



7 June 2017

2016 WATER QUALITY MONITORING REPORT

Vernon Compost Facility 551 Commonage Road Vernon, BC

Submitted to:
City of Kelowna
1435 Water Street
Kelowna, BC
V1Y 1J4

REPORT



Report Number: 1542527-004-R-Rev0

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) is pleased to provide the City of Kelowna (CoK) with this monitoring report that documents the results of water quality monitoring completed in 2016 at the Kelowna-Vernon Biosolids Composting Facility located at 551 Commonage Road in Vernon, BC (hereafter referred to as the Site). The monitoring data were collected by CoK personnel and provided to Golder for compiling this report.

It is our understanding that the purpose of the monitoring program is to assess potential leachate infiltration of stormwater runoff/leachate that is generated at the Site. The monitoring program addresses recommendations made by the BC Ministry of Environment (MoE) in a letter to the CoK entitled “*Response to the Notice of Proposed Expansion of Biosolid Composting Facility*”, dated 27 April 2010; and by Golder in subsequent letters and annual monitoring reports prepared for the CoK for submission to MoE.

2.0 BACKGROUND

The composting facility was constructed in 2006 and is located on Commonage Road in Vernon, BC (Figures 1 and 2). The Site composts wastewater treatment plant biosolid material and currently consists of an administration building, sludge receiving building, a mixing building, primary and secondary aeration cells, and a compost curing area. An expansion of the facility was completed in 2010, at which time the entire composting curing area was paved. Prior to the construction of the composting facility, a septage disposal facility was operated at the Site by the City of Vernon (CoV) and the North Okanagan Regional District (NORD).

The Site is surrounded primarily by undeveloped and agricultural land. Surface water bodies in close proximity to the Site include the following (refer to Figures 1 and 2):

- Drainage Pond: located approximately 100 m west of the composting facility, between the Site and Commonage Road, and used to store stormwater runoff generated at the Site.
- Rose’s Pond: located approximately 200 m northwest of the composting facility (and approximately 100 m northwest of the Drainage Pond), on the northwest side of Commonage Road.
- Davidson Pond: a privately owned pond on the Davidson Property, located approximately 100 m south of the composting facility (and approximately 200 m south and southwest of the Drainage Pond).

Stormwater runoff generated at the Site is directed towards a drainage trench along the Site’s south-western boundary, and then gravity-fed into the Drainage Pond (Figure 2). Water entering the drainage trench and Drainage Pond consists primarily of stormwater that may contain leachate from the compost material stored on the curing pads; and potentially process water runoff, as water is regularly added to the compost material, particularly in the hot summer months. Leachate from the primary and secondary aeration cells at the Site is directed to a holding tank and then truck-hauled for treatment at the CoV sewage reclamation facility, which discharges into MacKay Reservoir located approximately 2 km west-southwest of the Site (Golder, February 2010).

Effluent from, or on route to, the CoV’s sewage reclamation facility is periodically used to flush the drainage trench: in the summer months, treated (chlorinated) effluent from the Mackay Reservoir is used, and in the winter months, effluent on route to the Reservoir is diverted and treated (filtered and/or chlorinated), then used to flush the drainage trench. When the water level at the Drainage Pond is near capacity, water is pumped to the CoV’s sewage reclamation facility.



In 2009, the CoK retained Golder to complete an initial review of the Site, which was documented in the report titled *“Interim Report on Leachate Drainage Pond, Kelowna – Vernon Compost Facility”*, dated 17 February 2010. The purpose of the report was to compile local and regional data on the hydrogeology in the area, monitor water quality, and monitor drainage and pond water levels to assess potential infiltration of leachate. The 2010 report indicated that the Composting Facility and the Drainage Pond are located on dense glacial tills that inhibit water infiltration into the groundwater aquifer located within the underlying bedrock. It was inferred that water infiltrating into the ground would likely migrate along the top of the glacial till and may eventually discharge into local ponds (i.e., Davidson Pond and Rose’s Pond), with a small component of infiltration migrating vertically through the till into deeper bedrock fractures.

Between 2010 and 2015, the CoK conducted monitoring programs at the Drainage Pond, and at Davidson Pond and Rose’s Pond (except in 2013), to assess whether water at the Drainage Pond may be infiltrating into the ground and discharging into Rose’s Pond and/or Davidson Pond. The results of these monitoring programs have been documented in various reports prepared by Golder and submitted to the CoK.

In July 2010, CoK personnel installed an evaporation pan at the Drainage Pond to monitor daily water levels in the pan, along with water levels at the Drainage Pond, as an indicator of water loss due to evaporation or potential infiltration. In 2010, it was found that the regular flushing of the one-inch and/or six-inch drainage lines, combined with the outflow pump operating intermittently, did not allow for a meaningful assessment of water loss at the Drainage Pond. For this reason, subsequent recommendations were to conduct observations on days when the drainage lines were not flushing and the pump was shut-off, and when no rainfall was expected. Additional recommendations for 2016 included that readings/measurements be taken over three 48-hour periods; once in the spring months (i.e., May or June), once in the summer months (i.e., July or August) and again in the fall (i.e., September or October); and that consideration be given to collecting this evaporation pan and water level data with pressure transducers to capture the small level changes (Golder, 2016). As discussed below, no Drainage Pond level or evaporation pan readings were made by the CoK in 2016.

As per the 9 June 2016 amendments to the Organic Matter Recycling Regulation, a permit issued pursuant to the *Environmental Management Act* (EMA) is required for facilities that process food waste or biosolids; that have the design capacity to produce 5,000 dry tonnes or greater of compost per year; and that do not currently hold an approval or operation certificate. The CoK is currently in the process of applying to the MoE for a Regional Biosolids Composting Facility Permit. It is understood that the MoE will require that the drainage trench and Drainage Pond be lined with an impermeable liner; however, details of the permit that may affect future water quality monitoring requirements at the Site are not known at this time.

3.0 2016 SCOPE OF WORK

The 2016 monitoring included the following scope of work by CoK personnel:

- Collect monthly samples between March and September of 2016 at the Drainage Pond, Rose’s Pond and Davidson Pond for analysis of potential indicators of biosolids (i.e., septage) contaminants including:
 - Phosphorous, chloride, ammonia, nitrate, nitrite, total kjeldahl nitrogen and total nitrogen.
 - Biological oxygen demand (BOD) and chemical oxygen demand (COD).
 - Microbiological analyses (total coliforms and E.coli).
 - Metals (total and dissolved; with lower detection limits for total beryllium and total selenium).
 - pH, conductivity, total suspended solids (TSS) and hardness.
- Review of analytical results.



Attempts were made to measure Drainage Pond levels and corresponding evaporation pan levels in 2016; however, flushing of the drain lines prevented taking meaningful measurements.

Based on the above scope of work, Golder has prepared this monitoring report for submission to the MoE by the CoK. The monitoring report provides discussions on:

- Water quality results for the Drainage pond.
- Water quality results for Davidson Pond and Rose's Pond, including potential impacts from the Drainage Pond.
- Recommendations for the 2017 water quality monitoring program.

It is noted that recommendations for the 2017 water quality monitoring program may need to be modified in 2017 (and/or subsequent years) following issuance of the Regional Biosolids Composting Facility Permit, and dependent on the permit requirements.

4.0 SURFACE WATER ASSESSMENT CRITERIA

Pond water quality data were tabulated by Golder and compared to the following standards and/or criteria:

- Freshwater aquatic life (AW) standards in the BC Ministry of Environment (MoE) Contaminated Sites Regulation (CSR; B.C. Reg. 375/96, includes amendments up to B.C. Reg. 184/2016, 19 July 2016).
- Drinking water (DW) standards in the CSR.
- BC MoE's "*British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture, Summary Report*", dated January 2017 (BCWQG) for freshwater aquatic life (AW) criteria. Where applicable, the most conservative of the long-term average and short-term maximum guidelines are referenced.
- BC MoE's "*Working Water Quality Guidelines for British Columbia (2015)*" for freshwater aquatic life (AW) criteria.

According to BC MoE Technical Guidance Document 15: *Concentration Limits for the Protection of Aquatic Receiving Environments* (Version 1.0; April 2013):

- For maintained watercourses, the CSR AW standards are applicable to surface water, porewater and groundwater.
- Surface water in aquatic receiving environments other than maintained watercourses should be evaluated against the BCWQG.



For the purposes of this assessment, the Drainage Pond is considered to be a maintained watercourse; and as there is no overland flow from the Drainage Pond, and potential contaminants can only migrate through groundwater to other surface water bodies or drinking water wells, the water quality data from the Drainage Pond has been compared to the CSR AW and DW standards. Rose's Pond and Davidson Pond are considered to be aquatic receiving environments, and water quality data for these two ponds have been compared to the BCWQG, and conservatively against the CSR AW and DW standards.

In October 2016, the BC MoE announced the Stage 10 Omnibus changes to the CSR, which are effective as of 1 November 2017. As this report is for water quality monitoring conducted in 2016, the Stage 10 CSR standards have not been presented in this report. However, the Stage 10 CSR standards would apply in 2017.

For the comparison of ammonia concentrations, the BCWQG AW guideline for ammonia is pH and temperature dependent and was derived using the laboratory reported pH values for each sample and an assumed temperature of 10° Celsius.

For the comparison of metals concentrations, the total metals (unfiltered) concentrations in the samples were used for comparison to the CSR standards and the BCWQG AW guidelines (except for aluminum and cadmium, where BCWQG AW guidelines are for dissolved concentrations; and for iron, where there are BCWQG AW guidelines for both total and dissolved iron), in accordance with standard practice for surface water samples.

5.0 FIELD MONITORING

5.1 Field Monitoring

Field monitoring in 2016 was conducted between March and September 2016 and included the following tasks:

- Sampling of the Drainage Pond monthly in March through September 2016 (for a total of seven samples) and analysis of samples for septage contaminants listed under Section 3.0.
- Sampling of Davidson Pond and Rose's Pond monthly in March through September 2016 (for a total of seven samples) and analysis of samples for septage contaminants listed under Section 3.0.

5.2 Field Methods

CoK staff collected all water levels and water samples described in this report. Grab samples were collected from below the water surface near the shoreline of each pond, and placed in bottles supplied by ALS Environmental Laboratory (ALS) of Burnaby, BC. The sample bottles were placed in chilled coolers and transported via overnight courier. The ALS laboratory analytical reports were provided to Golder by the CoK. Golder tabulated the 2016 data to allow for an assessment of the water quality results; tabulated data are provided in this report along with the 2014 and 2015 data.



6.0 RESULTS

6.1 Drainage Pond Quality

A summary of the analytical results for water samples collected from the Drainage Pond in 2016 is presented in Table 1, attached. The ALS laboratory analytical reports (laboratory report numbers L1742616-1, L1752610-1, L1763882-1, L1777367-1, L1794599-1, L1811981-1 and L1832582-1) are included in Appendix A.

The following is a summary of the 2016 analytical results. Results were compared to the CSR AW and DW standards, where applicable.

- Ammonia (as N) concentrations exceeded the applicable CSR AW standard during the March and April sampling events (there is no CSR DW standard for ammonia-N).
- All other concentrations of nutrients parameters, chloride and total metals in the Drainage Pond were below the applicable CSR AW and DW standards.
- Nitrate (as N) concentrations were elevated in March and April compared to those in May through September.
- Parameter concentrations measured in 2016 were generally within the range of concentrations measured in 2014 and 2015, with the exception of the chloride concentration in April 2016 (129 mg/L), which was higher than those measured in 2014, 2015 and the remainder of 2016.
- Concentrations of total coliforms and E.coli in the samples collected from the Drainage Pond were the lowest in May, with most probable number (mpn) per 100 mL of 100 for total coliforms and <10 mpn/100 mL for E.coli. The highest concentrations were measured in August with total coliforms of >241,960 mpn/100mL and 130,000 mpn/100mL of E.coli.

6.2 Davidson Pond and Rose's Pond Quality

A summary of the analytical results for water samples collected from the neighbouring Davidson and Rose's Ponds in 2014 is presented in Table 2, attached. The ALS laboratory analytical reports (laboratory report numbers for Davidson Pond: L1742616-2, L1752610-2, L1763882-2, L1777367-2, L1794599-2, L1811981-2 and L1832582-2; and for Rose's Pond: L1742616-3, L1752610-3, L1763882-3, L1777367-3, L1794599-3, L1811981-3 and L1832582-3) are included in Appendix A.

The following is a summary of the 2016 analytical results. Results were compared to the BCWQG AW guidelines and the CSR AW and DW standards, where applicable.

6.2.1 Davidson Pond

Concentrations of most parameters were less than the BCWQG AW guidelines and CSR AW and DW standards during the seven sampling events in 2016, except for the following parameters:

- Chloride concentrations exceeded the long-term average BCWQG AW guideline and the CSR DW standard, but were less than the CSR AW standard and the short-term maximum BCWQG AW guideline, during all sampling events.



- The total magnesium concentrations measured in August and September exceeded the CSR DW standard (there are no BCWQG or CSR AW criteria for magnesium).
- The total sodium concentrations exceeded the CSR DW standard during all sampling events (there are no BCWQG or CSR AW criteria for sodium).
- The reported detection limit for total beryllium exceeded the applicable BCWQG AW guideline during all sampling events.

Samples collected from Davidson Pond during the 2016 sampling events had total coliform and E. coli counts that were generally elevated; however, between March and July, total coliform and E.coli counts were lower than at the Drainage Pond. The highest total coliform and E.coli counts at Davidson Pond were measured in September 2016, and were significantly higher than those measured in 2014, 2015 and the remainder of 2016. It appears that this sample may have been switched with the Drainage Pond sample collected in September 2016, based on historical counts recorded at both ponds from 2014 through 2016.

Parameter concentrations measured in 2016 at Davidson Pond were generally within the range of concentrations measured in 2014 and 2015.

6.2.2 Rose's Pond

Concentrations of most parameters were less than the BCWQG AW guidelines and CSR AW and DW standards during the seven sampling events in 2016, except for the following parameters:

- Total arsenic concentrations exceeded the BCWQG AW guideline during the July, August, and September sampling events, but were less than the CSR AW and DW standards.
- Chloride concentrations exceeded the long-term average BCWQG AW guideline and the CSR DW, but were less than the CSR AW standard, during all sampling events. The August chloride concentrations also exceeded the short-term maximum BCWQG AW guideline.
- Total magnesium concentrations exceeded the CSR DW standard during all sampling events.
- Total sodium concentrations exceeded the CSR DW standard during all sampling events.
- The reported detection limit for total beryllium exceeded the applicable BCWQG AW guideline during all sampling events.

Samples collected from Rose's Pond during the 2014 sampling events had total coliform counts that were generally elevated but typically lower than in the Drainage Pond.

Parameter concentrations measured in 2016 at Rose's Pond were generally within the range of concentrations measured in 2014 and 2015.



7.0 DISCUSSION

The concentrations of typical septage contaminants (ammonia, nitrate, nitrite, total nitrogen, orthophosphate and microbiological parameters) at the Drainage Pond, Davidson Pond and Rose's Pond were generally within the range of analysis from month to month during the sampling events in 2016, and generally within the range of concentrations previously measured in 2014 and 2015. The exception to this was the ammonia concentrations (particularly in the Drainage Pond) and the total coliforms and E.coli concentrations (in all three ponds), which exhibited variability between sampling events.

The ammonia concentrations at the Drainage Pond exceeded the CSR AW standard on two occasions in early 2016; however, all other parameter concentrations were below the applicable CSR AW and DW standards. The reported ammonia (as N) concentrations at the Drainage Pond were much greater than the nitrate (as N) and nitrite (as N) concentrations, indicative that little nitrification is occurring. The total nitrogen concentrations at the Drainage Pond were greater than the combined ammonia, nitrate and nitrite concentrations, indicative that a portion of the total nitrogen in the water samples was organic nitrogen.

Similar to the 2014 and 2015 water quality monitoring results, samples collected during the 2016 sampling events indicated that septage parameter concentrations and BOD were higher at the Drainage Pond than at Davidson Pond and Rose's Pond, as follows:

- Total nitrogen concentrations were more than approximately 2 times greater at the Drainage Pond than at Davidson Pond and Rose's Pond.
- BOD concentrations were up to approximately 6 times greater at the Drainage Pond than at Davidson Pond and Rose's Pond.
- Orthophosphate concentrations were approximately 1 to 3 orders of magnitude greater at the Drainage Pond than at Davidson Pond and Rose's Pond.
- Certain metals parameters were higher at the Drainage Pond than at Davidson Pond and Rose's Pond (including, but not limited to: aluminum, barium, boron, iron, manganese, molybdenum, phosphorus and zinc).

Similar to the 2014 and 2015 water quality monitoring results, samples collected during the 2016 sampling events indicated that certain inorganic and metals parameters were higher at Davidson Pond and Rose's Pond relative to the Drainage Pond, as follows:

- Chloride concentrations were approximately 3 times higher at Davidson Pond, and up to 6 times higher at Rose's Pond, than at the Drainage Pond.
- Magnesium concentrations were on average approximately 3 times higher at Davidson Pond, and approximately 1 order of magnitude greater at Rose's Pond, than at the Drainage Pond.
- Sodium concentrations were on average approximately 5 times higher at Davidson Pond, and approximately 1 order of magnitude greater at Rose's Pond, than at the Drainage Pond.
- Potassium concentrations were on average approximately 2 times higher at Davidson Pond, and approximately 4 to 5 times higher at Rose's Pond, than at the Drainage Pond.
- Arsenic concentrations were slightly higher at Rose's Pond than at Davidson Pond and the Drainage Pond.



8.0 CONCLUSIONS

Water potentially infiltrating from the Drainage Pond may be considered a source of contamination for groundwater, particularly with respect to ammonia, which exceeded applicable standards on two occasions in 2016; however, as it has previously been assessed that evaporation from the Drainage Pond is inferred to account for most of the losses within the Drainage Pond (compared to infiltration) and exceedances noted at one pond(s) were not noted at the other pond(s), the water quality at Davidson Pond and Rose's Pond does not appear to be adversely impacted by water that may be migrating from the Drainage Pond.

Should the City of Kelowna wish to assess groundwater quality in the area of the ponds, consideration could be given to installing monitoring wells between the Drainage Pond and Rose's Pond and between the Drainage Pond and Davidson Pond.

The City of Kelowna should confirm that the quality of the water pumped from the Drainage Pond to the City of Vernon's sewage reclamation facility is acceptable, particularly with respect to ammonia and orthophosphate concentrations.

9.0 RECOMMENDATIONS FOR 2017

Golder proposes monthly monitoring at the Drainage Pond and at the neighbouring Davidson Pond and Rose's Pond between April and November (or, when the pond is not frozen) in 2017, as follows:

- Collecting and analyzing samples for potential septage contaminants including:
 - Phosphorous (ortho-phosphate), chloride, ammonia, nitrate, nitrite, and total kjeldahl nitrogen.
 - BOD and COD.
 - Metals (total and dissolved).
 - pH, total dissolved solids (TDS), total suspended solids (TSS) and hardness.
- The City of Kelowna should request that the laboratory use lower detection limits for total beryllium (i.e., <0.0001 mg/L).
- Compile an annual report to the City of Kelowna with comparison of water sample results to applicable standards.
- Obtain evaporation pan readings and staff gauge measurement at the Drainage Pond. In order to have a meaningful interpretation of pond evaporation versus infiltration, it is recommended that these readings/measurements be taken over three 48-hour periods in 2017; once in the spring (i.e., May or June), once in the summer (i.e., July or August) and again in the fall (i.e., September or October). Consideration should be given to collecting this evaporation pan and water level data with pressure transducers to capture the small level changes.
- The field pH and temperature of the water samples should be measured with a properly-calibrated meter by City personnel during the collection of pond water samples, so that the suitability of the ammonia guidelines can be assessed. Often laboratory-measured pH can be slightly different than field pH, due to geochemical changes in the sample bottle during transport. The field pH and temperature will assist in the assessment of pond water quality and in determining the appropriate criteria to use in the comparison of analytical ammonia results.



- Additionally, samples should be taken such that minimal to no suspended particles or disturbed sediment are collected in the sampling bottles, and that no surface matter (i.e., algae) is inadvertently collected. Field notes should be recorded during sampling events and reviewed in conjunction with the analytical water quality data.

10.0 LIMITATIONS AND USE OF REPORT

This report was prepared for the exclusive use of the City of Kelowna. The findings, interpretations and conclusions are based solely on the Site conditions during the sampling events. The data presented in this report represent the leachate quality conditions at the sampling locations tested. Leachate conditions may vary with location, depth, sampling, methodology, analytical techniques and other factors.

Except where specifically stated to the contrary, the information contained in this report (including reports, information and data) was provided to Golder by others, and has not been independently verified or otherwise examined by Golder to determine its accuracy or completeness. Golder has relied in good faith on this information and does not accept responsibility of any deficiency, misstatements or inaccuracies contained in the report as a result of omissions, misinterpretation and/or fraudulent acts of the persons interviewed or contacted, or errors or omissions in the reviewed documentation.

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The services performed as described in this report were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

If new information is discovered during future work, including excavations, borings or other studies, Golder should be requested to re-evaluate the conclusions presented in this report and to provide amendments as required.

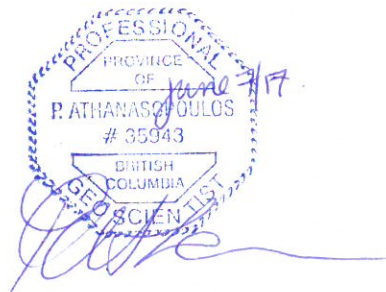


11.0 CLOSURE

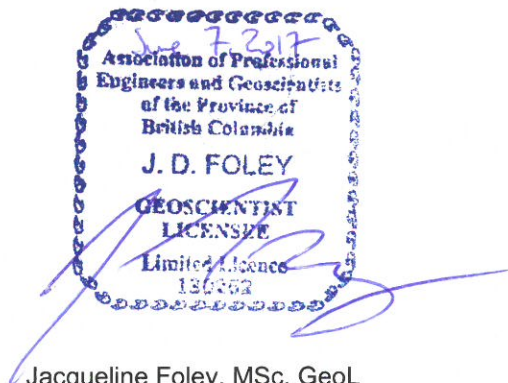
We trust that this report provides the information you require at this time. Should you have any questions or require additional information, please do not hesitate to contact the undersigned.

Yours very truly,

GOLDER ASSOCIATES LTD.



Pana Athanasopoulos, MSc, PGeo
Senior Hydrogeologist

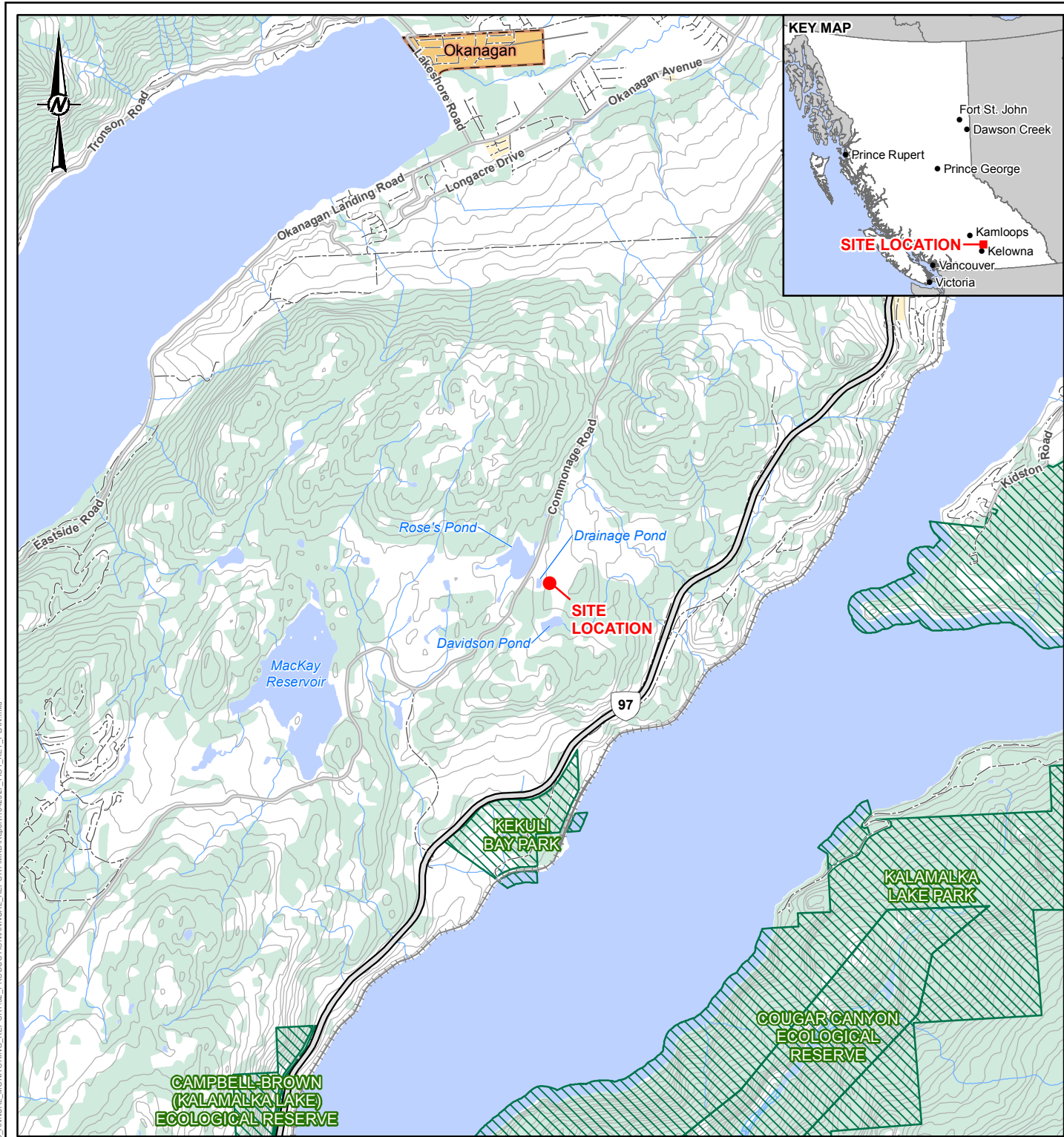


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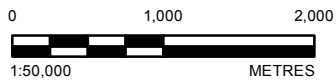
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LEGEND

- SITE LOCATION
- AIRFIELD
- INDIAN RESERVE
- PARK / PROTECTED AREA
- RESIDENTIAL AREA
- WETLAND
- WATERBODY
- WOODED AREA
- HIGHWAY
- MAJOR ROAD
- LOCAL ROAD
- RAILWAY
- WATERCOURSE
- CONTOUR (20m)



REFERENCES

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3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N

CLIENT
CITY OF KELOWNA

PROJECT
2016 ANNUAL MONITORING REPORT
BIOSOLID COMPOSTING FACILITY, VERNON, BC.

TITLE
KEY PLAN

CONSULTANT		YYYY-MM-DD	2017-06-07
		DESIGNED	HH
		PREPARED	AD/GI
		REVIEWED	HH
		APPROVED	PA

PROJECT NO.	PHASE	REV.	FIGURE
1542527		0	1

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI/A 25mm

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LEGEND

— MAJOR ROAD



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3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 11N

CLIENT
CITY OF KELOWNA

PROJECT
2016 ANNUAL MONITORING REPORT
BIOSOILD COMPOSTING FACILITY, VERNON, BC.

TITLE
SITE PLAN

CONSULTANT	YYYY-MM-DD	2017-06-07
	DESIGNED	HH
	PREPARED	AD
	REVIEWED	HH
	APPROVED	PA

PROJECT NO.	PHASE	REV.	FIGURE
1542527		0	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI/A

Table 1: 2014 - 2016 Results of Water Analyses - Drainage Pond
City of Kelowna-Vernon Biosolids Facility
Commonage Road, Vernon, BC

Location	Drainage Pond																								
	Laboratory ID Date	Aquatic Life CSR-AW ⁽¹⁾ (freshwater)	Notes	Drinking Water CSR-DW ⁽¹⁾	Notes	L1440745-1 07-Apr-14	L1462088-1 28-May-14	L1502217-1 13-Aug-14	L1515479-1 09-Sep-14	L1532630-1 14-Oct-14	L1547862-3 17-Nov-14	L1625288-1 10-Jun-15	L1645255-1 20-Jul-15	L1656492-1 11-Aug-15	L1669705-1 7-Sep-15	L1684336-1 6-Oct-15	L1698669-1 4-Nov-15	L1742616-1 8-Mar-16	L1752610-1 05-Apr-16	L1763882-1 03-May-16	L1777367-1 01-Jun-16	L1794599-1 05-Jul-16	L1811981-1 10-Aug-16	L1832582-1 21-Sep-16	
Dissolved Metals																									
aluminum				9.5		0.036	0.013	0.014	0.017	0.021	0.072	0.017	0.067	0.018	0.063	0.033	0.104	0.045	0.025	0.015	0.013	0.030	0.010	0.0185	
antimony	0.2			0.006		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
arsenic	0.05			0.01		0.0016	0.0012	0.0015	0.0016	0.0013	<0.0010	0.0011	0.0046	0.0012	0.0020	0.0016	0.0026	0.0031	0.0018	0.0012	0.0010	0.0021	0.0012	0.00114	
barium	10			1		<0.020	<0.020	<0.020	0.023	<0.020	<0.020	<0.020	0.028	0.020	<0.020	0.024	<0.020	0.032	0.032	0.026	0.026	0.020	0.033	0.030	
beryllium	0.053					<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0010	
bismuth						<0.20	<0.20	<0.20	-	-	-	-	<0.20	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	
boron	50			5		0.14	0.16	0.17	0.17	0.18	0.16	0.17	0.20	0.16	0.16	0.17	0.13	0.13	0.14	0.15	0.16	0.16	0.16	0.17	
cadmium	0.0001 - > 0.0006	H		0.005		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000154	<0.000050	<0.000050	<0.000050	0.000126	0.000088	<0.000050	<0.000050	<0.000050	<0.000050	0.0000229		
calcium						121	57.5	54.7	58.3	56.6	50.0	56.8	62.4	55.7	47.5	54.9	37.9	120	123	70.2	59.7	53.8	57.2	53.9	
chromium	0.010 ^{VI} , 0.090 ^{III}	V		0.05		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00064	<0.00050	0.00066	<0.00050	<0.00050	<0.00050	0.00064	0.00058	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	
cobalt	0.04					0.00055	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00064	<0.00050	<0.00050	<0.00050	<0.00050	0.00067	0.00069	<0.00050	<0.00050	<0.00050	<0.00050	0.00032	
copper	0.020 - 0.090	H		1		0.0025	0.0036	0.0059	0.0037	0.0025	0.0096	0.0030	0.0219	0.0030	0.0065	0.0045	0.0174	0.0147	0.0057	0.0024	0.0021	0.0048	0.0031	0.0036	
iron				6.5		<0.030	0.056	<0.030	0.046	<0.030	0.174	<0.030	0.210	<0.030	0.034	0.041	0.177	0.162	0.064	<0.030	0.053	0.072	0.037	0.043	
lead	0.040 - 0.160	H		0.01		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0015	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	
lithium				0.73	S	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.0095	
magnesium				100		66.4	25.1	23.3	24.4	24.4	21.7	23.6	25.2	22.4	19.4	21.9	15.2	66.8	69.0	31.4	23.9	22.1	22.1	21.2	
manganese				0.55		0.026	0.062	0.010	<0.010	<0.010	0.074	<0.010	0.023	<0.010	<0.010	<0.010	0.128	0.144	0.102	<0.010	0.139	0.050	0.102	0.0596	
mercury	0.001			0.001		<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.000025	
molybdenum	10			0.25		0.0060	0.0065	0.0072	0.0065	0.0049	0.0050	0.0057	0.0063	0.0053	0.0056	0.0057	0.0041	0.0065	0.0056	0.0049	0.0041	0.0052	0.0042	0.0040	
nickel	0.250 - 1.5	H				<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0016	
phosphorus						0.81	1.51	1.42	-	-	-	-	5.32	-	-	1.74	4.37	3.31	1.34	0.64	1.15	2.58	1.48	1.49	
potassium						24.6	20.9	28.6	-	-	-	-	76.4	-	-	24.3	25.6	31.3	24.9	21.1	21.7	25.4	20.5	20.3	
selenium	0.01			0.01		0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0039	0.0034	<0.0010	<0.0010	<0.0010	<0.0010	0.000507	
silicon						5.44	3.43	2.87	-	-	-	-	3.63	-	-	4.08	3.30	5.50	5.73	3.61	3.35	3.62	3.45	3.71	
silver	0.0005 - 0.015	H				<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000071	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000020	
sodium				200		126	103	107	106	98.2	99.2	93.9	110	100	86.9	94.8	71.2	125	148	118	103	99.5	105	101	
strontium				22	S	1.16	0.578	0.522	-	-	-	-	0.557	-	-	0.546	0.316	1.10	1.27	0.682	0.568	0.542	0.549	0.539	
thallium	0.003					<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.000014	<0.00020	<0.00020	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.00020	
tin				22	S	<0.030	<0.030	<0.030	-	-	-	-	<0.030	-	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.00050	
titanium	1					<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.010	
uranium	3			0.02		0.00478	0.00195	0.00197	0.00182	0.00179	-	0.00217	0.00246	0.00208	0.00198	0.00233	0.00079	0.00602	0.00606	0.00185	0.00173	0.00210	0.00194	0.00173	
vanadium						<0.030	<0.030	<0.030	<0.030	<0.030	0.00122	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.00097	
zinc	0.075 - > 2.4	H		5		0.0118	0.0254	0.0146	0.0134	0.0169	<0.030	0.0072	0.0508	0.0144	0.0137	0.0119	0.0448	0.0549	0.0423	0.0194	0.0248	0.0181	0.0238	0.0212	

Notes:

All concentrations in milligrams per litre (mg/L), unless otherwise noted.

(1) Standards from the Contaminated Sites Regulation (CSR), updated to July 2016.

Land Use abbreviations: AW (Aquatic Life); and DW (Drinking Water).

H = standard is Hardness dependent; pH = standard is pH dependent; Cl = standard is chloride dependent; S = refer to CSR Schedule 10; V = standard is valence dependent, VI=chromium VI and III=chromium III; T = standard varies with temperature (10 deg C assumed for ammonia criteria).

19.7 indicates parameter concentration exceeds applicable CSR AW or DW standards



APPENDIX A

ALS Laboratory Certificates of Analysis (2016)



CITY OF KELOWNA
ATTN: Marcia Browne
1595 Glenmore Road N.
Kelowna BC V1V 2C5

Date Received: 09-MAR-16
Report Date: 16-MAR-16 16:15 (MT)
Version: FINAL

Client Phone: 250-469-8796

Certificate of Analysis

Lab Work Order #: L1742616
Project P.O. #: 520747
Job Reference: 1186-202 EX-B
C of C Numbers:
Legal Site Desc:

Dean Watt, B.Sc.
Account Manager

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

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID			
	L1742616-1 Surface water 08-MAR-16 11:05 COMMONAGE DRAINAGE POND	L1742616-2 Surface water 08-MAR-16 12:10 DAVIDSON POND	L1742616-3 Surface water 08-MAR-16 12:20 ROSE'S POND	
Grouping	Analyte			
WATER				
Physical Tests	Conductivity (uS/cm)	1670	2480	5490
	Hardness (as CaCO3) (mg/L)	575	461	1310
	pH (pH)	7.82	8.75	8.47
	Total Suspended Solids (mg/L)	21.5	12.8	10.4
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	13.9	0.0111	0.0117
	Chloride (Cl) (mg/L)	112	254	468
	Nitrate (as N) (mg/L)	6.84	<0.10 ^{DLDS}	<0.25 ^{DLDS}
	Nitrite (as N) (mg/L)	0.513	<0.020 ^{DLDS}	<0.050 ^{DLDS}
	Total Nitrogen (mg/L)	25.1	1.69	1.67
	Orthophosphate-Dissolved (as P) (mg/L)	2.98	<0.0010	0.0023
Bacteriological Tests	E. coli (MPN/100mL)	2000	48	3
	Coliform Bacteria - Total (MPN/100mL)	37200	88	65
Total Metals	Aluminum (Al)-Total (mg/L)	0.225	0.056	0.022
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	0.00059
	Arsenic (As)-Total (mg/L)	0.0033	0.0026	0.0045
	Barium (Ba)-Total (mg/L)	0.048	<0.020	<0.020
	Beryllium (Be)-Total (mg/L)	<0.0050	<0.0050	<0.0050
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20
	Boron (B)-Total (mg/L)	0.13	<0.10	<0.10
	Cadmium (Cd)-Total (mg/L)	0.000146	<0.000050	<0.000050
	Calcium (Ca)-Total (mg/L)	123	61.7	65.4
	Chromium (Cr)-Total (mg/L)	0.00104	<0.00050	<0.00050
	Cobalt (Co)-Total (mg/L)	0.00076	<0.00050	<0.00050
	Copper (Cu)-Total (mg/L)	0.0234	<0.0010	<0.0025
	Iron (Fe)-Total (mg/L)	0.472	0.094	0.039
	Lead (Pb)-Total (mg/L)	<0.0010	<0.0010	<0.0010
	Lithium (Li)-Total (mg/L)	<0.050	<0.050	0.054
	Magnesium (Mg)-Total (mg/L)	66.1	75.9	280
	Manganese (Mn)-Total (mg/L)	0.265	0.111	0.201
	Mercury (Hg)-Total (mg/L)	<0.00020	<0.00020	<0.00020
	Molybdenum (Mo)-Total (mg/L)	0.0067	<0.0010	0.0016
	Nickel (Ni)-Total (mg/L)	<0.0050	<0.0050	<0.0050
	Phosphorus (P)-Total (mg/L)	3.85	<0.30	<0.30
	Potassium (K)-Total (mg/L)	33.3	32.6	84.6
Selenium (Se)-Total (mg/L)	0.0042	<0.0010	<0.0010	
Silicon (Si)-Total (mg/L)	5.98	1.25	1.49	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1742616-1	L1742616-2	L1742616-3
		Description	Surface water	Surface water	Surface water
		Sampled Date	08-MAR-16	08-MAR-16	08-MAR-16
		Sampled Time	11:05	12:10	12:20
		Client ID	COMMONAGE DRAINAGE POND	DAVIDSON POND	ROSE'S POND
Grouping	Analyte				
WATER					
Total Metals	Silver (Ag)-Total (mg/L)	0.000093	<0.000050	<0.000050	
	Sodium (Na)-Total (mg/L)	131	397	847	
	Strontium (Sr)-Total (mg/L)	1.16	0.648	0.620	
	Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	
	Tin (Sn)-Total (mg/L)	<0.030	<0.030	<0.030	
	Titanium (Ti)-Total (mg/L)	<0.050	<0.050	<0.050	
	Uranium (U)-Total (mg/L)	0.00615	0.00516	0.00466	
	Vanadium (V)-Total (mg/L)	<0.030	<0.030	<0.030	
	Zinc (Zn)-Total (mg/L)	0.0715	<0.0050	<0.0050	
Dissolved Metals	Dissolved Mercury Filtration Location	LAB	LAB	LAB	
	Dissolved Metals Filtration Location	LAB	LAB	LAB	
	Aluminum (Al)-Dissolved (mg/L)	0.045	<0.010	<0.010	
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	0.00053	
	Arsenic (As)-Dissolved (mg/L)	0.0031	0.0024	0.0046	
	Barium (Ba)-Dissolved (mg/L)	0.032	<0.020	<0.020	
	Beryllium (Be)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	
	Boron (B)-Dissolved (mg/L)	0.13	<0.10	<0.10	
	Cadmium (Cd)-Dissolved (mg/L)	0.000088	<0.000050	<0.000050	
	Calcium (Ca)-Dissolved (mg/L)	120	61.0	65.6	
	Chromium (Cr)-Dissolved (mg/L)	0.00058	<0.00050	<0.00050	
	Cobalt (Co)-Dissolved (mg/L)	0.00067	<0.00050	<0.00050	
	Copper (Cu)-Dissolved (mg/L)	0.0147	<0.0010	<0.0010	
	Iron (Fe)-Dissolved (mg/L)	0.162	<0.030	<0.030	
	Lead (Pb)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	
	Lithium (Li)-Dissolved (mg/L)	<0.050	<0.050	0.052	
	Magnesium (Mg)-Dissolved (mg/L)	66.8	75.0	278	
	Manganese (Mn)-Dissolved (mg/L)	0.144	<0.010	0.168	
	Mercury (Hg)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	
	Molybdenum (Mo)-Dissolved (mg/L)	0.0065	<0.0010	0.0011	
	Nickel (Ni)-Dissolved (mg/L)	<0.0050	<0.0050	<0.0050	
	Phosphorus (P)-Dissolved (mg/L)	3.31	<0.30	<0.30	
	Potassium (K)-Dissolved (mg/L)	31.3	31.6	83.0	
	Selenium (Se)-Dissolved (mg/L)	0.0039	<0.0010	<0.0010	
	Silicon (Si)-Dissolved (mg/L)	5.50	0.437	1.41	
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	
	Sodium (Na)-Dissolved (mg/L)	125	392	841	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1742616-1 Surface water 08-MAR-16 11:05 COMMONAGE DRAINAGE POND	L1742616-2 Surface water 08-MAR-16 12:10 DAVIDSON POND	L1742616-3 Surface water 08-MAR-16 12:20 ROSE'S POND	
Grouping	Analyte				
WATER					
Dissolved Metals	Strontium (Sr)-Dissolved (mg/L)	1.10	0.636	0.615	
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000020 ^{DLA}	<0.000050 ^{DLA}	
	Tin (Sn)-Dissolved (mg/L)	<0.030	<0.030	<0.030	
	Titanium (Ti)-Dissolved (mg/L)	<0.050	<0.050	<0.050	
	Uranium (U)-Dissolved (mg/L)	0.00602	0.00516	0.00472	
	Vanadium (V)-Dissolved (mg/L)	<0.030	<0.030	<0.030	
	Zinc (Zn)-Dissolved (mg/L)	0.0549	<0.0050	<0.0050	
Aggregate Organics	BOD (mg/L)	12.8	5.7	4.9	
	COD (mg/L)	158	1050	58	

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

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
WSMD	Water sample(s) for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.
WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Cadmium (Cd)-Total	DLA	L1742616-1, -2, -3
Duplicate	Chromium (Cr)-Total	DLA	L1742616-1, -2, -3
Duplicate	Cobalt (Co)-Total	DLA	L1742616-1, -2, -3
Duplicate	Copper (Cu)-Total	DLA	L1742616-1, -2, -3
Duplicate	Lead (Pb)-Total	DLA	L1742616-1, -2, -3
Duplicate	Nickel (Ni)-Total	DLA	L1742616-1, -2, -3
Duplicate	Selenium (Se)-Total	DLA	L1742616-1, -2, -3
Duplicate	Silver (Ag)-Total	DLA	L1742616-1, -2, -3
Duplicate	Thallium (Tl)-Total	DLA	L1742616-1, -2, -3
Duplicate	Nitrite (as N)	DLDS	L1742616-1, -2, -3
Duplicate	Nitrate (as N)	DLDS	L1742616-1, -2, -3
Duplicate	Nitrite (as N)	DLDS	L1742616-1, -2, -3
Duplicate	Nitrate (as N)	DLDS	L1742616-1, -2, -3
Duplicate	Nitrite (as N)	DLDS	L1742616-1, -2, -3
Certified Reference Material	Conductivity	LCS-H	L1742616-3
Matrix Spike	Calcium (Ca)-Total	MS-B	L1742616-1, -2, -3
Matrix Spike	Silicon (Si)-Total	MS-B	L1742616-1, -2, -3
Matrix Spike	Strontium (Sr)-Total	MS-B	L1742616-1, -2, -3
Matrix Spike	Calcium (Ca)-Total	MS-B	L1742616-1, -2, -3
Matrix Spike	Silicon (Si)-Total	MS-B	L1742616-1, -2, -3
Matrix Spike	Strontium (Sr)-Total	MS-B	L1742616-1, -2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1742616-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1742616-1, -2, -3
Matrix Spike	Ammonia, Total (as N)	MS-B	L1742616-1

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.
LCS-H	Lab Control Sample recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified.
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**
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- "BIOCHEMICAL OXYGEN DEMAND"
<p>This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.</p>			
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND
<p>This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.</p>			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			

Reference Information

COD-COL-VA	Water	Chemical Oxygen Demand by Colorimetric	APHA 5220 D. CHEMICAL OXYGEN DEMAND
This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.			
ECOLI-COLI-ENV-VA	Water	E.coli by Colilert	APHA METHOD 9223
This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO ₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.			
HG-DIS-CVAFS-VA	Water	Dissolved Hg in Water by CVAFS LOR=50ppt	APHA 3030B/EPA 1631E (mod)
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).			
HG-TOT-CVAFS-VA	Water	Total Hg in Water by CVAFS LOR=50ppt	EPA 1631E (mod)
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-DIS-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA SW-846 3005A/6010B
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA Method 4500-P (J) / NEMI 5735
This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH ₃ -NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Reference Information

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

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

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

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

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

mg/L - milligrams per litre.

< - Less than.

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


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

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

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

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



Report To			Report Format / Distribution			Service Requested (Rush for routine analysis subject to availability)												
Company: City of Kelowna			<input type="checkbox"/> Standard <input type="checkbox"/> Other			<input checked="" type="radio"/> Regular (Standard Turnaround Times - Business Days)												
Contact: Marcia Browne			<input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> Excel <input type="checkbox"/> Digital <input type="checkbox"/> Fax			<input type="radio"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT												
Address: 1595 Glenmore Road N. Kelowna BC V1V2C5			Email 1: mbrowne@kelowna.ca			<input type="radio"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT												
Phone: 250-469-8796 Fax: 250-862-3342			Email 2: mlewis@kelowna.ca			<input type="radio"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT												
Invoice To Same as Report? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Client / Project Information			Analysis Request												
Hardcopy of Invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Job #: 1186-202 EX -B			Please indicate below Filtered, Preserved or both (F, P, F/P)												
Company:			PO / AFE: 520747			Total metals	Dissolved metals	BOD, COD	T. Coliform, E. Coli	TSS, Ammonia	O-PO4-P	Total Nitrogen	NO2-N, NO3-N	Total hardness	EC	Chloride	pH	Number of Containers
Contact:			LSD:															
Address:			Quote #:															
Phone:			ALS Contact: Dean Watt															
Lab Work Order (lab use only)  L1742616-COFC			Sampler: Ingrid Gordon															
Sample #	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type															
(This description will appear on the report)																		
	Commonage Drainage Pond	08-Mar-16	11:05	Surface Water	X	X	X	X	X	X	X	X	X	X	X	X	X	5
	Davidson Pond	08-Mar-16	12:10	Surface Water	X	X	X	X	X	X	X	X	X	X	X	X	X	5
	Rose's Pond	08-Mar-16	12:20	Surface Water	X	X	X	X	X	X	X	X	X	X	X	X	X	5
Short Holding Time <i>Rush Processing</i>																		
Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details																		
Sewage biosolids - biohazardous material																		
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 provided on a separate Excel tab.																		
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.																		
SHIPMENT RELEASE (client use)						SHIPMENT RECEPTION (lab use only)						SHIPMENT VERIFICATION (lab use only)						
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations:	Yes / No ? If Yes add SIF							
			<i>lady</i>	<i>Mar 9</i>	<i>9 AM</i>	<i>6 °C</i>												



CITY OF KELOWNA
ATTN: Marcia Browne
1595 Glenmore Road N.
Kelowna BC V1V 2C5

Date Received: 06-APR-16
Report Date: 13-APR-16 17:59 (MT)
Version: FINAL

Client Phone: 250-469-8796

Certificate of Analysis

Lab Work Order #: L1752610
Project P.O. #: 520747
Job Reference: 1186-202 POND
C of C Numbers:
Legal Site Desc:

Dean Watt, B.Sc.
Account Manager

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

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1752610-1 SURFACE WATE 05-APR-16 11:15 COMMONAGE DRAINAGE POND	L1752610-2 SURFACE WATE 05-APR-16 09:00 DAVIDSON POND	L1752610-3 SURFACE WATE 05-APR-16 11:30 ROSE'S POND		
Grouping	Analyte					
WATER						
Physical Tests	Conductivity (uS/cm)	1710	2980	5790		
	Hardness (as CaCO3) (mg/L)	592	533	1410		
	pH (pH)	8.19	8.73	8.60		
	Total Suspended Solids (mg/L)	32.1	<3.0	7.6		
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	4.98	0.0283	0.0129		
	Chloride (Cl) (mg/L)	129	296	482		
	Nitrate (as N) (mg/L)	5.82	<0.10 ^{DLDS}	<0.25 ^{DLDS}		
	Nitrite (as N) (mg/L)	0.229	<0.020 ^{DLDS}	<0.050 ^{DLDS}		
	Total Kjeldahl Nitrogen (mg/L)	9.06	1.66	1.74		
	Total Nitrogen (mg/L)	15.6	1.70	1.78		
	Orthophosphate-Dissolved (as P) (mg/L)	1.19	<0.0010	<0.0010		
Bacteriological Tests	E. coli (MPN/100mL)	30	6	43		
	Coliform Bacteria - Total (MPN/100mL)	1780	71	205		
Total Metals	Aluminum (Al)-Total (mg/L)	0.182	0.0107	0.030		
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	0.00060		
	Arsenic (As)-Total (mg/L)	0.0019	0.00312	0.00405		
	Barium (Ba)-Total (mg/L)	0.039	0.020	<0.020		
	Beryllium (Be)-Total (mg/L)	<0.0050	<0.0010	<0.0010		
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.40 ^{DLHC}		
	Boron (B)-Total (mg/L)	0.14	<0.10 ^{DLA}	<0.20 ^{DLHC}		
	Cadmium (Cd)-Total (mg/L)	0.000071	<0.000010 ^{DLA}	<0.000025 ^{DLA}		
	Calcium (Ca)-Total (mg/L)	122	67.5	71.6		
	Chromium (Cr)-Total (mg/L)	0.00090	<0.0010	<0.0010 ^{DLA}		
	Cobalt (Co)-Total (mg/L)	0.00076	<0.00030	<0.00050 ^{DLA}		
	Copper (Cu)-Total (mg/L)	0.0118	<0.0010	<0.0025 ^{DLA}		
	Iron (Fe)-Total (mg/L)	0.409	<0.030	<0.060 ^{DLHC}		
	Lead (Pb)-Total (mg/L)	<0.0010	<0.00050	<0.00050		
	Lithium (Li)-Total (mg/L)	<0.050	0.0392	0.0540		
	Magnesium (Mg)-Total (mg/L)	68.6	91.1	306		
	Manganese (Mn)-Total (mg/L)	0.208	0.0340	0.113		
	Mercury (Hg)-Total (mg/L)	<0.00020	<0.0000050	<0.0000050		
	Molybdenum (Mo)-Total (mg/L)	0.0056	0.0011	0.0017		
	Nickel (Ni)-Total (mg/L)	<0.0050	0.0016	<0.0025 ^{DLA}		
	Phosphorus (P)-Total (mg/L)	1.88	<0.30	<0.60 ^{DLHC}		
	Potassium (K)-Total (mg/L)	26.7	39.2	89.9		
	Selenium (Se)-Total (mg/L)	0.0035	0.00020	0.00051		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1752610-1	L1752610-2	L1752610-3		
		Description	SURFACE WATE	SURFACE WATE	SURFACE WATE		
		Sampled Date	05-APR-16	05-APR-16	05-APR-16		
		Sampled Time	11:15	09:00	11:30		
		Client ID	COMMONAGE DRAINAGE POND	DAVIDSON POND	ROSE'S POND		
Grouping	Analyte						
WATER							
Total Metals	Silicon (Si)-Total (mg/L)	5.81	0.461	0.15			
	Silver (Ag)-Total (mg/L)	<0.000050	<0.000020	<0.000050	DLA		
	Sodium (Na)-Total (mg/L)	146	494	935			
	Strontium (Sr)-Total (mg/L)	1.23	0.773	0.711			
	Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020			
	Tin (Sn)-Total (mg/L)	<0.030	<0.00050	<0.00050			
	Titanium (Ti)-Total (mg/L)	<0.050	<0.010	<0.020	DLHC		
	Uranium (U)-Total (mg/L)	0.00592	0.00590	0.00514	DLA		
	Vanadium (V)-Total (mg/L)	<0.030	<0.0010	<0.0025	DLA		
	Zinc (Zn)-Total (mg/L)	0.0539	<0.0050	<0.010	DLHC		
Dissolved Metals	Dissolved Mercury Filtration Location	LAB	LAB	LAB			
	Dissolved Metals Filtration Location	LAB	LAB	LAB			
	Aluminum (Al)-Dissolved (mg/L)	0.025	<0.0050	<0.0050			
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	0.00052			
	Arsenic (As)-Dissolved (mg/L)	0.0018	0.00289	0.00416			
	Barium (Ba)-Dissolved (mg/L)	0.032	<0.020	<0.020			
	Beryllium (Be)-Dissolved (mg/L)	<0.0050	<0.0010	<0.0010	DLHC		
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.40	DLHC		
	Boron (B)-Dissolved (mg/L)	0.14	<0.10	<0.20	DLHC		
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050	<0.000010	<0.000025	DLA		
	Calcium (Ca)-Dissolved (mg/L)	123	66.9	70.6			
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.0010	<0.0010	DLA		
	Cobalt (Co)-Dissolved (mg/L)	0.00069	<0.00030	<0.00050	DLA		
	Copper (Cu)-Dissolved (mg/L)	0.0057	<0.0010	<0.0010	DLHC		
	Iron (Fe)-Dissolved (mg/L)	0.064	<0.030	<0.060	DLHC		
	Lead (Pb)-Dissolved (mg/L)	<0.0010	<0.00050	<0.00050			
	Lithium (Li)-Dissolved (mg/L)	<0.050	0.0386	0.0530			
	Magnesium (Mg)-Dissolved (mg/L)	69.0	89.0	300			
	Manganese (Mn)-Dissolved (mg/L)	0.102	0.00123	0.0464			
	Mercury (Hg)-Dissolved (mg/L)	<0.00020	<0.0000050	<0.0000050			
	Molybdenum (Mo)-Dissolved (mg/L)	0.0056	<0.0010	0.0014	DLA		
	Nickel (Ni)-Dissolved (mg/L)	<0.0050	0.0017	<0.0025	DLA		
	Phosphorus (P)-Dissolved (mg/L)	1.34	<0.30	<0.60	DLHC		
	Potassium (K)-Dissolved (mg/L)	24.9	35.9	85.9			
	Selenium (Se)-Dissolved (mg/L)	0.0034	0.00019	0.00033	DLHC		
	Silicon (Si)-Dissolved (mg/L)	5.73	0.417	<0.10	DLHC		
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000020	<0.000050	DLA		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1752610-1	L1752610-2	L1752610-3		
		Description	SURFACE WATE	SURFACE WATE	SURFACE WATE		
		Sampled Date	05-APR-16	05-APR-16	05-APR-16		
		Sampled Time	11:15	09:00	11:30		
		Client ID	COMMONAGE DRAINAGE POND	DAVIDSON POND	ROSE'S POND		
Grouping	Analyte						
WATER							
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)	148	464	908			
	Strontium (Sr)-Dissolved (mg/L)	1.27	0.730	0.691			
	Thallium (Tl)-Dissolved (mg/L)	<0.00010	<0.00020	<0.00020			
	Tin (Sn)-Dissolved (mg/L)	<0.030	<0.00050	<0.00050			
	Titanium (Ti)-Dissolved (mg/L)	<0.050	<0.010	<0.020 ^{DLHC}			
	Uranium (U)-Dissolved (mg/L)	0.00606	0.00588	0.00510			
	Vanadium (V)-Dissolved (mg/L)	<0.030	<0.0010 ^{DLA}	<0.0025 ^{DLA}			
	Zinc (Zn)-Dissolved (mg/L)	0.0423	<0.0050	<0.010 ^{DLHC}			
Aggregate Organics	BOD (mg/L)	13.6	<2.0	2.0			
	COD (mg/L)	86	57	66			

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

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
WSMD	Water sample(s) for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Nitrite (as N)	DLDS	L1752610-1, -2, -3
Duplicate	Nitrite (as N)	DLDS	L1752610-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1752610-1, -2, -3
Matrix Spike	Total Nitrogen	MS-B	L1752610-1, -2, -3
Matrix Spike	Total Nitrogen	MS-B	L1752610-1, -2, -3
Matrix Spike	Total Nitrogen	MS-B	L1752610-1, -2, -3
Matrix Spike	Total Nitrogen	MS-B	L1752610-1, -2, -3
Matrix Spike	Total Nitrogen	MS-B	L1752610-1, -2, -3

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.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
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**
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- "BIOCHEMICAL OXYGEN DEMAND"
<p>This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.</p>			
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND
<p>This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.</p>			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
COD-COL-VA	Water	Chemical Oxygen Demand by Colorimetric	APHA 5220 D. CHEMICAL OXYGEN DEMAND
<p>This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.</p>			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
<p>This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.</p>			
ECOLI-COLI-ENV-VA	Water	E.coli by Colilert	APHA METHOD 9223
<p>This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.</p>			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
<p>Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.</p>			
HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)
<p>Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.</p>			
HG-DIS-CVAFS-VA	Water	Dissolved Hg in Water by CVAFS LOR=50ppt	APHA 3030B/EPA 1631E (mod)
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United</p>			

Reference Information

States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

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

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

HG-TOT-CVAFS-VA Water Total Hg in Water by CVAFS LOR=50ppt EPA 1631E (mod)

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

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

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

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

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

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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

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

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

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

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

N-T-COL-VA Water Total Nitrogen in water by Colour APHA Method 4500-P (J) / NEMI 5735

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

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

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

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

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

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

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

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

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

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

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

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

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

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

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

Reference Information

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

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

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

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

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

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

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

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

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

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

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

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

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

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

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

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

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

mg/L - milligrams per litre.

< - Less than.

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

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

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

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

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

Report To	Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company: City of Kelowna	<input type="checkbox"/> Standard <input type="checkbox"/> Other	<input checked="" type="radio"/> Regular (Standard Turnaround Times - Business Days)
Contact: Marcia Browne	<input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> Excel <input type="checkbox"/> Digital <input type="checkbox"/> Fax	<input type="radio"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address: 1595 Glenmore Road N. Kelowna BC V1V2C5	Email 1: mbrowne@kelowna.ca	<input type="radio"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
Phone: 250-469-8796 Fax: 250-862-3342	Email 2: mlewis@kelowna.ca	<input type="radio"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT
	Email 3: igordon@kelowna.ca	

Invoice To Same as Report? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Client / Project Information	Analysis Request																																																				
Hardcopy of Invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Job #: 1186-202 POND	Please indicate below Filtered, Preserved or both (F, P, F/P)																																																				
Company:	PO / AFE: 520747	<table border="1" style="width:100%; border-collapse: collapse; text-align: center;"> <tr> <td>Total metals</td> <td>Dissolved metals</td> <td>BOD, COD</td> <td>T. Coliform, E. Coli</td> <td>TSS, Ammonia</td> <td>O-PO4-P</td> <td>Total Nitrogen, TKN</td> <td>NO2-N, NO3-N</td> <td>Total hardness</td> <td>EC</td> <td>Chloride</td> <td>pH</td> <td rowspan="4" style="writing-mode: vertical-rl; transform: rotate(180deg);">Number of Containers</td> </tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table>		Total metals	Dissolved metals	BOD, COD	T. Coliform, E. Coli	TSS, Ammonia	O-PO4-P	Total Nitrogen, TKN	NO2-N, NO3-N	Total hardness	EC	Chloride	pH	Number of Containers																																						
Total metals	Dissolved metals			BOD, COD	T. Coliform, E. Coli	TSS, Ammonia	O-PO4-P	Total Nitrogen, TKN	NO2-N, NO3-N	Total hardness	EC	Chloride	pH	Number of Containers																																								
Contact:	LSD:																																																					
Address:	Quote #:																																																					
Phone: Fax:	ALS Contact: Dean Watt	Sampler:																																																				

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total metals	Dissolved metals	BOD, COD	T. Coliform, E. Coli	TSS, Ammonia	O-PO4-P	Total Nitrogen, TKN	NO2-N, NO3-N	Total hardness	EC	Chloride	pH	Number of Containers
	Commonage Drainage Pond	05-Apr-16	11:15	Surface Water	X	X	X	X	X	X	X	X	X	X	X	X	5
	Davidson Pond	05-Apr-16	9:00	Surface Water	X	X	X	X	X	X	X	X	X	X	X	X	5
	Rose's Pond	05-Apr-16	11:30	Surface Water	X	X	X	X	X	X	X	X	X	X	X	X	5



Short Holding Time
Rush Processing

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Please use CCME/ BC WQG guidelines for both Davidson Pond and Rose's Pond for Total Metals Analysis and continue using BC CSR guidelines for Commonage Drainage Pond.

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 provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)				SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF	
			Leon	APR - 6 2016	8:30	2 °C					



CITY OF KELOWNA
ATTN: Marcia Browne
1595 Glenmore Road N.
Kelowna BC V1V 2C5

Date Received: 04-MAY-16
Report Date: 12-MAY-16 17:05 (MT)
Version: FINAL

Client Phone: 250-469-8796

Certificate of Analysis

Lab Work Order #: L1763882
Project P.O. #: 520747
Job Reference: 1186-202 POND
C of C Numbers:
Legal Site Desc:

Dean Watt, B.Sc.
Account Manager

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

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1763882-1 SURFACE WATE 03-MAY-16 12:05 COMMONAGE DRAINAGE POND	L1763882-2 SURFACE WATE 03-MAY-16 11:05 DAVIDSON POND	L1763882-3 SURFACE WATE 03-MAY-16 12:20 ROSE'S POND	
Grouping	Analyte				
WATER					
Physical Tests	Conductivity (uS/cm)	1050	3100	5940	
	Hardness (as CaCO3) (mg/L)	305	566	1440	
	pH (pH)	9.11	8.81	8.62	
	Total Suspended Solids (mg/L)	22.4	3.4	5.8	
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.0232	0.0238	0.0321	
	Chloride (Cl) (mg/L)	105	304	479	
	Nitrate (as N) (mg/L)	0.029	<0.10 ^{DLDS}	<0.25 ^{DLDS}	
	Nitrite (as N) (mg/L)	0.0886	<0.020 ^{DLDS}	<0.050 ^{DLDS}	
	Total Kjeldahl Nitrogen (mg/L)	2.39	1.54	1.53	
	Total Nitrogen (mg/L)	2.98	1.55	1.55	
	Orthophosphate-Dissolved (as P) (mg/L)	0.464	<0.0010	0.0011	
Bacteriological Tests	E. coli (MPN/100mL)	<10	1	42	
	Coliform Bacteria - Total (MPN/100mL)	100	365	387	
Total Metals	Aluminum (Al)-Total (mg/L)	0.066	<0.0060 ^{DLA}	<0.015 ^{DLA}	
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	0.00071	
	Arsenic (As)-Total (mg/L)	0.0013	0.00298	0.00475	
	Barium (Ba)-Total (mg/L)	0.027	<0.020	<0.020	
	Beryllium (Be)-Total (mg/L)	<0.0050	<0.0010	<0.0010	
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	
	Boron (B)-Total (mg/L)	0.15	<0.10	<0.10	
	Cadmium (Cd)-Total (mg/L)	<0.000050	<0.000010 ^{DLA}	<0.000025 ^{DLA}	
	Calcium (Ca)-Total (mg/L)	65.5	66.4	70.9	
	Chromium (Cr)-Total (mg/L)	<0.00050	<0.0010	<0.0010	
	Cobalt (Co)-Total (mg/L)	<0.00050	<0.00030	<0.00050 ^{DLA}	
	Copper (Cu)-Total (mg/L)	0.0039	0.0012	<0.0025 ^{DLA}	
	Iron (Fe)-Total (mg/L)	0.130	<0.030	<0.030	
	Lead (Pb)-Total (mg/L)	<0.0010	<0.00050	<0.00050	
	Lithium (Li)-Total (mg/L)	<0.050	0.0402	0.0592	
	Magnesium (Mg)-Total (mg/L)	30.4	89.8	308	
	Manganese (Mn)-Total (mg/L)	0.109	0.0405	0.0511	
	Mercury (Hg)-Total (mg/L)	<0.00020	<0.0000050	<0.0000050	
	Molybdenum (Mo)-Total (mg/L)	0.0052	0.0017	0.0019	
	Nickel (Ni)-Total (mg/L)	<0.0050	0.0019	<0.0025 ^{DLA}	
	Phosphorus (P)-Total (mg/L)	0.93	<0.30	<0.30	
	Potassium (K)-Total (mg/L)	19.9	37.7	91.6	
Selenium (Se)-Total (mg/L)	<0.0010	0.00011	<0.00025 ^{DLA}		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1763882-1 SURFACE WATE 03-MAY-16 12:05 COMMONAGE DRAINAGE POND	L1763882-2 SURFACE WATE 03-MAY-16 11:05 DAVIDSON POND	L1763882-3 SURFACE WATE 03-MAY-16 12:20 ROSE'S POND	
Grouping	Analyte				
WATER					
Total Metals	Silicon (Si)-Total (mg/L)	3.56	0.340	0.253	
	Silver (Ag)-Total (mg/L)	<0.000050	<0.000020	<0.000050 ^{DLA}	
	Sodium (Na)-Total (mg/L)	110	487	969	
	Strontium (Sr)-Total (mg/L)	0.642	0.779	0.693	
	Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	
	Tin (Sn)-Total (mg/L)	<0.030	<0.00050	<0.00050	
	Titanium (Ti)-Total (mg/L)	<0.050	0.012	0.013	
	Uranium (U)-Total (mg/L)	0.00265	0.00611	0.00574	
	Vanadium (V)-Total (mg/L)	<0.030	<0.0010 ^{DLA}	<0.0025 ^{DLA}	
	Zinc (Zn)-Total (mg/L)	0.0240	<0.0050	<0.0050	
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	
	Aluminum (Al)-Dissolved (mg/L)	0.015	<0.0050	<0.0050	
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	0.00062	
	Arsenic (As)-Dissolved (mg/L)	0.0012	0.00328	0.00463	
	Barium (Ba)-Dissolved (mg/L)	0.026	<0.020	<0.020	
	Beryllium (Be)-Dissolved (mg/L)	<0.0050	<0.0010	<0.0010	
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.20	
	Boron (B)-Dissolved (mg/L)	0.15	<0.10	<0.10	
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050	<0.000010 ^{DLA}	<0.000025 ^{DLA}	
	Calcium (Ca)-Dissolved (mg/L)	70.2	70.6	72.5	
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.0010	<0.0010	
	Cobalt (Co)-Dissolved (mg/L)	<0.00050	<0.00030	<0.00050 ^{DLA}	
	Copper (Cu)-Dissolved (mg/L)	0.0024	<0.0010	<0.0010	
	Iron (Fe)-Dissolved (mg/L)	<0.030	<0.030	<0.030	
	Lead (Pb)-Dissolved (mg/L)	<0.0010	<0.00050	<0.00050	
	Lithium (Li)-Dissolved (mg/L)	<0.050	0.0427	0.0614	
	Magnesium (Mg)-Dissolved (mg/L)	31.4	94.6	307	
	Manganese (Mn)-Dissolved (mg/L)	<0.010	0.0343	0.0373	
	Mercury (Hg)-Dissolved (mg/L)	<0.00020	<0.0000050	<0.0000050	
	Molybdenum (Mo)-Dissolved (mg/L)	0.0049	0.0011	0.0018	
	Nickel (Ni)-Dissolved (mg/L)	<0.0050	0.0016	<0.0025 ^{DLA}	
	Phosphorus (P)-Dissolved (mg/L)	0.64	<0.30	<0.30	
	Potassium (K)-Dissolved (mg/L)	21.1	39.1	92.7	
	Selenium (Se)-Dissolved (mg/L)	<0.0010	0.00012	<0.00025 ^{DLA}	
	Silicon (Si)-Dissolved (mg/L)	3.61	0.261	0.248	
	Silver (Ag)-Dissolved (mg/L)	<0.000050	0.000025	<0.000050 ^{DLA}	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1763882-1	L1763882-2	L1763882-3		
		Description	SURFACE WATE	SURFACE WATE	SURFACE WATE		
		Sampled Date	03-MAY-16	03-MAY-16	03-MAY-16		
		Sampled Time	12:05	11:05	12:20		
		Client ID	COMMONAGE DRAINAGE POND	DAVIDSON POND	ROSE'S POND		
Grouping	Analyte						
WATER							
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)	118	510	983			
	Strontium (Sr)-Dissolved (mg/L)	0.682	0.820	0.707			
	Thallium (Tl)-Dissolved (mg/L)	<0.00010	<0.00020	<0.00020			
	Tin (Sn)-Dissolved (mg/L)	<0.030	<0.00050	<0.00050			
	Titanium (Ti)-Dissolved (mg/L)	<0.050	0.013	0.012			
	Uranium (U)-Dissolved (mg/L)	0.00185	0.00627	0.00586			
	Vanadium (V)-Dissolved (mg/L)	<0.030	<0.0010 ^{DLA}	<0.0025 ^{DLA}			
	Zinc (Zn)-Dissolved (mg/L)	0.0194	<0.0050	<0.0050			
Aggregate Organics	BOD (mg/L)	7.3	<2.0	<2.0			
	COD (mg/L)	60	56	56			

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

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
LPML	Lab-Preserved for Total Metals. Sample received with pH > 2 and preserved at the lab. Total Metals results may be biased low.
WSMD	Water sample(s) for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Nitrite (as N)	DLDS	L1763882-1, -2, -3
Duplicate	Cadmium (Cd)-Dissolved	DLM	L1763882-1, -2, -3
Method Blank	Chromium (Cr)-Total	MB-LOR	L1763882-1, -2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1763882-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1763882-1, -2, -3
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1763882-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1763882-1, -2, -3
Matrix Spike	Total Nitrogen	MS-B	L1763882-2, -3
Matrix Spike	Total Nitrogen	MS-B	L1763882-2, -3
Matrix Spike	Calcium (Ca)-Total	MS-B	L1763882-1, -2, -3
Matrix Spike	Silicon (Si)-Total	MS-B	L1763882-1, -2, -3
Matrix Spike	Strontium (Sr)-Total	MS-B	L1763882-1, -2, -3
Matrix Spike	Total Nitrogen	MS-B	L1763882-1
Matrix Spike	Total Nitrogen	MS-B	L1763882-1
Matrix Spike	Antimony (Sb)-Total	MS-B	L1763882-1, -2, -3
Matrix Spike	Arsenic (As)-Total	MS-B	L1763882-1, -2, -3
Matrix Spike	Manganese (Mn)-Total	MS-B	L1763882-1, -2, -3
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1763882-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1763882-1, -2, -3

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.
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**
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- "BIOCHEMICAL OXYGEN DEMAND"
<p>This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.</p>			
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND
<p>This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.</p>			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
COD-COL-VA	Water	Chemical Oxygen Demand by Colorimetric	APHA 5220 D. CHEMICAL OXYGEN DEMAND
<p>This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.</p>			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
<p>This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.</p>			

Reference Information

ECOLI-COLI-ENV-VA	Water	E.coli by Colilert	APHA METHOD 9223
<p>This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.</p>			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
<p>Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO₃ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.</p>			
HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)
<p>Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.</p>			
HG-DIS-CVAFS-VA	Water	Dissolved Hg in Water by CVAFS LOR=50ppt	APHA 3030B/EPA 1631E (mod)
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).</p>			
HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)
<p>Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.</p>			
HG-TOT-CVAFS-VA	Water	Total Hg in Water by CVAFS LOR=50ppt	EPA 1631E (mod)
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).</p>			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
<p>Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.</p>			
<p>Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.</p>			
MET-DIS-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA SW-846 3005A/6010B
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).</p>			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
<p>Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.</p>			
<p>Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.</p>			
MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B
<p>This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).</p>			
N-T-COL-VA	Water	Total Nitrogen in water by Colour	APHA Method 4500-P (J) / NEMI 5735
<p>This analysis is carried out using procedures adapted from APHA Method 4500-P (J) "Persulphate Method for Simultaneous Determination of Total Nitrogen and Total Phosphorus" and National Environmental Methods Index - Nemi method 5735.</p>			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
<p>This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.</p>			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
<p>This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.</p>			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Reference Information

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Chain of Custody Numbers:

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.



CITY OF KELOWNA
ATTN: Marcia Browne
1595 Glenmore Road N.
Kelowna BC V1V 2C5

Date Received: 02-JUN-16
Report Date: 15-JUN-16 18:29 (MT)
Version: FINAL

Client Phone: 250-469-8796

Certificate of Analysis

Lab Work Order #: L1777367
Project P.O. #: 520747
Job Reference: 1186-202 POND
C of C Numbers:
Legal Site Desc:

Dean Watt, B.Sc.
Account Manager

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

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ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1777367-1	L1777367-2	L1777367-3
		Description	Surface Water	Surface Water	Surface Water
		Sampled Date	01-JUN-16	01-JUN-16	01-JUN-16
		Sampled Time	11:30	10:45	10:20
		Client ID	COMMONAGE DRAINAGE POND	DAVIDSON POND	ROSE'S POND
Grouping	Analyte				
WATER					
Physical Tests	Conductivity (uS/cm)	992	3250	6350	
	Hardness (as CaCO3) (mg/L)	247	561	1460	
	pH (pH)	8.17	8.66	8.57	
	Total Suspended Solids (mg/L)	7.5	<3.0	5.5	
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	1.55	0.0208	0.0210	
	Chloride (Cl) (mg/L)	98.7	312	515	
	Nitrate (as N) (mg/L)	0.521	<0.10 ^{DLDS}	<0.25 ^{DLDS}	
	Nitrite (as N) (mg/L)	0.0606	<0.020 ^{DLDS}	<0.050 ^{DLDS}	
	Total Kjeldahl Nitrogen (mg/L)	3.08	2.49	1.54	
	Total Nitrogen (mg/L)	3.66	2.49	1.54	
	Orthophosphate-Dissolved (as P) (mg/L)	0.968	<0.0010	<0.0010	
Bacteriological Tests	E. coli (MPN/100mL)	70	<1	11	
	Coliform Bacteria - Total (MPN/100mL)	>24196	387	921	^{DLA}
Total Metals	Aluminum (Al)-Total (mg/L)	0.116	0.0063	<0.015	
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	0.00054	
	Arsenic (As)-Total (mg/L)	0.0011	0.00317	0.00441	
	Barium (Ba)-Total (mg/L)	0.029	<0.020	<0.020	
	Beryllium (Be)-Total (mg/L)	<0.0050	<0.0010	<0.0010	
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	
	Boron (B)-Total (mg/L)	0.16	<0.10	<0.10	
	Cadmium (Cd)-Total (mg/L)	<0.000050	<0.000010 ^{DLA}	<0.000025 ^{DLA}	
	Calcium (Ca)-Total (mg/L)	58.9	64.1	62.2	
	Chromium (Cr)-Total (mg/L)	<0.00050	<0.0010	<0.0010	
	Cobalt (Co)-Total (mg/L)	<0.00050	<0.00030	<0.00050 ^{DLA}	
	Copper (Cu)-Total (mg/L)	0.0036	0.0010	<0.0025 ^{DLA}	
	Iron (Fe)-Total (mg/L)	0.225	<0.030	<0.030	
	Lead (Pb)-Total (mg/L)	<0.0010	<0.00050	<0.00050	
	Lithium (Li)-Total (mg/L)	<0.050	0.0423	0.0601	
	Magnesium (Mg)-Total (mg/L)	23.8	93.1	300	
	Manganese (Mn)-Total (mg/L)	0.158	0.0415	0.0312	
	Mercury (Hg)-Total (mg/L)	<0.00020	<0.0000050	<0.0000050	
	Molybdenum (Mo)-Total (mg/L)	0.0045	<0.0010	0.0014	
	Nickel (Ni)-Total (mg/L)	<0.0050	0.0014	<0.0025 ^{DLA}	
	Phosphorus (P)-Total (mg/L)	1.20	<0.30	<0.30	
Potassium (K)-Total (mg/L)	22.0	40.4	83.8		
Selenium (Se)-Total (mg/L)	<0.0010	<0.00010 ^{DLA}	<0.00025 ^{DLA}		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1777367-1	L1777367-2	L1777367-3
		Description	Surface Water	Surface Water	Surface Water
		Sampled Date	01-JUN-16	01-JUN-16	01-JUN-16
		Sampled Time	11:30	10:45	10:20
		Client ID	COMMONAGE DRAINAGE POND	DAVIDSON POND	ROSE'S POND
Grouping	Analyte				
WATER					
Total Metals	Silicon (Si)-Total (mg/L)		3.54	1.05	0.129
	Silver (Ag)-Total (mg/L)		<0.000050	<0.000020	<0.000050 ^{DLA}
	Sodium (Na)-Total (mg/L)		103	481	935
	Strontium (Sr)-Total (mg/L)		0.566	0.783	0.600
	Thallium (Tl)-Total (mg/L)		<0.00020	<0.00020	<0.00020
	Tin (Sn)-Total (mg/L)		<0.030	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)		<0.050	<0.010	<0.010
	Uranium (U)-Total (mg/L)		0.00204	0.00540	0.00486
	Vanadium (V)-Total (mg/L)		<0.030	<0.0010 ^{DLA}	<0.0025 ^{DLA}
	Zinc (Zn)-Total (mg/L)		0.0229	<0.0050	<0.0050
Dissolved Metals	Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location		FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)		0.013	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)		<0.00050	<0.00050	0.00051
	Arsenic (As)-Dissolved (mg/L)		0.0010	0.00333	0.00442
	Barium (Ba)-Dissolved (mg/L)		0.026	<0.020	<0.020
	Beryllium (Be)-Dissolved (mg/L)		<0.0050	<0.0010	<0.0010
	Bismuth (Bi)-Dissolved (mg/L)		<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)		0.16	<0.10	<0.10
	Cadmium (Cd)-Dissolved (mg/L)		<0.000050	<0.000010 ^{DLA}	<0.000025 ^{DLA}
	Calcium (Ca)-Dissolved (mg/L)		59.7	66.5	65.9
	Chromium (Cr)-Dissolved (mg/L)		<0.00050	<0.0010	<0.0010
	Cobalt (Co)-Dissolved (mg/L)		<0.00050	<0.00030	<0.00050 ^{DLA}
	Copper (Cu)-Dissolved (mg/L)		0.0021	<0.0010	<0.0010
	Iron (Fe)-Dissolved (mg/L)		0.053	<0.030	<0.030
	Lead (Pb)-Dissolved (mg/L)		<0.0010	<0.00050	<0.00050
	Lithium (Li)-Dissolved (mg/L)		<0.050	0.0444	0.0615
	Magnesium (Mg)-Dissolved (mg/L)		23.9	95.8	315
	Manganese (Mn)-Dissolved (mg/L)		0.139	0.0302	0.00671
	Mercury (Hg)-Dissolved (mg/L)		<0.00020	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)		0.0041	<0.0010	0.0014
	Nickel (Ni)-Dissolved (mg/L)		<0.0050	0.0013	<0.0025 ^{DLA}
	Phosphorus (P)-Dissolved (mg/L)		1.15	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)		21.7	40.4	86.7
	Selenium (Se)-Dissolved (mg/L)		<0.0010	0.00012	<0.00025 ^{DLA}
	Silicon (Si)-Dissolved (mg/L)		3.35	1.06	0.104
	Silver (Ag)-Dissolved (mg/L)		<0.000050	<0.000020	<0.000050 ^{DLA}

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1777367-1	L1777367-2	L1777367-3		
		Description	Surface Water	Surface Water	Surface Water		
		Sampled Date	01-JUN-16	01-JUN-16	01-JUN-16		
		Sampled Time	11:30	10:45	10:20		
		Client ID	COMMONAGE DRAINAGE POND	DAVIDSON POND	ROSE'S POND		
Grouping	Analyte						
WATER							
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)	103	488	968			
	Strontium (Sr)-Dissolved (mg/L)	0.568	0.803	0.623			
	Thallium (Tl)-Dissolved (mg/L)	<0.00010	<0.00020	<0.00020			
	Tin (Sn)-Dissolved (mg/L)	<0.030	<0.00050	<0.00050			
	Titanium (Ti)-Dissolved (mg/L)	<0.050	<0.010	<0.010			
	Uranium (U)-Dissolved (mg/L)	0.00173	0.00537	0.00483			
	Vanadium (V)-Dissolved (mg/L)	<0.030	<0.0010 ^{DLA}	<0.0025 ^{DLA}			
	Zinc (Zn)-Dissolved (mg/L)	0.0248	<0.0050	<0.0050			
Aggregate Organics	BOD (mg/L)	3.7	<2.0	<2.0			
	COD (mg/L)	37	61	61			

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

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
LPML	Lab-Preserved for Total Metals. Sample received with pH > 2 and preserved at the lab. Total Metals results may be biased low.
WSMD	Water sample(s) for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Aluminum (Al)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Antimony (Sb)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Beryllium (Be)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Chromium (Cr)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Cobalt (Co)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Lead (Pb)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Nickel (Ni)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Silver (Ag)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Thallium (Tl)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Tin (Sn)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Aluminum (Al)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Beryllium (Be)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Cadmium (Cd)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Chromium (Cr)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Cobalt (Co)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Copper (Cu)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Lead (Pb)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Nickel (Ni)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Selenium (Se)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Silver (Ag)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Thallium (Tl)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Tin (Sn)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Vanadium (V)-Dissolved	DLA	L1777367-1, -2, -3
Duplicate	Nitrite (as N)	DLDS	L1777367-1, -2, -3
Duplicate	Nitrate (as N)	DLDS	L1777367-1, -2, -3
Duplicate	Nitrite (as N)	DLDS	L1777367-1, -2, -3
Duplicate	Nitrate (as N)	DLDS	L1777367-1, -2, -3
Duplicate	Cadmium (Cd)-Dissolved	DLM	L1777367-1, -2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1777367-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1777367-1, -2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1777367-1, -2, -3
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1777367-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1777367-1, -2, -3
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1777367-1, -2, -3
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1777367-1, -2, -3
Matrix Spike	Copper (Cu)-Dissolved	MS-B	L1777367-1, -2, -3
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1777367-1, -2, -3
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1777367-1, -2, -3
Matrix Spike	Silicon (Si)-Total	MS-B	L1777367-1, -2, -3
Matrix Spike	Aluminum (Al)-Total	MS-B	L1777367-1, -2, -3
Matrix Spike	Aluminum (Al)-Dissolved	MS-B	L1777367-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1777367-1, -2, -3
Matrix Spike	Nickel (Ni)-Dissolved	MS-B	L1777367-1, -2, -3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
	Detection Limit adjusted for required dilution

Reference Information

DLA	
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- "BIOCHEMICAL OXYGEN DEMAND"
		This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.	
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND
		This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.	
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.	
COD-COL-VA	Water	Chemical Oxygen Demand by Colorimetric	APHA 5220 D. CHEMICAL OXYGEN DEMAND
		This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.	
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
		This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.	
ECOLI-COLI-ENV-VA	Water	E.coli by Collert	APHA METHOD 9223
		This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.	
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
		Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.	
HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)
		Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.	
HG-DIS-CVAFS-VA	Water	Dissolved Hg in Water by CVAFS LOR=50ppt	APHA 3030B/EPA 1631E (mod)
		This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).	
HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)
		Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.	
HG-TOT-CVAFS-VA	Water	Total Hg in Water by CVAFS LOR=50ppt	EPA 1631E (mod)
		This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).	
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
		Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.	
		Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.	
MET-DIS-ICP-VA	Water	Dissolved Metals in Water by ICPOES	EPA SW-846 3005A/6010B

Reference Information

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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

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

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

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

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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

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

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

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

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

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

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

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

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

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.

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

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

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

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

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

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

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

TKN-CALC-VA Water TKN in Water (Calculation) BC MOE LABORATORY MANUAL (2005)

Total Kjeldahl Nitrogen is a calculated parameter. Total Kjeldahl Nitrogen (calc) = Total Nitrogen - [Nitrite (as N) + Nitrate (as N)].

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

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

Reference Information

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

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

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

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

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

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

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

mg/L - milligrams per litre.

< - Less than.

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

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

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

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

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



Report To		Report Format / Distribution				Service Requested (Rush for routine analysis subject to availability)									
Company: City of Kelowna		<input type="checkbox"/> Standard <input type="checkbox"/> Other <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> Excel <input type="checkbox"/> Digital <input type="checkbox"/> Fax				<input checked="" type="radio"/> Regular (Standard Turnaround Times - Business Days) <input type="radio"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT <input type="radio"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT <input type="radio"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT									
Contact: Marcia Browne		Email 1: mbrowne@kelowna.ca													
Address: 1595 Glenmore Road N. Kelowna BC V1V2C5		Email 2: mlewis@kelowna.ca													
Phone: 250-469-8796 Fax: 250-862-3342		Email 3: igordon@kelowna.ca													

Invoice To Same as Report? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Client / Project Information				Please indicate below Filtered, Preserved or both (F, P, F/P)													
Hardcopy of Invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Job #: 1186-202 POND																	
Company:		PO / AFE: 520747																	
Contact:		LSD:																	
Address:		Quote #:																	
Phone:		ALS Contact: Dean Watt				Sampler:													



L1777367-COFC

Sample #	Description	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total metals	Dissolved metals	BOD, COD	T. Coliform, E. Coli	TSS, Ammonia	O-PO4-P	Total Nitrogen, TKN	NO2-N, NO3-N	Total hardness	EC	Chloride	pH	Number of Containers
	Commonage Drainage Pond	01-Jun-16	11:30	Surface Water	X	X	X	X	X	X	X	X	X	X	X	X	5
	Davidson Pond	01-Jun-16	10:45	Surface Water	X	X	X	X	X	X	X	X	X	X	X	X	5
	Rose's Pond	01-Jun-16	10:20	Surface Water	X	X	X	X	X	X	X	X	X	X	X	X	5

Short Holding Time
Rush Processing

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Please use CCME/ BC WQG guidelines for both Davidson Pond and Rose's Pond for Total Metals Analysis and continue using BC CSR guidelines for Commonage Drainage Pond.

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 provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
			<i>lady</i>	<i>June 2</i>	<i>8:30 AM</i>	<i>5 °C</i>				



CITY OF KELOWNA
ATTN: Marcia Browne
1595 Glenmore Road N.
Kelowna BC V1V 2C5

Date Received: 07-JUL-16
Report Date: 15-JUL-16 12:59 (MT)
Version: FINAL

Client Phone: 250-469-8796

Certificate of Analysis

Lab Work Order #: L1794599
Project P.O. #: 520747
Job Reference: 1186-202 POND
C of C Numbers:
Legal Site Desc:

Dean Watt, B.Sc.
Account Manager

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

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1794599-1 Surface Water 05-JUL-16 12:30 COMMONAGE DRAINAGE POND	L1794599-2 Surface Water 05-JUL-16 10:45 DAVIDSON POND	L1794599-3 Surface Water 05-JUL-16 13:00 ROSE'S POND	
Grouping	Analyte				
WATER					
Physical Tests	Conductivity (uS/cm)	919	3140	6050	
	Hardness (as CaCO3) (mg/L)	225	540	1440	
	pH (pH)	8.03	8.77	8.72	
	Total Suspended Solids (mg/L)	24.8	6.0	4.6	
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	1.84	0.0143	0.0184	
	Chloride (Cl) (mg/L)	102	307	533	DLDS
	Nitrate (as N) (mg/L)	0.408	<0.10	<0.25	DLDS
	Nitrite (as N) (mg/L)	0.159	<0.020	<0.050	DLDS
	Total Kjeldahl Nitrogen (mg/L)	2.81	1.72	1.64	
	Total Nitrogen (mg/L)	3.38	1.72	1.64	
	Orthophosphate-Dissolved (as P) (mg/L)	2.01	<0.0010	<0.0010	
Bacteriological Tests	E. coli (MPN/100mL)	411	<1	326	PEHR
	Coliform Bacteria - Total (MPN/100mL)	64900	>2419.6	>2419.6	PEHR
Total Metals	Aluminum (Al)-Total (mg/L)	0.080	<0.0060	0.021	
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	0.00063	
	Arsenic (As)-Total (mg/L)	0.0023	0.00358	0.00519	
	Barium (Ba)-Total (mg/L)	0.027	<0.020	<0.020	
	Beryllium (Be)-Total (mg/L)	<0.0050	<0.0010	<0.0010	
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.20	
	Boron (B)-Total (mg/L)	0.17	<0.10	<0.10	
	Cadmium (Cd)-Total (mg/L)	<0.000050	<0.000010	<0.000025	DLA
	Calcium (Ca)-Total (mg/L)	54.4	59.9	59.1	
	Chromium (Cr)-Total (mg/L)	<0.00050	<0.0010	<0.0010	
	Cobalt (Co)-Total (mg/L)	<0.00050	<0.00030	<0.00050	DLA
	Copper (Cu)-Total (mg/L)	0.0070	<0.0010	<0.0025	DLA
	Iron (Fe)-Total (mg/L)	0.179	<0.030	<0.030	
	Lead (Pb)-Total (mg/L)	<0.0010	<0.00050	<0.00050	
	Lithium (Li)-Total (mg/L)	<0.050	0.0474	0.0647	
	Magnesium (Mg)-Total (mg/L)	22.1	97.7	314	
	Manganese (Mn)-Total (mg/L)	0.124	0.0110	0.0355	
	Mercury (Hg)-Total (mg/L)	<0.00020	<0.0000050	<0.0000050	
	Molybdenum (Mo)-Total (mg/L)	0.0055	<0.0010	0.0014	
	Nickel (Ni)-Total (mg/L)	<0.0050	0.0017	<0.0025	DLA
	Phosphorus (P)-Total (mg/L)	2.99	<0.30	<0.30	
	Potassium (K)-Total (mg/L)	25.5	41.1	92.7	
	Selenium (Se)-Total (mg/L)	<0.0010	<0.00010	<0.00025	DLA

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1794599-1	L1794599-2	L1794599-3
		Description	Surface Water	Surface Water	Surface Water
		Sampled Date	05-JUL-16	05-JUL-16	05-JUL-16
		Sampled Time	12:30	10:45	13:00
		Client ID	COMMONAGE DRAINAGE POND	DAVIDSON POND	ROSE'S POND
Grouping	Analyte				
WATER					
Total Metals	Silicon (Si)-Total (mg/L)		3.75	1.46	0.348
	Silver (Ag)-Total (mg/L)		<0.000050	<0.000020	<0.000050 ^{DLA}
	Sodium (Na)-Total (mg/L)		99.8	520	991
	Strontium (Sr)-Total (mg/L)		0.549	0.832	0.580
	Thallium (Tl)-Total (mg/L)		<0.00020	<0.00020	<0.00020
	Tin (Sn)-Total (mg/L)		<0.030	<0.00050	<0.00050
	Titanium (Ti)-Total (mg/L)		<0.050	<0.010	<0.010
	Uranium (U)-Total (mg/L)		0.00224	0.00583	0.00518
	Vanadium (V)-Total (mg/L)		<0.030	<0.0010 ^{DLA}	<0.0025 ^{DLA}
	Zinc (Zn)-Total (mg/L)		0.0191	<0.0050	<0.0050
Dissolved Metals	Dissolved Mercury Filtration Location		FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location		FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)		0.030	<0.0050	<0.0050
	Antimony (Sb)-Dissolved (mg/L)		<0.00050	<0.00050	0.00057
	Arsenic (As)-Dissolved (mg/L)		0.0021	0.00316	0.00502
	Barium (Ba)-Dissolved (mg/L)		0.020	<0.020	<0.020
	Beryllium (Be)-Dissolved (mg/L)		<0.0050	<0.0010	<0.0010
	Bismuth (Bi)-Dissolved (mg/L)		<0.20	<0.20	<0.20
	Boron (B)-Dissolved (mg/L)		0.16	<0.10	0.11
	Cadmium (Cd)-Dissolved (mg/L)		<0.000050	<0.000010 ^{DLA}	<0.000025 ^{DLA}
	Calcium (Ca)-Dissolved (mg/L)		53.8	58.3	59.0
	Chromium (Cr)-Dissolved (mg/L)		<0.00050	<0.0010	<0.0010
	Cobalt (Co)-Dissolved (mg/L)		<0.00050	<0.00030	<0.00050 ^{DLA}
	Copper (Cu)-Dissolved (mg/L)		0.0048	<0.0010	<0.0010
	Iron (Fe)-Dissolved (mg/L)		0.072	<0.030	<0.030
	Lead (Pb)-Dissolved (mg/L)		<0.0010	<0.00050	<0.00050
	Lithium (Li)-Dissolved (mg/L)		<0.050	0.0453	0.0625
	Magnesium (Mg)-Dissolved (mg/L)		22.1	95.8	314
	Manganese (Mn)-Dissolved (mg/L)		0.050	0.00362	0.0208
	Mercury (Hg)-Dissolved (mg/L)		<0.00020	<0.0000050	<0.0000050
	Molybdenum (Mo)-Dissolved (mg/L)		0.0052	<0.0010	0.0014
	Nickel (Ni)-Dissolved (mg/L)		<0.0050	0.0016	<0.0025 ^{DLA}
	Phosphorus (P)-Dissolved (mg/L)		2.58	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)		25.4	40.1	92.9
	Selenium (Se)-Dissolved (mg/L)		<0.0010	0.00012	<0.00025 ^{DLA}
	Silicon (Si)-Dissolved (mg/L)		3.62	1.40	0.301
	Silver (Ag)-Dissolved (mg/L)		<0.000050	<0.000020	<0.000050 ^{DLA}

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1794599-1	L1794599-2	L1794599-3		
		Description	Surface Water	Surface Water	Surface Water		
		Sampled Date	05-JUL-16	05-JUL-16	05-JUL-16		
		Sampled Time	12:30	10:45	13:00		
		Client ID	COMMONAGE DRAINAGE POND	DAVIDSON POND	ROSE'S POND		
Grouping	Analyte						
WATER							
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)	99.5	506	990			
	Strontium (Sr)-Dissolved (mg/L)	0.542	0.808	0.578			
	Thallium (Tl)-Dissolved (mg/L)	<0.00010	<0.00020	<0.00020			
	Tin (Sn)-Dissolved (mg/L)	<0.030	<0.00050	<0.00050			
	Titanium (Ti)-Dissolved (mg/L)	<0.050	<0.010	<0.010			
	Uranium (U)-Dissolved (mg/L)	0.00210	0.00538	0.00505			
	Vanadium (V)-Dissolved (mg/L)	<0.030	<0.0010 ^{DLA}	<0.0025 ^{DLA}			
	Zinc (Zn)-Dissolved (mg/L)	0.0181	<0.0050	<0.0050			
Aggregate Organics	BOD (mg/L)	10.8	<2.0	<2.0			
	COD (mg/L)	102	58	59			

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

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
WSMT	Water sample(s) for total mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.
WSMD	Water sample(s) for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Nitrite (as N)	DLDS	L1794599-1, -2, -3
Duplicate	Nitrate (as N)	DLDS	L1794599-1, -2, -3
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1794599-1, -2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1794599-1, -2, -3
Matrix Spike	Iron (Fe)-Dissolved	MS-B	L1794599-1, -2, -3
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1794599-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1794599-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1794599-1, -2, -3
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1794599-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1794599-1, -2, -3
Matrix Spike	Total Nitrogen	MS-B	L1794599-2, -3
Matrix Spike	Total Nitrogen	MS-B	L1794599-2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1794599-1, -2, -3
Matrix Spike	Uranium (U)-Dissolved	MS-B	L1794599-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1794599-1, -2, -3
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1794599-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1794599-1, -2, -3
Matrix Spike	Silicon (Si)-Total	MS-B	L1794599-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1794599-1, -2, -3
Matrix Spike	Aluminum (Al)-Total	MS-B	L1794599-1, -2, -3
Matrix Spike	Copper (Cu)-Total	MS-B	L1794599-1, -2, -3

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

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- "BIOCHEMICAL OXYGEN DEMAND"
<p>This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.</p>			
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND
<p>This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.</p>			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
COD-COL-VA	Water	Chemical Oxygen Demand by Colorimetric	APHA 5220 D. CHEMICAL OXYGEN DEMAND
<p>This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.</p>			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

Reference Information

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

ECOLI-COLI-ENV-VA Water E.coli by Colilert APHA METHOD 9223

This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.

HARDNESS-CALC-VA Water Hardness APHA 2340B

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

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-DIS-CVAFS-VA Water Dissolved Hg in Water by CVAFS LOR=50ppt APHA 3030B/EPA 1631E (mod)

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

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

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

HG-TOT-CVAFS-VA Water Total Hg in Water by CVAFS LOR=50ppt EPA 1631E (mod)

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

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

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

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

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

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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

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

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

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

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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

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

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

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

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

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

Reference Information

NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H "pH Value"
This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode			
It is recommended that this analysis be conducted in the field.			
PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value
This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode			
It is recommended that this analysis be conducted in the field.			
PO4-DO-COL-VA	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.			
TCOLI-COLI-ENV-VA	Water	Total coliform by Colilert	APHA METHOD 9223
This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is quantified by a statistical estimation of bacteria density (most probable number).			
TKN-CALC-VA	Water	TKN in Water (Calculation)	BC MOE LABORATORY MANUAL (2005)
Total Kjeldahl Nitrogen is a calculated parameter. Total Kjeldahl Nitrogen (calc) = Total Nitrogen - [Nitrite (as N) + Nitrate (as N)].			
TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC
This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.			

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

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

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

Chain of Custody Numbers:

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.



CITY OF KELOWNA
ATTN: Marcia Browne
1595 Glenmore Road N.
Kelowna BC V1V 2C5

Date Received: 11-AUG-16
Report Date: 19-AUG-16 17:51 (MT)
Version: FINAL

Client Phone: 250-469-8796

Certificate of Analysis

Lab Work Order #: L1811981
Project P.O. #: 520747
Job Reference: 1186-202 POND
C of C Numbers:
Legal Site Desc:

Dean Watt, B.Sc.
Account Manager

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ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1811981-1 SURFACE WATE 10-AUG-16 13:15 COMMONAGE DRAINAGE POND	L1811981-2 SURFACE WATE 10-AUG-16 13:00 DAVIDSON POND	L1811981-3 SURFACE WATE 10-AUG-16 12:45 ROSE'S POND		
Grouping	Analyte					
WATER						
Physical Tests	Conductivity (uS/cm)	961	3470	6800		
	Hardness (as CaCO3) (mg/L)	234	563	1570		
	pH (pH)	8.19	8.82	8.76		
	Total Suspended Solids (mg/L)	5.0	3.4	3.8		
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	0.965	0.0455	0.0520		
	Chloride (Cl) (mg/L)	99.2	336	632		
	Nitrate (as N) (mg/L)	0.533	<0.10 ^{DLDS}	<0.25 ^{DLDS}		
	Nitrite (as N) (mg/L)	0.127	<0.020 ^{DLDS}	<0.050 ^{DLDS}		
	Total Kjeldahl Nitrogen (mg/L)	2.77	1.73	1.61		
	Total Nitrogen (mg/L)	3.26	1.81	1.66		
	Orthophosphate-Dissolved (as P) (mg/L)	1.21	0.0010	0.0020		
Bacteriological Tests	E. coli (MPN/100mL)	130000	21	<1		
	Coliform Bacteria - Total (MPN/100mL)	>241960	>241960	<1		
Total Metals	Aluminum (Al)-Total (mg/L)	0.088	0.0435	0.024		
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	0.00060		
	Arsenic (As)-Total (mg/L)	0.0011	0.00347	0.00501		
	Barium (Ba)-Total (mg/L)	0.033	<0.020	<0.020		
	Beryllium (Be)-Total (mg/L)	<0.0050	<0.0010	<0.0010		
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.40 ^{DLHC}		
	Boron (B)-Total (mg/L)	0.14	<0.10 ^{DLA}	<0.20 ^{DLHC}		
	Cadmium (Cd)-Total (mg/L)	<0.000050	<0.000010 ^{DLA}	<0.000025 ^{DLA}		
	Calcium (Ca)-Total (mg/L)	54.5	54.9	52.8		
	Chromium (Cr)-Total (mg/L)	0.00177	<0.0010	<0.0010		
	Cobalt (Co)-Total (mg/L)	<0.00050	<0.00030	<0.00050 ^{DLA}		
	Copper (Cu)-Total (mg/L)	0.0047	<0.0010	<0.0025 ^{DLA}		
	Iron (Fe)-Total (mg/L)	0.141	0.054	<0.060 ^{DLHC}		
	Lead (Pb)-Total (mg/L)	<0.0010	<0.00050	<0.00050		
	Lithium (Li)-Total (mg/L)	<0.050	0.0495	0.0622		
	Magnesium (Mg)-Total (mg/L)	21.2	104	354		
	Manganese (Mn)-Total (mg/L)	0.126	0.0149	0.0356		
	Mercury (Hg)-Total (mg/L)	<0.00020	<0.0000050	<0.0000050		
	Molybdenum (Mo)-Total (mg/L)	0.0045	0.0011	0.0011		
	Nickel (Ni)-Total (mg/L)	<0.0050	0.0021	0.0026		
	Phosphorus (P)-Total (mg/L)	1.53	<0.30	<0.60 ^{DLHC}		
	Potassium (K)-Total (mg/L)	19.9	44.5	103		
Selenium (Se)-Total (mg/L)	<0.0010	0.00016	<0.00025 ^{DLA}			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1811981-1 SURFACE WATE 10-AUG-16 13:15 COMMONAGE DRAINAGE POND	L1811981-2 SURFACE WATE 10-AUG-16 13:00 DAVIDSON POND	L1811981-3 SURFACE WATE 10-AUG-16 12:45 ROSE'S POND		
Grouping	Analyte					
WATER						
Total Metals	Silicon (Si)-Total (mg/L)	3.46	1.61	0.38	DLA	
	Silver (Ag)-Total (mg/L)	<0.000050	<0.000020	<0.000050		
	Sodium (Na)-Total (mg/L)	101	561	1050		
	Strontium (Sr)-Total (mg/L)	0.527	0.772	0.480		
	Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020		
	Tin (Sn)-Total (mg/L)	<0.030	<0.00050	<0.00050		
	Titanium (Ti)-Total (mg/L)	<0.050	<0.010	<0.020	DLHC	
	Uranium (U)-Total (mg/L)	0.00210	0.00623	0.00483	DLA	
	Vanadium (V)-Total (mg/L)	<0.030	<0.0010	<0.0025	DLA	
	Zinc (Zn)-Total (mg/L)	0.0237	<0.0050	<0.010	DLHC	
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD		
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD		
	Aluminum (Al)-Dissolved (mg/L)	0.010	<0.0050	0.0086		
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	0.00062		
	Arsenic (As)-Dissolved (mg/L)	0.0012	0.00340	0.00523		
	Barium (Ba)-Dissolved (mg/L)	0.033	<0.020	<0.020		
	Beryllium (Be)-Dissolved (mg/L)	<0.0050	<0.0010	<0.0010	DLHC	
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.40	DLHC	
	Boron (B)-Dissolved (mg/L)	0.16	<0.10	<0.20	DLHC	
	Cadmium (Cd)-Dissolved (mg/L)	<0.000050	<0.000010	<0.000025	DLA	
	Calcium (Ca)-Dissolved (mg/L)	57.2	54.2	51.8		
	Chromium (Cr)-Dissolved (mg/L)	<0.00050	<0.0010	<0.0010	DLA	
	Cobalt (Co)-Dissolved (mg/L)	<0.00050	<0.00030	<0.00050	DLA	
	Copper (Cu)-Dissolved (mg/L)	0.0031	<0.0010	0.0012	DLHC	
	Iron (Fe)-Dissolved (mg/L)	0.037	<0.030	<0.060	DLHC	
	Lead (Pb)-Dissolved (mg/L)	<0.0010	<0.00050	<0.00050		
	Lithium (Li)-Dissolved (mg/L)	<0.050	0.0467	0.0648		
	Magnesium (Mg)-Dissolved (mg/L)	22.1	104	349		
	Manganese (Mn)-Dissolved (mg/L)	0.102	0.00863	0.00583		
	Mercury (Hg)-Dissolved (mg/L)	<0.00020	<0.0000050	<0.0000050		
	Molybdenum (Mo)-Dissolved (mg/L)	0.0042	<0.0010	0.0012		
	Nickel (Ni)-Dissolved (mg/L)	<0.0050	0.0021	0.0028	DLHC	
	Phosphorus (P)-Dissolved (mg/L)	1.48	<0.30	<0.60	DLHC	
	Potassium (K)-Dissolved (mg/L)	20.5	43.3	99.4	DLA	
	Selenium (Se)-Dissolved (mg/L)	<0.0010	<0.00010	<0.00025	DLA	
	Silicon (Si)-Dissolved (mg/L)	3.45	1.50	0.34	DLA	
	Silver (Ag)-Dissolved (mg/L)	<0.000050	<0.000020	<0.000050	DLA	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1811981-1 SURFACE WATE 10-AUG-16 13:15 COMMONAGE DRAINAGE POND	L1811981-2 SURFACE WATE 10-AUG-16 13:00 DAVIDSON POND	L1811981-3 SURFACE WATE 10-AUG-16 12:45 ROSE'S POND		
Grouping	Analyte					
WATER						
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)	105	551	1020		
	Strontium (Sr)-Dissolved (mg/L)	0.549	0.764	0.469		
	Thallium (Tl)-Dissolved (mg/L)	<0.00010	<0.00020	<0.00020		
	Tin (Sn)-Dissolved (mg/L)	<0.030	<0.00050	<0.00050		
	Titanium (Ti)-Dissolved (mg/L)	<0.050	<0.010	<0.020 ^{DLHC}		
	Uranium (U)-Dissolved (mg/L)	0.00194	0.00553	0.00490		
	Vanadium (V)-Dissolved (mg/L)	<0.030	<0.0010 ^{DLA}	<0.0025 ^{DLA}		
	Zinc (Zn)-Dissolved (mg/L)	0.0238	<0.0050	<0.010 ^{DLHC}		
Aggregate Organics	BOD (mg/L)	<2.0	<2.0	<2.0		
	COD (mg/L)	55	101	69		

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Antimony (Sb)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Beryllium (Be)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Lead (Pb)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Silver (Ag)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Tin (Sn)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Vanadium (V)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Aluminum (Al)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Beryllium (Be)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Chromium (Cr)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Copper (Cu)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Selenium (Se)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Silver (Ag)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Thallium (Tl)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Tin (Sn)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Vanadium (V)-Dissolved	DLA	L1811981-1, -2, -3
Duplicate	Chloride (Cl)	DLDS	L1811981-1, -2, -3
Duplicate	Nitrite (as N)	DLDS	L1811981-1, -2, -3
Method Blank	Copper (Cu)-Total	MB-LOR	L1811981-1, -2, -3
Matrix Spike	Iron (Fe)-Dissolved	MS-B	L1811981-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1811981-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1811981-1, -2, -3
Matrix Spike	Total Nitrogen	MS-B	L1811981-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1811981-2, -3
Matrix Spike	Silicon (Si)-Total	MS-B	L1811981-1, -2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1811981-1, -2, -3
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1811981-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1811981-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1811981-1, -2, -3
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1811981-1, -2, -3
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1811981-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1811981-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1811981-2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1811981-2, -3

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.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
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**
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- "BIOCHEMICAL OXYGEN DEMAND"
<p>This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.</p>			
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND
<p>This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous</p>			

Reference Information

BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.

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.

COD-COL-VA Water Chemical Oxygen Demand by Colorimetric APHA 5220 D. CHEMICAL OXYGEN DEMAND

This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.

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

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

ECOLI-COLI-ENV-VA Water E.coli by Colilert APHA METHOD 9223

This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.

HARDNESS-CALC-VA Water Hardness APHA 2340B

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

HG-D-CVAA-VA Water Diss. Mercury in Water by CVAAS or CVAFS APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

HG-DIS-CVAFS-VA Water Dissolved Hg in Water by CVAFS LOR=50ppt APHA 3030B/EPA 1631E (mod)

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

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

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

HG-TOT-CVAFS-VA Water Total Hg in Water by CVAFS LOR=50ppt EPA 1631E (mod)

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

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

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

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

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

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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

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

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

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

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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

Reference Information

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

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

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

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

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

NH2-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.

NH3-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.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Chain of Custody Numbers:

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.



CITY OF KELOWNA
ATTN: Marcia Browne
1595 Glenmore Road N.
Kelowna BC V1V 2C5

Date Received: 22-SEP-16
Report Date: 29-SEP-16 18:50 (MT)
Version: FINAL

Client Phone: 250-469-8796

Certificate of Analysis

Lab Work Order #: L1832582
Project P.O. #: 520747
Job Reference: 1186-202 POND
C of C Numbers:
Legal Site Desc:

Dean Watt, B.Sc.
Account Manager

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1832582-1 Surface Water 21-SEP-16 11:20 COMMONAGE DRAINAGE POND	L1832582-2 Surface Water 21-SEP-16 12:20 DAVIDSON POND	L1832582-3 Surface Water 21-SEP-16 11:00 ROSES POND	
Grouping	Analyte				
WATER					
Physical Tests	Conductivity (uS/cm)	962	3550	7030	
	Hardness (as CaCO3) (mg/L)	222	565	1620	
	pH (pH)	8.24	8.62	8.56	
	Total Suspended Solids (mg/L)	<3.0	<3.0	4.8	
Anions and Nutrients	Ammonia, Total (as N) (mg/L)	2.33	0.0278	0.0237	
	Chloride (Cl) (mg/L)	99.4	347	537	
	Nitrate (as N) (mg/L)	0.336	<0.10 ^{DLDS}	<0.25 ^{DLDS}	
	Nitrite (as N) (mg/L)	0.211	<0.020 ^{DLDS}	<0.050 ^{DLDS}	
	Total Kjeldahl Nitrogen (mg/L)	4.16	1.72	1.55	
	Total Nitrogen (mg/L)	4.71	1.72	1.55	
	Orthophosphate-Dissolved (as P) (mg/L)	1.36	<0.0010	<0.0010	
Bacteriological Tests	E. coli (MPN/100mL)	<10	2720	<10	
	Coliform Bacteria - Total (MPN/100mL)	1660	488000 ^{DLA}	2480	
Total Metals	Aluminum (Al)-Total (mg/L)	0.116	<0.015 ^{DLA}	0.015	
	Antimony (Sb)-Total (mg/L)	<0.00050	<0.00050	0.00063	
	Arsenic (As)-Total (mg/L)	0.00136	0.00358	0.00525	
	Barium (Ba)-Total (mg/L)	0.034	<0.020	<0.020	
	Beryllium (Be)-Total (mg/L)	<0.0010	<0.0010	<0.0010	
	Bismuth (Bi)-Total (mg/L)	<0.20	<0.20	<0.40 ^{DLHC}	
	Boron (B)-Total (mg/L)	0.16	<0.10 ^{DLA}	<0.20 ^{DLHC}	
	Cadmium (Cd)-Total (mg/L)	0.0000468	<0.000025 ^{DLA}	<0.000025 ^{DLA}	
	Calcium (Ca)-Total (mg/L)	53.1	52.4	52.5	
	Chromium (Cr)-Total (mg/L)	<0.0010	<0.0010 ^{DLA}	<0.0010 ^{DLA}	
	Cobalt (Co)-Total (mg/L)	0.00042	<0.00050 ^{DLA}	<0.00050 ^{DLA}	
	Copper (Cu)-Total (mg/L)	0.0117	<0.0025 ^{DLA}	<0.0025 ^{DLA}	
	Iron (Fe)-Total (mg/L)	0.206	<0.030	<0.060 ^{DLHC}	
	Lead (Pb)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Lithium (Li)-Total (mg/L)	0.0107	0.0501	0.0752	
	Magnesium (Mg)-Total (mg/L)	22.0	110	370	
	Manganese (Mn)-Total (mg/L)	0.147	0.0841	0.0426	
	Mercury (Hg)-Total (mg/L)	<0.0000050	0.0000089	<0.0000050	
	Molybdenum (Mo)-Total (mg/L)	0.0044	<0.0010 ^{DLA}	<0.0010 ^{DLA}	
	Nickel (Ni)-Total (mg/L)	<0.0025 ^{DLB}	<0.0025 ^{DLA}	<0.0025 ^{DLA}	
	Phosphorus (P)-Total (mg/L)	1.66	<0.30	<0.60 ^{DLHC}	
	Potassium (K)-Total (mg/L)	22.1	46.2	105	
Selenium (Se)-Total (mg/L)	0.000534	<0.00025 ^{DLA}	<0.00025 ^{DLA}		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1832582-1 Surface Water 21-SEP-16 11:20 COMMONAGE DRAINAGE POND	L1832582-2 Surface Water 21-SEP-16 12:20 DAVIDSON POND	L1832582-3 Surface Water 21-SEP-16 11:00 ROSES POND	
Grouping	Analyte				
WATER					
Total Metals	Silicon (Si)-Total (mg/L)	3.96	1.63	0.43	
	Silver (Ag)-Total (mg/L)	0.000063	<0.000050 ^{DLA}	<0.000050 ^{DLA}	
	Sodium (Na)-Total (mg/L)	108	596	1090	
	Strontium (Sr)-Total (mg/L)	0.558	0.784	0.483	
	Thallium (Tl)-Total (mg/L)	<0.00020	<0.00020	<0.00020	
	Tin (Sn)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Titanium (Ti)-Total (mg/L)	<0.010	<0.010	<0.020 ^{DLHC}	
	Uranium (U)-Total (mg/L)	0.00193	0.00481	0.00434	
	Vanadium (V)-Total (mg/L)	0.00126	<0.0025 ^{DLA}	<0.0025 ^{DLA}	
	Zinc (Zn)-Total (mg/L)	0.0284	<0.0050	<0.010 ^{DLHC}	
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	
	Aluminum (Al)-Dissolved (mg/L)	0.0185	<0.0050	0.0073	
	Antimony (Sb)-Dissolved (mg/L)	<0.00050	<0.00050	0.00066	
	Arsenic (As)-Dissolved (mg/L)	0.00114	0.00338	0.00521	
	Barium (Ba)-Dissolved (mg/L)	0.030	<0.020	<0.020	
	Beryllium (Be)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	
	Bismuth (Bi)-Dissolved (mg/L)	<0.20	<0.20	<0.40 ^{DLA}	
	Boron (B)-Dissolved (mg/L)	0.17	<0.10	<0.20 ^{DLA}	
	Cadmium (Cd)-Dissolved (mg/L)	0.0000229	<0.000010	<0.000025 ^{DLA}	
	Calcium (Ca)-Dissolved (mg/L)	53.9	53.6	51.1	
	Chromium (Cr)-Dissolved (mg/L)	<0.0010	<0.0010	<0.0010	
	Cobalt (Co)-Dissolved (mg/L)	0.00032	<0.00030	<0.00050 ^{DLA}	
	Copper (Cu)-Dissolved (mg/L)	0.0036	<0.0010	<0.0010 ^{DLA}	
	Iron (Fe)-Dissolved (mg/L)	0.043	<0.030	<0.060 ^{DLA}	
	Lead (Pb)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	
	Lithium (Li)-Dissolved (mg/L)	0.0095	0.0434	0.0645	
	Magnesium (Mg)-Dissolved (mg/L)	21.2	105	362	
	Manganese (Mn)-Dissolved (mg/L)	0.0596	0.0273	0.0257	
	Mercury (Hg)-Dissolved (mg/L)	<0.000025 ^{DLM}	<0.0000050	<0.0000050	
	Molybdenum (Mo)-Dissolved (mg/L)	0.0040	<0.0010	<0.0010	
	Nickel (Ni)-Dissolved (mg/L)	0.0016	0.0012	<0.0025 ^{DLA}	
	Phosphorus (P)-Dissolved (mg/L)	1.49	<0.30	<0.60 ^{DLA}	
	Potassium (K)-Dissolved (mg/L)	20.3	43.9	108	
	Selenium (Se)-Dissolved (mg/L)	0.000507	0.00016	<0.00025 ^{DLA}	
	Silicon (Si)-Dissolved (mg/L)	3.71	1.51	0.39	
	Silver (Ag)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000050 ^{DLA}	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1832582-1 Surface Water 21-SEP-16 11:20 COMMONAGE DRAINAGE POND	L1832582-2 Surface Water 21-SEP-16 12:20 DAVIDSON POND	L1832582-3 Surface Water 21-SEP-16 11:00 ROSES POND	
Grouping	Analyte				
WATER					
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)	101	560	1140	
	Strontium (Sr)-Dissolved (mg/L)	0.539	0.761	0.521	
	Thallium (Tl)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	
	Tin (Sn)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.020 ^{DLA}	
	Uranium (U)-Dissolved (mg/L)	0.00173	0.00526	0.00436	
	Vanadium (V)-Dissolved (mg/L)	0.00097	<0.0010 ^{DLA}	<0.0025 ^{DLA}	
	Zinc (Zn)-Dissolved (mg/L)	0.0212	<0.0050	<0.010 ^{DLA}	
Aggregate Organics	BOD (mg/L)	6.2	2.1	<2.0	
	COD (mg/L)	75	75	76	

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Chromium (Cr)-Total	MB-LOR	L1832582-1, -2, -3
Method Blank	Copper (Cu)-Total	MB-LOR	L1832582-1, -2, -3
Method Blank	Manganese (Mn)-Total	MB-LOR	L1832582-1, -2, -3
Method Blank	Nickel (Ni)-Total	MB-LOR	L1832582-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1832582-1, -2, -3
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1832582-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1832582-1, -2, -3
Matrix Spike	Silicon (Si)-Dissolved	MS-B	L1832582-1, -2, -3
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1832582-1, -2, -3

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.
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- "BIOCHEMICAL OXYGEN DEMAND"
<p>This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.</p>			
BOD5-VA	Water	Biochemical Oxygen Demand- 5 day	APHA 5210 B- BIOCHEMICAL OXYGEN DEMAND
<p>This analysis is carried out using procedures adapted from APHA Method 5210 B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.</p>			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
COD-COL-VA	Water	Chemical Oxygen Demand by Colorimetric	APHA 5220 D. CHEMICAL OXYGEN DEMAND
<p>This analysis is carried out using procedures adapted from APHA Method 5220 "Chemical Oxygen Demand (COD)". Chemical oxygen demand is determined using the closed reflux colourimetric method.</p>			
EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.
<p>This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.</p>			
ECOLI-COLI-ENV-VA	Water	E.coli by Colilert	APHA METHOD 9223
<p>This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.</p>			
HARDNESS-CALC-VA	Water	Hardness	APHA 2340B
<p>Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.</p>			
HG-D-CVAA-VA	Water	Diss. Mercury in Water by CVAAS or CVAFS	APHA 3030B/EPA 1631E (mod)
<p>Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.</p>			
HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)
<p>Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.</p>			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Reference Information

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

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

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

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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

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

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

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

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

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

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

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

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

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

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

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

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

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

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.

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

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

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

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

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

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

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

TKN-CALC-VA Water TKN in Water (Calculation) BC MOE LABORATORY MANUAL (2005)

Total Kjeldahl Nitrogen is a calculated parameter. Total Kjeldahl Nitrogen (calc) = Total Nitrogen - [Nitrite (as N) + Nitrate (as N)].

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

Reference Information

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

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

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

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

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

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

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

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

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

mg/L - milligrams per litre.

< - Less than.

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

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

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

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

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



Short Holding Time

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Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC # _____

Page ____ of ____

Report To Company: City of Kelowna Contact: Marcia Browne Address: 1595 Glenmore Road N. Kelowna BC V1V2C5 Phone: 250-469-8796 Fax: 250-862-3342			Report Format / Distribution <input type="checkbox"/> Standard <input type="checkbox"/> Other <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> Excel <input type="checkbox"/> Digital <input type="checkbox"/> Fax Email 1: mbrowne@kelowna.ca Email 2: mlewis@kelowna.ca Email 3: jgordon@kelowna.ca			Service Requested (Rush for routine analysis subject to availability) <input checked="" type="radio"/> Regular (Standard Turnaround Times - Business Days) <input type="radio"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT <input type="radio"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT <input type="radio"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT																																																																																																			
Invoice To Same as Report? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Hardcopy of Invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Company: Contact: Address: Phone:			Client / Project Information Job #: 1186-202 POND PO / AFE: 520747 SD: Quote #:			Analysis Request Please indicate below Filtered, Preserved or both (F, P, F/P)																																																																																																			
Lab Work Order (lab use only)			ALS Contact: Dean Watt			Sampler:			<table border="1"> <thead> <tr> <th>Total metals</th> <th>Dissolved metals</th> <th>BOD, COD</th> <th>T. Coliform, E. Coli</th> <th>TSS, Ammonia</th> <th>O-PO4-P</th> <th>Total Nitrogen, TKN</th> <th>NO2-N, NO3-N</th> <th>Total hardness</th> <th>EC</th> <th>Chloride</th> <th>pH</th> <th>Number of Containers</th> </tr> </thead> <tbody> <tr> <td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>5</td> </tr> <tr> <td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>5</td> </tr> <tr> <td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>5</td> </tr> </tbody> </table>													Total metals	Dissolved metals	BOD, COD	T. Coliform, E. Coli	TSS, Ammonia	O-PO4-P	Total Nitrogen, TKN	NO2-N, NO3-N	Total hardness	EC	Chloride	pH	Number of Containers	X	X	X	X	X	X	X	X	X	X	X	X	5	X	X	X	X	X	X	X	X	X	X	X	X	5	X	X	X	X	X	X	X	X	X	X	X	X	5																																
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Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details Please use CCME/ BC WQG guidelines for both Davidson Pond and Rose's Pond for Total Metals Analysis and continue using BC CSR guidelines for Commonage Drainage Pond. Please return cooler, ice packs and replacment bottles and preservatives. Thank you																																																																																																									
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 provided on a separate Excel tab. Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.																																																																																																									
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As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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