
收样日期 Sampling Date	2016 年 02 月 25 日 Feb 25, 2016	报告日期 Report Date	2016 年 03 月 10 日 Mar 10, 2016
矿区/项目名称 Mining Area /Project Name	Well ID 39845	来样状态 Sample State	无色透明 Colorless and Transparent
检验项目 Test Items	矿泉水分析 Mineral water analysis		
检验依据 Test Basis	GB/T8538-2008		
主要仪器设备 Main Instrument and Equipment	AFS-830a 双道原子荧光光度计（D403）、Agilent7700x 电感耦合等离子体质谱仪(D483)、PHS-3C PH 计（酸度计）（D508）（D509）、XGY-1011A 原子荧光光度计(D482) 、TAS-990F 原子吸收分光光度计（D404）、UV2800S 双光束紫外可见分光光度计(D498) Dual-channel atomic fluorescence spectrometry /Inductively coupled plasma mass spectrometry/PH meter/Atomic fluorescence spectrometer/Atomic absorption spectrophotometer /Double beam UV visible spectrophotometer.		

检验环境 Testing Environment	温度（℃） Temperature	20-25	湿度（%） Humidity	50-70

备注 Remark	检验结论：依据 GB/T8538-2008《饮用天然矿泉水检验方法》进行了检测，所检项目符合 GB 8537-2008《饮用天然矿泉水》的要求。 检验结果见报告第 2-3 页。 Test conclusion: On the basis of "Methods for examination of drinking natural mineral water" (GB/T8538-2008) to check, the inspection items in accordance with the "Drinking natural mineral water" (GB8537-2008) requirements. Test Results is on the page 3 of this Testing Report.

批准： Approver 王宇田	审核： Examiner 刘爱东	主检： Controller 杨郑雅

国土资源部南昌矿产资源监督检测中心
（江西省地质调查研究院）
Nanchang Mineral Resources Supervision and Inspection Center of National Land and Resources
(Jiangxi Geological Survey Research Institute)
检 验 结 果 Test Result

检验批号 test Lot：C16027　　共 3 页　第 2 页　2/3

检验编号：C160270001 Test Number:	分析类别：矿泉水分析 Analysis Class: Analysis of mineral water	取样日期：2016 年 02 月 24 日 Sampling Date: Feb 24, 2016
送样编号：Well ID 39845 Sample #:	取样地点：7072 Walch Road, Clinton, BC V0K 2H0,Canada Sampling Address:	收样日期：2016 年 02 月 25 日 Date Received: Feb 25, 2016
	取样水温： Sampling Temperature　　取样气温：	完成日期：2016 年 03 月 10 日 Completion: Mar 10, 2016

分析项目 Analysis Items $B^{Z\pm}$		$\rho(B^{Z\pm})$ /mg·L^{-1}	$C(1/ZB^{Z\pm})$/ (mmol·L^{-1})	$X(1/ZB^{Z\pm})$ /%	分析项目 Analysis Items	ρ (B)/ (mg·L^{-1})	分析项目 Analysis Items	ρ (B)/ (mg·L^{-1})
阳离子 Cations	K^+	5.47	0.140	0.97	氰化物 Prussiate	<0.002	Mn	0.562
	Na^+	28.86	1.256	8.74	游离 CO_2 Free CO_2	44.50	Cu	0.002
	Ca^{2+}	55.60	2.774	19.31	侵蚀性 CO_2 Corrodibility CO_2	/	Zn	0.002
	Mg^{2+}	123.80	10.188	70.93	耗氧量 Consumed Oxygen	2.31	总 Cr	<0.001
	Al^{3+}	0.00	0.000	0.00	溶解固形物 Dissolved Solids	/	Sr	0.215
	NH^+_4	0.10	0.006	0.04	可溶 SiO_2 Soluble SiO_2	30.42	Ba	0.020
					H_2SiO_3	39.55	Li	0.011
					溶解性总固体 Total Dissolved Solids	784.16	Ni	0.001
					总硬度 Total Hardness	648.68	Co	<0.001
					暂时硬度 Temporary Hardness	410.63	V	<0.005
	总计 total	213.83	14.364	100.00	永久硬度 Permanent Hardness	238.05	Sb	<0.002
					负 硬 度 Negative Hardness	0.00	TFe	0.05

阴离子 Anions	Cl^-	88.07	2.484	16.65	总碱度 Total Alkalinity	410.63	I	<0.005
	SO_4^{2-}	200.00	4.164	27.92	总酸度 Total Acid Degree	50.62	Se	<0.002
	HCO_3^-	500.68	8.206	55.02	色度 Chroma	0.5 度	As	<0.005
	CO_3^{2-}	0.00	0.000	0.00	浑浊度 Turbidity	0.93 度	Hg	<0.0001
	NO_3^-	0.50	0.008	0.05	菌落总数 Total Number of Colony	/ CFU/mL	Pb	<0.001
	OH^-	0.00	0.000	0.00	大肠菌群 Coli Group	/ MPN/100mL	Cd	<0.001
	F^-	1.00	0.053	0.36	pH	7.20	Mo	0.015
	HPO_4^{2-}	/	/	/	肉眼可见物 Visible Substances	无异物 No foreign body	Ag	<0.001
					臭 Odor 煮前 Before Boi	无异臭 No	挥发酚类 Volatile Phenols	<0.002
					臭 Odor 煮后 After Boiled	无异臭 No	硼酸盐（B） Borate (B)	0.037
					味 Taste 煮前 Before Boi	无异味 No	溴酸盐 Bromate	/
	总计 total	790.25	14.915	100.00	味 Taste 煮后 After Boiled	无异味 No	NO_2^-	<0.002
							硫化物(S^{2-}) Sulfied	/
备注 Remark	ρ (Sr)/(mg.L^{-1})=0.215±0.009 ρ (H_2SiO_3)/(mg.L^{-1})=39.55±0.37							

2018 Samples

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2149052-1	L2149052-2			
	Description	Water	Water			
	Sampled Date	17-AUG-18	17-AUG-18			
	Sampled Time	10:10	10:45			
	Client ID	DUCK LAKE	SALT LAKE			
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	3220	72100			
	Hardness (as CaCO3) (mg/L)	1680 HTC	150000 HTC			
	Total Dissolved Solids (mg/L)	2650	232000 RRV			
Anions and Nutrients	Chloride (Cl) (mg/L)	73	120			
	Silicate (as SiO2) (mg/L)	2.47	2.91			
Total Metals	Aluminum (Al)-Total (mg/L)	0.0353	4.18			
	Antimony (Sb)-Total (mg/L)	0.00059	<0.020 DLA			
	Arsenic (As)-Total (mg/L)	0.00595	0.044			
	Barium (Ba)-Total (mg/L)	0.00461	0.100			
	Beryllium (Be)-Total (mg/L)	<0.00020 DLA	<0.020 DLA			
	Bismuth (Bi)-Total (mg/L)	<0.00010 DLA	<0.010 DLA			
	Boron (B)-Total (mg/L)	0.427	<2.0 DLA			
	Cadmium (Cd)-Total (mg/L)	<0.000010 DLA	<0.0010 DLA			
	Calcium (Ca)-Total (mg/L)	7.27	289			
	Cesium (Cs)-Total (mg/L)	0.000027	<0.0020 DLA			
	Chromium (Cr)-Total (mg/L)	0.00032	<0.020 DLA			
	Cobalt (Co)-Total (mg/L)	<0.00020 DLA	<0.020 DLA			
	Copper (Cu)-Total (mg/L)	<0.0010 DLA	<0.10 DLA			
	Iron (Fe)-Total (mg/L)	0.051	7.3			
	Lead (Pb)-Total (mg/L)	<0.00010 DLA	<0.010 DLA			
	Lithium (Li)-Total (mg/L)	0.0200	<0.20 DLA			
	Magnesium (Mg)-Total (mg/L)	403	36100			
	Manganese (Mn)-Total (mg/L)	0.00975	0.942			
	Mercury (Hg)-Total (mg/L)	<0.0000050	0.000055			
	Molybdenum (Mo)-Total (mg/L)	0.0117	0.088			
	Nickel (Ni)-Total (mg/L)	<0.0010 DLA	<0.10 DLA			
	Phosphorus (P)-Total (mg/L)	<0.10 DLA	13			
	Potassium (K)-Total (mg/L)	87.8	1620			
	Rubidium (Rb)-Total (mg/L)	0.0160	0.145			
	Selenium (Se)-Total (mg/L)	0.00030	<0.010 DLA			
	Silicon (Si)-Total (mg/L)	1.53	<20 DLA			
	Silver (Ag)-Total (mg/L)	<0.000040 DLB	<0.0020 DLA			
	Sodium (Na)-Total (mg/L)	330	18600			
	Strontium (Sr)-Total (mg/L)	0.0129	8.64			
	Sulfur (S)-Total (mg/L)	351	69600			
	Tellurium (Te)-Total (mg/L)	<0.00040 DLA	<0.040 DLA			
	Thallium (Tl)-Total (mg/L)	<0.000020 DLA	<0.0020 DLA			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2149052-1	L2149052-2			
	Description	Water	Water			
	Sampled Date	17-AUG-18	17-AUG-18			
	Sampled Time	10:10	10:45			
	Client ID	DUCK LAKE	SALT LAKE			
Grouping	**Analyte**					
WATER						
Total Metals	Thorium (Th)-Total (mg/L)	DLA <0.00020	DLA <0.020			
	Tin (Sn)-Total (mg/L)	DLA <0.00020	DLA <0.020			
	Titanium (Ti)-Total (mg/L)	0.00256	DLA 0.19			
	Tungsten (W)-Total (mg/L)	DLA <0.00020	DLA <0.020			
	Uranium (U)-Total (mg/L)	0.00668	0.0450			
	Vanadium (V)-Total (mg/L)	0.0011	DLA <0.10			
	Zinc (Zn)-Total (mg/L)	DLA <0.0060	DLA <0.60			
	Zirconium (Zr)-Total (mg/L)	0.00018	DLA <0.012			

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Aluminum (Al)-Total	MB-LOR	L2149052-1, -2
Method Blank	Calcium (Ca)-Total	MB-LOR	L2149052-1, -2
Method Blank	Magnesium (Mg)-Total	MB-LOR	L2149052-1, -2
Method Blank	Manganese (Mn)-Total	MB-LOR	L2149052-1, -2
Method Blank	Silver (Ag)-Total	MB-LOR	L2149052-1, -2
Method Blank	Strontium (Sr)-Total	MB-LOR	L2149052-1, -2
Matrix Spike	Silicate (as SiO2)	MS-B	L2149052-1, -2

Qualifiers for Individual Parameters Listed:

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

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
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-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)
Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.
This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.			
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.			

** 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:

EHD CONSULTING LTD
ATTN: Ian Chadwick
204-1139 12th Street
Kamloops BC V2B7Z2

Date Received: 17-AUG-18
Report Date: 05-OCT-18 10:30 (MT)
Version: FINAL REV. 2

Client Phone: 250-434-4529

Certificate of Analysis

Lab Work Order #: L2149052

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Comments: ADDITIONAL 28-SEP-18 12:56
Metasilicic Acid = (MW of Silicate / MW of Metasilicic Acid)x ___ mg/L of SiO2 = ____ mg/L of Metasilicic Acid

L2149052-1 Metasilicic Acid 3.21 mg/L

L2149052-2 Metasilicic Acid 3.78 mg/L

Amanda Lampreau
Supervisor

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

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 17 - 721768

Page of

Report To	Contact and company name below will appear on the final report
Company:	EHD
Contact:	
Phone:	
	Company address below will appear on the final report
Street:	
City/Province:	
Postal Code:	
Invoice To	Same as Report To ☐ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☐ PDF ☐ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☐ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax
Email 2
Email 3

Invoice Distribution

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax
Email 2

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E-100%] ☐ | Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):	L2149052	ALS Contact:	Sampler:

Analysis Request

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

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals (F)	EC (F)	TDS (F)	Silicate / Metasilicate (F)	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	Duck Lake	17 Aug 18	10:10								
	Salt Lake	"	10:45								

L2149052-COFC

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human consumption/ use? ☐ YES ☐ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

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

INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C			
16	15				

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Amber Beevers	Date:	Time:	Received by:	Date: 17 Aug 18	Time: 12:50	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

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

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

EHD CONSULTING LTD
ATTN: Ian Chadwick
204-1139 12th Street
Kamloops BC V2B7Z2

Date Received: 16-AUG-18
Report Date: 22-AUG-18 12:00 (MT)
Version: FINAL

Client Phone: 250-434-4529

Certificate of Analysis

Lab Work Order #: L2148397

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Comments: Metasilicic Acid = (MW of Silicate / MW of Metasilicic Acid)x ___ mg/L of SiO2 = _____ mg/L of Metasilicic Acid

L2148397-1 Metasilicic Acid 26.91 mg/L

L2148397-2 Metasilicic Acid 24.70 mg/L

L2148397-3 Metasilicic Acid 26.39 mg/L

Amanda Lampreau
Supervisor

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2148397-1	L2148397-2	L2148397-3		
	Description	Water	Water	Water		
	Sampled Date	15-AUG-18	15-AUG-18	15-AUG-18		
	Sampled Time	14:10	14:00	13:30		
	Client ID	HIGHWAY 1 WEST CULVERT, CUT OFF CREEK	GRAVEL PIT RD, CUT OFF CREEK	REG CON PARK, CUT OFF CREEK		
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	676	680	678		
	Hardness (as CaCO3) (mg/L)	351 HTC	355 HTC	366 HTC		
	Total Dissolved Solids (mg/L)	420	419	425		
Anions and Nutrients	Silicate (as SiO2) (mg/L)	20.7	19.0	20.3		
Total Metals	Aluminum (Al)-Total (mg/L)	0.0893	0.0789	0.0782		
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Arsenic (As)-Total (mg/L)	0.00075	0.00073	0.00076		
	Barium (Ba)-Total (mg/L)	0.0505	0.0518	0.0506		
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050		
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Total (mg/L)	0.0000092	0.0000088	0.0000077		
	Calcium (Ca)-Total (mg/L)	86.2	88.6	92.6		
	Cesium (Cs)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Chromium (Cr)-Total (mg/L)	0.00077	0.00059	0.00063		
	Cobalt (Co)-Total (mg/L)	0.00013	0.00011	0.00011		
	Copper (Cu)-Total (mg/L)	0.00064	0.00050	0.00060		
	Iron (Fe)-Total (mg/L)	0.189	0.157	0.170		
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050		
	Lithium (Li)-Total (mg/L)	0.0021	0.0020	0.0022		
	Magnesium (Mg)-Total (mg/L)	32.8	32.4	32.7		
	Manganese (Mn)-Total (mg/L)	0.0255	0.0215	0.0223		
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050		
	Molybdenum (Mo)-Total (mg/L)	0.00203	0.00199	0.00220		
	Nickel (Ni)-Total (mg/L)	0.00073	0.00067	0.00070		
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Total (mg/L)	2.29	2.20	2.25		
	Rubidium (Rb)-Total (mg/L)	0.00069	0.00067	0.00068		
	Selenium (Se)-Total (mg/L)	0.000786	0.000792	0.000808		
	Silicon (Si)-Total (mg/L)	9.50	9.81	9.72		
	Silver (Ag)-Total (mg/L)	<0.000020 DLB	<0.000020 DLB	<0.000020 DLB		
	Sodium (Na)-Total (mg/L)	8.27	7.66	8.25		
	Strontium (Sr)-Total (mg/L)	0.253	0.257	0.271		
	Sulfur (S)-Total (mg/L)	12.2	12.3	12.4		
	Tellurium (Te)-Total (mg/L)	<0.00020	<0.00020	<0.00020		
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2148397-1	L2148397-2	L2148397-3		
	Description	Water	Water	Water		
	Sampled Date	15-AUG-18	15-AUG-18	15-AUG-18		
	Sampled Time	14:10	14:00	13:30		
	Client ID	HIGHWAY 1 WEST CULVERT, CUT OFF CREEK	GRAVEL PIT RD, CUT OFF CREEK	REG CON PARK, CUT OFF CREEK		
Grouping	**Analyte**					
WATER						
Total Metals	Thorium (Th)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Titanium (Ti)-Total (mg/L)	0.00485	0.00412	0.00429		
	Tungsten (W)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Uranium (U)-Total (mg/L)	0.000926	0.000913	0.000976		
	Vanadium (V)-Total (mg/L)	0.00113	0.00109	0.00111		
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030		
	Zirconium (Zr)-Total (mg/L)	0.000074	0.000081	0.000089		

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Selenium (Se)-Total	MB-LOR	L2148397-1, -2, -3
Method Blank	Silver (Ag)-Total	MB-LOR	L2148397-1, -2, -3
Matrix Spike	Calcium (Ca)-Total	MS-B	L2148397-1, -2, -3
Matrix Spike	Manganese (Mn)-Total	MS-B	L2148397-1, -2, -3
Matrix Spike	Sodium (Na)-Total	MS-B	L2148397-1, -2, -3
Matrix Spike	Strontium (Sr)-Total	MS-B	L2148397-1, -2, -3
Matrix Spike	Silicate (as SiO2)	MS-B	L2148397-1, -2, -3

Qualifiers for Individual Parameters Listed:

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

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
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-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)
Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.
This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.			
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.			

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

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

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

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

EHD CONSULTING LTD
ATTN: Ian Chadwick
204-1139 12th Street
Kamloops BC V2B7Z2

Date Received: 05-SEP-18
Report Date: 01-OCT-18 17:09 (MT)
Version: FINAL REV. 2

Client Phone: 250-434-4529

Certificate of Analysis

Lab Work Order #: L2158415

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Comments: ADDITIONAL 28-SEP-18 12:57
Metasilicic Acid = (MW of Silicate / MW of Metasilicic Acid)x ___ mg/L of SiO2 = _____ mg/L of Metasilicic Acid

L2158415-1 Metasilicic Acid 18.98 mg/L

Amanda Lampreau
Supervisor

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ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2158415-1				
	Description	water				
	Sampled Date	04-SEP-18				
	Sampled Time	11:30				
	Client ID	CUTOFF CREEK - OFF KELLY LAKE ROAD, WEST OF AQUIFER BOUNDRY				
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	452				
	Hardness (as CaCO3) (mg/L)	226 HTC				
	Total Dissolved Solids (mg/L)	287				
Anions and Nutrients	Chloride (Cl) (mg/L)	1.87				
	Silicate (as SiO2) (mg/L)	14.6				
Total Metals	Aluminum (Al)-Total (mg/L)	0.0668				
	Antimony (Sb)-Total (mg/L)	<0.00010				
	Arsenic (As)-Total (mg/L)	0.00053				
	Barium (Ba)-Total (mg/L)	0.0510				
	Beryllium (Be)-Total (mg/L)	<0.00010				
	Bismuth (Bi)-Total (mg/L)	<0.000050				
	Boron (B)-Total (mg/L)	<0.010				
	Cadmium (Cd)-Total (mg/L)	0.0000138				
	Calcium (Ca)-Total (mg/L)	61.1				
	Cesium (Cs)-Total (mg/L)	<0.000010				
	Chromium (Cr)-Total (mg/L)	0.00047				
	Cobalt (Co)-Total (mg/L)	<0.00010				
	Copper (Cu)-Total (mg/L)	0.00072				
	Iron (Fe)-Total (mg/L)	0.164				
	Lead (Pb)-Total (mg/L)	<0.000050				
	Lithium (Li)-Total (mg/L)	0.0020				
	Magnesium (Mg)-Total (mg/L)	17.9				
	Manganese (Mn)-Total (mg/L)	0.0249				
	Mercury (Hg)-Total (mg/L)	<0.0000050				
	Molybdenum (Mo)-Total (mg/L)	0.00173				
	Nickel (Ni)-Total (mg/L)	<0.00050				
	Phosphorus (P)-Total (mg/L)	<0.050				
	Potassium (K)-Total (mg/L)	1.33				
	Rubidium (Rb)-Total (mg/L)	0.00054				
	Selenium (Se)-Total (mg/L)	0.000418				
	Silicon (Si)-Total (mg/L)	7.04				
	Silver (Ag)-Total (mg/L)	<0.000010				
	Sodium (Na)-Total (mg/L)	4.89				
	Strontium (Sr)-Total (mg/L)	0.228				
	Sulfur (S)-Total (mg/L)	9.79				
	Tellurium (Te)-Total (mg/L)	<0.00020				
	Thallium (Tl)-Total (mg/L)	<0.000010				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2158415-1				
	Description	water				
	Sampled Date	04-SEP-18				
	Sampled Time	11:30				
	Client ID	CUTOFF CREEK - OFF KELLY LAKE ROAD, WEST OF AQUIFER BOUNDRY				
Grouping	**Analyte**					
WATER						
Total Metals	Thorium (Th)-Total (mg/L)	<0.00010				
	Tin (Sn)-Total (mg/L)	<0.00010				
	Titanium (Ti)-Total (mg/L)	0.00350				
	Tungsten (W)-Total (mg/L)	<0.00010				
	Uranium (U)-Total (mg/L)	0.000462				
	Vanadium (V)-Total (mg/L)	0.00071				
	Zinc (Zn)-Total (mg/L)	<0.0030				
	Zirconium (Zr)-Total (mg/L)	<0.000060				

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Nickel (Ni)-Total	MB-LOR	L2158415-1
Matrix Spike	Barium (Ba)-Total	MS-B	L2158415-1
Matrix Spike	Calcium (Ca)-Total	MS-B	L2158415-1
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2158415-1
Matrix Spike	Manganese (Mn)-Total	MS-B	L2158415-1
Matrix Spike	Sodium (Na)-Total	MS-B	L2158415-1
Matrix Spike	Strontium (Sr)-Total	MS-B	L2158415-1

Qualifiers for Individual Parameters Listed:

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

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
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-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)
Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
SILICATE-COL-VA	Water	Silicate by Colourimetric analysis	APHA 4500-SiO2 E.
This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method.			
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.			

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

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

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

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 721946

Page of

Report To	Contact and company name below will appear on the final report
Company:	EHD Consulting
Contact:	IAN CHADWICK
Phone:	250-319-7329
	Company address below will appear on the final report
Street:	#204 1139 12th Street
City/Province:	Kamloops
Postal Code:	V2R 8N2
Invoice To	Same as Report To ☐ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☐ PDF ☐ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☐ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: ehdconsulting@shaw.ca
Email 2
Email 3

Invoice Distribution

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax
Email 2

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☑ 3 day [P3-25%] ☐ 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E-100%] ☐ Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:
Job #:
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#
Major/Minor Code: Routing Code:
Requisitioner:
Location:
ALS Contact: Sampler:

ALS Lab Work Order # (lab use only): L2158415

Analysis Request

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

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TDS	Conductivity	Metals	Silicate	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	~~Cutoff Creek~~ - off Kelly Lake Road	4-09-18	1130								
	CUTOFF CREEK west of aquifer boundary										

L2158415-COFC

RUSH

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO
Are samples for human consumption/ use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

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

INITIAL COOLER TEMPERATURES °C: 12 12
FINAL COOLER TEMPERATURES °C:

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: [signature]	Date: 5-9-18	Time: 0845	Received by: [signature]	Date: SEP 05 2018	Time: 8:30	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

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

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

White Paper Co. 604 951-3900

EHD CONSULTING LTD
ATTN: Ian Chadwick
204-1139 12th Street
Kamloops BC V2B7Z2

Date Received: 19-OCT-18
Report Date: 25-OCT-18 17:06 (MT)
Version: FINAL

Client Phone: 250-434-4529

Certificate of Analysis

Lab Work Order #: L2184303

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers: 17-721907
Legal Site Desc:

Amanda Lampreau
Supervisor

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L2184303-1 Water 18-OCT-18 16:25 GAINOR LAKE	L2184303-2 Water 18-OCT-18 16:50 CUTOFF CREEK WEST	L2184303-3 Water 18-OCT-18 16:00 GAINOR WELL 48288	L2184303-4 Water 18-OCT-18 17:00 CUTOFF CREEK EAST	L2184303-5 Water 18-OCT-18 17:53 SALT LAKE
WATER						
Physical Tests	Colour, True (CU)	<5.0	5.4	<5.0	6.8	48.8
	Conductivity (uS/cm)	640	621	1190	637	53200
	Hardness (as CaCO3) (mg/L)	363 HTC	357 HTC	801 HTC	362 HTC	58700 HTC
	pH (pH)	8.25	8.31	7.88	8.48	8.45
	Total Dissolved Solids (mg/L)	384	389	776	363	109000 RRV
	Turbidity (NTU)	0.63	1.07	10.6	1.42	18.9
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	324	307	667	306	1030
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	5.0	<1.0	21.0	141
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	324	312	667	327	1170
	Bromide (Br) (mg/L)	<0.25 DLDS	<0.050	<0.25 DLDS	<0.25 DLDS	<5.0 DLDS
	Chloride (Cl) (mg/L)	<2.5 DLDS	2.99	6.5 DLDS	4.8 DLDS	435 DLDS
	Fluoride (F) (mg/L)	0.10	0.107	<0.10 DLDS	<0.10 DLDS	<2.0 DLDS
	Nitrate (as N) (mg/L)	0.187	0.0454	0.608	0.065	<0.50
	Nitrite (as N) (mg/L)	<0.0050 DLDS	0.0011	<0.0050 DLDS	<0.0050 DLDS	<0.10 DLDS
	Silicate (as SiO2) (mg/L)	20.3	17.5	30.5	18.1	0.72 SFT
	Sulfate (SO4) (mg/L)	40.3	41.5	41.9	40.8	69700
Total Metals	Aluminum (Al)-Total (mg/L)	0.0031	0.0507	0.284	0.0544	<0.30 DLA
	Antimony (Sb)-Total (mg/L)	0.00013	0.00011	<0.00010	<0.00010	<0.010 DLA
	Arsenic (As)-Total (mg/L)	0.00068	0.00053	0.00060	0.00061	0.015
	Barium (Ba)-Total (mg/L)	0.0269	0.0544	0.0292	0.0492	0.022
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.010 DLA
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.0050 DLA
	Boron (B)-Total (mg/L)	0.013	<0.010	<0.010	<0.010	<1.0 DLA
	Cadmium (Cd)-Total (mg/L)	0.0000112	0.0000097	0.000166	0.0000095	<0.00050 DLA
	Calcium (Ca)-Total (mg/L)	85.5	95.5	199	92.2	179
	Cesium (Cs)-Total (mg/L)	<0.000010	<0.000010	0.000013	<0.000010	<0.0010 DLA
	Chromium (Cr)-Total (mg/L)	0.00135	0.00048	0.00208	0.00063	<0.010 DLA
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	0.00041	0.00010	<0.010 DLA
	Copper (Cu)-Total (mg/L)	<0.00050	0.00053	0.00218	0.00066	<0.050 DLA
	Iron (Fe)-Total (mg/L)	<0.010	0.113	0.914	0.121	<1.0 DLA
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	0.000054	<0.000050	<0.0050 DLA
	Lithium (Li)-Total (mg/L)	0.0019	0.0021	0.0033	0.0021	<0.10 DLA
	Magnesium (Mg)-Total (mg/L)	36.4	28.9	74.0	32.0	14200
	Manganese (Mn)-Total (mg/L)	0.00062	0.0255	0.0106	0.0188	0.139
	Mercury (Hg)-Total (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000025 DLM
	Molybdenum (Mo)-Total (mg/L)	0.00420	0.00199	0.00361	0.00220	0.0333

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2184303-6				
	Description	Water				
	Sampled Date	18-OCT-18				
	Sampled Time	12:00				
	Client ID	DUCK LAKE				
Grouping	**Analyte**					
WATER						
Physical Tests	Colour, True (CU)	6.6				
	Conductivity (uS/cm)	3080				
	Hardness (as CaCO3) (mg/L)	1580 HTC				
	pH (pH)	9.13				
	Total Dissolved Solids (mg/L)	2470				
	Turbidity (NTU)	1.29				
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	804				
	Alkalinity, Carbonate (as CaCO3) (mg/L)	389				
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0				
	Alkalinity, Total (as CaCO3) (mg/L)	1190				
	Bromide (Br) (mg/L)	<1.0 DLDS				
	Chloride (Cl) (mg/L)	75				
	Fluoride (F) (mg/L)	<0.40 DLDS				
	Nitrate (as N) (mg/L)	<0.10 DLDS				
	Nitrite (as N) (mg/L)	<0.020 DLDS				
	Silicate (as SiO2) (mg/L)	2.60				
	Sulfate (SO4) (mg/L)	891				
Total Metals	Aluminum (Al)-Total (mg/L)	0.0125				
	Antimony (Sb)-Total (mg/L)	0.00058				
	Arsenic (As)-Total (mg/L)	0.00588				
	Barium (Ba)-Total (mg/L)	0.00360				
	Beryllium (Be)-Total (mg/L)	<0.00020 DLA				
	Bismuth (Bi)-Total (mg/L)	<0.00010 DLA				
	Boron (B)-Total (mg/L)	0.427				
	Cadmium (Cd)-Total (mg/L)	0.000150				
	Calcium (Ca)-Total (mg/L)	6.64				
	Cesium (Cs)-Total (mg/L)	0.000026				
	Chromium (Cr)-Total (mg/L)	0.00023				
	Cobalt (Co)-Total (mg/L)	<0.00020 DLA				
	Copper (Cu)-Total (mg/L)	0.0044				
	Iron (Fe)-Total (mg/L)	<0.020 DLA				
	Lead (Pb)-Total (mg/L)	0.00021				
	Lithium (Li)-Total (mg/L)	0.0198				
	Magnesium (Mg)-Total (mg/L)	379				
	Manganese (Mn)-Total (mg/L)	0.0147				
	Mercury (Hg)-Total (mg/L)	<0.0000050				
	Molybdenum (Mo)-Total (mg/L)	0.0116				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L2184303-1 Water 18-OCT-18 16:25 GAINOR LAKE	L2184303-2 Water 18-OCT-18 16:50 CUTOFF CREEK WEST	L2184303-3 Water 18-OCT-18 16:00 GAINOR WELL 48288	L2184303-4 Water 18-OCT-18 17:00 CUTOFF CREEK EAST	L2184303-5 Water 18-OCT-18 17:53 SALT LAKE
WATER						
Total Metals	Nickel (Ni)-Total (mg/L)	<0.00050	0.00060	0.00671	0.00063	<0.050 DLA
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	0.053	<0.050	<5.0 DLA
	Potassium (K)-Total (mg/L)	2.52	2.18	1.56	2.37	551
	Rubidium (Rb)-Total (mg/L)	0.00063	0.00077	0.00057	0.00069	0.053
	Selenium (Se)-Total (mg/L)	0.000914	0.000628	0.00590	0.000683	<0.0050 DLA
	Silicon (Si)-Total (mg/L)	10.6	8.42	15.3	8.85	<10 DLA
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.0010 DLA
	Sodium (Na)-Total (mg/L)	8.54	6.97	10.5	8.36	6620
	Strontium (Sr)-Total (mg/L)	0.278	0.262	0.353	0.263	3.11
	Sulfur (S)-Total (mg/L)	15.3	15.1	18.6	15.6	27100
	Tellurium (Te)-Total (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.020 DLA
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.0010 DLA
	Thorium (Th)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.010 DLA
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.010 DLA
	Titanium (Ti)-Total (mg/L)	<0.00030	0.00217	0.0141	0.00306	<0.030 DLA
	Tungsten (W)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.010 DLA
	Uranium (U)-Total (mg/L)	0.00157	0.000922	0.00311	0.00103	0.0160
	Vanadium (V)-Total (mg/L)	0.00119	0.00074	0.00289	0.00088	<0.050 DLA
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	0.0030	<0.0030	<0.30 DLA
	Zirconium (Zr)-Total (mg/L)	<0.000060	0.000080	0.000262	0.000068	<0.0060 DLA

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2184303-6				
	Description	Water				
	Sampled Date	18-OCT-18				
	Sampled Time	12:00				
	Client ID	DUCK LAKE				
Grouping	**Analyte**					
WATER						
Total Metals	Nickel (Ni)-Total (mg/L)	<0.0010 DLA				
	Phosphorus (P)-Total (mg/L)	<0.10 DLA				
	Potassium (K)-Total (mg/L)	86.1				
	Rubidium (Rb)-Total (mg/L)	0.0155				
	Selenium (Se)-Total (mg/L)	0.00033				
	Silicon (Si)-Total (mg/L)	1.43				
	Silver (Ag)-Total (mg/L)	<0.000020 DLA				
	Sodium (Na)-Total (mg/L)	309				
	Strontium (Sr)-Total (mg/L)	0.00962				
	Sulfur (S)-Total (mg/L)	376				
	Tellurium (Te)-Total (mg/L)	<0.00040 DLA				
	Thallium (Tl)-Total (mg/L)	<0.000020 DLA				
	Thorium (Th)-Total (mg/L)	<0.00020 DLA				
	Tin (Sn)-Total (mg/L)	<0.00020 DLA				
	Titanium (Ti)-Total (mg/L)	0.00176				
	Tungsten (W)-Total (mg/L)	<0.00020 DLA				
	Uranium (U)-Total (mg/L)	0.00685				
	Vanadium (V)-Total (mg/L)	0.0010				
	Zinc (Zn)-Total (mg/L)	0.0079				
	Zirconium (Zr)-Total (mg/L)	0.00024				

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

Reference Information

Qualifiers for Individual Samples Listed:

Sample Number	Client Sample ID	Qualifier	Description
L2184303-1	GAINOR LAKE	SRPF	Sample received partially frozen

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Total	MS-B	L2184303-1, -2, -3, -4, -5, -6
Matrix Spike	Calcium (Ca)-Total	MS-B	L2184303-1, -2, -3, -4, -5, -6
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2184303-1, -2, -3, -4, -5, -6
Matrix Spike	Silicon (Si)-Total	MS-B	L2184303-1, -2, -3, -4, -5, -6
Matrix Spike	Sodium (Na)-Total	MS-B	L2184303-1, -2, -3, -4, -5, -6
Matrix Spike	Strontium (Sr)-Total	MS-B	L2184303-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis
SFT	Sample was filtered due to turbidity interference. Result reflects soluble analyte concentration.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

BR-L-IC-N-VA	Water	Bromide in Water by IC (Low Level)	EPA 300.1 (mod)

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

CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)

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

COLOUR-TRUE-VA	Water	Colour (True) by Spectrometer	BCMOE Colour Single Wavelength

This analysis is carried out using procedures adapted from British Columbia Environmental Manual "Colour- Single Wavelength." Colour (True Colour) is determined by filtering a sample through a 0.45 micron membrane filter followed by analysis of the filtrate using the platinum-cobalt colourimetric method.
Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.

EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

F-IC-N-VA	Water	Fluoride in Water by IC	EPA 300.1 (mod)

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

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

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

HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

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

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

Reference Information

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

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

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

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

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

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.

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

This analysis is carried out using procedures adapted from APHA Method 4500-SiO2 E. "Silica". Silicate (molybdate-reactive silica) is determined by the molybdosilicate-heteropoly blue colourimetric method. Arsenic (5+) above 100 mg/L is a negative interference on this test.

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

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

TDS-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.

** 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:

17-721907

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2184303-COFC

COC Number: 17 - 721907

Page of

Report To	Contact and company name below will appear on the final report
Company:	EHD Consulting
Contact:	Ian Chadwick
Phone:	
	Company address below will appear on the final report
Street:	
City/Province:	
Postal Code:	
Invoice To	Same as Report To ☐ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☐ PDF ☐ EXCEL | | EDD (DIGITAL)
Quality Control (QC) Report with Report ☐ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☐ EMAIL | | MAIL ☐ FAX
Email 1 or Fax
Email 2
Email 3

Invoice Distribution

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax
Email 2

Project Information

ALS Account # / Quote #: EHD100
Job #:
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: PO#
Major/Minor Code: Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only): L2184303
ALS Contact: Sampler:

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E-100%] ☐ | Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

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

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	FULL-Tot+Dis-VA	Silicate	Specified Alk	NoBact T	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	GAINOR LAKE	18Oct18	4:25	water							
	CUTOFF CREEK WEST		4:50								
	GAINOR WELL 48288		4:00								
	CUTOFF CREEK EAST		5:00								
	SALT LAKE		5:53								
	DUCK LAKE		12:00								

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ YES ☐ NO
Are samples for human consumption/ use?
| | YES | | NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

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

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
8	8	6	5				

SHIPMENT RELEASE (client use)

Released by: Date: 19/10/18 Time: 1370

INITIAL SHIPMENT RECEPTION (lab use only)

Received by: Date: 19Oct18 Time: 1:30pm.

FINAL SHIPMENT RECEPTION (lab use only)

Received by: Date: Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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

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

JULY 2017 FRONT