



Hutchinson

Environmental Sciences Ltd.

Oak Lake Water Quality
Monitoring Report and Lake
Management Plan

Prepared for: City of Quinte West
Job #: J180050

October 18, 2019



October 18, 2019

HESL Job #: J180050

Mr. Chris Angelo
Director Public Works & Environmental Services
City of Quinte West
7 Creswell Drive
Trenton, ON K8V 5R6

Dear Mr. Angelo:

Re: J180050 - Oak Lake Water Quality Monitoring Report and Lake Management Plan

We are pleased to submit our report on water quality and management of Oak Lake. Oak Lake is a typical kettle lake with moderate nutrient concentrations that are driven by shoreline development practices, septic systems, agricultural inputs and internal loading. Macrophytes are abundant and algae followed a typical succession pattern until *Mougeotia spp.*, a species of filamentous green algae, spread throughout much of the lake in the summer of 2019. *Mougeotia spp.* are a nuisance for recreational uses but are non-toxic to humans and other aquatic life. Abundant algae and plant growth can however reduce oxygen concentrations as part of decomposition, which can in turn negatively impact aquatic life such as fish populations.

Water level management was identified as a major concern for residents and their properties but there are differing opinions on a water management objective. Two culverts were removed in the late winter of 2018, which appeared to help lower water levels in the spring of 2019.

Oak Lake has been well studied and several lake management recommendations have been both made and incorporated into policy, but it is unclear how successful previous recommendations and policies have been. We developed new recommendations that included realigning the adjacent agricultural tile drain so it no longer drains into Oak Lake, developing a bylaw to enforce appropriate sewage treatment system design and maintenance, as well as others related to shoreline development practices, water level management, aquatic vegetation management, waterfowl control, active lake management and long-term monitoring.

Please contact me if you have any questions or concerns.

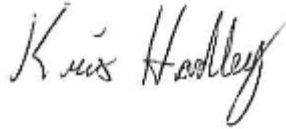
Sincerely,
per: Hutchinson Environmental Sciences Ltd.

Brent Parsons, M.Sc.
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Oak Lake Water Quality Monitoring Report and Lake Management Plan

Signatures

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Oak Lake Water Quality Monitoring Report and Lake Management Plan

Executive Summary

Hutchinson Environmental Sciences Ltd. (HESL) was retained by the City of Quinte West to complete a Water Quality Assessment of Oak Lake with input from the Ministry of Environment, Conservation and Parks (MECP) and Lower Trent Conservation (LTC). The “Oak Lake Water Quality Monitoring Report and Lake Management Plan” was designed to characterize water quality conditions in Oak Lake and develop lake management recommendations through public engagement, background review, field investigations and expert input.

Oak Lake is well-studied, and a variety of background material was reviewed and analyzed to 1) help characterize conditions in the lake and watershed, and 2) provide historic data that could be compared to 2018 data and allow for the assessment of changes over time.

HESL staff collected water quality samples on August 16, 2018, October 29, 2018, February 11, 2019, March 28, 2019 and May 8, 2019 to capture seasonal variability and high flows when samples could be collected from the inflowing tile drain. Samples were collected from 11 open water sites and three tributary sites. A sediment sample was collected on August 16, 2018 from OL-1 using a gravity corer. Phytoplankton (i.e. algae) samples were collected via 0.5 m deep grab samples from OL-1 on August 16, 2018, February 11, 2019, May 8, 2019 to characterize seasonal variability of algal assemblages, and from observed filamentous algal assemblages on May 8, 2019 and July 4, 2019. Field investigations also included an examination of water levels, determination of the impact of culvert elevation on water levels during each sampling event and documented through photographs.

Information on septic systems, the nature of shoreline development and lake management concerns was gathered through a mailed-out questionnaire and scoped level 1 septic site investigations in 2018. Site investigations were completed from August 21 to 26, 2018 at 80 properties where landowners were present and allowed access.

Nutrient concentrations indicate that Oak Lake is mesotrophic and average annual phosphorus concentrations have remained stable at 0.014 mg/L since 2001. Winter measurements made in 2019 showed that phosphorus and nitrate concentrations were markedly elevated. This could be driven by a variety of processes. Nutrient concentrations were also elevated in the inflowing tile drain which drains approximately 40 hectares of agricultural lands that are used to grow corn and raise both cattle and pigs. Concentrations were similar to those observed in the literature and typical of enriched agricultural runoff. Bacteria concentrations were generally low in Oak Lake, and lower than concentrations measured as part of past studies.

Phosphorus was enriched in the sediments of Oak Lake. The total phosphorus concentration of 1990 µg/g exceeded the Lowest Effect Level (600 µg/g) and was close to the Severe Effect Level (2000 µg/g) identified in the Provincial Guidelines (Ministry of Environment and Energy, 1993; Table 11), suggesting a high potential internal load to the lake.

The phytoplankton community at OL-1 followed typical seasonal succession during our sampling program. Phytoplankton was dominated by Chrysophytes and Cryptophytes in the winter, with substantially increased green algae (Chlorophytes) relative abundance in the spring and increased cyanobacteria during the late summer/fall sampling event. The filamentous algal colonies observed in the water during spring and



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summer 2019 sampling were comprised of *Mougeotia spp.*, a diverse genus of green algae which includes many of the most common filamentous green algal species in freshwaters. Blooms of filamentous green algae, such as *Mougeotia*, can be a nuisance for recreational uses but are non-toxic to humans and other aquatic life.

The development patterns, lot size and nature of waterfront land use at Oak Lake does not meet the current environmental standards associated with waterfront development. Lots on Oak Lake are highly developed and while many septic systems showed no evidence of poor repair, the maintenance periods reported by residents varied substantially, problems were noted with some systems, and many that were not examined due to lack of landowner permission may be in poor repair. Similar conditions were noted in 2001 and there is little evidence that Best Management Practices and recommendations such as establishing natural shorelines or improving septic system maintenance from previous studies (e.g. LTC 2002, Ontario Lake Assessments, 2002a) have been implemented.

The combined phosphorus load from runoff, atmospheric deposition, septic system leaching, and sediment internal load was 312.5 to 336.5 kg/yr (based on internal load estimates of 136 and 160 kg/yr respectively). Internal loading from sediments represent the largest source of phosphorus to Oak Lake, contributing almost 50% of the annual load; followed by septic systems, which contribute one third of the total annual load. Runoff from agricultural land uses was also an appreciable source of phosphorus, adding approximately 15% of the total phosphorus load.

Results from the mailed-out questionnaire indicated that 47% of landowners consider that water levels are “good as is”, while 30% believe water levels are currently too high and 23% believe water levels are currently too low, so it is clear there are differing perspectives on the most appropriate water levels in Oak Lake. Our culvert inspections indicated that water flow isn’t impeded by sediment build-up in the culverts or in the adjacent areas, but the system is instead limited by a very small drainage area adjacent to Culvert #2 and largely controlled by the management of wetland water levels via Culvert #5. Water level management is a challenge moving forward because of climate change and it is particularly challenging in Oak Lake because a) development setbacks are limited and nearshore areas are flat so slight changes in water levels impact residences and water intake lines, b) there is limited inflow or outflow so there isn’t much water to work with, and c) there are differing opinions on a water management objective.

Oak Lake has been well studied and several lake management recommendations have been both made and incorporated into policy, but it is unclear how successful previous recommendations and policies have been. We developed new recommendations that included realigning the adjacent agricultural tile drain so it no longer drains into Oak Lake, developing a bylaw to enforce appropriate sewage treatment system design and maintenance, as well as others related to shoreline development practices, water level management, aquatic vegetation management, waterfowl control, active lake management and long-term monitoring. Successful execution of the management recommendations requires buy-in by shoreline residents and enforcement.



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1. Introduction

Oak Lake is a small (51 ha), shallow, isolated lake with no defined inflows or outflows, whose hydrology is driven by groundwater and surface runoff from a small (287 hectare) agriculturally-dominated watershed with deep, loamy soils (Figure 1; Ontario Lake Assessment, 2000). Oak Lake has a mean depth of 3.3 m, a maximum depth of 10.6 m and only 11% of the lake is greater than 7.5 m (Lower Trent Conservation (LTC), 2002; MECP, 2018). It supports a warmwater fish community, including Northern Pike (*Esox Lucius*), Smallmouth Bass (*Micropterus dolomieu*), Largemouth Bass (*Micropterus salmoides*), Yellow Perch (*Perca flavescens*), Rock Bass (*Ambloplites rupestris*), Brown Bullhead (*Ameiurus nebulosus*), Pumpkinseed (*Lepomis gibbosus*) and Longnose Gar (*Lepisosteus osseus*; LTC, 2002).

Previous data collection on the lake by the City of Quinte West and MECP identified several management challenges including phosphorus enrichment (range 0.01 - 0.02 mg/L), oxygen deficiency, elevated nearshore bacteria concentrations and excessive growth of the aquatic macrophyte Eurasian Water Milfoil (*Myriophyllum spicatum*). A list of the previous studies consulted is provided in Section 2.1. Recent community concern also identified issues with rising lake levels (City of Quinte West City Council, April 30th, 2018) and aquatic macrophyte growth, while MECP was called in to investigate and assess the impact of a significant manure spill on the eastern shore in the winter of 2018. These incidents reflect the challenge of managing lakes in the face of multiple stressors and community concerns and highlighted the need for this study.

Hutchinson Environmental Sciences Ltd. (HESL) was retained by the City of Quinte West to complete a Water Quality Assessment of Oak Lake with input from the Ministry of Environment, Conservation and Parks (MECP) and Lower Trent Conservation (LTC). The “Oak Lake Water Quality Monitoring Report and Lake Management Plan” was designed to characterize water quality conditions in Oak Lake and develop lake management recommendations through public engagement, background review, field investigations and expert input. The study was completed through the following tasks:

- Compilation and review of existing data collected on Oak Lake and its watershed,
- Completion of a four-season sampling program of water quality, sediment quality and phytoplankton from August 2018 to July 2019,
- Inspections of sewage treatment systems and shoreline development practices,
- Culvert inspections in relation to water level management,
- Calculation of a phosphorus budget, and
- Development of various lake management recommendations.

The study also included several project team meetings, public open houses and a mailed-out questionnaire designed to solicit information from residents and the project team. Methods, results and discussion related to the above-noted tasks are provided in the report, as are management recommendations based on the findings.



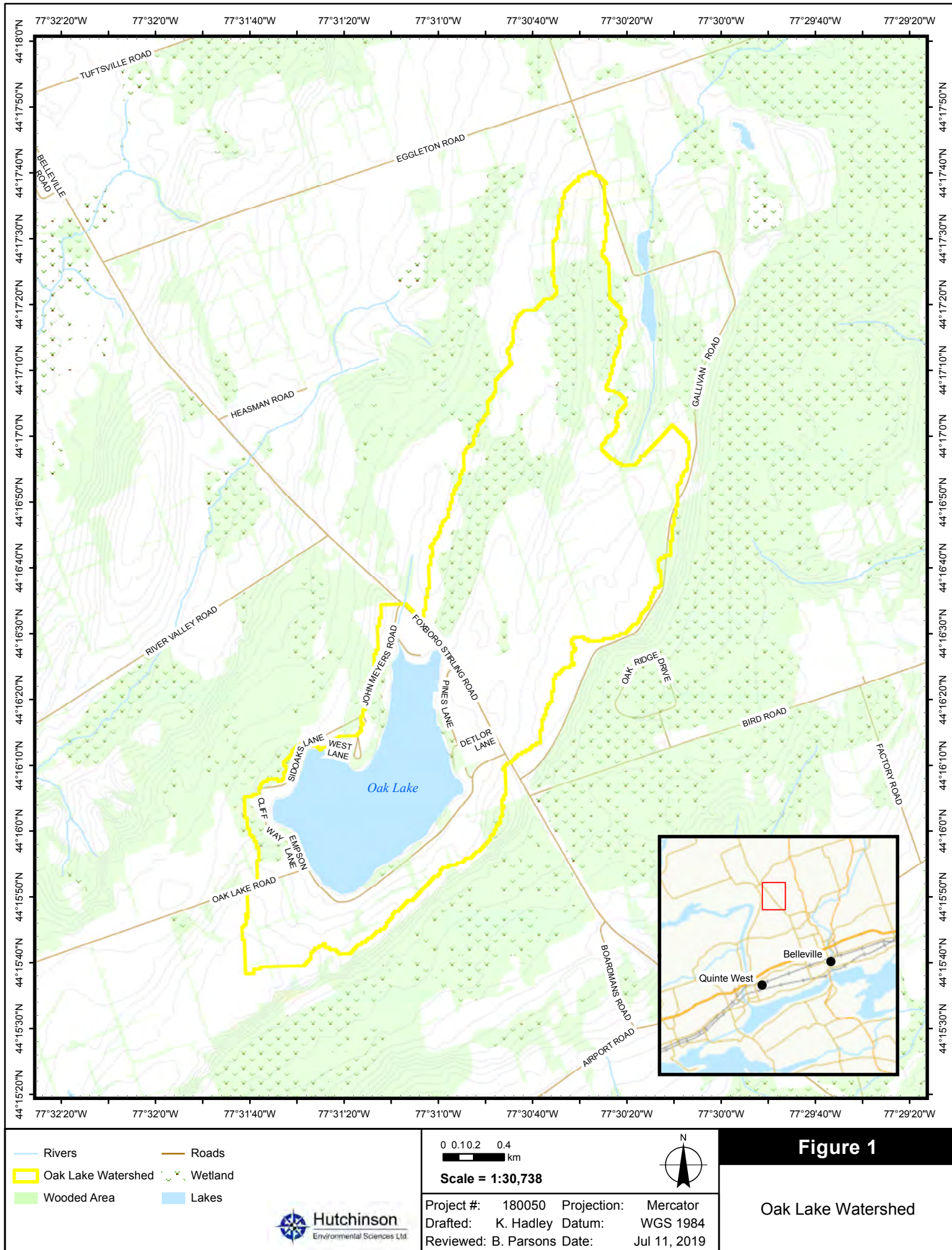


Figure 1

Oak Lake Watershed



Project #: 180050 Projection: Mercator
 Drafted: K. Hadley Datum: WGS 1984
 Reviewed: B. Parsons Date: Jul 11, 2019

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2. Methods

2.1 Background Review

Oak Lake is well-studied, and a variety of background material was reviewed and analyzed to 1) help characterize conditions in the lake and watershed, and 2) provide historic data that could be compared to 2018 data and allow for the assessment of changes over time.

The following studies were consulted as part of the background review:

- City of Quinte West. 2011. Updated Summary Report – Oak Lake
- City of Quinte West. 2017. Official Plan. Amended December 4, 2017.
- City of Quinte West. 2017. Planning Advisory Committee Presentation.
- City of Quinte West. 2014. Comprehensive Zoning By-Law.
- Lower Trent Conservation. 1978. Aquatic Plant Growth Control.
- Lower Trent Conservation. 2002. Oak Lake Shoreline Regeneration Plan.
- Ministry of Environment. 1973. Report of Water Quality in Oak Lake Sidney Twp. Hastings County
- Ministry of Environment. 2005. Oak Lake Agricultural Runoff Assessment
- Ministry of Environment and Climate Change. 2013. Agricultural Runoff Assessment
- Ministry of Environment and Climate Change. 2014. Oak Lake Water Quality Assessment
- Ministry of Environment and Climate Change. Lake Partner Program data 2002 - 2014.
- Ministry of Environment, Conservation and Parks. 2018. Provincial Officer's Report
- Ministry of Environment, Conservation and Parks. 2018. Oak Lake Manure Spill
- Ontario Lake Assessments. 2000. Water Quality Summary and Lake Sensitivity Evaluation for Oak Lake.
- Ontario Lake Assessments. 2002a. An Evaluation of the On-Site Sewage Disposal Systems for Properties Fronting on Oak Lake.
- Ontario Lake Assessments. 2002b. An Assessment of the Water Quality of Oak Lake

2.2 Water Quality

HESL staff collected water quality samples on August 16, 2018, October 29, 2018, February 11, 2019, March 28, 2019 and May 8, 2019 to capture seasonal variability and high flows when samples could be collected from the inflowing tile drain. Samples were collected from 11 open water sites (OL-1 to OL-11) and three tributary sites ((Trib-2, Trib-4 and Trib-5), Figure 2).

Sample sites were selected to a) overlap previously sampled locations to allow for temporal comparisons, b) characterize water quality across the lake and c) sample the limited inflows and outflows when those tributary sites contained flowing water (Table 1). Trib-4 and Trib-5 were located at the outfall of the tile drain and ~10 m upstream of its confluence with Oak Lake, respectively. The tiles drain approximately 40 hectares of adjacent agricultural lands. Trib-2 was only sampled on one occasion due to a lack of flowing water, while Trib-1 and Trib-3 were never sampled due to a lack of flowing water.

Samples were either analyzed for a full suite of chemical parameters (i.e. water quality station) or just bacteria (i.e. bacteria only station), again to overlap with historical data and to help characterize bacteria concentrations which are often spatially variable (Table 1). OL-1-bottom was also sampled approximately



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1-m off bottom and samples were analyzed for total suspended solids, total phosphorus and iron to support the calculation and assessment of any internal phosphorus loading. All samples were collected, stored on ice and analyzed by ALS Laboratories in Kitchener or Winnipeg depending on the parameter.

Samples collected from the water quality sampling stations were analyzed for the following parameters: total hardness, total suspended solids, total alkalinity, total ammonia, chloride, nitrate, total Kjeldahl nitrogen, total phosphorus, sulfate, dissolved organic carbon, *E. coli*, fecal coliforms, fecal streptococcus, *Pseudomonas aeruginosa*, chlorophyll a, and metals, while samples collected from the bacteria only sampling stations were analyzed for *E. coli*, fecal coliforms, fecal streptococcus and *Pseudomonas aeruginosa*. Temperature, conductivity, dissolved oxygen and pH were measured with a YSI multimeter at 0.5 m depth during each event at every water quality and bacteria only sampling location. Field measurements of temperature, conductivity, dissolved oxygen and pH were also measured at 1-m water depth intervals at OL-1 throughout the water column during each water sampling event.

Table 1. Type of Water Quality Sampling Locations.

Sample Site	Water Quality Station	Bacteria Only Station	Sample Site Descriptions	GPS Coordinates	Water Depth (m)
OL-1	✓		Long-term deep water quality	44°15'59.21"N	12
OL-1-Bottom ¹	✓			77°31'20.76"W	
OL-2	✓		Nearshore water quality	44°15'51.76"N 77°31'23.48"W	0.8
OL-3		✓	Nearshore water quality	44°16'0.53"N 77°31'31.26"W	1.2
OL-4		✓	Nearshore water quality	44°16'8.37"N 77°31'27.83"W	2.4
OL-5		✓	Nearshore water quality	44°16'8.50"N 77°31'16.12"W	0.9
OL-6		✓	Nearshore water quality	44°16'15.67"N 77°31'10.13"W	1.2
OL-7	✓		Nearshore water quality	44°16'24.26"N 77°31'3.70"W	1.1
OL-8		✓	Nearshore water quality	44°16'14.51"N 77°31'0.18"W	0.8
OL-9	✓		Nearshore water quality adjacent to inflowing agricultural drainage	44°16'5.91"N 77°30'55.61"W	2.1
OL-10		✓	Nearshore water quality	44°15'57.46"N 77°31'6.87"W	0.8
OL-11		✓	Nearshore water quality	44°15'53.42"N 77°31'14.17"W	1.0



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Trib-2	✓		Outflowing lake water quality		<0.5
Trib-4	✓		Inflowing agricultural drainage		<0.5
Trib-5	✓		Inflowing agricultural drainage		<0.5

¹ Samples were only analyzed for total suspended solids, total phosphorus and iron.

Values below detection limit were replaced with a value equivalent to half the detection limit for statistical summaries. Water quality parameters were evaluated against applicable Provincial Water Quality Objectives (PWQOs; MOE, 1994) and Canadian Water Quality Guidelines (CWQGs) for the protection of Freshwater Aquatic Life (FAL) (CCME, 2012). PWQOs are protective of all life forms of aquatic life at all life stages during indefinite exposure to water and are used to make water quality management decisions. CWQGs provide science-based goals for the quality of aquatic ecosystems.



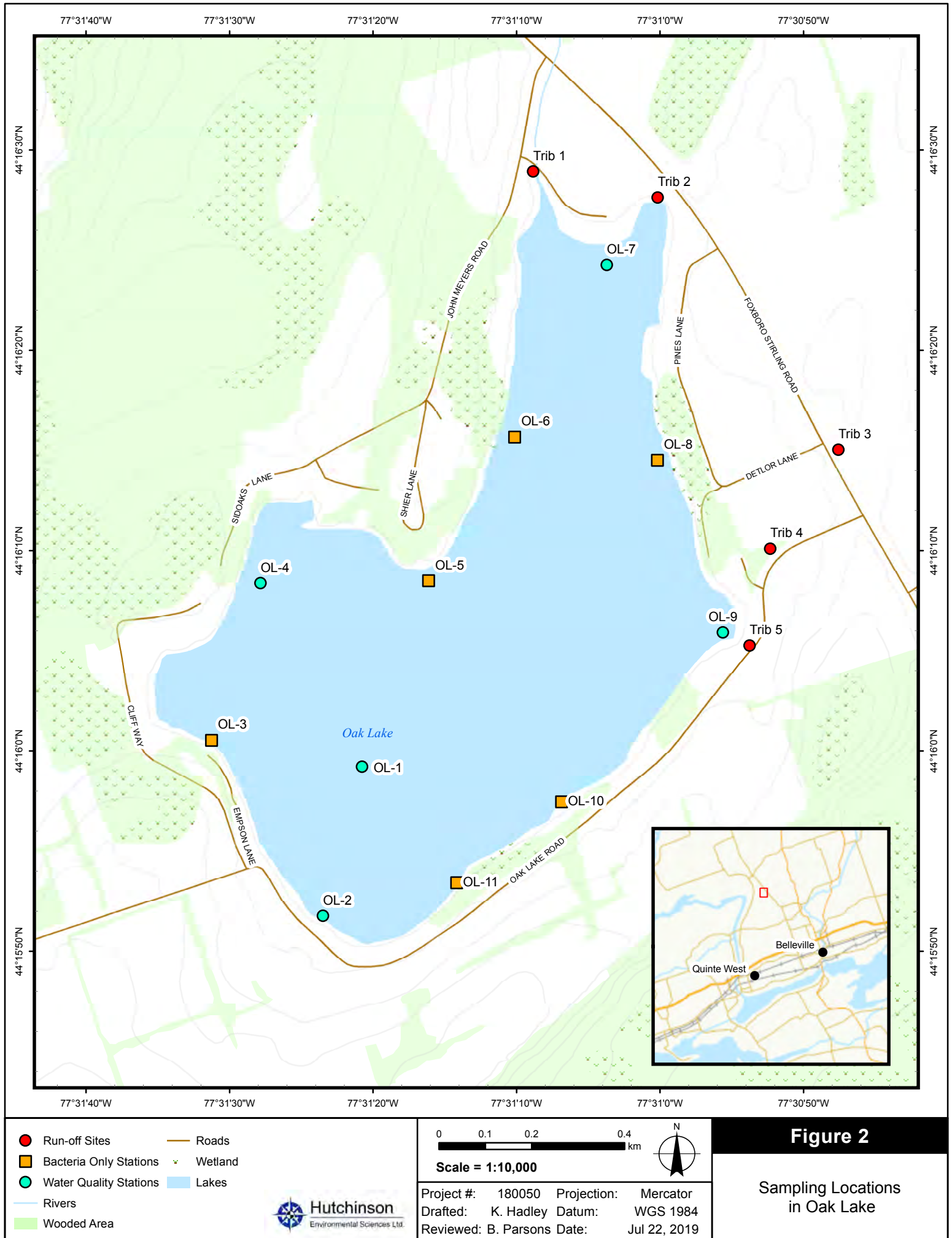


Figure 2

**Sampling Locations
in Oak Lake**

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2.3 Sediment Quality

A sediment sample was collected on August 16, 2018 from OL-1 using a gravity corer. The top 5 cm of the sediment core was removed using a cross-section extruder and analyzed for a standard suite of parameters (phosphorus, total Kjeldahl nitrogen and metals) at ALS Laboratories in Kitchener. Sediment quality parameters were evaluated against applicable Guidelines for the Protection and Management of Aquatic Sediment in Ontario (Ministry of Environment and Energy, 1993) and Canadian Sediment Quality Guidelines (CWQGs) for the protection of Freshwater Aquatic Life (CCME, 2012).

Samples were also analyzed at Guelph University for Psenner fractionation to quantify the chemical forms of phosphorus in the sediments and provide context for the assessment of internal loading of nutrients from the sediments in Oak Lake.

2.4 Phytoplankton

Phytoplankton (i.e. algae) samples were collected via 0.5 m deep grab samples from OL-1 on August 16, 2018, February 11, 2019, May 8, 2019 to characterize seasonal variability of algal assemblages, and from observed filamentous algal assemblages on May 8, 2019 and July 4, 2019. Samples were preserved with Lugol's iodine solution and submitted to ALS Laboratories in Winnipeg, Ontario for taxonomic identification to the lowest practical taxonomic level and enumeration (cells/unit volume of water). Samples collected on July 4, 2019 were also assessed for microcystin concentrations which are toxins produced by cyanobacteria (i.e. blue-green algae). Phytoplankton abundance was evaluated against World Health Organization (WHO, 2003) guidelines for cyanobacteria and microcystin abundance was evaluated against Guidelines for Canadian Recreational Water Quality (Health Canada, 2012).

2.5 Inspections of Sewage Treatment Systems and Shoreline Development Practices

"An Evaluation of the On-Site Sewage Disposal Systems for Properties Fronting on Oak Lake" (Ontario Lake Assessments, 2002a) was completed in 2001 to identify substandard systems and provide an educational tool for shoreline owners that would encourage maintenance of sewage systems due to the potential impacts on water quality. Systems were classified as high, moderate or low risk depending on proximity to the water, physical condition and maintenance schedule. The degree of development of each property was also evaluated according to the amount of naturalized area, size of remaining buffer strip and percentage of property occupied by buildings.

Updated information on septic systems, the nature of shoreline development and lake management concerns was also gathered through a mailed-out questionnaire and scoped level 1 septic site investigations in 2018. The questionnaire and site investigations were designed to allow for a comparison with 2001 data and to assess changes in the condition of septic systems and shoreline development practices over the last 17 years. Information was also collected to assess key septic system and shoreline development aspects that may influence lake health, and to characterize landowner's lake management concerns, satisfaction with the lake and recreational use for input into the development of lake management recommendations. The questionnaire that was mailed out to 141 shoreline residents is provided in Appendix A.



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Site investigations were completed from August 21 to 26, 2018 at 86 properties where landowners were present and allowed access. Investigations were completed to confirm information provided in the questionnaire and collect additional information on shoreline development practices (% cleared lawn, presence of absence of buffer strip, % property developed), sewage system condition (i.e. evidence of septic failure), and other incidental information.

2.6 Phosphorus Budget

Phosphorus is often the limiting nutrient for growth of algae and macrophytes in freshwater systems and is present in human and domestic waste and agricultural runoff, while the clearing of forests and vegetation reduces the ability of lands to retain phosphorus. Phosphorus loads from the watershed, atmosphere, sewage treatment systems, and lake sediments were estimated based on loading rates presented in protocols or peer-reviewed literature, or through data collected as part of this study. The quantification of phosphorus loads allows phosphorus loads and potential reduction measures to be compared in a like-for-like manner and used to inform management recommendations.

2.6.1 Watershed Phosphorus Load

An export coefficient modelling approach was used to assess the relative contributions of external phosphorus sources (land use runoff) to Oak Lake. Export coefficient modelling is a well-established method of estimating phosphorus export for a specific site, in the absence of measured data. The total phosphorus load transported to the lake is predicted as the sum of export of phosphorus from each land use in the catchment using the equation:

$$L = \sum EiAi + P$$

Where L is the phosphorus load delivered to the lake, Ei is the export coefficient (kg/ha/yr) selected for the specific land use, Ai is the area (ha) of the land use, and P is the input from precipitation to the lake (surface area).

This approach serves as the foundation for the Phosphorus Budget Tool for the Lake Simcoe Watershed ("P Tool"; HESL 2011). The P Tool was developed by Hutchinson Environmental Sciences Ltd. (HESL), Greenland International Consulting Ltd. and Stoneleigh Associates for the Ontario Ministry of the Environment, to provide a consistent science-based approach when estimating phosphorus loadings from stormwater runoff in the Lake Simcoe watershed (HESL 2011). It uses literature derived phosphorus export coefficients (kg/ha/yr) combined with the area of the different land use types present in a watershed to estimate the external phosphorus load (kg/yr) to the lake.

The P Tool was used to estimate non-point source phosphorus loadings from land uses to Oak Lake. Land use classifications and export coefficients used for the analysis were based on those in the Tool (Table 2).



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Table 2. Phosphorus Export Coefficients Used in the Oak Lake Phosphorus Budget.

Land Use	Export Coefficient (kg/ha/yr)	Rationale
Forest	0.06	Mean phosphorus export for all 'monitored' Lake Simcoe subwatersheds (n = 7) derived using phosphorus loads from CANWET modeling. Monitored subwatersheds were those with sufficient measured data to validate and calibrate the model (HESL 2011, HESL 2014a).
Transition	0.07	
Wetland	0.05	
Aggregate	0.08	
Residential	0.13	
Agriculture	0.36	Maximum export coefficient (range: 0.11 to 0.36 kg/ha/yr) for all 'monitored' Lake Simcoe subwatersheds (n = 7). The maximum export coefficient was selected because tile drains (direct channels to the lake) are present in agricultural fields and contain elevated phosphorus concentrations (0.15 mg/L - 0.57 mg/L (Section 3.1.2) when flowing.
Open Water/ Atmosphere	0.26	Calculated from the mean measured atmospheric load of 19 tonnes/yr averaged over 5 years from 2002 to 2007 to the surface of Lake Simcoe (surface area = 722 km ²) (LSRCA, 2009).

The Oak Lake watershed area is 287 ha. Land use areas were determined using the Southern Ontario Land Resource Information System Version 2.0 (MNR 2015) in a GIS environment, and cross-checked with Google Earth imagery and ground-truthing. Agriculture is the dominant land use, comprising 130.5 ha, or 46% of the watershed area (Figure 3, Table 3). Forests, wetlands, and open water areas represent a lesser proportion (12% to 17%) of the watershed. Residential land uses (e.g. homes, manicured lawns, driveways and roads) surround the lake (Figure 3) and cover 9% of the watershed. Transitional and aggregate land uses represent a minor (<5%) portion (Figure 3, Table 3) of the watershed area.

Table 3. Land Uses Areas in the Oak Lake Watershed.

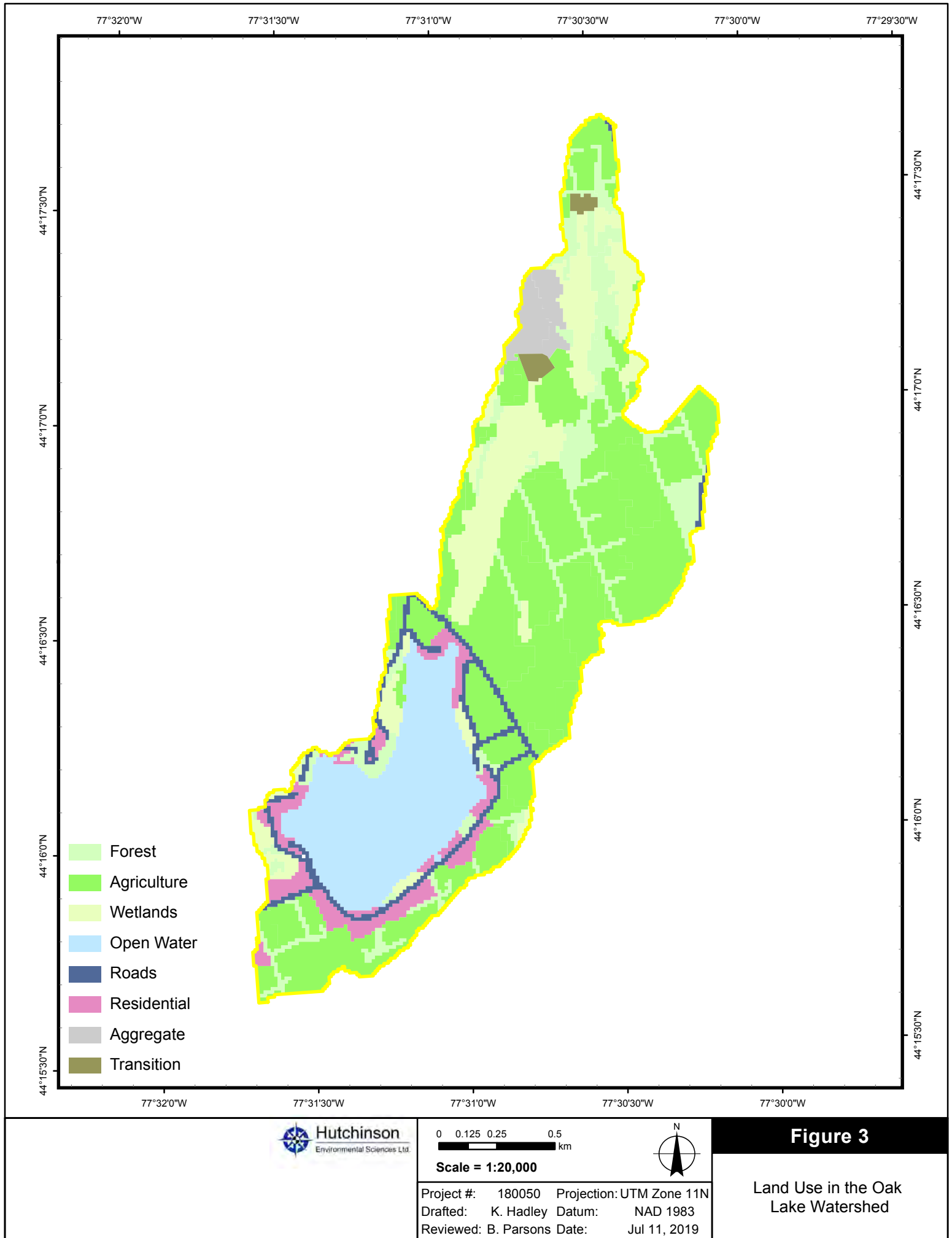
Land Use	Area (ha)
Agriculture	130.5
Wetland	38.8
Forest	33.6
Transition	2.1
Residential	26.2
Aggregate	7.1
Open Water/Atmosphere	48.4
Total	286.8



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It should be noted that phosphorus concentrations from the tile drain at sampling locations Trib-4 and Trib-5 were collected but it is not possible to assign a phosphorus load from the tile drain and associated agricultural lands unless flows and related phosphorus concentrations in the tile drain are quantified continuously throughout the year. Also, we acknowledge that a pig manure spill occurred on February 12-16, 2018 which resulted in a large, one-time load of phosphorus, in addition to other pollutants entering Oak Lake. This phosphorus load cannot be estimated and was assumed to be a non-recurring event and so was not entered into the phosphorus budget but the occurrence of the manure spill and elevated nutrient concentrations in the tile drain justify elevated phosphorus loading rates recommended in related literature and protocols.





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2.6.2 Sewage Treatment System Phosphorus Load

Phosphorus loads from sewage treatment systems were estimated based on guidance in Province of Ontario (2010):

- septic load rate (0.66 kg/capita yrs/yr) * occupancy rate (0.69 to 2.56) * # of units

Occupancy rates were determined based on the results of 52 completed questionnaires that answered question #3 (Do you use your cottage or residence: summer only, summer and occasionally in winter, regularly throughout the year, permanent resident) and assigned a corresponding usage from Province of Ontario (2010) for permanent (2.56 capita yrs/yr), extended seasonal (1.27 capita yrs/yr) or seasonal (0.69 capita yrs/yr) usage. The occupancy rates of the remaining residences from landowners who did not provide the information were assumed based on the ratio of occupancies from those who did.

2.6.3 Internal Phosphorus Load

Internal loading of phosphorus to the lake from sediments occurs under anoxic conditions and may represent a significant input of nutrients to the system. In some cases, internal loading can account for over half of the total annual phosphorus load to shallow lakes and may prevent improvements in water quality when managing point and non-point source pollution (Søndergaard, 2003). Internal phosphorus is released from sediments primarily in dissolved form that is available for biological uptake by algae and cyanobacteria and so may trigger nuisance growths. In addition, some cyanobacteria are able to take phosphorus directly from the sediments.

A commonly used method to calculate the internal load is the Nürnberg in-situ method (Nürnberg 1988, 2009), which is based on changes in phosphorus concentrations between two dates. This approach assumes that the external phosphorus and the water loads to Oak Lake remain static between the two dates and that any increase in lake phosphorus concentrations is due to internal loading. This method is appropriate for Oak Lake because it receives very little inflow or outflow, especially between spring and late summer which are the dates typically used in the assessment to calculate the summer internal load, which makes up the majority of the annual internal load.

The equation for strongly stratified lakes was used to calculate the summer internal phosphorus load as the difference between end-of-summer hypolimnetic phosphorus mass and phosphorus mass from samples collected at the beginning of the anoxic period (i.e. spring):

$$\text{Summer internal phosphorus load} = (\text{end of summer phosphorus concentration} * \text{volume of Oak Lake}) - (\text{phosphorus concentration at the beginning of the anoxic period} * \text{volume of Oak Lake}) / \text{area of lake}$$

The same equation was used to calculate the winter internal phosphorus load as the difference between winter hypolimnetic phosphorus mass and phosphorus mass from samples collected after fall turnover:

$$\text{Winter internal phosphorus load} = (\text{phosphorus concentration under ice} * \text{volume of Oak Lake}) - (\text{phosphorus concentration after fall turnover} * \text{volume of Oak Lake}) / \text{area of lake}$$



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2.7 Water Levels

Rising lake levels were identified as a major concern for residents and their properties. Water level management recommendations were informed by the background review, which included review of historical water levels and survey results focused on a) the level of concern related to water level fluctuation, b) seriousness of problems with lake (including water level fluctuation), c) whether water levels are too high, too low or are good as is, and d) what impacts water levels have had on shoreline properties.

Field investigations included an examination of water levels, determination of the impact of culvert elevation on water levels during each sampling event and documented through photographs.

It should be noted that although water level fluctuation and water level management has become the primary issue of concern for residents, the current study was focused on water quality and not on management of water levels. The scope of study did include consideration of water levels and how management would impact water quality and so that was addressed but determination of an engineered solution for water levels was outside of the scope of the current study. We have, however, included recommendations on steps needed to address water level management issues for Oak Lake.

3. Results

3.1 Water Quality

Water quality results for open water sites (i.e. minimum, maximum and mean) are summarized by site on Table 4 and by season on Table 5, while results for tributary sites are presented on Table 6. Bacteria results are summarized for open water sites on Table 8 and Table 9, and for tributary sites on Table 10.

A master spreadsheet with all water quality results is presented in Appendix B, while additional laboratory related water quality information such as Chains of Custody, Sample Receipt Confirmations and Certificates of Analysis are provided in Appendix C.

3.1.1 Temperature

Temperature profiles followed typical seasonal stratification found in dimictic lakes. Stratification, the separation of the lake into distinctive thermal layers which do not mix, was established in May/June and persisted throughout the summer until fall overturn in late September (Figure 4). The establishment of thermal stratification in lakes prevents mixing of water between the warm surface waters (epilimnion) and the relatively cool deeper water (hypolimnion) and as a result prevents oxygen rich surface water from mixing with oxygen depleted bottom waters. As oxygen is consumed in the deep water over time by bacterial decomposition and other processes, anoxia may develop and result in internal phosphorus loading to the lake (See Section 3.1.2)

3.1.1 Dissolved Oxygen

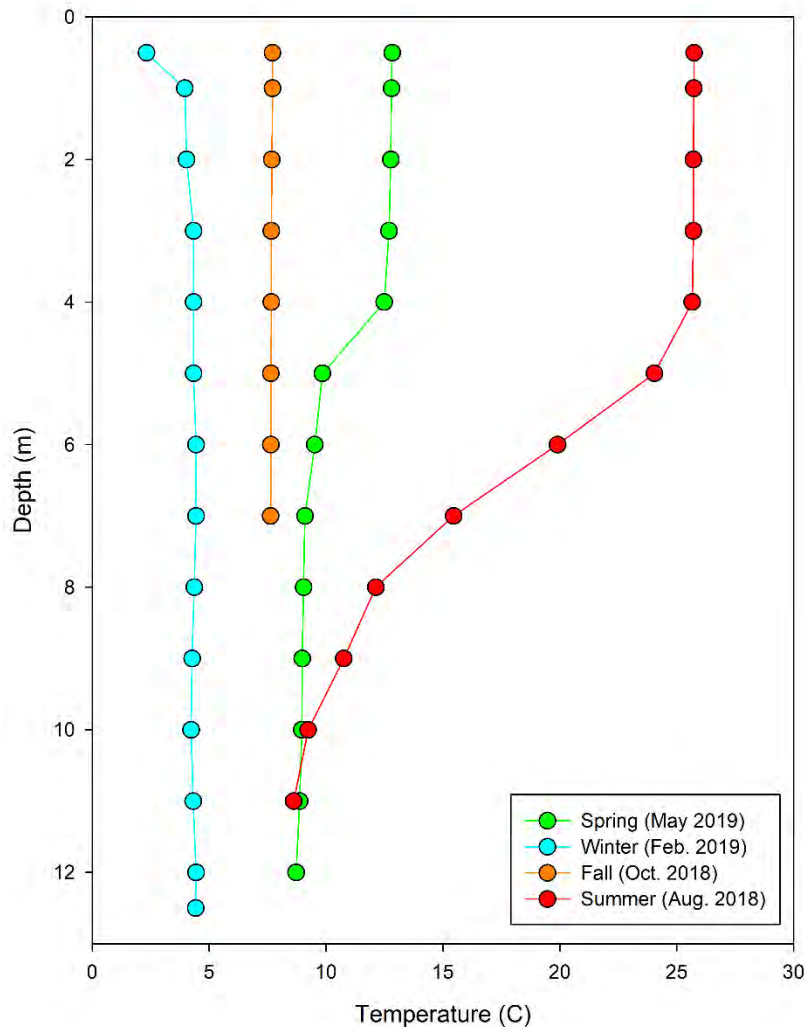
Dissolved oxygen concentrations were similar between sites and followed a seasonal pattern where the lowest concentrations were recorded in summer and concentrations increased in fall and winter/spring in an inverse relationship with water temperature (Table 5). The relationship between water temperature and



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dissolved oxygen exists because solubility of dissolved oxygen decreases as temperature increases. Profiles indicated that the lake was stratified at ~6-9m in summer, fall and winter.

Figure 4. Seasonal Temperature Profiles in Oak Lake, 2018/2019



Dissolved oxygen concentrations at Trib-2, Trib-4 and Trib-5 ranged from 44.4% (6.41 mg/L) to 132% (14.17 mg/L). The lowest concentrations were recorded at Trib-4 and Trib-5 downstream of the tile drain in the winter, likely because the organic inputs from the tile drain resulted in abundant bacteria that use up the oxygen during respiration.

Dissolved oxygen increased between 6 and 7 m, where algal assemblages and associated photosynthesis provided increased oxygen, before sharply declining to approximately 0.67 mg/L at 9 m on August 16, 2018, indicating the bottom of the lake was anoxic (i.e. lacked oxygen) at that time (Figure 5). MECP measured a similar oxygen profile in September 2018 where dissolved oxygen conditions <1 mg/L were measured at 8 m and deeper. Dissolved oxygen (and water temperatures) were similar throughout the water column on

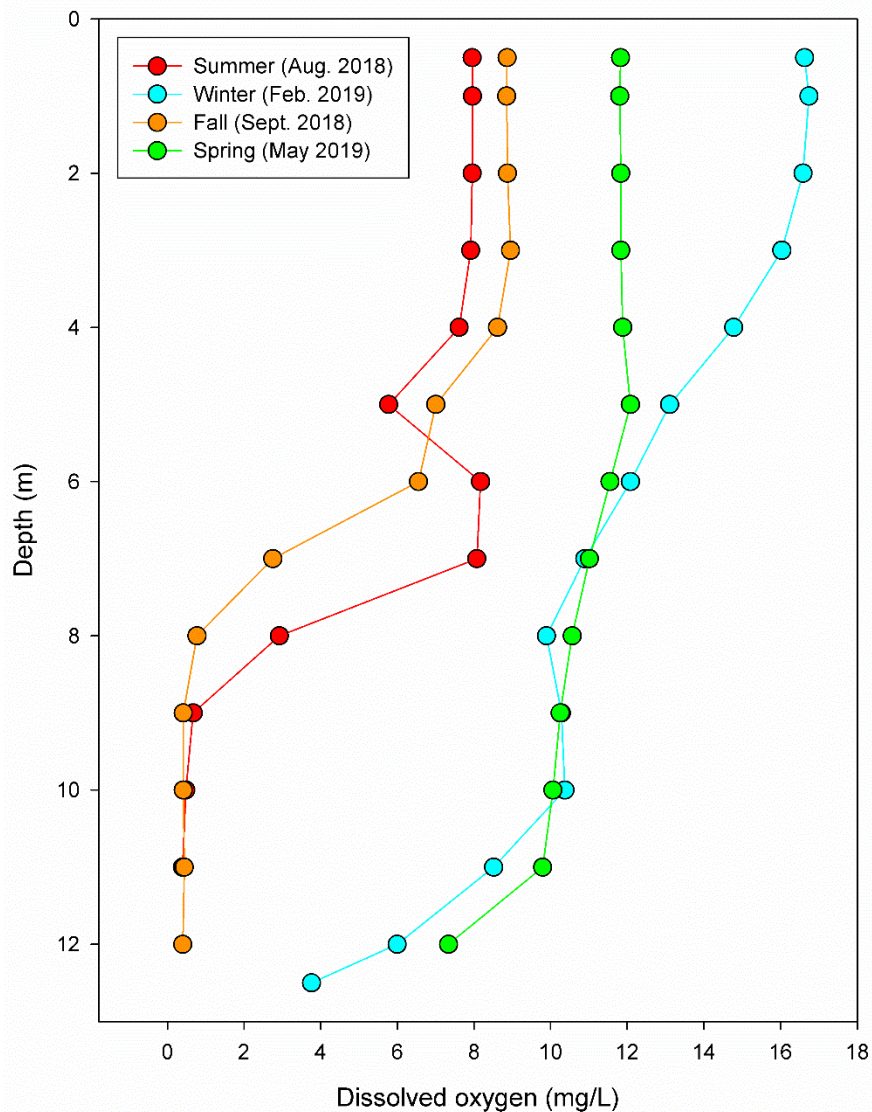


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September 1, 2018, February 11, 2019 and May 8, 2019, indicating the lake was mixed and not thermally stratified.

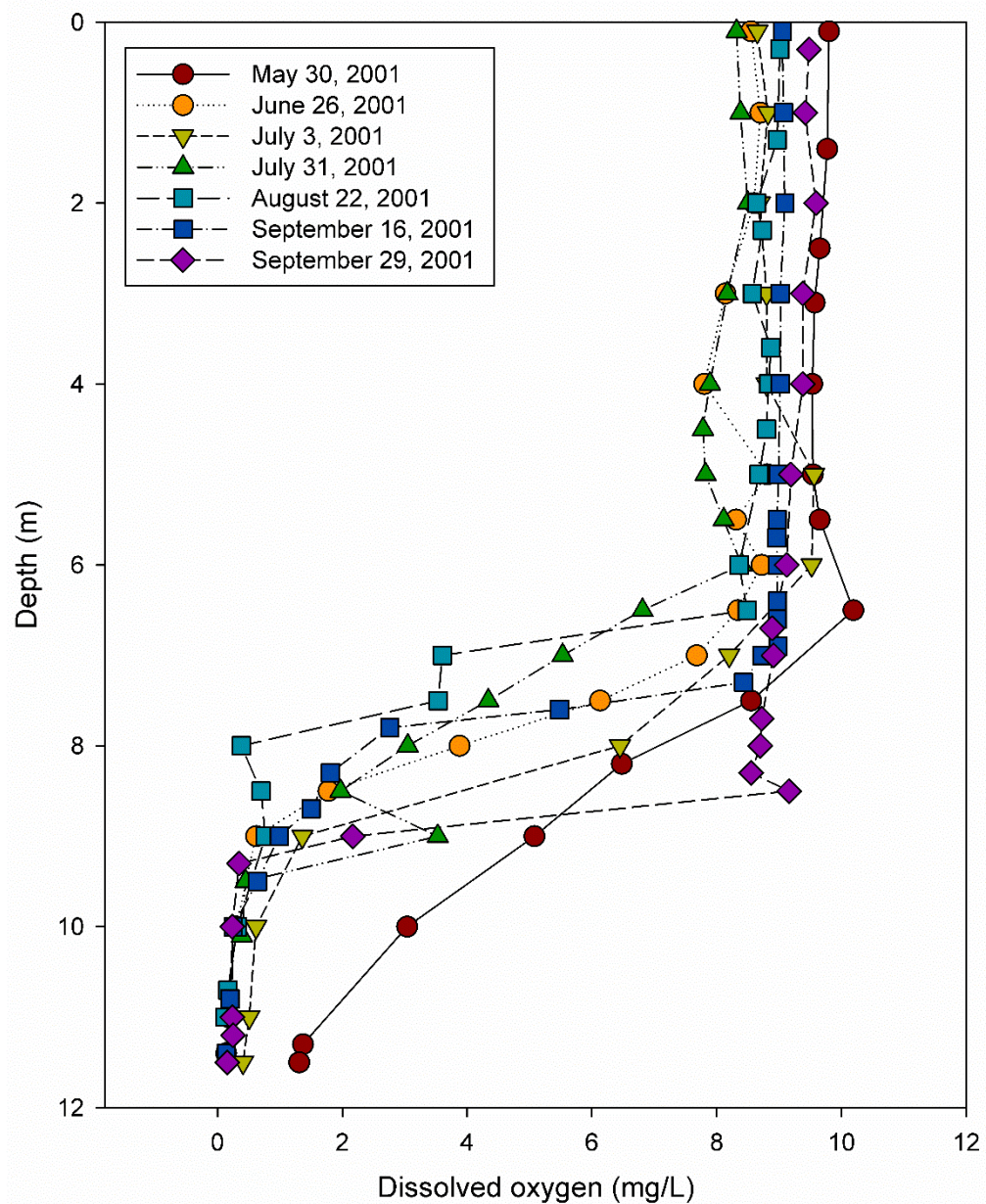
A number of dissolved oxygen profiles were recorded by Ontario Lake Assessment (OLA, 2002b) throughout the open water season in 2001 (Figure 6). The profiles showed that dissolved oxygen concentrations declined sharply below approximately 7-8 metres and remained near zero throughout the rest of the water column. Dissolved oxygen concentrations measured at the beginning (i.e. May 30, 2011) and end (i.e. January 29, 2011) of the sampling season contained the highest oxygen concentrations at the greatest depths, as they represented early summer conditions after spring overturn and earlier winter conditions, both prior to any substantial oxygen demand. The OLA profiles showed the same oxygen conditions documented by HESL and MECP in 2018-2019.

Figure 5. Seasonal Dissolved Oxygen Profiles in Oak Lake, 2018/2019.



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Figure 6. Seasonal Dissolved Oxygen Profiles in Oak Lake, 2001.



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Table 4. Water Quality Summary by Site.

	Units	Guideline	OL-1			OL-2			OL-4			OL-7			OL-9		
Field Parameters			Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean
Temperature	°C		2.32	25.74	12.15	2.98	24.94	12.14	3.47	25.43	12.46	2.47	24.63	11.82	2.57	25.04	11.83
Conductivity	µS/cm^c		274	328	293	271	328	300	269	330	301	287	344	313	264	330	301
	µS/cm		156	282	222	177	270	224	182	271	226	188	286	233	179	264	223
Dissolved Oxygen	%	47	91.9	123.3	106.2	88.7	113.3	100.5	94.1	124.6	108	73.2	118	100.3	71.8	115.3	98.7
	mg/L		7.95	16.62	11.84	7.35	13.59	11.17	8.34	16.4	11.92	6.88	15.22	11.66	5.93	15.42	11.24
pH	pH units	6.5 - 8.5	8.08	8.77	8.39	7.71	8.84	8.2	8.02	8.82	8.44	7.93	8.84	8.3	7.97	8.81	8.29
Physical Tests (Water)																	
Hardness (as CaCO ₃)	mg/L		59.00	85.60	72.90	61.00	83.60	73.15	59.00	83.60	71.90	54.00	83.50	69.13	55.00	87.90	74.98
pH	pH units	6.5 - 8.5	7.97	8.60	8.21	7.95	8.66	8.25	7.92	8.62	8.22	7.61	8.70	8.19	7.59	8.81	8.16
Total Suspended Solids	mg/L		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	4.30	2.58	2.00	3.10	2.60
Anions and Nutrients (Water)																	
Alkalinity, Total (as CaCO ₃)	mg/L		50.00	83.00	67.00	49.00	81.00	68.25	46.00	81.00	65.25	48.00	80.00	64.25	41.00	83.00	67.00
Ammonia, Total (as N)	mg/L		0.07	0.13	0.11	0.01	0.54	0.16	0.02	0.21	0.11	0.03	0.37	0.17	0.05	0.74	0.39
Unionized Ammonia	mg/L	0.02	0.0007	0.03	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.02	0.01	0.00	0.03	0.01
Chloride (Cl)	mg/L	120	49.60	51.60	51.05	49.60	57.90	52.63	48.90	51.60	50.43	50.20	53.70	52.10	49.30	51.80	51.08
Nitrate (as N)	mg/L	13	0.01	0.08	0.03	0.01	0.09	0.04	0.01	0.21	0.06	0.01	0.26	0.08	0.02	0.30	0.09
Total Kjeldahl Nitrogen	mg/L		0.37	0.65	0.51	0.53	0.74	0.61	0.46	0.82	0.59	0.46	0.81	0.66	0.63	1.02	0.77
Total Phosphorus (Top)	mg/L	0.02	0.009	0.053	0.021	0.008	0.037	0.017	0.010	0.018	0.013	0.005	0.071	0.026	0.022	0.151	0.061
Total Phosphorus (Bottom)	mg/L		0.007	0.032	0.020												
Sulfate (SO ₄)	mg/L		1.54	2.04	1.78	1.55	2.17	1.81	1.54	2.04	1.78	1.13	2.23	1.71	1.61	2.52	1.92
Organic / Inorganic Carbon (Water)																	
Dissolved Organic Carbon	mg/L		5.88	6.19	5.98	4.89	6.54	5.78	4.85	6.47	5.72	5.30	7.68	6.30	5.02	8.23	6.69
Plant Pigments (Water)																	
Chlorophyll a	mg/L		1.63	6.92	3.91	2.55	13.50	6.70	2.65	4.65	3.90	2.76	10.20	5.68	3.40	9.23	7.18
Total Metals (Water)																	
Aluminum (Al)-Total	mg/L	0.075	0.0119	0.0196	0.0157	0.0066	0.0252	0.0140	0.0059	0.0139	0.0100	0.0077	0.0350	0.0173	0.0083	0.0658	0.0338
Antimony (Sb)-Total	mg/L		0.00010	0.00011	0.00010	0.00010	0.00011	0.00010	0.00010	0.00013	0.00011	0.00010	0.00011	0.00010	0.00010	0.00016	0.00012
Arsenic (As)-Total	mg/L	0.005	0.0005	0.0006	0.0006	0.0005	0.0006	0.0006	0.0005	0.0007	0.0006	0.0005	0.0006	0.0005	0.0005	0.0007	0.0006
Barium (Ba)-Total	mg/L		0.015	0.016	0.016	0.014	0.017	0.016	0.014	0.016	0.015	0.014	0.016	0.015	0.013	0.019	0.016



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Boron (B)-Total	mg/L	0.2	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Cadmium (Cd)-Total	mg/L	0.0001	0.000005	0.000006	0.000005	0.000005	0.000017	0.000009	0.000005	0.000014	0.000008	0.000005	0.000030	0.000013	0.000005	0.000052	0.000021
Calcium (Ca)-Total	mg/L		18.8	29.6	24.6	19.6	28.9	24.6	18.8	28.8	24.3	16.7	28.6	23.0	17.2	30.3	25.2
Chromium (Cr)-Total	mg/L	0.1	0.0005	0.0091	0.0062	0.0005	0.0005	0.0005	0.0005	0.0006	0.0005	0.0005	0.0014	0.0008	0.0005	0.0005	0.0005
Cobalt (Co)-Total	mg/L	0.0006	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Copper (Cu)-Total	mg/L	0.005	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.002	0.001	0.002	0.001
Iron (Fe)-Total	mg/L	0.3	0.013	0.050	0.035	0.012	0.050	0.027	0.012	0.050	0.023	0.044	0.062	0.050	0.020	0.091	0.052
Lead (Pb)-Total	mg/L	0.005	0.00005	0.00005	0.00005	0.00005	0.00006	0.00005	0.00005	0.00009	0.00006	0.00005	0.00009	0.00006	0.00005	0.00016	0.00009
Magnesium (Mg)-Total	mg/L		2.66	2.85	2.79	2.76	2.84	2.81	2.50	3.05	2.81	2.40	2.93	2.79	2.87	2.99	2.94
Manganese (Mn)-Total	mg/L		0.004	0.006	0.005	0.003	0.005	0.004	0.003	0.005	0.004	0.010	0.014	0.011	0.006	0.039	0.017
Molybdenum (Mo)-Total	mg/L	0.01	0.00011	0.00021	0.00017	0.00009	0.00012	0.00011	0.00008	0.00010	0.00009	0.00005	0.00014	0.00010	0.00008	0.00022	0.00013
Nickel (Ni)-Total	mg/L	0.025	0.0005	0.0024	0.0011	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Potassium (K)-Total	mg/L		1.40	2.20	1.78	1.40	1.86	1.70	1.44	1.74	1.60	1.70	2.27	1.92	1.51	4.38	2.56
Rubidium (Rb)-Total	mg/L		0.0013	0.0017	0.0014	0.0013	0.0015	0.0014	0.0012	0.0013	0.0012	0.0013	0.0017	0.0015	0.0013	0.0021	0.0016
Selenium (Se)-Total	mg/L	0.1	0.00005	0.00007	0.00006	0.00005	0.00005	0.00005	0.00005	0.00006	0.00005	0.00005	0.00007	0.00006	0.00005	0.00009	0.00006
Silicon (Si)-Total	mg/L		0.10	0.15	0.12	0.10	0.11	0.10	0.10	0.11	0.10	0.10	0.22	0.16	0.10	0.43	0.22
Sodium (Na)-Total	mg/L		27.9	29.2	28.5	27.5	32.1	29.6	25.7	30.1	27.8	28.6	31.3	30.2	28.2	30.6	29.5
Strontium (Sr)-Total	mg/L		0.058	0.066	0.062	0.058	0.067	0.063	0.056	0.064	0.059	0.053	0.066	0.058	0.058	0.067	0.063
Sulfur (S)-Total	mg/L		0.71	0.84	0.78	0.77	0.87	0.82	0.71	0.83	0.78	0.68	1.11	0.88	0.82	0.96	0.88
Titanium (Ti)-Total	mg/L		0.0003	0.0070	0.0026	0.0003	0.0004	0.0003	0.0003	0.0004	0.0003	0.0003	0.0013	0.0006	0.0003	0.0028	0.0012
Uranium (U)-Total	mg/L	0.005	0.00002	0.00003	0.00002	0.00002	0.00003	0.00002	0.00002	0.00003	0.00002	0.00001	0.00003	0.00002	0.00003	0.00005	0.00004
Zinc (Zn)-Total	mg/L	0.02	0.003	0.003	0.003	0.003	0.006	0.004	0.003	0.004	0.003	0.003	0.004	0.003	0.003	0.010	0.005
Aggregate Organics (Water)																	
BOD	mg/L		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.9	2.2	2.0	2.7	2.2

Note: Minimum values are presented as ½ the detection limit for results that were less than the detection limit. Mean results were also calculated using ½ the detection limit.

Table 5. Water Quality Summary by Season

		08-May-19			16-Aug-18			29-Oct-18			11-Feb-19		
Field Measurements	Units	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean
Temperature	°C	12.83	13.98	13.17	24.63	25.74	25.16	6.21	7.80	7.24	2.32	3.47	2.76
Conductivity	µS/cm^c	328	330	329	264	287	274	293	299	295	274	344	309
	µS/cm	252	260	255	264	286	275	188	197	194	156	196	178
Dissolved Oxygen	%	111.8	118.0	114.1	71.8	101.6	86.6	91.9	98.9	95.4	100.9	124.6	114.8
	mg/L	11.8	12.3	12.0	5.9	8.3	7.3	11.0	12.2	11.5	13.6	16.6	15.5
pH		8.29	8.54	8.41	7.71	8.39	8.07	8.77	8.84	8.82	7.93	8.08	8.00
Physical Tests													
Hardness (as CaCO ₃)	mg/L	84	88	85	54	61	58	70	77	74	65	80	73
pH	pH units	8.27	8.38	8.31	8.60	8.81	8.68	7.97	8.07	8.02	7.59	7.97	7.81
Total Suspended Solids	mg/L	1.00	1.00	1.00	1.00	2.40	1.28	1.00	2.90	1.38	1.00	4.30	2.08
Anions and Nutrients													
Alkalinity, Total (as CaCO ₃)	mg/L	80.0	83.0	81.6	41.0	50.0	46.8	62.0	65.0	64.2	64.0	80.0	72.8
Ammonia, Total (as N)	mg/L	0.005	0.738	0.254	0.025	0.130	0.052	0.145	0.562	0.365	0.051	0.210	0.121
Unionized Ammonia	mg/L	0.0005	0.0308	0.0119	0.005	0.025	0.011	0.002	0.009	0.006	0.001	0.002	0.001
Chloride (Cl)	mg/L	49.3	50.2	49.7	51.6	53.4	52.0	51.1	51.7	51.4	48.9	57.9	52.7
Nitrate (as N)	mg/L	0.010	0.027	0.013	0.010	0.010	0.010	0.010	0.010	0.010	0.080	0.299	0.187
Total Kjeldahl Nitrogen	mg/L	0.500	0.780	0.610	0.500	0.640	0.582	0.460	0.650	0.562	0.370	1.020	0.752
Phosphorus, Total	mg/L	0.0104	0.0215	0.0135	0.0106	0.0255	0.0152	0.0050	0.0441	0.0152	0.0182	0.1510	0.0662
Sulfate (SO ₄)	mg/L	1.84	1.88	1.86	1.13	1.68	1.55	1.54	1.68	1.59	2.04	2.52	2.20
Organic / Inorganic Carbon													
Dissolved Organic Carbon	mg/L	4.85	5.91	5.19	6.19	7.68	6.84	5.87	6.19	5.98	5.56	8.23	6.36
Plant Pigments													
Chlorophyll a	µg/L	2.55	5.72	3.40	2.76	8.44	4.72	4.02	7.63	5.92	1.63	13.50	7.84
Total Metals													
Aluminum (Al)-Total	mg/L	0.0059	0.0119	0.0084	0.0077	0.0272	0.0157				0.0101	0.0658	0.0303
Antimony (Sb)-Total	mg/L	0.00005	0.00005	0.00005	0.00005	0.00010	0.00006				0.00011	0.00016	0.00012
Arsenic (As)-Total	mg/L	0.00046	0.00053	0.00050	0.00060	0.00070	0.00064				0.00047	0.00069	0.00057
Barium (Ba)-Total	mg/L	0.0155	0.0162	0.0158	0.0134	0.0147	0.0142				0.0149	0.0187	0.0163
Beryllium (Be)-Total	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005				0.00005	0.00005	0.00005
Bismuth (Bi)-Total	mg/L	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025				0.000025	0.000025	0.000025
Boron (B)-Total	mg/L	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050				0.0050	0.0100	0.0060
Cadmium (Cd)-Total	mg/L	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025	0.0000025				0.0000061	0.0000519	0.0000238
Calcium (Ca)-Total	mg/L	28.6	30.3	29.2	16.7	19.6	18.2	23.4	26.1	24.9	22.0	27.1	24.9
Cesium (Cs)-Total	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005				0.000005	0.000005	0.000005
Chromium (Cr)-Total	mg/L	0.00025	0.00139	0.00054	0.00025	0.00909	0.00202				0.00025	0.00025	0.00025
Cobalt (Co)-Total	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005				0.00005	0.00011	0.00006
Copper (Cu)-Total	mg/L	0.0005	0.0013	0.0007	0.0005	0.0005	0.0005				0.0005	0.0049	0.0021
Iron (Fe)-Total	mg/L	0.018	0.044	0.027	0.012	0.046	0.031	0.025	0.025	0.025	0.012	0.091	0.041
Lead (Pb)-Total	mg/L	0.000025	0.000051	0.000030	0.000025	0.000025	0.000025				0.000025	0.000162	0.000085

Lithium (Li)-Total	mg/L	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005				0.0005	0.0005	0.0005
Magnesium (Mg)-Total	mg/L	2.76	2.99	2.87	2.82	3.05	2.92	2.82	2.93	2.86	2.40	2.92	2.66
Manganese (Mn)-Total	mg/L	0.00504	0.01010	0.00647	0.00392	0.01420	0.00686				0.00341	0.03900	0.01193
Molybdenum (Mo)-Total	mg/L	0.000102	0.000124	0.000112	0.000025	0.000207	0.000097				0.000098	0.000217	0.000150
Nickel (Ni)-Total	mg/L	0.00025	0.00025	0.00025	0.00025	0.00238	0.00068				0.00025	0.00025	0.00025
Potassium (K)-Total	mg/L	1.70	1.86	1.77	1.40	1.80	1.51				1.63	4.38	2.46
Rubidium (Rb)-Total	mg/L	0.00125	0.00146	0.00133	0.00126	0.00136	0.00130				0.00121	0.00210	0.00165
Selenium (Se)-Total	mg/L	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025				0.000053	0.000094	0.000069
Silicon (Si)-Total	mg/L	0.005	0.005	0.005	0.110	0.160	0.126				0.005	0.430	0.162
Silver (Ag)-Total	mg/L	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025				0.000025	0.000025	0.000025
Sodium (Na)-Total	mg/L	27.5	28.6	28.0	29.1	31.3	30.1				25.7	32.1	29.3
Strontium (Sr)-Total	mg/L	0.0643	0.0671	0.0657	0.0555	0.0583	0.0570				0.0527	0.0667	0.0607
Sulfur (S)-Total	mg/L	0.710	0.840	0.796	0.680	0.850	0.768				0.790	1.110	0.914
Tellurium (Te)-Total	mg/L	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001				0.0001	0.0001	0.0001
Thallium (Tl)-Total	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005				0.000005	0.000005	0.000005
Thorium (Th)-Total	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005				0.00005	0.00005	0.00005
Tin (Sn)-Total	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005				0.00005	0.00005	0.00005
Titanium (Ti)-Total	mg/L	0.00015	0.00350	0.00085	0.00015	0.00037	0.00019				0.00035	0.00281	0.00120
Tungsten (W)-Total	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005				0.00005	0.00005	0.00005
Uranium (U)-Total	mg/L	0.000027	0.000035	0.000031	0.000005	0.000027	0.000018				0.000020	0.000050	0.000028
Vanadium (V)-Total	mg/L	0.000250	0.000250	0.000250	0.000250	0.000250	0.000250				0.000250	0.000250	0.000250
Zinc (Zn)-Total	mg/L	0.001500	0.005700	0.002700	0.001500	0.001500	0.001500				0.001500	0.010300	0.004780
Zirconium (Zr)-Total	mg/L	0.000150	0.000150	0.000150	0.000150	0.000150	0.000150				0.000150	0.000150	0.000150
Aggregate Organics													
BOD	mg/L	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.90	1.92

Note: Minimum values are presented as ½ the detection limit for results that were less than the detection limit. Mean results were also calculated using ½ the detection limit.

Table 6. Water Quality Results from Tributary Sites.

		Guideline	Trib-2	Trib-4			Trib-5		
Field Measurements	Units		8-May-2019	Minimum	Maximum	Mean	Minimum	Maximum	Mean
Temperature	°C		14.85	0.67	8.32	3.55	0.07	12.62	5.22
Conductivity	µS/cm^c		335	251	607	371	246	589	382
	µS/cm		270	134	413	229	128	449	252
Dissolved Oxygen	%	47	112.5	44.4	94.0	61.9	45.4	132.0	75.0
	mg/L		11.63	6.41	10.71	7.88	6.10	14.17	9.02
pH	pH units	6.5 - 8.5	8.38	7.95	8.77	8.31	7.97	8.24	8.12
Physical Tests (Water)									
Hardness (as CaCO3)	mg/L		84.8	97.0	287.0	221.3	96.0	279.0	210.3
pH	pH units	6.5 - 8.5	8.23	7.03	7.63	7.41	7.15	7.98	7.60
Total Suspended Solids	mg/L		1.0	10.3	15.3	12.0	4.6	5.5	5.1
Anions and Nutrients (Water)									
Alkalinity, Total (as CaCO3)	mg/L		83	108	280	218	109	270	214
Ammonia, Total (as N)	mg/L		0.026	0.940	2.210	1.447	0.641	1.580	1.010
Unionized Ammonia	mg/L	0.02	0.002	0.0186	0.0461	0.0316	0.0063	0.0245	0.0180
Chloride (Cl)	mg/L	120	51.1	6.7	12.2	9.7	6.8	14.4	10.5
Nitrate (as N)	mg/L	13	0.010	0.786	6.720	2.783	0.491	6.580	2.596
Total Kjeldahl Nitrogen	mg/L		0.37	2.33	3.45	2.72	1.60	2.71	2.19
Phosphorus, Total	mg/L	0.02	0.020	0.153	0.572	0.351	0.148	0.512	0.353
Sulfate (SO4)	mg/L		1.85	3.65	8.28	6.17	3.39	7.97	6.19
Organic / Inorganic Carbon (Water)									
Dissolved Organic Carbon	mg/L		5.2	6.5	22.9	13.6	6.7	22.1	12.6
Plant Pigments (Water)									
Chlorophyll a	ug/L		6.1	14.2	14.2	14.2	16.0	16.0	16.0
Total Metals (Water)									
Aluminum (Al)-Total	mg/L	0.075	0.0108	0.0495	0.278	0.1655	0.0224	0.128	0.0703
Antimony (Sb)-Total	mg/L		0.00005	0.00011	0.00014	0.0001267	0.00012	0.00013	0.0001233
Arsenic (As)-Total	mg/L	0.005	0.00053	0.00053	0.00139	0.00093	0.00062	0.00121	0.0008767
Barium (Ba)-Total	mg/L		0.0157	0.0251	0.0534	0.0409	0.0218	0.0427	0.03533
Beryllium (Be)-Total	mg/L		0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Bismuth (Bi)-Total	mg/L		0.000025	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025
Boron (B)-Total	mg/L	0.2	0.005	0.011	0.031	0.02	0.011	0.023	0.018
Cadmium (Cd)-Total	mg/L	0.0001	0.0000025	0.000011	0.0000313	0.0000239	0.0000122	0.0000238	0.000017
Calcium (Ca)-Total	mg/L		29.2	32.5	100.0	77.2	32.6	98.5	73.3
Cesium (Cs)-Total	mg/L		0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Chromium (Cr)-Total	mg/L	0.1	0.00140	0.00053	0.00082	0.00063	0.00025	0.00160	0.00081
Cobalt (Co)-Total	mg/L	0.0006	0.00005	0.00030	0.00126	0.00068	0.00023	0.00115	0.00061
Copper (Cu)-Total	mg/L	0.005	0.00050	0.00150	0.00520	0.00280	0.00130	0.00520	0.00267

Iron (Fe)-Total	mg/L	0.3	0.06500	0.20600	0.96700	0.47300	0.13300	0.82600	0.37967
Lead (Pb)-Total	mg/L	0.005	0.00003	0.00010	0.00017	0.00015	0.00005	0.00014	0.00010
Lithium (Li)-Total	mg/L		0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
Magnesium (Mg)-Total	mg/L		2.90	3.72	8.93	6.86	3.61	8.28	6.61
Manganese (Mn)-Total	mg/L		0.0097	0.1560	0.8600	0.4033	0.1120	1.3100	0.5537
Molybdenum (Mo)-Total	mg/L	0.01	0.00013	0.00049	0.00069	0.00056	0.00056	0.00059	0.00057
Nickel (Ni)-Total	mg/L	0.025	0.00025	0.00025	0.00110	0.00064	0.00051	0.00079	0.00062
Phosphorus (P)-Total	mg/L		0.025	0.146	0.635	0.365	0.136	0.587	0.379
Potassium (K)-Total	mg/L		1.72	6.38	11.30	8.32	6.48	11.50	8.51
Rubidium (Rb)-Total	mg/L		0.0013	0.0016	0.0024	0.0020	0.0015	0.0026	0.0021
Selenium (Se)-Total	mg/L	0.1	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Silicon (Si)-Total	mg/L		0.50	2.00	4.51	3.29	1.85	3.72	2.76
Silver (Ag)-Total	mg/L		0.000025	0.000025	0.000025	0.000025	0.000025	0.000025	0.000025
Sodium (Na)-Total	mg/L		29.30	3.18	6.79	5.57	3.45	8.50	6.35
Strontium (Sr)-Total	mg/L		0.067	0.060	0.183	0.138	0.059	0.183	0.133
Sulfur (S)-Total	mg/L		0.81	1.32	2.97	2.26	1.25	2.86	2.22
Tellurium (Te)-Total	mg/L		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Thallium (Tl)-Total	mg/L		0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Thorium (Th)-Total	mg/L		0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Tin (Sn)-Total	mg/L		0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Titanium (Ti)-Total	mg/L		0.00037	0.00228	0.01230	0.00713	0.00093	0.00484	0.00242
Tungsten (W)-Total	mg/L		0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Uranium (U)-Total	mg/L	0.005	0.00003	0.00029	0.00282	0.00127	0.00025	0.00169	0.00089
Vanadium (V)-Total	mg/L		0.00025	0.00116	0.00222	0.00157	0.00109	0.00125	0.00118
Zinc (Zn)-Total	mg/L	0.02	0.00150	0.00400	0.01160	0.00790	0.00490	0.01890	0.01250
Zirconium (Zr)-Total	mg/L		0.00015	0.00015	0.00015	0.00015	0.00015	0.00015	0.00015
Aggregate Organics (Water)	mg/L								
BOD			1.50	4.90	12.60	8.75	2.90	11.10	7.00

Note: Minimum values are presented as ½ the detection limit for results that were less than the detection limit. Mean results were also calculated using ½ the detection limit.

Oak Lake Water Quality Monitoring Report and Lake Management Plan**3.1.2 Nutrients****3.1.2.1 Phosphorus**

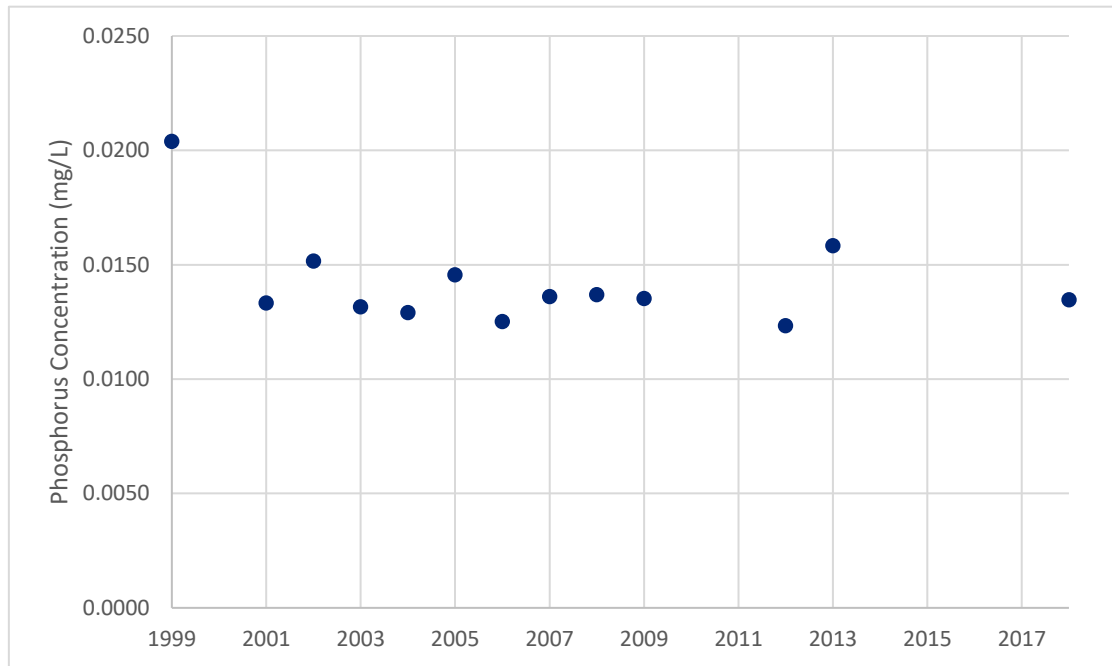
Phosphorus can enter lakes via external loading from the watershed, precipitation or through internal loading. Effluent from sewage treatment systems and stormwater runoff can have particularly high loadings. Phosphorus is the primary limiting nutrient in freshwaters in support of macrophyte and algal growth. Concentrations ranged between 0.005 mg/L and 0.151 mg/L at open water sites and exhibited considerable spatial and seasonal patterns (Table 4, Table 5). Average concentrations at open water sites were much higher in the winter (0.07 mg/L) than spring (0.01 mg/L), summer (0.02 mg/L) or fall (0.02 mg/L). Average concentrations were also much higher at OL-9 (0.06 mg) than the rest of the sites (0.01 mg/L - 0.03 mg/L).

Phosphorus concentrations were elevated at Trib-4 and Trib-5 on each sampling occasion (0.15 mg/L – 0.57 mg/L) with the highest average concentrations measured on February 11, 2019 (0.54 mg/L) and declining throughout the late winter (0.36 mg/L) and early spring (0.15 mg/L; Appendix B; Table 6) .

The average phosphorus concentration at OL-1 was 0.021 mg/L based on all data collected, and 0.010 during the open water season, the latter of which is lower than the PWQO for phosphorus concentrations during the ice-free period (0.02 mg/L) that is recommended to “avoid nuisance concentrations of algae in lakes”. 72 samples have been collected and analyzed at OL-1 as part of a variety of background studies between 1999 and 2014. Historical phosphorus concentrations ranged between 0.002 and 0.032 mg/L with an average concentration of 0.014 mg/L. Annual average phosphorus concentrations at OL-1 between 1999 - 2018 were calculated from historical data and were consistent over time beyond a somewhat elevated concentration in 1999 (0.02 mg/L; Figure 7). Mann Kendall trend analysis did not find a significant trend in total phosphorus concentrations ($p=0.46$).



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Figure 7. Average Annual Phosphorus Concentrations at OL-1 Over Time

Phosphorus concentrations at OL-1, 1 m off bottom, ranged between 0.007 mg/L on October 29, 2018 and 0.0321 mg/L on August 16, 2018 (Table 7). Phosphorus concentrations at OL-1 were similar near the surface and 1 m off bottom on May 8, 2019 and October 29, 2018 (Table 7). Concentrations were ~3x higher near bottom on August 16, 2018 yet ~3x higher at the surface on February 11, 2019 when samples were collected under ice.

11 samples were collected at OL-1, 1 m off bottom during historical studies, including approximately monthly during the open water season in 2001. Concentrations ranged between 0.01 mg/L and 0.1 mg/L with an average of 0.04 mg/L while the average concentration in 2018/19 was 0.02 mg/L.

Table 7. Phosphorus Concentrations at OL-1 from Near Surface Samples and Samples Collected 1 metre off Bottom

	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019
OL-1 (top)	0.0108	0.0086	0.0532	0.0104
OL-1 (btm)	0.0321	0.007	0.0193	0.0137

All phosphorus concentrations at Trib-4 and Trib-5 were elevated and ranged from 0.148 mg/L to 0.572 mg/L with the highest concentrations noted on February 11, 2019 and March 28, 2019 (Table 6).

3.1.2.2 Nitrogen Parameters

Nitrate occurs from nitrate oxidation of nitrogen compounds, notably ammonia from septic systems and agricultural runoff, and it can cause excessive growth of algae and macrophytes when phosphorus is also



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enriched. Nitrate ranged from 0.03 mg/L to 0.3 mg/L at open water sites (Table 4). Average concentrations were much higher in the winter (0.19 mg/L) than other seasons (0.01 mg/L - 0.03 mg/L; Table 5). Highest average concentrations were noted at OL-9 (0.09 mg/L) but all concentrations were well below the CCME toxicity guideline of 3 mg/L. Concentrations measured at Trib-4 and Trib-5 were elevated, some beyond the CCME guidelines, and ranged from 0.49 mg/L to 6.72 mg/L with the highest concentrations noted on May 8, 2019 (Table 6).

Total Kjeldahl Nitrogen (TKN) is a measure of ammonia plus organic nitrogen and is generally related to the supply of ammonia from the hydrolysis of organic compounds. TKN concentrations ranged between 0.37 mg/L and 1.02 mg/L, averaged 0.62 mg/L and were similar between sites and seasons (Table 4 and Table 5). Concentrations measured at Trib-4 and Trib-5 sites averaged 2.15 mg/L (Table 6). There are no provincial or federal water quality guidelines for TKN but McNeeley et al. (1979) recommended that a range of 0.1 mg/L to 0.5 mg/L is indicative of surface waters that are not affected by organic inputs.

Ammonia concentrations were converted to unionized ammonia because it is the most toxic form to aquatic biota and has a PWQO of 0.02 mg/L. Concentrations ranged between 0.0005 mg/L and 0.031 mg/L and exceeded the guideline of 0.02 mg/L at OL-1 on August 16, 2018 (0.025 mg/L), and OL-7 (0.021 mg/L) and OL-9 (0.031 mg/L) on May 8, 2019 (Table 4; Table 5). The concentration at OL-1 on August 16, 2018 appears erroneous based on other water quality results from that day of sampling. Total ammonia nitrogen at OL-1 on August 16, 2018 was 0.130 mg/L, 10x what was recorded at the other lake stations that same day suggesting potential contamination of the sample. Unionized ammonia concentrations ranged from 0.001 mg/L – 0.046 mg/L at the tributary sites and exceeded the PWQO on numerous occasions.

3.1.3 Other Notable Parameters

3.1.3.1 Metals

Concentrations of metals in Oak Lake are summarized in Table 4. Beryllium, Bismuth, Cesium, Lithium, Silver, Tellurium, Thallium, Thorium, Tin, Tungsten, Vanadium and zirconium were all below detection limits in all samples collected. Eighteen of the metals measured have available Provincial Water Quality Objectives (PWQO). No exceedances of PWQO guidelines were noted.

3.1.3.2 Chlorophyll *a*

Chlorophyll *a* is a photosynthetic pigment which is often used as a proxy to determine the abundance of algae in lakes and rivers. A detailed examination of phytoplankton assemblages is provided in Section 3.3. The average chlorophyll *a* concentration was higher in the winter (7.84 µg/L) than the other seasons (3.4 µg/L - 5.9 µg/L; Table 5), which is likely a result of limited light availability under ice. Algae tend to cluster in the winter directly under the ice which can result in increased chlorophyll *a* concentrations.

3.1.4 Bacteria

E. coli are a species of fecal coliform bacteria that comes from warm-blooded animals, including humans and are a useful indicator of potential pathogens in the water. Values ranged from less than the detection limit to 18 colony forming units (CFU)/100 mL, and averaged 2 CFU/100 mL at the open water sites (Table 8; Table 9). Concentrations measured at the tributary sites were slightly higher (range = 1 - 22 CFU/100 mL, mean = 9.14 CFU/100 mL) but all concentrations were low compared to the PWQO of 100 *E. coli*/100



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mL and Health Canada's single-sample maximum concentration of 400 *E. coli*/100 mL or geometric mean concentration (minimum five samples) of 200 *E. coli*/100 mL for primary contact recreation guideline (Health Canada, 2012; Table 10). Provincial and Health Canada water quality guidelines are based on a geometric mean of 5 samples within a one-month period because bacteria concentrations are notably variable both spatially and temporally. Bacteria sampling to the degree required by the Health Canada and PWQO guidelines was beyond the scope of this study, however the guidelines provide a useful point of reference.

Samples were collected and analyzed for *E. coli* in 2001 on May 30, Jul 3, July 31, August 22 and September 16 by Ontario Lake Assessments from the same sample sites used in 2018. Data collected in 2001 ranged from 0 CFU/100 mL - 300 CFU/100 mL and averaged 20.5 CFU/100 mL. The minimum detection limit was higher in 2001, indicating that non-detects at half the detection limit are greater than those data in 2018 but it is clear that *E. coli* concentrations were lower in 2018 than 2001.

Fecal coliforms are a subset of total coliform bacteria and are commonly fecal in origin. Concentrations ranged from 0 CFU/100 mL - 21 CFU/100 mL (mean = 2.40 CFU/100 mL) at open water sites and 2 CFU/100 mL - 50 CFU/100 mL (mean = 14.7 CFU/100 mL) at tributary sites (Table 8; Table 9; Table 10). Average fecal coliform concentrations were also much lower in 2018 than those measured in 2001 (mean = 114 CFU/100 mL).

Fecal streptococcus lab results refer to all members of genus names *Streptococcus* and *Enterococcus*, which are commonly referred to as *Fecal streptococci* and are an index of fecal pollution used for recreational waters. Concentrations ranged from 0.5 CFU/100 mL - 113 CFU/100 mL (mean = 11.19 CFU/100 mL) at open water sites and from 0.5 to >200 CFU/100 mL at tributary sites (Table 8; Table 9; Table 10). Average concentrations for all open water sites were highest in the summer (10.1 CFU/100mL) and winter (14.2 CFU/100mL) while average concentrations were highest at OL-9 (28 CFU/100mL) and OL-10 (41 CFU/100 mL). Average open water concentrations were again lower than those reported in 2001 (mean = 53.5 CFU/100 mL). Elevated *Fecal streptococcus* concentrations were found at Trib-4 and Trib-5 on February 11, 2019 (66 CFU/100 mL and 74 CFU/100mL) and March 28, 2019 (>200 CFU/100 mL and >200 CFU/100 mL). We are not aware of provincial or federal water quality guidelines for *Fecal streptococcus* so those comparisons have not been completed but studies have indicated that rates of gastroenteritis increased when densities exceeded 32/100 mL and bathers exhibited higher illness rates at 20 CFU/100 mL (Environmental Protection Agency, 2012).

Pseudomonas aeruginosa is a causative agent in many infections when present in recreational waters. *Pseudomonas aeruginosa* concentrations ranged from 0.5 CFU/100 mL - 117 CFU/100 mL (mean = 13.5 CFU/100 mL) at open water sites and from 3 CFU/100 mL - 43 CFU/100 mL (mean = 24.6 CFU/100 mL) at tributary sites (Table 8; Table 9; Table 10). Levels of *Pseudomonas aeruginosa* in Ontario recreational waters range from 0/100 mL to more than 100/100 mL with a median level is typically less than 1/100 mL (MOE 1984). *Pseudomonas* levels in excess of 100 organisms/100 mL can be measured in waters receiving surface drainage from urban areas. Lastly, for primary recreation British Columbia recommends that at least 5 samples are collected in a 30-day period and the level of *Pseudomonas aeruginosa* not exceed 2/100 mL in at least 75% of the samples (Ministry of Water, Land and Air Protection, 2001).



Table 8. Bacteria Summary by Site

	OL-1			OL-2			OL-3			OL-4			OL-5			OL-6		
Bacteriological Tests	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean
E. Coli	0.0	1.0	0.3	0.0	1.0	0.5	1.0	2.0	1.3	0.0	10.0	2.8	0.0	6.0	2.3	0.0	4.0	1.8
Fecal Coliforms	0.0	2.0	0.5	0.0	4.0	1.3	0.0	4.0	1.4	0.0	6.0	2.3	0.0	4.0	1.6	0.0	2.0	1.0
Fecal Streptococcus	0.5	3.0	1.3	0.5	5.0	3.1	0.5	37.0	14.3	0.5	4.0	1.4	1.0	4.0	2.8	0.5	26.0	11.4
Pseudomonas aeruginosa	0.5	4.0	1.4	0.5	11.0	3.1	0.5	29.0	14.8	0.5	49.0	12.6	4.0	21.0	12.5	4.0	58.0	31.0
	OL-7			OL-8			OL-9			OL-10			OL-11					
Bacteriological Tests	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean			
E. Coli	0.0	4.0	2.0	0.0	6.0	2.3	1.0	14.0	5.0	0.0	18.0	4.8	0.0	14.0	3.8			
Fecal Coliforms	0.0	6.0	2.5	0.0	2.0	1.0	0.0	21.0	8.8	0.0	7.0	2.0	0.0	14.0	3.9			
Fecal Streptococcus	1.0	12.0	4.5	1.0	51.0	14.0	2.0	59.0	28.0	3.0	113.0	40.8	0.5	4.0	1.8			
Pseudomonas aeruginosa	0.5	62.0	19.3	4.0	117.0	60.5	0.5	16.0	4.4	3.0	12.0	7.5	1.0	16.0	8.5			

Table 9. Bacteria Summary by Season

	08-May-19			28-Aug-18			28-Oct-18			22-Feb-19		
Bacteriological Tests	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean
E. Coli	0.0	3.0	0.8	1.0	14.0	3.6	0.0	3.0	3.6	0.0	18.0	3.6
Fecal Coliforms	0.0	2.0	0.6	1.0	14.0	4.4	0.0	10.0	4.4	0.0	21.0	4.4
Fecal Streptococcus	0.5	3.0	0.9	0.5	34.0	10.1	0.5	20.0	10.1	0.5	113.0	10.1
Pseudomonas aeruginosa	0.5	16.0	6.3	0.5	117.0	25.3	0.5	0.5	25.3	0.5	0.5	25.3

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Table 10. Bacteria Results from Tributary Sites

	Trib-2	Trib-4			Trib-5		
Bacteriological Tests (Water)	8-May-2019	Minimum	Maximum	Mean	Minimum	Maximum	Mean
E. Coli	22.0	3.0	19.0	8.7	1.0	12.0	5.3
Fecal Coliforms	50.0	5.0	20.0	10.7	2.0	11.0	7.0
Fecal Streptococcus	2.0	7.0	66.0	36.5	6.0	74.0	40.0
Pseudomonas aeruginosa	3.0	16.0	43.0	29.5	20.0	41.0	30.5

3.2 Sediment Quality

Phosphorus was enriched in the sediments of Oak Lake. The total phosphorus concentration of 1990 µg/g exceeded the Lowest Effect Level (600 µg/g) and was close to the Severe Effect Level (2000 µg/g) identified in the Provincial Guidelines (Ministry of Environment and Energy, 1993; Table 11), suggesting a high potential internal load to the lake.

All metal concentrations were lower than Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (CCME, 2012) and the Provincial Guideline's Severe Effect Level (Ministry of Environment and Energy, 1993) but Arsenic (8.59 µg/g), Cadmium (1.70 µg/g), Copper (25.5 µg/g), Lead (126 µg/g), Nickel (17.2 µg/g) and Zinc (120 µg/g) all exceeded the corresponding Low Effect Levels. The Low Effect Level is a concentration which has no effect on the majority of sediment-dwelling organisms and is considered clean to marginally polluted. It is also worth noting that some of these metals are naturally elevated based on the geology of the lake and associated watershed. For example, a background level of copper concentrations in the Great Lakes is 25 µg/g, roughly the same concentration noted in Oak Lake.

Table 11. Phosphorus, TKN and Metal Concentrations in Sediment from OL-1

	Units	Guideline		OL-1
		LEL	SEL	
Phosphorus (P)	µg/g	600	2000	1990
Leachable Anions & Nutrients (Soil)				
Total Kjeldahl Nitrogen	%			2.34
Metals (Soil)				
Aluminum (Al)	µg/g			18000
Antimony (Sb)	µg/g			1.14
Arsenic (As)	µg/g	6	33	8.59
Barium (Ba)	µg/g			128
Beryllium (Be)	µg/g			0.65
Bismuth (Bi)	µg/g			0.49



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Boron (B)	µg/g			12.9
Cadmium (Cd)	µg/g			1.70
Calcium (Ca)	µg/g			8960
Chromium (Cr)	µg/g	26	110	25.2
Cobalt (Co)	µg/g			7.20
Copper (Cu)	µg/g	16	110	25.5
Iron (Fe)	µg/g			21800
Lead (Pb)	µg/g	31	250	126
Lithium (Li)	µg/g			15.4
Magnesium (Mg)	µg/g			4350
Manganese (Mn)	µg/g	460	1100	283
Molybdenum (Mo)	µg/g			1.29
Nickel (Ni)	µg/g	16	75	17.2
Potassium (K)	µg/g			1630
Selenium (Se)	µg/g			2.27
Silver (Ag)	µg/g			0.27
Sodium (Na)	µg/g			996
Strontium (Sr)	µg/g			25.8
Sulfur (S)	µg/g			13300
Thallium (Tl)	µg/g			0.275
Tin (Sn)	µg/g			4.9
Titanium (Ti)	µg/g			404
Tungsten (W)	µg/g			<0.50
Uranium (U)	µg/g			0.963
Vanadium (V)	µg/g			35.7
Zinc (Zn)	µg/g	120	820	180
Zirconium (Zr)	µg/g			1.5

3.2.1 Phosphorus Fractionation

Phosphorus fractionation resulted in concentrations of six different chemical forms. Three forms have the potential to be released into the water column: loosely sorbed phosphorus, iron associated phosphorus (Fe-P) and organic phosphorus, while the remaining three forms (residual phosphorus, Ca-phosphorus and Al-phosphorus) are generally immobile (Messer et al. 1983). Loosely sorbed P contains loosely attached phosphorus, phosphorus associated with CaCO_3 which occurs in hardwater lakes, and phosphorus dissolved in porewater. Fe-P are forms of phosphorus that are adsorbed to iron (Fe) and manganese (Mn)



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and that can be released under conditions of low redox potential (i.e. anoxic waters). Available organic-P forms originate mostly from settled organisms, such as aquatic plants, algae, and bacteria. Ca-P forms are assumed to consist mainly of apatite (Rydin, 2000), which is highly insoluble (Lukawska-Matuszewska and Burska, 2011) and thus not considered releasable. Al-P are forms of phosphorus that are exchangeable with hydroxides (OH⁻), mainly aluminum hydroxides. The last form of phosphorus is residual-P which consists mainly of refractory organic P and inert inorganic P that are stable and unlikely to be released under most conditions (Rydin, 2000).

Releasable phosphorus concentrations amounted to 706 µg/g or 40% of the total sample which is comparable to other studies that have looked at these concentrations of releasable phosphorus (e.g. Hutchinson Environmental Sciences Ltd., 2016; Yasserli and Van Goethem, 2016). HESL (2016) quantified a range of 22% - 74% releasable phosphorus from sediments collected in Pigeon Lake, Alberta as part of in-lake management investigations, while Yasserli and Van Goethem (2016) noted a range of 39% - 54% as part of a similar study of Elk Lake, British Columbia. It should be noted however, that these studies were investigating active in-lake management techniques to control algae blooms so releasable phosphorus was likely high compared to most lakes. Unfortunately, similar data in lakes that are not being actively investigated for in-lake management are not available with which to further compare results.

Table 12. Phosphorus Fraction Results for Sediment Collected at OL-1

Phosphorus fraction	"Loosely sorbed-P" (NH ₄ Cl-P)	"Fe-P" (BD-P)	"Organic-P" (NaOH-tot-P-nrP), Calculated	"Al-P" (NaOH-rP)	"Ca-P" (HCl-P)	"Res-P" (Residual-P)
Units	ug/g	ug/g	ug/g	ug/g	ug/g	ug/g
OL-1	54.6	134.5	517.2	424.6	226.6	392.8

3.3 Phytoplankton

Phytoplankton in Oak Lake were sampled on August 16th, 2018, February 11th, May 8th, and July 4th, 2019, to characterize the algal community. During the 2019 sampling events, a filamentous green algal bloom was observed during water quality sample collection in May and an additional phytoplankton sample was collected to characterize the algal bloom (Photograph 1). An additional sample was collected in July to further describe the bloom. Microcystin (i.e. toxin) analysis was not performed in May 2019 as field observation indicated that the bloom was green algae and not harmful blue-green cyanobacteria. Microcystin analysis was completed in July 2019 despite similar observations as part of a conservative approach and was below analytical detection limits (0.20 µg/L) in both samples tested.

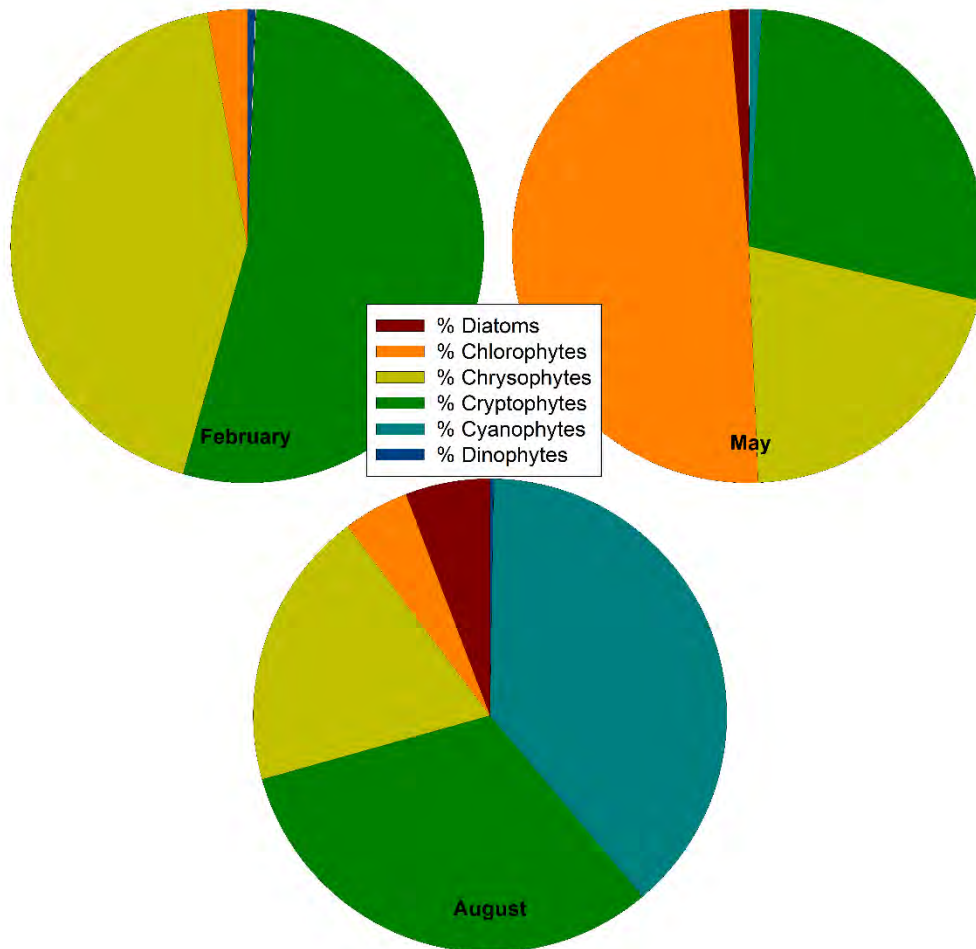
The phytoplankton community at OL-1 followed typical seasonal succession during our sampling program. Phytoplankton was dominated by Chrysophytes and Cryptophytes in the winter, with substantially increased green algae (Chlorophytes) relative abundance in the spring and increased cyanobacteria during the late summer/fall sampling event (Figure 8).



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The filamentous algal colonies observed in the water during May and July of 2019 sampling were comprised of *Mougeotia* spp., a diverse genus of green algae (Chlorophytes) which includes many of the most common filamentous green algal species in freshwaters (Guiry & Guiry, 2013; Tapolczai et al. 2014). Blooms of filamentous green algae, such as *Mougeotia*, can be a nuisance for recreational uses but are non-toxic to humans and other aquatic life. In July, 2 phytoplankton samples were collected, Algae 1 was taken from the thick surface accumulations and Algae 2 from a less dense algal mat sampled offshore in ~0.5m of water (Figure 10). Chrysophyte algae comprised a significant portion of the Algae 1 sample. Chrysophytes are small colonial organisms which were likely entrained within the filamentous *Mougeotia* bloom, however based on field observations the bloom in the lake was predominantly comprised of *Mougeotia* species.

Figure 8. Summary of Phytoplankton Relative Abundance at OL-1.



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Figure 9. Summary of Phytoplankton Relative Abundance of the Sampled Bloom (May 8, 2019).

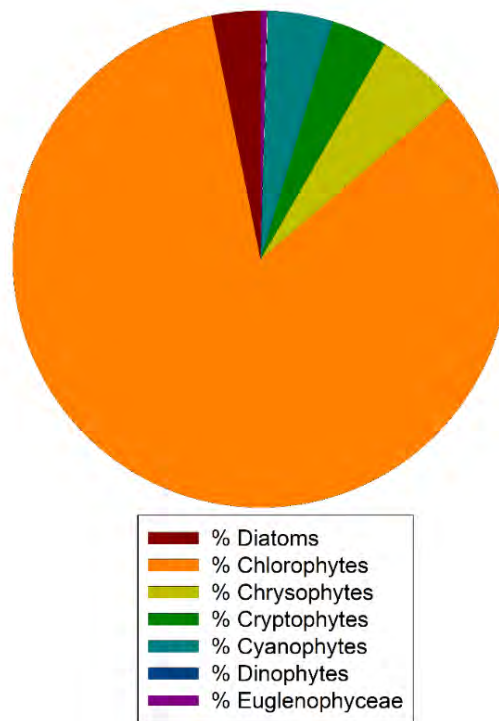
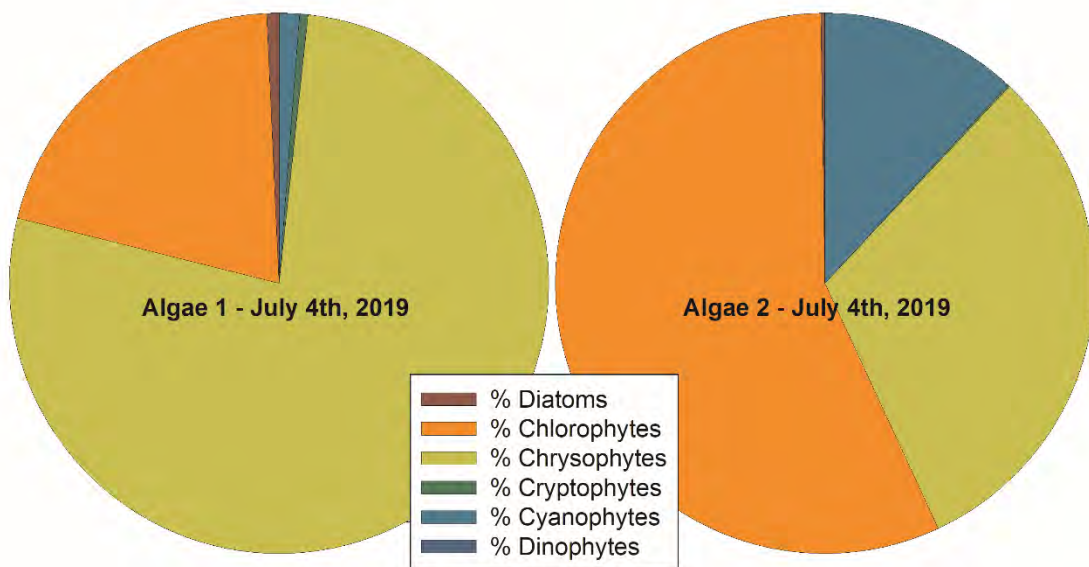


Figure 10. Summary of Phytoplankton Relative Abundance of the Sampled Bloom (July 4, 2019).



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Photograph 1. One of many filamentous algal colonies observed on May 8, 2019.



Photograph 2. A close-up view of abundant filamentous algal observed on July 4, 2019.



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3.4 Inspections of Sewage Treatment Systems and Shoreline Development Practices

The City of Quinte West identified ninety shoreline owners on Oak Lake, at least one of which leases shoreline individual lots, and 115 residences. 81 questionnaires were completed, and 86 surveys were completed on shoreline lots. Characterization of septic systems and shoreline development practices was completed through compilation of survey results and field investigations. 81 respondents of 159 the surveys that were circulated indicated the type of septic system used to service their residence: 20 (25%) used holding tanks, 59 (73%) tank and bed systems and 2 (2%) outhouses, which was similar to the results indicated in 2001 (i.e. 19% holding tanks, 79% tank and bed systems and 2% outhouses).

Maintenance ranged considerably for both holding tanks and tank and bed systems with maintenance/pump outs ranging between 1 - 12.5 years for holding tanks (mean = every 2.36 years) and 1 to never for tank and bed systems (mean = every 2.49 years).

Visual indications of septic system problems were noted at 8 properties as thick vegetation (4), tree roots (3) or divots (1) present in the tile bed. Thick vegetation may indicate a partially plugged pipe or a pipe close to the surface that can be accessed by roots, tree roots can plug the distribution pipes, and divots are usually caused by collapsed pipes or supporting material due to old age. One resident mentioned that a neighbour empties their holding tank directly into the lake while many residents did not respond to the survey, provide information or provide access for site investigations so the number of systems with problems is likely higher than what was indicated in our survey. It was also evident that many sewage treatment systems are low-lying and would be underwater at certain times of the year. It wasn't possible to quantify the number of those systems or describe the degree of related water quality impairment because a) we couldn't define the boundaries of all sewage system components as part of a visual assessment, and b) the assessment wasn't completed during high water levels or in relation to a surveyed high water mark. The issue is however addressed further In Section 5.0 - Management Recommendations.

22.4% of systems were classified as either high or moderate risk in 2001 based on the age of the system, setback, physical condition and indicated maintenance frequency. High and moderate risk systems were identified based on different information in 2018 so a temporal comparison could not be completed with 2001 data but more importantly, high and moderate risk systems were moved to the top of the queue for more detailed investigations (as discussed in 4.4). High and moderate risk systems included systems with one or more of the following characteristics:

- Systems that were not surveyed in 2018 due to a lack of homeowner permission or presence during investigations (81)
- Evidence of septic failure (8)
- Maintenance interval > 5 yr for tank and bed systems, maintenance interval > 1 yr for holding tank systems or unknown maintenance interval (33)
- Distance between shoreline and sewage treatment system of <15 m (Ontario Building Code requirement) (33)
- Privvy systems (2)

The distance between the shoreline and the closest part of the septic system ranged from 2.5 - 91 m (mean = 18.5 m). The average distance between the primary residence and the shoreline on Oak Lake was predominantly <10 m (56%) with lesser occurrences of distances 10-20 m (30%), 20-30 m (6%) or >30 m



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(8%). The majority (69%) of residences contained no buffer strip between the developed portions of the lot and the shoreline despite a general lack of restrictions to having a more naturalized vegetated area. Ontario Lake Assessments (2002a) indicated that 24% of properties retained a buffer strip which is similar to 2018 (31%).

10% - 90% of the area of properties were developed (mean = 47%) and % cleared lawn ranged from 10% - 100% (mean = 68%) both of which align with 2001 results (i.e. 79% contained >50% lawn and 83% were >50% developed).

Additional landowner comments were received via the City of Quinte West throughout the study as part of completed surveys, emails, letters and comments at public meetings. All comments were reviewed and considered during reporting. Landowner comments and responses are provided in Appendix D.

3.5 Whole Lake Phosphorus Budget

3.5.1 Watershed Phosphorus Load

The total phosphorus export to the lake from runoff from all sources was estimated as 56.6 kg/yr (Table 13). Agricultural runoff had the highest phosphorus export of the land uses, representing 83% (47.0 kg/yr) of the phosphorus load. The high phosphorus load from the agricultural land use is supported by the nutrient enriched tributary sites (Section 3.1.2) conveying runoff from the agricultural fields, and anecdotal observations by numerous residents of direct runoff from agricultural sites prior to the 2018 manure spill. Residential land uses exported 5 kg/yr of phosphorus to the lake, comprising 9% of the total but this does not include phosphorus loading from sewage treatment systems which are estimated in Section 3.6.3. Phosphorus loads from wetlands, forested areas, aggregate and transitional (i.e. area between forested and aggregate lands, and between forested and agricultural lands) lands were small, and represented less than 10% of the total load (Table 13, Figure 11).

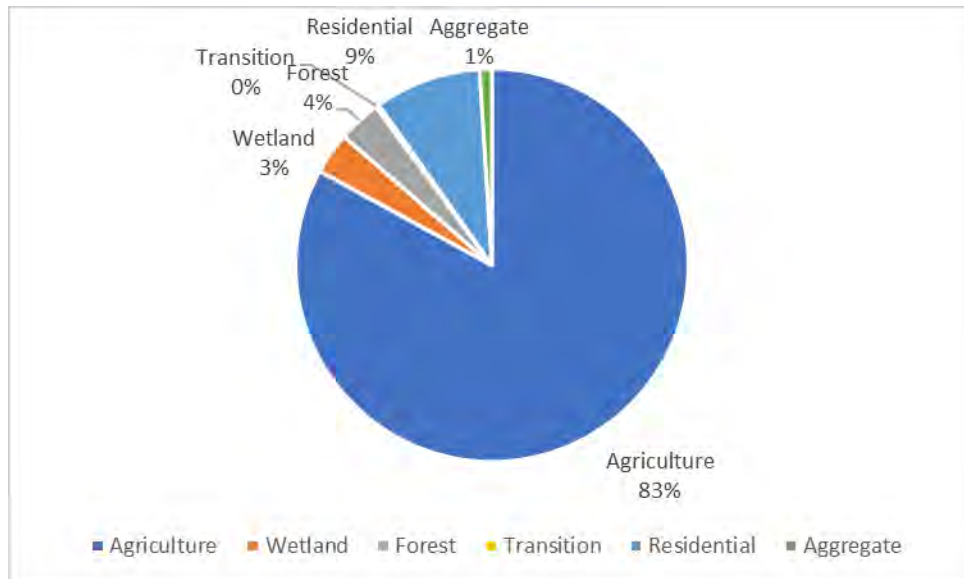
Table 13. Watershed Phosphorus Budget.

Land Use	Area (ha)	Export Coefficient (kg/ha/yr)	Phosphorous Load (kg/yr)	% Load
Agriculture	130.5	0.36	47.0	83%
Wetland	38.8	0.05	1.9	3%
Forest	33.6	0.06	2.0	4%
Transition	2.1	0.07	0.1	0%
Residential	26.2	0.19	5.0	9%
Aggregate	7.1	0.08	0.6	1%
Total	286.8		69.2	



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Figure 11. Watershed Phosphorus Contributions.



3.5.2 Atmospheric Phosphorus Load

The atmospheric phosphorus load to Oak Lake was estimated as 12.6 kg/yr.

$$51 \text{ ha} * 0.26 \text{ kg/ha/yr} = 12.6 \text{ kg/yr}$$

3.5.3 Sewage Treatment System Phosphorus Load

The type of sewage treatment system was indicated by 81 of the residents who responded to the circulated questionnaire: 59 residences were serviced with tank and bed systems, 20 with holding tanks and 2 with outhouses. Existing ratios of sewage treatment systems were calculated based on the information provided and the type of systems used to service the remaining residences were assumed based on the existing ratios resulting in an assumed count of existing treatment systems for the entire 115 shoreline residences: 84 residences serviced with a tank and bed system, 28 with holding tanks and 3 with outhouses. The phosphorus load associated with holding tanks were not included in the calculations per recommendations in Province of Ontario (2010) because theoretically the treated effluent and associated phosphorus concentrations are removed after the waste is pumped out and taken outside of the watershed.

The occupancy rates of residences (i.e. summer (10), summer and some winter (6), regularly (9) or permanent (27)) were indicated on 52 of the completed questionnaires. The occupancy rates on the questionnaires were associated with occupancy rates recommended in Province of Ontario (2010): summer = seasonal, summer and some winter = extended seasonal, regularly = extended seasonal, permanent = permanent. Ratios were calculated based on information provided in completed questionnaires and used to assume the occupancy rates of the remaining residences resulting in the following occupancy rates for the 84 tank and bed systems: seasonal (16), extended seasonal (24), permanent (44).

$$\text{Permanent: } 44 \text{ units} * 2.56 \text{ cap yrs/yr} * 0.66 \text{ kg/cap/yr} = 74.34 \text{ kg/yr}$$

$$\text{Extended Seasonal: } 24 \text{ units} * 1.27 \text{ cap yrs/yr} * 0.66 \text{ kg/cap/yr} = 20.12 \text{ kg/yr}$$



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*Seasonal: 16 units * 0.69 cap yrs/yr * 0.66 kg /cap/yr = 7.29 kg/yr*

*Outhouses: 3 units * 0.175 cap yrs/yr * 0.66 kg/cap/yr = 0.35 kg/yr*

The potential phosphorus load associated with sewage treatment systems on Oak Lake is 107.16 kg/yr.

3.5.4 Internal Phosphorus Load

Internal loading of phosphorus is a common problem in freshwater lakes in Ontario and can be exacerbated in lakes where dissolved oxygen is reduced in bottom waters creating a condition called anoxia. Dissolved oxygen profiles collected for Oak Lake by HESL and the MECP show anoxic conditions setup early on Oak Lake (June) and persist through much of the ice-free period (September/October), suggesting the potential for internal loading of phosphorus to the lake is high.

Summer internal loads were calculated by comparing phosphorus concentrations from samples collected 1 m off bottom at OL-1 on May 30 and September 16, 2001, as well as May 8, 2019 and August 16, 2018. Estimated internal phosphorus loads were 177 kg/yr based on 2001 data and 168 kg based on 2018 data which indicates good agreement between years. An average internal load of 172.5 kg/yr was calculated based on both years.

A winter internal load of 41 kg was calculated based on data collected on October 29, 2018 and February 11, 2019.

The total internal phosphorus load using the average summer internal load and the winter internal load from 2018/19 was 213.5 kg (172.5 kg/yr + 41 kg/yr).

Table 14. Internal Phosphorus Loads Calculated using the In-Situ Method.

Date	Phosphorus Concentration (mg/L)	Date	Phosphorus Concentration (mg/L)	Phosphorus Load (kg)
May 30, 2001	0.047	September 16, 2001	0.100	177
May 8, 2019	0.0137	August 16, 2018	0.064	168
Mean				172.5
October 29, 2018	0.007	February 11, 2019	0.0193	41
Total Annual				213.5

3.5.5 Whole Lake Phosphorus Load

The combined phosphorus load from runoff, atmospheric deposition, septic system leaching, and sediment internal load was 390 kg/yr (Table 15). Internal loading from sediments represent the largest source of phosphorus to Oak Lake, contributing 55% of the annual load; followed by septic systems, which contribute 27% of the total annual load. The role of septic systems in phosphorus loading to lakes is likely overstated, however, as recent studies show substantial attenuation and binding of septic system phosphorus by mineralized soil such that there is a low likelihood that the phosphorus migrates to the lake (Robertson et



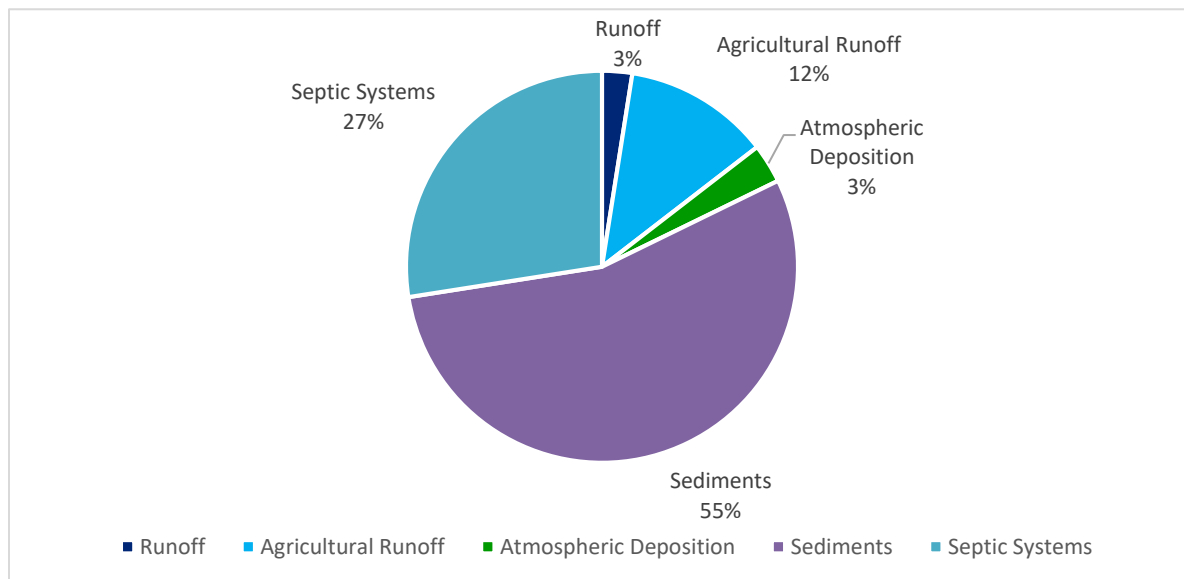
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al. 2005). Runoff from agricultural land uses was also an appreciable source of phosphorus, adding approximately 12% of the total phosphorus load. Atmospheric deposition and runoff from other land uses (e.g. residential, forests, wetlands) were minor contributors, with less than 6% of the total phosphorous load combined (Table 15, Figure 12).

Table 15. Whole Lake Phosphorus Budget.

Phosphorus Source	Phosphorus Load (kg/yr)	% Load
Runoff	9.7	2%
Agricultural Runoff	47	12%
Atmospheric Deposition	12.6	3%
Internal Load from Sediments	213.5	55%
Septic Systems	107.2	27%
Total	390	100%

Figure 12. Whole Lake Phosphorus Contributions.



3.6 Water Levels

Water level is partially controlled by six culverts (Figure 13). Culvert #1 passes water underneath Neighbourly Road to a large ditch that runs along John Meyers Road (Photographs 2 and 3). Culvert #2 is located underneath Foxboro Stirling Road (Highway 14), which conveys flow to the north from the ditch into a small wetland that is surrounded by forest and agricultural fields (Photographs 4 and 5). Culvert #3 conveys flow from Oak Lake underneath Foxboro Stirling Road to a small wetland and culvert #4 before transitioning to a large wetland surrounded by forest and agricultural fields. Culverts #5 and #6 are located at the far northern end of the wetland and appears to partially control water levels through this part of the



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system. Culverts #5 and #6 were removed by the City of Quinte West in late winter 2019 to help lower water levels in Oak Lake.



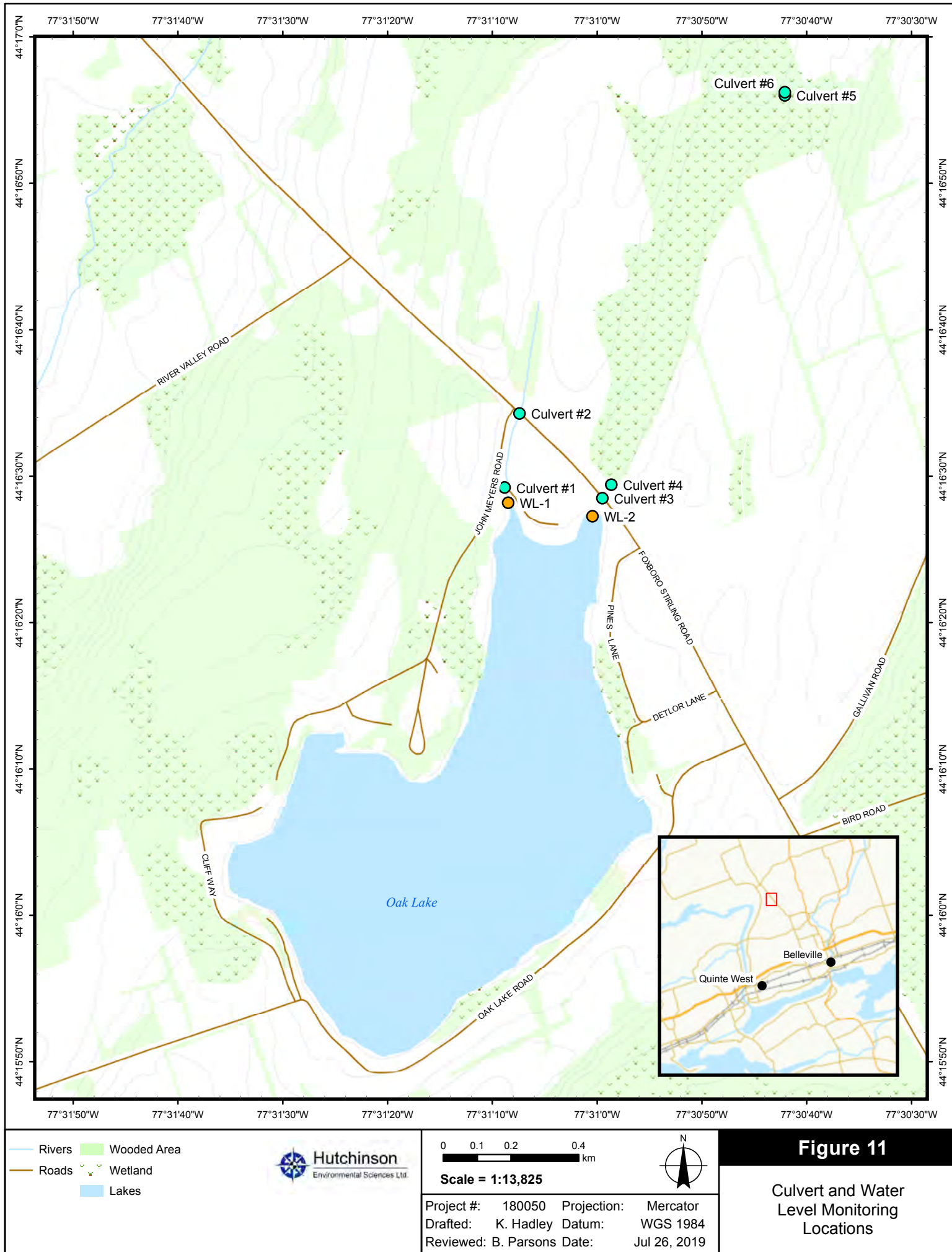


Figure 11

**Culvert and Water
Level Monitoring
Locations**

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Photographs 2 and 3. A view from Culvert #1 facing Oak Lake (left) and facing the ditch to the north (right).



Photographs 4 and 5. A dredged section of the ditch located adjacent to Culvert #2 (left) and a view of the isolated wetland facing north from Culvert #2 (right).



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Photographs 6 - 8. A view of the inlet of Culvert #3 at Oak Lake (top left), the outlet draining north of Highway #14 into the wetland (top right), Culvert #4 located about 6 m downstream, and the adjacent wetland (bottom).



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Culvert inspections were completed at Culverts #1 - #4 on each sampling event. The culverts were almost always partially to fully submerged during observations but very few flows were noted as the systems are relatively stagnant (Table 16):

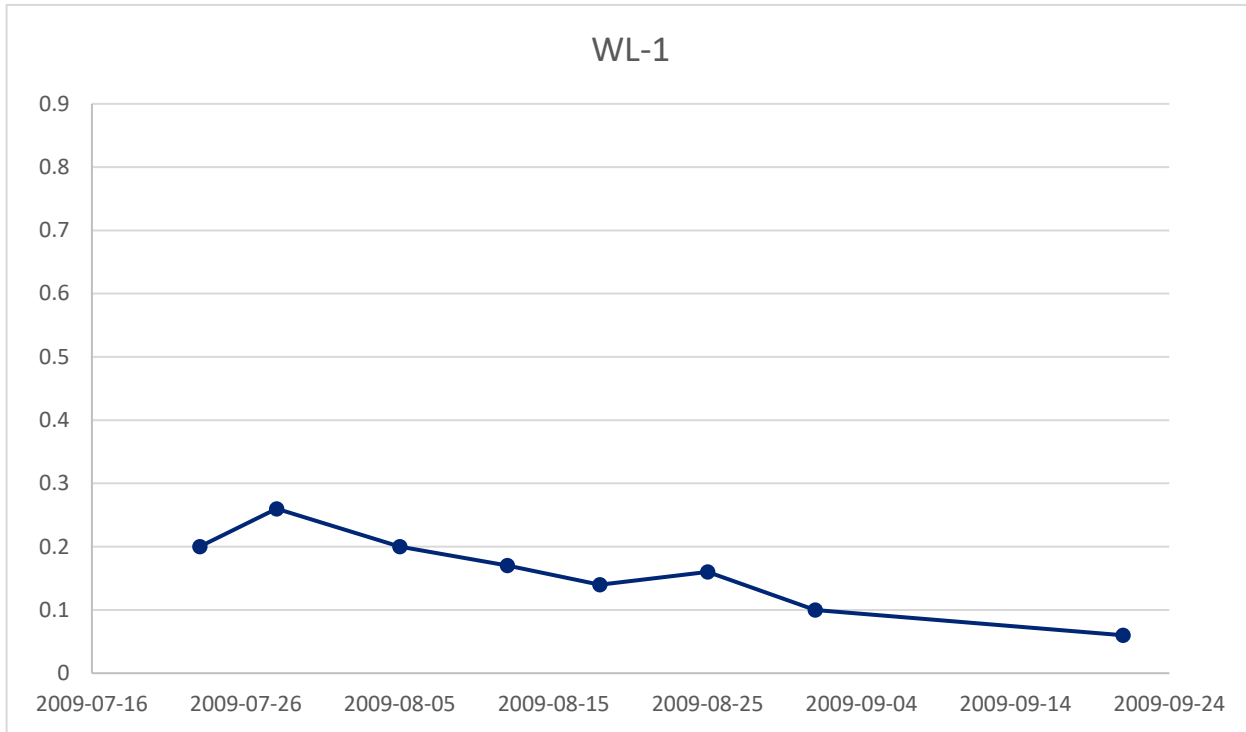
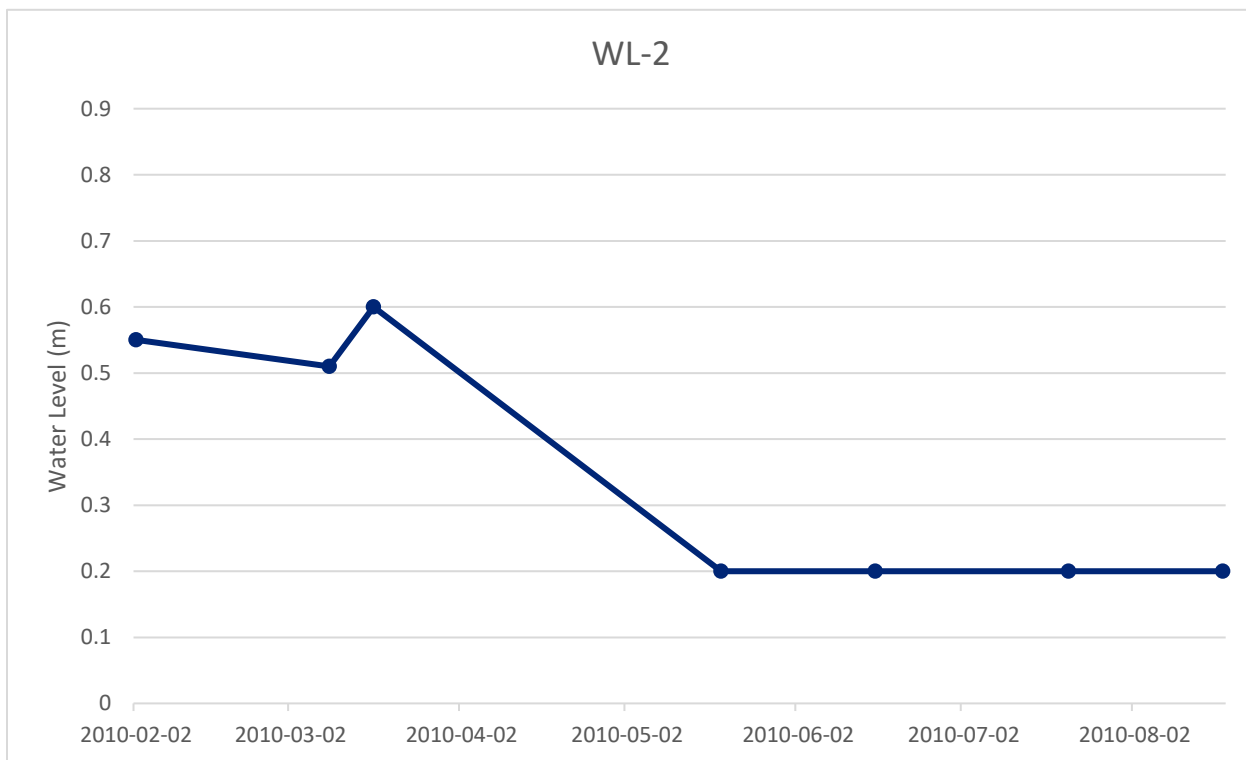
- very slight flow was observed on October 29, 2018 moving south towards the lake, likely as a result of excavation on the south side of Culvert #2,
- very slight flow was observed flowing away from the lake along Culverts #3 and #4 on March 28, 2019, and
- moderate flow was observed flowing away from the lake along Culverts #3 and #4 on May 8, 2019.

Water levels were monitored by the City of Quinte West approximately weekly from July 23 to September 21 in 2009 at WL-1, approximately monthly from February 2, 2010 to August 18, 2010 at WL-2, and at a variable time scale at both locations between March 14 and August 31, 2011.

Water levels remained consistent at WL-1 in the late summer in 2009 (Figure 14). Water levels were highest at WL-2 in February and March 2010 before decreasing throughout the remainder of the monitoring period (Figure 15). In 2011, water levels were highest in the spring but remained relatively consistent through the remainder of the year (Figure 16).



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**Figure 14. Water Levels Measured at WL-1 in 2009.****Figure 15. Water Levels Measured at WL-2 in 2010.**

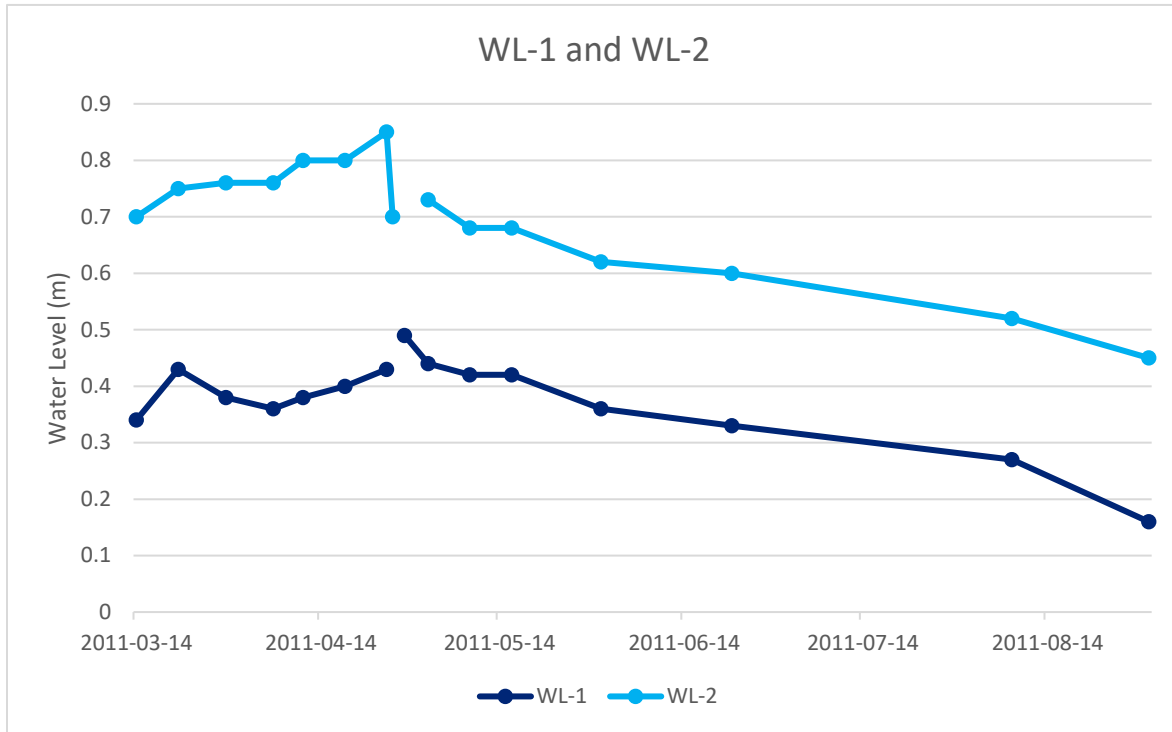
Oak Lake Water Quality Monitoring Report and Lake Management Plan**Figure 16. Water Levels Measured at WL-1 and WL-2 in 2011.**

Table 16. Results of Culvert Inspections

Date	Culvert #1			Culvert #2			Culvert #3			Culvert #4		
	Water Level at Outlet	Flow at Outlet	Notes	Water Level at Outlet	Flow at Outlet	Notes	Water Level at Outlet	Flow at Outlet	Notes	Water Level at Outlet	Flow at Outlet	Notes
August 16, 2018	Fully submerged	No flow		Partially submerged	No flow		Partially submerged	No flow		Partially submerged	No flow	
October 29, 2018	Fully submerged	No flow	Recent evidence of ditch being excavated to increase flow	Slightly submerged	Limited flow to lake, likely as a result of recent dredging	Recent evidence of ditch being excavated to increase flow	Partially submerged	No flow		Partially submerged	No flow	
March 28, 2019	Fully submerged	No flow		Partially submerged	No flow	Still frozen	Fully submerged	Very little flow		Fully submerged	Very little flow	
May 8, 2019	Fully submerged	No flow		Partially submerged	No flow		Partially submerged	Flowing	Water quality sample collected	Fully submerged	Flowing	

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4. Discussion

4.1 Water Quality

Temperature profiles in Oak Lake followed typical seasonal stratification found in dimictic lakes which prevents mixing of water between the warm surface waters (epilimnion) and the relatively cool deeper water (hypolimnion) and as a result the bottom waters in Oak Lake were anoxic throughout much of the growing season in 2001 and in 2018 due to thermal stratification and respiration requirements associated with the decomposition of organic plant material in the sediments. Anoxic conditions were noted at OL-1 but hypoxia or anoxia is likely present throughout much of the hypolimnion and at the sediment/water interface. Anoxia drives internal loading of nutrients from the lake sediments into the water column as is further discussed in Section 4.5.

Nutrient concentrations indicate that Oak Lake is mesotrophic and average annual phosphorus concentrations have remained stable at 0.014 mg/L since 2001. Winter measurements made in 2019 showed that phosphorus and nitrate concentrations were markedly elevated. This could be driven by a variety of processes such as:

- Elevated nutrient concentrations in the inflowing tile drain
- Under ice anoxia at the water sediment interface driving increased internal loading of phosphorus
- Continued inflow of elevated nutrient concentrations in groundwater from an agriculture dominated catchment
- Reduced uptake of nutrients by plants in winter
- Increased under ice generation of nitrate due to increased rates of nitrification which is common under ice. Knowles and Lean (1987) reported substantial rates of nitrate accumulation (i.e. 13 µg/L/d) using in situ water column measurements in Lake St. George, Ontario, a similar, mesotrophic, small (140 ha) kettle lake in central Ontario.

Nutrient concentrations were also elevated in the inflowing tile drain which drains approximately 40 hectares of agricultural lands that are used to grow corn and raise both cattle and pigs. As a result runoff from these lands is nutrient-enriched from fertilizer and manure inputs, and related adsorption of nutrients to suspended solids in runoff generated by erosion and soil disturbance. Nutrient concentrations in tile drainage from agricultural fields are highly variable and significant portions of phosphorus loss can be in dissolved form which is bioavailable to aquatic plants and algae. Moore (2016) noted that phosphorus concentrations in tile drainage varied between less than the detection limit to 9.75 mg/L. Clement (2016) examined nine different tile drains that drained between 7 and 80 acres, and noted phosphorus concentrations ranged between 0.01 mg/L and 0.56 mg/L, and Fleming et al. (1998) calculated an average phosphorus concentration of 0.48 mg/L from tile drains at twenty farms in southwestern Ontario. Concentrations of 0.15 mg/L to 0.57 mg/L measured at Trib-4 and Trib-5 in this study were therefore similar to those observed in the literature and typical of enriched agricultural runoff. Oak Lake is a small kettle lake and so these inputs could be a significant driver of nutrient enrichment in the lake.

Bacteria concentrations were generally low in Oak Lake, and lower than concentrations measured as part of past studies but elevated concentrations of *Fecal streptococci* (>200 CFU/100 mL) were noted at Trib-4



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and Trib-5 on March 28, 2019 and elevated concentrations of *Pseudomonas aeruginosa* (117 CFU/100 mL) were observed at OL-8 on August 16, 2018 indicating that runoff posed a threat to water quality.

4.2 Sediment Quality

Phosphorus concentration in sediment at OL-1 was high in relation to Provincial guidelines and it is in the high range of typical concentrations noted in lakes (1000 µg/g - 2000 µg/g; New Hampshire Department of Environmental Services, 1995). Releasable phosphorus concentrations are similar to those reported in other studies that were focused on in-lake management techniques to control cyanobacteria blooms (e.g. Hutchinson Environmental Sciences Ltd., 2016; Yasseri and Van Goethem, 2016). It is clear that phosphorus concentrations and releasable phosphorus fractions are relatively high in sediment in Oak Lake and extended periods of anoxia in Oak Lake indicate that the internal phosphorus load to Oak Lake is substantial as is further discussed in Section 4.5.

4.3 Phytoplankton

The phytoplankton community at OL-1 followed typical seasonal succession during our sampling program. Phytoplankton was dominated by Chrysophytes and Cryptophytes in the winter, with substantially increased green algae (Chlorophytes) relative abundance in the spring and increased cyanobacteria during the late summer/fall sampling event. Phytoplankton succession in northern, temperate waterbodies is driven by changes in nutrients, water stability and light regime, and Oak Lake is no different. Briefly, winter phytoplankton under the ice is commonly dominated by small motile algae which are adapted to low light, low water temperature and high water-column stability, such as Chrysophytes (e.g., *Dinobryon*, *Mallomonas*, and *Synura*) and Cryptophytes (e.g., *Cryptomonas* and *Rhodomonas*)

In the late winter, light availability improves as the snowpack melts, resulting in increased abundance of dinoflagellates and small centric diatoms. As ice cover is lost in the spring, mixing in the water column creates conditions of low stability and high nutrient concentrations. This results in a marked increase in phytoplankton productivity, particularly diatoms, and is frequently the annual peak in phytoplankton biomass. This spring bloom is often dominated by a single species (e.g. *Asterionella*, or *Cyclotella*). Sampling at Oak Lake did not capture increased diatom production which may be a result of the timing of sampling or other nutrient limitation (e.g., silica) favouring green algae communities.

During initial summer stratification, increased water temperature stabilizes the water column and light availability increases, while nutrient concentrations decline. Total phytoplankton biomass generally decreases as grazing pressure from zooplankton rapidly increases. By late summer high water temperatures and water column stability often favour Chrysophytes and colonial green algae. When silica concentrations are high diatoms may replace green algae, however if silica becomes depleted dinoflagellates and cyanobacteria often dominate the phytoplankton assemblage. As plankton consume available nitrogen resources to below detectable concentrations, cyanobacteria can become increasingly dominant (e.g. see August results in Figure 6). Cyanobacteria are capable of fixing molecular nitrogen from the atmosphere and regulating their buoyancy to take advantage of nutrients outside the photic zone. Certain species of cyanobacteria may also be recruited into the water column directly from resting stages in the sediments, drawing phosphorus directly from lake sediments rather than relying on the limited resources available in the lake water.



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The mixing of the water column in the fall is characterized by decreased water temperatures and light availability along with increased concentrations of key nutrients (phosphorus and nitrogen). Large unicellular and filamentous diatoms often dominate fall phytoplankton assemblages.

Cyanobacteria identified during August sampling included species of *Anabaena*, *Aphanizomenon*, *Aphanocapsa*, *Aphanothece*, *Chroococcus*, *Gomphosphaeria*, *Planktolyngbya* and *Pseudanabaena*, some of which can produce toxins which are harmful to humans and aquatic life. The World Health Organization (WHO) guidelines suggest low probability of adverse health effects at 20,000 cells/mL of cyanobacteria. Cyanobacteria concentrations in Oak Lake during our sampling program were measured at 601 cells/mL, well below the WHO guideline, however ongoing monitoring for cyanobacterial blooms is recommended in addition to public education on identifying and reporting potential algal blooms to the appropriate authority (i.e., Ministry of Conservation and Parks; MECP) as discussed in Section 5.7.

The filamentous algal colonies observed in the water during spring sampling were predominantly comprised of *Mougeotia spp.*, which can be a nuisance for recreational uses but are non-toxic to humans and other aquatic life. Blooms of this species have not been clearly related to nutrient levels, nor is there sufficient evidence to connect this algal bloom to the manure spill which occurred in 2018. Ongoing algae monitoring on the lake is recommended to track algae bloom frequency and monitor any potential cyanobacteria later in the year when the water temperature favours cyanobacterial blooms. Blooms of *Mougeotia*, while not toxic to humans, may have an impact on the lake in the near future. After a significant bloom, oxygen concentrations in the lake (during the decomposition of algal material) is expected to decline. Oak Lake already has depleted oxygen concentrations in the deep waters and an increased oxygen demand during decomposition may impact the potential internal loading from lake sediments and may also put pressure on fish communities and could in extreme cases result in fish kills.

4.4 Sewage Treatment Systems and Shoreline Development Practices

The development patterns, lot size and nature of waterfront land use at Oak Lake does not meet the current environmental standards associated with waterfront development. HESL (2014) reviewed current development standards in 12 jurisdictions across North America and found that minimum lot frontages range from 30 m to 90 m, lot sizes range from 0.19 ha to 1.2 ha, minimum building setbacks range from 7.6 m to 90 m but are typically ~20m, and the most common septic setback is 30 m. South Frontenac, which is located north of Kingston and is more local than the other jurisdictions reviewed, has a minimum lot frontage of 91 m, lot area of 1 ha, building setback of 30 m. Lot sizes and setbacks are variable on Oak Lake but in general lot frontages and sizes are small and both average septic (18.5 m) and building setbacks (56% < 10 m) are substantially less than current standards (Photographs 9 and 10).

Lots on Oak Lake are highly developed (i.e. average development footprint = 47%) which is substantially higher than the range in limits for impervious surface on a lot (15% - 30%) managed by Hew Hampshire, Maine, Minnesota and Wisconsin (HESL 2014), or the findings from over 225 research studies that predict water quality decline when watershed impervious cover exceeds 10% or severe degradation beyond 25% (Center for Watershed Protection, 2003). Naturalized buffers are also generally lacking despite a lack of physical restrictions and instead, manicured lawns dominate the landscape (Photographs 11 and 12).



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While many septic systems showed no evidence of poor repair, the maintenance periods reported by residents varied substantially, problems were noted with some systems, and many that were not examined due to lack of landowner permission may be in poor repair. Similar conditions were noted in 2001 and there is little evidence that Best Management Practices and recommendations such as establishing natural shorelines or improving septic system maintenance from previous studies (e.g. LTC 2002, Ontario Lake Assessments, 2002a) have been implemented.

Unmanaged waterfront development may degrade water quality through nutrient loading associated with stormwater and wastewater runoff. Small lot sizes and setbacks, high development footprints, lawns and associated fertilizer use, old and poorly maintained sewage treatment systems and a lack of natural shoreline buffers that would help to mitigate these practices, are all major threats to the water quality of Oak Lake and represent areas for potential improvement. While the lot sizes and setbacks are established, more effort on naturalization, reduction in manicured areas and development of naturalized shoreline buffers would stabilize shorelines, improve wildlife and songbird habitat and reduce nutrient runoff.



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Photographs 9 and 10. A view of typical residences on Oak Lake which highlights the small lots, small setbacks and highly developed nature of the nearshore environment.



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Photographs 11 and 12. A view of residences on Oak Lake which highlights the small setbacks, manicured lawns and lack of natural shoreline buffers.



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4.5 Phosphorus Budget

Phosphorus is the primary nutrient that limits the growth of algae and aquatic plants. The primary sources of phosphorus that enrich Oak Lake are internal loading from sediments (44% - 48%), septic systems (32% - 34% as potential but likely lower) and agricultural runoff (14% - 15%).

Other important sources of phosphorus that were not quantified as part of the study are the manure spill in 2018 and waterfowl feces as a few residents noted that 500 - 1000 Canadian Geese (*Branta canadensis*) can be observed on the lake in the fall at a given time. The impacts of the manure spill could not be quantified but as discussed previously, this is not expected to be a recurring event and provides justification for selecting elevated nutrient loading rates for calculation of the phosphorus load from agricultural lands.

Quantification of the impact of waterfowl species on nutrient loading is complex because ~87% of the phosphorus from goose feces is derived from the lake itself as food passes quickly through a goose and the process is part of the nutrient cycle as opposed to a source (Fleming and Fraser, 2001). Phosphorus from feces is however also more bioavailable for uptake by aquatic plants and algae. Quantification of waterfowl impacts was not included as part of the study but waterfowl feces can lead to elevated concentrations of bacteria, pathogens and nutrients so management recommendations have been provided in Section 5.8 to try and minimize those impacts.

4.6 Water Levels

Results from the mailed-out questionnaire indicated that 47% of landowners consider that water levels are “good as is”, while 30% believe water levels are currently too high and 23% believe water levels are currently too low, so it is clear there are differing perspectives on the most appropriate water levels in Oak Lake. Furthermore, 32 residents indicated water levels were their greatest concern while 22 noted it was of no concern so there is a wide range of opinions on the issue.

Our knowledge of water levels in the lake is limited to site observations and the restricted 2009 - 2011 dataset which indicates, unsurprisingly, that water levels are relatively consistent and the highest water levels occur in the late winter and spring. Our culvert inspections indicated that water flow isn't impeded by sediment build-up in the culverts or in the adjacent areas, but the system is instead limited by a very small drainage area adjacent to Culvert #2 and largely controlled by the management of wetland water levels via Culverts #5 and #6. According to residents, water levels have however dropped in Oak Lake following sediment removal, so water levels appear to be controlled by both sediment build-up and wetland water levels, in addition to a myriad of climate-related factors.

Water level management is a challenge moving forward because of climate change and it is particularly challenging in Oak Lake because a) development setbacks are limited and nearshore areas are flat so slight changes in water levels impact residences and water intake lines, b) there is limited inflow or outflow so there isn't much water to work with, c) flooded sewage treatment systems are a source of nutrients to Oak Lake, and d) there are differing opinions on a water management objective.



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5. Management Recommendations

Lake management should be guided by scientific data as well as inputs from local users. Results were presented in Section 4 and are discussed in Section 5, both of which included specific results from the mailed-out questionnaire where appropriate. The questionnaire also included questions and responses associated with overarching concerns, seriousness of problems with Oak Lake and recreational activities.

The questionnaire was mailed to 159 residents and 80 responded. Respondents considered the following issues to be the greatest concern in Oak Lake (number of respondents expressing concern): agriculture (54), water quality for recreation (46), aesthetics (35), water quality for consumption (33), water level (32) and dead fish (30). Issues which were identified as not a concern included too much recreation (48) and too much development (31). Agriculture (33), water quality for recreation (18) and water level (13) were noted as the most serious issues, while too much recreation (4) and too much development (1) were noted as the least serious. In terms of recreational activities on Oak Lake, sitting by the water/enjoying the view (66) was the most popular, followed by swimming/wading nearshore (56), and canoeing/rowing (35).

Oak Lake has been well-studied over the years and many studies have included lake management recommendations, some of which have been translated into policies to manage and protect the water quality of Oak Lake and the health of its residents. Section 9.3 of the City of Quinte West Official Plan (2017) identifies Oak Lake as being at risk and establishes the Oak Lake Special Policy Area (Area Specific Policy 3), which is intended to facilitate the improvement of the overall water quality of Oak Lake and to protect the health and safety of the shoreline residents. We have consolidated previous recommendations and existing policy under common themes and added additional recommendations where appropriate so that all of the recommendations and policies can be examined as a whole, to critically examine the success or lack thereof of pre-existing policy, and to not “reinvent the wheel” and duplicate previous recommendations.

5.1 Development Planning

Oak Lake is almost entirely developed so recommendations and policies have been primarily focused on redevelopment, such as conversion from seasonal to permanent residency, consolidation of lots, additions, renovations and/or alterations.

5.1.1 Previous Recommendations

An Evaluation of the On-Site Sewage Disposal Systems for Properties Fronting on Oak Lake (Ontario Lake Assessments, 2002a):

- The Municipality should establish measures in the official plan which are protective of water quality, shoreline alteration, and deter further urbanization of Oak Lake. These protective measures could include: establishing stringent setback requirements for re-development, preventing conversions from seasonal to permanent residences, setting maximum building envelope size
- Where development on existing vacant lots of record meet the criteria below, only seasonal residences should be considered. Existing vacant lots of record should not be developed on the basis of on-site disposal unless the sewage system and building can be setback >30 metres from the high-water mark. Where a setback of >15 to 30 metres from the high-water mark can be



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achieved then development should be conditional upon a seasonal residence only on a holding tank. Existing vacant lots of record that can not achieve a setback of > 15 metres from the high-water mark should not be developed.

- The setback distance for redevelopment of a seasonal residence on an existing lot should require a minimum setback distance as remote from the water as the lot will allow. Any lot that can not achieve a setback distance of 30 metres from the high-water mark for the septic system should be serviced on the basis of a holding tank.

Oak Lake Shoreline Regeneration Plan (LTC, 2002):

- New development (buildings and septic systems) be set back 15 to 30m from the shoreline. Under no circumstances should new buildings/septics be permitted within 15 metres of the shore. For development proposed between 15 and 30 metres from the shore, an Environmental Impact Assessment should be completed to determine if there will be any impacts on water quality or fish habitat.
- Conversion of seasonal to permanent residences should not be permitted.
- Additions onto existing buildings should be discouraged. No additions should be permitted within 15 metres of the shoreline as naturalization is encouraged in this zone. For additions proposed between 15 and 30 metres from the shore, an Environmental Impact Assessment should be completed to determine if there will be any impacts on water quality or fish habitat.

5.1.2 Existing Policies

Oak Lake was identified as being at risk with respect to water quality and the ability to sustain the level of shoreline development based on findings in Ontario Lake Assessments 2002a and 2002b. Several policies were developed and incorporated into the City of Quinte West Official Plan (2017) with the aim to improve water quality in the lake. Policies are sorted in the Official Plan per Area Specific Policy 3A which is in the vicinity of Oak Lake and Area Specific Policy 3B which encompasses the balance of the Oak Lake drainage basin.

City of Quinte West Official Plan (2017):

9.3.2.2 Residential Development Policies Notwithstanding any policies of this Plan to the Contrary:

- (i) The creation of new lots is prohibited within the Area Specific Policy “3A.”
- (ii) The consolidation of lots within the Area Specific Policy “3A” shall be permitted provided:
 - (a) the lot consideration is not for the purpose of, directly or indirectly, the conversion of a seasonal residence to a permanent residence;
 - (b) the existing building footprint is maintained, or an increased setback is achieved from the high-water mark of Oak Lake for the building and sewage disposal system;
 - (c) where the consolidation involves two or more vacant lots, development within 30 metres of the high-water mark of Oak Lake is prohibited;



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(d) a natural vegetative buffer is established along the shoreline abutting such lots to a distance to be determined as part of the Environmental Impact Assessment identified in (v) below; and
 (e) an Environmental Impact Assessment is completed by a qualified professional to the satisfaction of the City in consultation with the Lower Trent Conservation for the subject property addressing such issues as:

- the impact of the proposed development on water quality and fish habitat;
- mitigation measures to be taken for the protection of the water quality and fish habitat of Oak Lake;
- the identification of the extent and composition of the natural vegetative buffer to be established along the shoreline of the subject property;
- other matters as deemed necessary by the City in consultation with the Lower Trent Conservation; and

(f) the requirements of 9.3.2.2 (viii) of this Plan, if applicable, are adhered to.

(iii) The development of existing vacant lots of record within 30 metres of the high-water mark of Oak Lake is prohibited.

(iv) The development of existing vacant lots of record greater than 30 metres from the high water mark of Oak Lake shall be permitted subject to the completion of an Environmental Impact Assessment by a qualified professional to the satisfaction of the City, in consultation with the Lower Trent Conservation for the subject property addressing such issues as:

- the impact of the proposed development on water quality and fish habitat of Oak Lake; and
- mitigation measures to be taken for the protection of water quality and fish habitat of Oak Lake; and
- the identification of the extent and composition of natural vegetative buffer to be established along the shoreline of the subject property; and
- other matters as deemed necessary by the City in consultation with the Lower Trent Conservation.

(v) Notwithstanding (iv) above, on existing vacant lots of record where a private sewage disposal system can be located in excess of 30 metres from the high water mark of Oak Lake, minor encroachments into the required 30 metre setback for a proposed seasonal residential dwelling may be considered without an amendment to the Plan subject to:

(a) The completion of an Environmental Impact Assessment is completed by a qualified professional to the satisfaction of the City in consultation with the Lower Trent Conservation for the subject addressing such issues as:

- the impact of the proposed development on water quality and fish habitat;
- mitigation measures to be taken for the protection of the water quality and fish habitat of Oak Lake;
- the identification of the extent and composition of the natural vegetative buffer to be established along the shoreline of the subject property; and
- other matters as deemed necessary by the City in consultation with the Lower Trent Conservation.



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(vii) The conversion of seasonal residences to permanent residences shall be prohibited within the Oak Lake Specific Policy Area.

(viii) Additions, renovations and/or alterations to any residence shall only be permitted where:

- (a) the proposed addition, renovation and/or alteration is not for the purpose of, directly or indirectly, the conversion of a seasonal residence to a permanent residence;
- (b) the proposed addition, renovation and/or alteration does not create an increase, or potential for increase, in wastewater load from such residence;
- (c) the existing building footprint is maintained or an increased setback from the high-water mark of Oak Lake for the building and sewage disposal system;
- (d) a natural vegetative buffer is established along the shoreline to a distance to be determined as part of the Environmental Impact Assessment identified in (e) below; and
- (e) an Environmental Impact Assessment is completed by a qualified professional to the satisfaction of the City in consultation with the Lower Trent Conservation for the subject property for all development to be completed within 30 metres of the high-water mark addressing such issues as:
 - the impact of the proposed development on water quality and fish habitat;
 - mitigation measures to be taken for the protection of the water quality and fish habitat of Oak Lake;
 - the identification of the extent and composition of the natural vegetative buffer to be established along the shoreline of the subject property; and
 - other matters as deemed necessary by the City in consultation with the Lower Trent Conservation.
- (f) Written confirmation is obtained from the local Health Unit stating that the existing sewage disposal system is capable of accommodating the proposed addition, renovation and/or alteration in accordance with all applicable laws and regulations.

(ix) Notwithstanding subsection (viii) above, renovation and/or alteration shall be permitted without an Environmental Impact Assessment in circumstances where:

- (a) the proposed renovation and/or alteration is to restore the building to a safe condition provided that it is not for the purpose of, directly or indirectly, conversion from a seasonal residence to a permanent residence; and
- (b) there is no increase in the size of the building or an increase, or potential for increase, in wastewater load.

(x) Alterations to land within 30 metres of the high-water mark of Oak Lake will only be permitted subject to the completion of an Environmental Impact Assessment by a qualified professional to the satisfaction of the City in consultation with the Lower Trent Conservation for the subject property addressing such issues as:

- the impact of the proposed alteration on water quality and fish habitat;
- mitigation measures to be taken for the protection of the water quality and fish habitat of Oak Lake;
- the identification of the extent and composition of a natural vegetative buffer to be established along the shoreline of the subject property; and
- other matters as deemed necessary by the City in consultation with the Lower Trent Conservation.



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9.3.3 Area Specific Policy Area “B”

9.3.3.1 Permitted Uses

(i) Except where specifically referenced to the contrary, the permitted use of all lands within the Area Specific Policy “B” shall be in keeping with the underlying land use designation identified on Schedule “A” and referenced in Sections 5.1, 5.2 and 5.8 of this Plan.

9.3.3.2 Residential Development Policies

(i) Except where specifically referenced to the contrary, the residential development policies for all lands within the Area Specific Policy “B” shall be in keeping with the underlying land use designation identified on Schedule “A” and referenced in Sections 5.1, 5.2 and 5.8 of this Plan.

5.1.3 New Recommendations

Previous recommendations have been successfully converted into policies that are aimed at minimizing impacts to water quality associated with various development activities. We have not suggested any new recommendations but question how effectively these policies are enforced. Official Plan policies and Implementation Guidelines are just that, policies and guidelines (HESL, 2014b). They cannot be enforced through immediate remedies or the court system. In the Planning jurisdictions throughout Canada and the United States, enforcement is done through Bylaws and Ordinances.

Enforcement through bylaws passed under the Planning Act must be done through the court system which can be very frustrating due to:

- Time to get the matter to trial,
- Cost of court proceedings,
- Challenge of collecting evidence,
- End result of low fines and little retribution.

Many municipalities may not want to make the necessary significant expenditures to go through the court system to enforce their bylaws (HESL, 2014b). Bylaws passed under other legislation, however, can be more easily enforced. A Site Alteration Bylaw passed pursuant to the Municipal Act, for example, can contain items of immediate response to a violation. Stop Work Orders and Orders to Remedy can be embedded in the bylaw and enforced immediately upon infraction. The Township of Seguin and the Township of Muskoka Lakes each enforce approximately 20 - 25 infractions every year. The Township of Seguin takes the approach that they need to go to court to prevent future contraventions and court cases.

Quinte West has an Application Form for Oak Lake Drainage Basin Zoning By-Law Amendment – Holding Removal – Site Plan Control, and the Comprehensive Zoning By-law (City of Quinte West, 2014) but nonetheless, the City of Quinte West should review the enforceability of their development-related policies through this lens and upon past performance, and assess both the tools and staff needed to enforce the policies that exist. Further discussions related to planning tools and enforcement are outside the scope of the project and are better deliberated by planning staff and/or lawyers.



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5.2 Sewage Treatment Systems

Visual septic inspections were completed in 2001 and 2018, and similar septic re-inspection programs are completed by many Municipalities and Conservation Authorities throughout Ontario in order to identify septic systems with some benchmark of failure such as soft ground or ponding. The re-inspection programs are important in diagnosing failing septic systems, many of which were designed for much less use than they receive, and to increase awareness because it is ultimately the homeowner's responsibility to ensure their septic system is operating effectively (Ontario Building Code (OBC), 2006, Section 8.9.2.3 (2)) and is in compliance with the Ontario Building Code regulations. Visual septic system inspections are however limited by landowners providing access and the visual nature of the assessment.

5.2.1 Previous Recommendations

An Evaluation of the On-Site Sewage Disposal Systems for Properties Fronting on Oak Lake (Ontario Lake Assessments, 2002a):

- The Municipality should establish measures in the official plan which are protective of water quality, shoreline alteration, and deter further urbanization of Oak Lake. These protective measures could include: development of a by-law to ensure pump out frequency and maintenance of all septic systems.
- The Municipality should develop a mechanism to ensure all septic tanks and holding tanks are maintained and pumped on a frequent schedule.

Oak Lake Shoreline Regeneration Plan (LTC, 2002):

- Septic systems should be inspected regularly, and the septic tanks pumped routinely. Faulty systems should be replaced with new systems to meet the current standards. Recommendations regarding the maintenance of septic systems will form part of the concurrent study of septic systems.

5.2.2 New Recommendations

The modelled phosphorus load from septic systems on Oak Lake is substantial (107 kg/yr), many systems are poorly maintained, and limited setbacks and a general lack of shoreline buffers limit the potential for nutrient-laden runoff to be attenuated. The impacts of sewage systems should be considered in terms of both design and maintenance. A more detailed, in-depth examination of sewage treatment systems that are often completed as part of home inspections should be completed for every system on Oak Lake, starting with the systems that have been categorized as moderate or high risk as discussed in Section 4.4. to assess design and functionality. Detailed sewage treatment system surveys should include the following components:

- Building permits and associated documentation for each sewage treatment system should be gathered to determine the age of each system, the capacity of each system to handle the size of the associated residence and other OBC requirements.



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- The functionality of each system should be determined through an examination of tank condition, liquid levels, baffles, scum and sludge depth. A flush test should also be completed to determine the ability of the leaching bed to disperse effluent.
- Replace dysfunctional systems with systems that meet the OBC and consider systems that are specifically designed to attenuate phosphorus such as the Waterloo EC-P, Ecoflo DpEC system or utilization of iron-rich, non-calcareous “B” horizon soils for construction of leaching beds.

In terms of maintenance, we agree with previous recommendations that are focused on implementing a bylaw that forces sewage treatment systems to be maintained on a regular basis such as that used to identify moderate or high risk systems (i.e. once per year for holding tanks or once every 5 years for tank and bed systems).

5.3 Shoreline Development Practices

A shoreline buffer is an area along the shoreline that is naturally vegetated or re-vegetated. Shoreline buffers are a well-studied mitigation measure associated with waterfront development. The availability of information results from the well-known and established effectiveness of shoreline buffers in mitigating the impacts of stormwater through filtering, infiltration and attenuation. Buffers filter sediment and other pollutants, and absorb nutrients from runoff, thereby helping to mitigate impacts of stormwater (Beacon Environmental, 2012). Vegetative buffers can also mitigate social density by screening the view of the shoreline from the lake and providing a buffer for view and noise between lots and maintain more of a wilderness perspective.

Shoreline development practices on Oak Lake are predominantly establishment and maintenance of manicured lawns. Manicured, carpet-like green grass lawns are a relatively recent phenomenon that became established during suburbanization after World War II (Steinberg, 2007). Manicured lawns, especially those which are fertilized, have a wide variety of environmental repercussions but are particularly bad practice when living adjacent to a waterbody. Natural shoreline vegetation filters runoff, prevents erosion, provides wildlife habitat, and ultimately help to mitigate impacts to water quality associated with residential development.

5.3.1 Previous Recommendations

An Evaluation of the On-Site Sewage Disposal Systems for Properties Fronting on Oak Lake (Ontario Lake Assessments, 2002a):

- The Municipality should establish measures in the official plan which are protective of water quality, shoreline alteration, and deter further urbanization of Oak Lake. These protective measures could include protection against tree removal, or maximum lawn sizes.
- Direct runoff from hardened surfaces to the lake carries pesticides, fertilizers, sediment, and other contaminants to the lake. Landowners should ensure that runoff from hardened surfaces does not go directly into the lake. On sloping shorelines, cares should be taken to ensure that pathways to the water are angled along the slope so that runoff is not channelled directly to the water.



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- The use of pesticides and fertilizers should be reduced, and preferably eliminated. Fertilizers on lawns can run off into the lake and contribute to excessive growth of aquatic plants.

Oak Lake Shoreline Regeneration Plan (LTC, 2002):

- On the land:
 - Leave an unmown strip of natural vegetation along the length of the shoreline
 - Establish a vegetative buffer – aim for a minimum of 15 metres (the wider the better)
 - Incorporate a variety of native vegetation in the buffer strip including trees, shrubs, grasses and wildflowers
 - Remove invasive exotic species, like purple loosestrife, yellow flag iris and buckhorn, that disrupt native vegetation
- For work in the water:
 - Replace retaining walls with natural materials
 - Maintain rocks, gravel, woody debris and aquatic plants in the shallow waters
 - Remove concrete docks and replace with floating, canti-lever, or post construction docks.
- Direct runoff from hardened surface to the lake carries pesticides, fertilizers, sediment, and other contaminants to the lake. Landowners should ensure that runoff from hardened surfaces does not go directly to the lake.
- The use of pesticides and fertilizers should be reduced, and preferably eliminated.

5.3.2 Existing Policies

City of Quinte West Official Plan (2017):

- The City and the Lower Trent Conservation are encouraged to work with the Oak Hill Lake Association and the land owners within the Oak Lake Special Policy Area to develop a land stewardship program to provide educational and practical means for land owners for the improvements of individual properties and every day operational practices.

5.3.3 New Recommendations

A variety of previous recommendations have focused on improving shoreline development practices on Oak Lake, but little has changed over the intervening time period. We recommend that:

- Improved shoreline and property management should be made an enforceable condition of any application for a building permit or redevelopment on Oak Lake.



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- Stewardship activities on existing lots that do not seek a building permit are encouraged through public awareness and education.

5.4 Water Level Management

Water level, water quality and aquatic biota are intrinsically linked through a wide variety of processes which can not all be discussed here-in but in summary, water level change has a marked impact on a) sediment and nutrient fluxes in lakes, mainly through the establishment of macrophytes because water levels affect light availability and associated growth of macrophytes, and b) phytoplankton assemblages because of changes to macrophyte abundance, sedimentation and grazing rates (Coops and Hosper, 2002). Our study did not, however, reveal any consensus or majority opinion on water level management among lake residents

5.4.1 Previous Recommendations

Oak Lake Shoreline Regeneration Plan (LTC, 2002):

- The culvert on the north side of Oak Lake Road, at the intersection with Empson Lan and Cliff Way, is not working efficiently. Runoff from the road ditch overflows onto adjacent properties and the boat launch causing erosional damage. Drainage in this area should be re-designed to ensure that it is not affecting adjacent properties or running off directly into the lake.
- The two culverts on County Road 14 appear to be interfering with hydrological and biological (pike spawning) connections between the wetlands and the lake.

5.4.2 Recommendations

While no clear consensus on water level concern resulted from the survey, water level should remain relatively stable year-round at a level that avoids flooding damage, submersion of sewage treatment systems, erosion of shorelines and uprooting of trees in the riparian zone but also allows for boating access to docks and doesn't cause water lines to be exposed. The culvert system on Oak Lake is generally fixed as elevation of the culverts cannot be changed like a dam.

An integral first step in Water Level Management is the determination of a consensus opinion on the problem(s), translating that to management objectives and linking the objectives with surveyed, standardized water levels on Oak Lake. Management objectives are typically associated with avoiding property damage, but they should also incorporate ecological considerations such as water quality, fish migration and spawning, etc. such as those mentioned by LTC (2002). Management objectives can then be related to high and low lake level limits that support the ecology of the lake. Typically, lakes are drawn down during the fall and winter to provide storage capacity for spring run-off and rain, and levels are increased in the late spring early summer to a summer start level. It is not clear to what extent the existing system can be manipulated, such as alteration to the sluice gate or excavation of sediment, to meet the water level objectives. If the existing system is deemed inappropriate a water budget should be completed and engineered solutions proposed. A water budget would consider the volumes of water in Oak Lake and



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its watershed and considers the hydrologic cycle and flow paths from recharge to discharge over a variety of spatial and temporal scales (Conservation Ontario, 2010).

In the meantime, to avoid further property damage the system could be partially manipulated through replacement of Culverts #4 and #5, which should continue to lower high water levels in the spring like was completed in the late winter of 2019 after removal of Culvert #5. Sediment removal has been used to clear the culverts and lower water levels effectively in the past. Sediment removal should continue to be used, if needed, following culvert replacement.

- Replace Culverts #4 and #5 with larger, more recessed culverts so that high water levels in Oak Lake can be drained more effectively through that drainage system
- Continue to remove sediment from culverts as a water level management technique
- Assess the degree of flooding of properties and sewage treatment systems during high water levels. Develop site-specific mitigation measures to reduce social and environmental impacts from flooding such as construction of flood walls and dry flood proofing
- Establish a staff gauge on Oak Lak and collect seasonal water level data
- Establish water level management objectives
- Relate objectives to water levels on Oak Lake
- Determine if the existing drainage system, including the replacement of Culvert #4 and #5 can meet the objectives
- Complete a water budget and design an alternative water control system for Oak Lake ((if required)

5.5 Agricultural Runoff

Agriculture was noted as the issue of greatest concern (54) and the most serious problem (33) by residents in the mailed questionnaires. Nutrient enrichment of lakes is a global problem and nutrient loadings from agriculture are well known as a major driver of these changes in water quality (Withers et al. 2014) so it is not surprising that nutrient-rich and on occasion bacteria-rich runoff from the tile drain characterized by sites Trib-4 and Trib-5 is of concern to residents .

Mr. Larry Detlor and Mr. Greg Barr own and operate the majority of agricultural lands located in the Oak Lake watershed, which are northeast of the lake. Mr. Detlor raises cattle and Mr. Barr raises pigs while both also grow soybeans and corn. A large swath of the agricultural lands is drained via a tile drain that drains in a southwestern direction adjacent to both farms, flows underneath Foxboro-Stirling Road (#14) and eventually into Oak Lake. The manure spill that occurred in 2018 occurred as a result of a ruptured manure storage silo on Mr. Barr's land and conveyance of manure through the tile drain. The spill was reported to MECP and Hastings Prince Edward Public Health, and since that time Mr. Barr has removed tile drains from that area.



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5.5.1 Previous Recommendations

Oak Lake Shoreline Regeneration Plan (LTC, 2002):

- The upland portions of the watershed are predominantly void of woodland vegetation communities. This is resulting in increased runoff, decreased groundwater recharge, and some site-specific erosion problems. Reforestation is recommended for areas that are not being used for agricultural practices. Where there is agriculture, best management practices should be adopted (e.g. vegetative buffers, grassed waterways, no-till or reduce till, contour planting, etc.)

5.5.2 Existing Policies

9.3.2.3 Agricultural Development Policies

(i) The City, in consultation with the Lower Trent Conservation and the Hastings Federation of Agriculture, shall conduct an assessment of the impact of agricultural run-off on the water quality of Oak Lake.

(ii) The City, in consultation with the Hastings Federation of Agriculture, shall encourage all farm operations within the Oak Lake Special Policy Area to complete Environmental Farm Plans in an effort to minimize the impact of sources of nutrients on Oak Lake.

9.3.3.3 Agricultural Development Policies

(i) Except where specifically referenced to the contrary, the agricultural development policies for all lands within the Area Specific Policy “B” shall be in keeping with the underlying land use designation identified on Schedule “A” and referenced in Sections 5.1 and 5.2 of this Plan.

(ii) The City, in consultation with the Lower Trent Conservation and the Hastings Federation of Agriculture, shall conduct an assessment of the impact of agricultural run-off on the water quality of Oak Lake.

(iii) The City, in consultation with the Hastings Federation of Agriculture, shall encourage all farm operations within the Oak Lake Area Specific Policy to complete Environmental Farm Plans in an effort to minimize the impact of sources of nutrients on Oak Lake.

5.5.3 New Recommendations

A variety of best management practices can be used to minimize nutrient runoff from agricultural lands. Mr. Detlor and Mr. Barr currently plant cover crops and use no-till crop management, two common stewardship practices and manure stockpiles have been moved previously to reduce nutrient enriched runoff. Additionally, we recommend that:

- The tile drain is re-routed along Foxboro Stirling Road (#14), approximately 500 m north up to the wetland (Figure 17). The wetland flows away from the lake (see Section 4.6) and wetlands can retain nutrients through a variety of biotic and abiotic factors (HESL 2017). Mr. Detlor, Mr. Barr and the City of Quinte West have agreed to this recommendation. A quotation has been provided from K.G. Reid Trenching and Construction Ltd. for to complete the work for \$230,000.



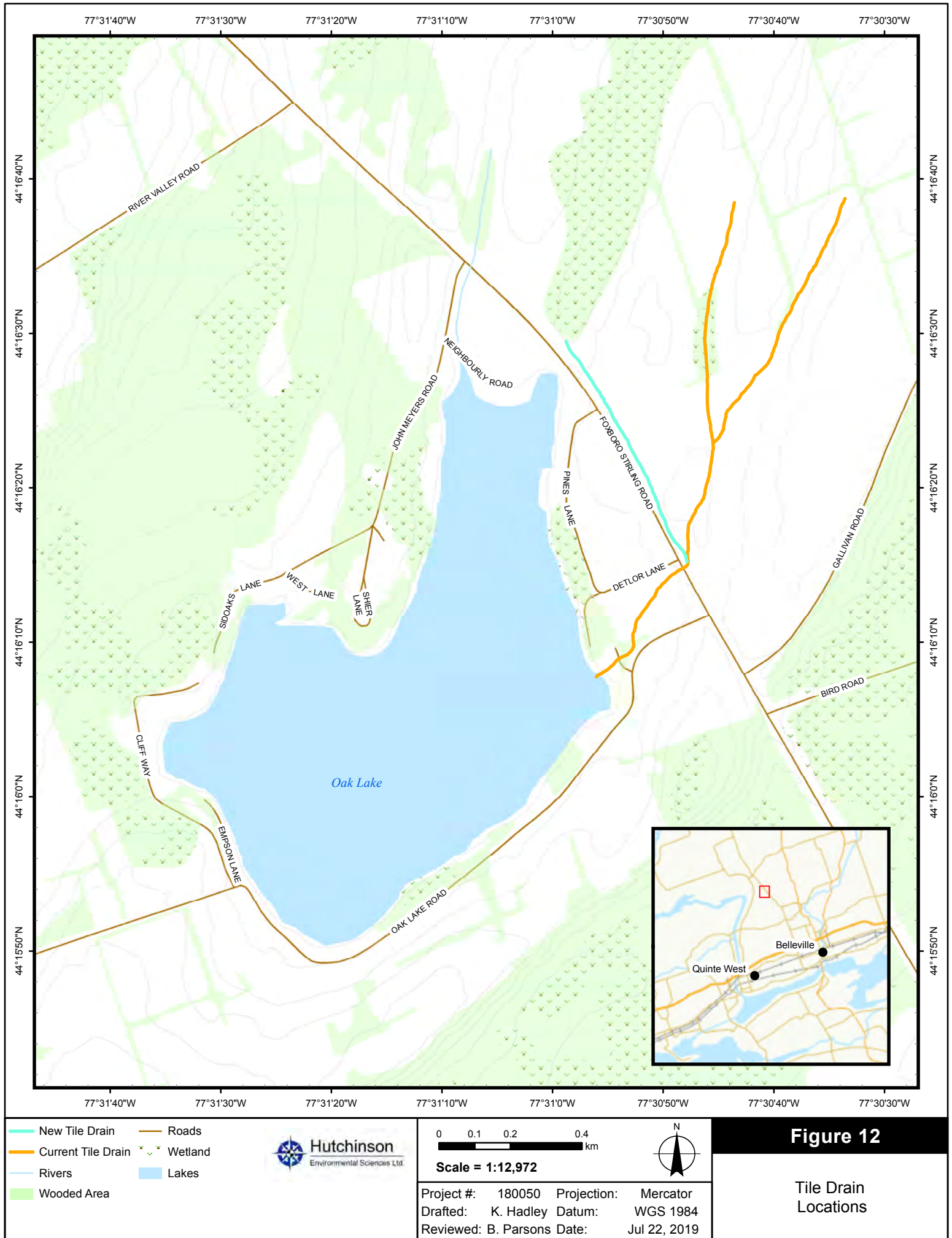


Figure 12

Tile Drain
Locations



0 0.1 0.2 0.4
km

Scale = 1:12,972



Project #:	180050	Projection:	Mercator
Drafted:	K. Hadley	Datum:	WGS 1984
Reviewed:	B. Parsons	Date:	Jul 22, 2019

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5.6 Aquatic Vegetation Management

Macrophytes are abundant in Oak Lake and dense macrophytes are common in shallow lakes with nutrient rich sediments and good water clarity so the accumulation of macrophytes is not surprising. Macrophytes are a natural feature of Oak Lake that provide fish habitat and reduce algal concentrations through competition for light and nutrients.

MOE noted the presence of abundant and widespread growth of aquatic plants almost 50 years ago (MOE 1973) but beyond anecdotal information from residents, it is unclear how macrophyte abundance has changed over time. Macrophyte abundance has likely increased over time due to the presence of Eurasian Watermilfoil (*Myriophyllum spicatum*), which is one of the most widely distributed invasive aquatic plant species in the world and it is also present in Oak Lake, as well as a result of anthropogenic nutrient inputs and the natural aging process of lakes which results in more wetland-like characteristics such as shallower depths and increased nutrient concentrations. Also, residents noted that it has become increasingly difficult to access their dock via boats because of macrophyte density.

5.6.1 Previous Recommendations

Oak Lake Shoreline Regeneration Plan (LTC, 2002):

- Aquatic vegetation in the northeast corner of the lake, and wetland vegetation fringing this reach of shoreline, is dominated by invasive alien plants. Establishment of native emergent vegetation in this area would help improve nutrient cycling.

5.6.2 Recommendations

A variety of physical (i.e. raking, hand pulling, rotovating), chemical (i.e. Reward) and biological removal (i.e. weevils) options exist but management of macrophytes will be a challenge because the inherent lake characteristics of Oak Lake that encourage growth can't be changed, climate change promotes macrophyte growth, Eurasian Watermilfoil is present in Oak Lake, the sediments likely contain a dense seed bed, and removal often results in the generation of many plant fragments, many of which can root directly, so any reductions will be temporary. Also, removal of macrophytes can result in oxygen depletion, shifts in zooplankton abundance, sediment disturbance, and most notably encourage algae growth, especially toxic cyanobacteria (Wojciechowski et al. 2016).

Aquatic plant removal should be minimized to those areas where they threaten or impair water use (e.g. beaches) and where it is deemed necessary, hand pulling should be used and plant fragments should be controlled to encourage further dispersal. Pulling should also be completed outside of the spring spawning period for resident fish species (July 15th) so that sensitive life stage is protected.

Motorized boats stir up sediment and sediment-related nutrients into the water column and propellers cut up plants which encourages dispersal as mentioned previously. We recognize that motorized boats are a popular recreational use of Oak Lake, but a motorized boat ban would help limit nutrient resuspension and aquatic plant dispersal in Oak Lake and should be considered.

We recommend that the following measures are implemented:



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- Limit macrophyte removal to small areas, complete removal outside of sensitive fish windows (after July 15), utilize hand pulling in the areas and limit the dispersal of plant fragments by removing entire plants. Dispose of the plants/materials on dry land to prevent it from entering the water.
- Consider banning motorized boats, implementing a speed limit or restricting motor size.

5.7 Waterfowl Control

The predominant waterfowl species utilizing Oak Lake appears to be Canada Geese which is a migratory bird that is protected under the Migratory Birds Convention Act. Geese prefer manicured grassy areas near open water for feeding and security reasons (AECOM, 2009) and according to residents, populations have increased over time. Presence of geese in the fall but not earlier in the year indicates that Oak Lake is used as a migratory stopover location. Several management approaches have been developed to control nuisance populations of Canada Geese such as non-lethal passive deterrents, active scare techniques and lethal management.

5.7.1 New Recommendations

We have reviewed management techniques and recommend the following techniques to control nuisance Canada Geese populations on Oak Lake:

- Discourage feeding by residents
- Landscape Alteration
 - Increase natural shoreline buffer to make the nearshore less appealing to Geese
 - Obstruct views of the shoreline to make Geese feel less comfortable
 - Install barriers such as flash tape or monofilament strands along the shoreline to prevent goose access to lawns
- Use a professional dog handler to scare geese away from the site.

5.8 Active Lake Management

A number of different active lake management methods can be used to reduce internal phosphorus loads to lakes: 1) oxygenation or aeration which prevents the development of anoxia and release of phosphorus from sediments, 2) sediment inactivation which prevents the release of phosphorus from sediments, and 3) withdrawal methods designed to remove internally loaded phosphorus from bottom waters.

Oxygenation/aeration is typically accomplished via direct injection of oxygen or air into the hypolimnion by a diffuser or through prevention or breakdown of stratification to allow circulation throughout the entire water column. Prepas et al. 1997 utilized a fine bubble, pure oxygen diffuser system in Amisk Lake, Alberta to increase oxygen concentrations in bottom waters and reduce cyanobacterial blooms. Hypolimnetic dissolved oxygen concentrations were maintained above 5 mg/L, total phosphorus concentrations in the



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hypolimnion decreased by > 50%, total algal biomass decreased by 33% and the dominant assemblage shifted from cyanobacteria to diatoms. Other commonly used injection systems like the Lake Lung have proven ineffective because of damage sustained during ice break-up.

Laminar Flow Inversion and Oxygenation System, offered by Clean Flo, and SolarBee systems are two water circulation systems that are designed to mix water throughout the water column and prevent stratification of the water column. The Laminar Flow Inversion and Oxygenation System pumps compressed air through a ceramic diffuser which creates a laminar flow as it rises to the surface. The SolarBee system is a solar-powered circulation system that draws water from a specified depth and discharges it to the surface. SolarBees could be used to circulate the surface waters in the shallow portions of Oak Lake and more importantly, the deep waters in the central portion of the lake by setting intake hoses at different depths.

Sediment phosphorus inactivation is a popular technique used to bind organic and inorganic phosphorus in sediment using typically either aluminum sulfate (alum) or lanthanum enriched clay (i.e. Phoslock) to prevent internal phosphorus loading. Macrophytes can disrupt the effectiveness of sediment inactivation through interference with application or sediment phosphorus recycling from below the floc layer by plant senescence and decay. Macrophytes are abundant throughout Oak Lake so we have not recommended sediment inactivation.

Active lake management has been completed in Ontario (e.g. sediment inactivation - Swan Lake, City of Markham, aeration - Lake Wilcox, City of Richmond Hill), in other provinces and is a common practice in the United States and Europe but it's not common in Ontario and therefore permitting can be challenging. Government authorities in Ontario generally focus on watershed Best Management Practices (BMPs) but BMPs are often inadequate when restoring phosphorus impaired lakes (Osgood, 2017). The number of algal blooms increased significantly in Ontario between 1994 and 2011 (Winter et al. 2011) and will likely continue to increase due to increased nutrient inputs and factors associated with climate change. Active lake management will be required in more lakes moving forward due to the ineffectiveness of watershed BMPs in many situations and the predicted rise in the number of algal blooms so we hope that government authorities will permit active lake management measures in the future, if required to protect recreational opportunities and ecological values.

5.8.1 New Recommendations

Average phosphorus concentrations during the open-water season at OL-1 do not exceed Provincial Water Quality Objectives and cyanobacteria (i.e. blue green algae), which are known to scavenge nutrients from sediments, were largely absent during our study so there is insufficient evidence to justify active lake management at this time. Internal loading does however provide a substantial phosphorus load to Oak Lake on an annual basis and options should be researched if phosphorus concentrations increase substantially, or cyanobacteria blooms become prevalent.

We recommend:

- Contact Canadian distributors of line diffusers, bubblers, and water circulation systems, collect information on costs and proven reliability of each system for reducing internal loading. Compare costs, advantages and disadvantages of each system, and applicability for reducing internal loading



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of nutrients in Oak Lake. Include LTC and MECP in the process to ensure that potential options will be permitted if required in the future.

- If oxygenation or aeration are utilized in the future, assess deep water conditions prior to installation of bubblers to determine appropriate depth of circulation in relation to decaying vegetation and unconsolidated substrates to ensure those materials are not circulated throughout the lake.

5.9 Long-term Water Quality Monitoring

A number of water quality monitoring programs have been completed in Oak Lake and we have attempted to assimilate datasets herein.

5.9.1 Previous Recommendations

An Evaluation of the On-Site Sewage Disposal Systems for Properties Fronting on Oak Lake (Ontario Lake Assessments, 2002a):

- The Municipality should maintain a water quality sampling program to establish a good baseline water quality data set from which to base planning decisions in the future.

Oak Lake Water Quality Assessment (MECP, 2018):

- Future monitoring should include three sample locations and efforts to ensure that comparisons between basins and sampling years can be made. The City should request that MEPC's Environment Monitoring and Reporting Branch assist or take-over the long-term monitoring program for Oak Lake.
- A study of lake sediments is also recommended for the 2019 sampling season.

5.9.2 Existing Policies

City of Quinte West Official Plan (2017):

- The City, in consultation with the Lower Trent Conservation and local Health Unit, shall establish an annual water sampling program for the on-going of the water quality of Oak Lake.

5.9.3 New Recommendations

Future sampling should build off of existing datasets to maximize the potential to determine long term trends, assess outstanding issues identified through 2018/19 sampling and evaluate the effectiveness of management recommendations once those measures are implemented. We recommend that:

- Long-term monitoring of phosphorus from OL-1 is continued during spring overturn to provide a high-level indication of the trend in phosphorus in Oak Lake. Sampling can be completed by volunteers through MECP's Lake Partner Program and organized through the Friends of Oak Lake.



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- Winter sampling is completed in 2020 to determine if elevated nutrient concentrations observed in February 2019 (as discussed in Section 4.1) are common or were a “one off”.
- Ongoing seasonal sampling of field parameters, nutrients and phytoplankton are collected at the water quality stations to best define water quality conditions and assess the effectiveness of management recommendations as they are completed.

6. Conclusions

Oak Lake is a typical kettle lake with moderate nutrient concentrations that are driven by shoreline development practices, septic systems, agricultural inputs and internal loading. Nutrient concentrations have remained stable over time while bacteria concentrations have largely declined compared to 2001 data. Concentrations of nutrients in the tile drain that drains adjacent agricultural lands was high but similar to concentrations measured in other agricultural runoff in Ontario. Lastly, nutrient concentrations were elevated in the winter compared to other seasons, likely as a result of a variety of processes discussed in Section 4.1.

Macrophytes are abundant and algae followed a typical succession pattern until *Mougeotia spp.*, a species of filamentous green algae, spread throughout much of the lake in the summer of 2019. *Mougeotia spp.* are a nuisance for recreational uses but are non-toxic to humans and other aquatic life. Blooms of this species have not been clearly related to nutrient levels, nor is there sufficient evidence to connect this algal bloom to the 2018 manure spill.

Water level management is a challenge in Oak Lake because a) development setbacks are limited and nearshore areas are flat so slight changes in water levels impact residences and water intake lines, b) there is limited inflow or outflow so there isn't much water to work with, and c) there are differing opinions on a water management objective. Culvert #5 was removed in the late winter of 2019, which appeared to help lower water levels in the spring of 2019.

Oak Lake has been well studied and several lake management recommendations have been both made and incorporated into policy, but it is unclear how successful previous recommendations and policies have been. We developed new recommendations that included realigning the adjacent agricultural tile drain so it no longer drains into Oak Lake, developing a bylaw to enforce appropriate sewage treatment system design and maintenance, as well as others related to shoreline development practices, water level management, aquatic vegetation management, waterfowl control, active lake management and long-term monitoring. Successful execution of the management recommendations requires buy-in by shoreline residents and enforcement.



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Appendix A. Mailed Out Questionnaire



Oak Lake Water Quality Assessment Survey

Hutchinson Environmental Sciences Ltd. (HESL) is pleased to have been selected by the City of Quinte West to perform a water quality assessment on Oak Lake. The purpose of the project is to analyze existing data and complete a water quality sampling program to inform the development of a lake management plan and prevent further degradation of water quality of Oak Lake. Findings will be documented in a detailed technical report to the City and at several public meetings, including the first public meeting on:

Wednesday, August 15th
Farmtown Park, Stirling
437 W Front Street
Stirling, ON
5:00 p.m. – 7:00 p.m.

The intent of this survey is to introduce Hutchinson Environmental Sciences Ltd. to the residents and cottagers in the Oak Lake area and gather information on the public's lake use and their perception of the severity of water quality issues in the lake. This survey is an important opportunity for lake residents to voice their concerns to HESL and the City so that appropriate management recommendations are developed. Hutchinson Environmental Sciences Ltd. is a small team of highly qualified aquatic scientists with extensive experience working on lakes in Ontario. Brent Parsons will act as Project Manager and client liaison. Dr Kristopher Hadley will lead field collection, data analysis and reporting, and will be supported by Clarke Heitman who will also perform door-to-door septic system inspections.

Completed questionnaires can be mailed to Hutchinson Environmental at 1-5 Chancery Lane, Bracebridge ON, P1L 2E3. Any questions on the project should be directed to Chris Angelo, Director, Public Works and Environmental Services (613) 392-2841 ext. 4406 or chrisa@quintewest.ca.

Thank-you for taking the time to ensure that local knowledge and concerns are incorporated into the Oak Lake Water Quality Assessment.



P.O. Box 490
7 Creswell Drive
Trenton, Ontario K8V 5R6
Telephone: 613-392-2841
www.quintewest.ca

1. What is your name, address, and email (for future correspondence)
2. How long have you owned your cottage or residence at Oak Lake?
3. Do you use your cottage or residence:
 - Summer only
 - Summer and occasionally in winter
 - Regularly throughout the year
 - Permanent resident
4. Which of the following concerns (if any) have you had about your lake during the past 5 years? (Check one box for each concern)

	No Concern	Some Concern	Great Concern	Don't Know
Dead fish or declining fish population				
Poor or declining quality of the lake water for consumption (drinking, cooking)				
Poor or declining quality of the lake for swimming or other water recreation				
Water level fluctuation				
Agricultural run-off				
Poor or declining aesthetic appearance of the lake and shoreline				
Too much recreational activity				
Too much shoreline development				
Other (specify)				

Very dissatisfied 1 2 3 4 5 Very satisfied

1-5 Chancery Lane
Bracebridge ON, P1L 2E3
Phone: (705) 645-0021
Email: bracebridge@environmentalsciences.ca
environmentalsciences.ca

P.O. Box 490
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Trenton, Ontario K8V 5R6
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www.quintewest.ca

6. Please rate the seriousness of the following problems in your lake by identifying the three (3) most serious concerns. Place a 1 next to the most serious concern and so on.

- ☐ Dead fish or declining fish population
- ☐ Poor or declining quality of the lake water for consumption (drinking/cooking)
- ☐ Poor or declining quality of the lake for swimming or other water recreation
- ☐ Water level fluctuation
- ☐ Agricultural run-off
- ☐ Poor or declining aesthetic appearance of the lake and shoreline
- ☐ Too much recreational activity
- ☐ Too much shoreline development

7. Lake Level

- a. What is your opinion on the current water level of Oak Lake
- ☐ Water level is currently too high
 - ☐ Water level is currently too low
 - ☐ Water level is good as it is
- b. What impacts (if any) have water levels had on your property (Mark all that apply)?
- ☐ High water encroaching on property
 - ☐ Flooding of house/cottage
 - ☐ Receding water causing exposure of additional shoreline
 - ☐ Other (Please specify)

8. Agricultural Run-off

A recent manure spill in early 2018 (reported February 26th, 2018) has been documented and investigated by Hastings Prince Edward Public Health and the Ministry of the Environment and Climate Change.

- a. Prior to the recent 2018 spill, have you or you family observed agricultural run-off to Oak Lake
- ☐ Yes
 - ☐ No
- b. If Yes, please specify the location where you observed the run-off

9. How often do you/your family participate in the following activities in Oak Lake?

Activity	Never/Rarely	Occasionally (2-3 time per summer)	Frequently (at least once per week)
Swimming/wading nearshore			
Sitting by water/enjoying the view			
Motorboating/waterskiing			
Canoeing/rowing			
Fishing			

10. Characterize your waterfront (check all that apply)

- ☐ Sandy beach
- ☐ Wetland
- ☐ Natural vegetation (shrubs, wildflowers, trees)
- ☐ Grass
- ☐ Hardened (concrete, wood retaining wall)
- ☐ Other

11. What is the average distance between your house/cottage and water?

- ☐ < 10 metres (30 feet)
- ☐ 10 – 20 metres (30 - 65 feet)
- ☐ 20 – 30 metres (65 - 100 feet)
- ☐ >30 metres (100 feet)

12. What restrictions are between your house/cottage and the lake that would limit your ability to establish a vegetative buffer?

- ☐ Tile bed for septic system
- ☐ Paved hardened driveway
- ☐ Accessory buildings
- ☐ Other

13. What type of septic system do you have?

- ☐ Holding tank
- ☐ Septic tank and filter or leaching bed

- ☐ Composting toilet
- ☐ Greywater system
- ☐ Other

14. Approximate distance between shoreline and closest portion of septic system
_____m or _____ft

15. Number of years since your septic system was last maintained/pumped _____

16. What changes have you observed since you moved here?

17. What issues do you think are affecting the water quality of the lake?

18. Other comments:

Appendix B. Water Quality Master Spreadsheet



Client Sample ID			OL-1	OL-1	OL-1	OL-1	OL-2	OL-2	OL-2
Date Sampled			16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019
ALS Sample ID			L2148866-1	L2189621-1	L2232152-1	L2270097-1	L2148866-2	L2189621-2	L2232152-2
Parameter	Lowest Detection Limit	Units	Water	Water	Water	Water	Water	Water	Water
Field Measurements									
Temperature		C	25.74	7.71	2.32	12.83	24.94	7.65	2.98
Conductivity		uS/cm^c	277	294	274	328	271	294	305
		uS/cm	282	197	156	252	270	196	177
Dissolved Oxygen		%	97.6	91.9	123.3	111.9	88.7	98.9	100.9
		mg/L	7.95	10.95	16.62	11.82	7.35	11.76	13.59
pH			8.25	8.77	8.08	8.47	7.71	8.84	7.95
Physical Tests (Water)									
Hardness (as CaCO3)	10	mg/L	59	73	74	85.6	61	70	78
pH	0.10	pH units	8.60	7.99	7.97	8.29	8.66	8.04	7.95
Total Suspended Solids	2.0	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Anions and Nutrients (Water)									
Alkalinity, Total (as CaCO3)	10	mg/L	50	62	73	83	49	65	78
Ammonia, Total (as N)	0.020	mg/L	0.130		0.071	0.134	0.025	0.539	0.051
Chloride (Cl)	0.50	mg/L	51.6	51.4	51.6	49.6	51.6	51.4	57.9
Nitrate (as N)	0.020	mg/L	<0.020	<0.020	0.080	<0.020	<0.020	<0.020	0.090
Total Kjeldahl Nitrogen	0.15	mg/L	0.50	0.65	0.37	0.53	0.57	0.59	0.74
Phosphorus, Total	0.0030	mg/L	0.0108	0.0086	0.0532	0.0104	0.0106	0.0084	0.0372
Sulfate (SO4)	0.30	mg/L	1.68	1.54	2.04	1.85	1.68	1.55	2.17
Unionized Ammonia									
Organic / Inorganic Carbon (Water)									
Dissolved Organic Carbon	0.50	mg/L	6.19	5.92	5.88	5.91	6.54	5.94	5.76
Bacteriological Tests (Water)									
E. Coli	2	CFU/100mL	1	0	0	0	1	0	1
Fecal Coliforms	2	CFU/100mL	2	0	0	0	4	0	0
Fecal Streptococcus	1	CFU/100mL	3	0.5	1	0.5	4	5	3
Pseudomonas aeruginosa	1	CFU/100mL	4	0.5	0.5	0.5	11	0.5	0.5
Plant Pigments (Water)									
Chlorophyll a	0.10	ug/L	4.40	6.92	1.63	2.68	4.01	6.74	13.50
Total Metals (Water)									
Aluminum (Al)-Total	0.0050	mg/L	0.0196		0.0155	0.0119	0.0101		0.0252
Antimony (Sb)-Total	0.00010	mg/L	0.00010		0.00011	<0.00010	<0.00010		0.00011
Arsenic (As)-Total	0.00010	mg/L	0.00062		0.00054	0.00050	0.00064		0.00054
Barium (Ba)-Total	0.00010	mg/L	0.0147		0.0159	0.0162	0.0144		0.0171
Beryllium (Be)-Total	0.00010	mg/L	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
Bismuth (Bi)-Total	0.000050	mg/L	<0.000050		<0.000050	<0.000050	<0.000050		<0.000050
Boron (B)-Total	0.010	mg/L	<0.010		<0.010	<0.010	<0.010		<0.010
Cadmium (Cd)-Total	0.0000050	mg/L	<0.0000050		0.0000061	<0.0000050	<0.0000050		0.0000169
Calcium (Ca)-Total	0.050	mg/L	18.8	24.7	25.1	29.6	19.6	23.4	26.4
Cesium (Cs)-Total	0.000010	mg/L	<0.000010		<0.000010	<0.000010	<0.000010		<0.000010
Chromium (Cr)-Total	0.00050	mg/L	0.00909		<0.00050	<0.00050	<0.00050		<0.00050
Cobalt (Co)-Total	0.00010	mg/L	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
Copper (Cu)-Total	0.0010	mg/L	<0.0010		<0.0010	<0.0010	<0.0010		0.0013
Iron (Fe)-Total	0.010	mg/L	0.043	<0.050	0.013	0.033	0.012	<0.050	0.027
Lead (Pb)-Total	0.000050	mg/L	<0.000050		<0.000050	<0.000050	<0.000050		0.000057
Lithium (Li)-Total	0.0010	mg/L	<0.0010		<0.0010	<0.0010	<0.0010		<0.0010
Magnesium (Mg)-Total	0.0050	mg/L	2.82	2.85	2.66	2.84	2.84	2.82	2.83
Manganese (Mn)-Total	0.00050	mg/L	0.00599		0.00374	0.00560	0.00392		0.00341
Molybdenum (Mo)-Total	0.000050	mg/L	0.000207		0.000183	0.000108	0.000086		0.000109
Nickel (Ni)-Total	0.00050	mg/L	0.00238		<0.00050	<0.00050	<0.00050		<0.00050
Phosphorus (P)-Total	0.050	mg/L	<0.050		0.068	<0.050	<0.050		<0.050
Potassium (K)-Total	0.050	mg/L	1.40		2.20	1.75	1.40		1.83
Rubidium (Rb)-Total	0.00020	mg/L	0.00130		0.00168	0.00132	0.00126		0.00151
Selenium (Se)-Total	0.000050	mg/L	<0.000050		0.000070	<0.000050	<0.000050		0.000053
Silicon (Si)-Total	0.10	mg/L	0.12		0.15	<0.10	0.11		<0.10
Silver (Ag)-Total	0.000050	mg/L	<0.000050		<0.000050	<0.000050	<0.000050		<0.000050
Sodium (Na)-Total	0.050	mg/L	29.2		28.3	27.9	29.1		32.1
Strontium (Sr)-Total	0.0010	mg/L	0.0578		0.0626	0.0661	0.0583		0.0667
Sulfur (S)-Total	0.50	mg/L	0.71		0.84	0.78	0.77		0.87
Tellurium (Te)-Total	0.00020	mg/L	<0.00020		<0.00020	<0.00020	<0.00020		<0.00020
Thallium (Tl)-Total	0.000010	mg/L	<0.000010		<0.000010	<0.000010	<0.000010		<0.000010
Thorium (Th)-Total	0.00010	mg/L	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
Tin (Sn)-Total	0.00010	mg/L	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
Titanium (Ti)-Total	0.00030	mg/L	<0.00030		0.00035	<0.0070	<0.00030		<0.0080
Tungsten (W)-Total	0.00010	mg/L	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
Uranium (U)-Total	0.000010	mg/L	0.000018		0.000022	0.000027	0.000021		0.000023
Vanadium (V)-Total	0.00050	mg/L	<0.00050		<0.00050	<0.00050	<0.00050		<0.00050
Zinc (Zn)-Total	0.0030	mg/L	<0.0030		<0.0030	<0.0030	<0.0030		0.0047
Zirconium (Zr)-Total	0.00030	mg/L	<0.00030		<0.00030	<0.00030	<0.00030		<0.00030
Aggregate Organics (Water)									
BOD	2.0	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0

OL-2	OL-4	OL-4	OL-4	OL-4	OL-7	OL-7	OL-7	OL-7	OL-9	OL-9	OL-9
8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019
L2270097-2	L2148866-3	L2189621-3	L2232152-3	L2270097-3	L2148866-4	L2189621-4	L2232152-4	L2270097-4	L2148866-5	L2189621-5	L2232152-5
Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
12.98	25.43	7.8	3.47	13.15	24.63	6.21	2.47	13.98	25.04	6.81	2.57
328	269	293	310	330	287	294	344	328	264	299	312
253	271	196	182	255	286	188	196	260	264	194	179
113.3	101.6	94.1	124.6	111.8	73.2	98.5	111.4	118	71.8	93.8	113.7
11.96	8.34	11.17	16.4	11.75	6.88	12.19	15.22	12.34	5.93	11.41	15.42
8.29	8.39	8.82	8.02	8.54	8.03	8.84	7.93	8.4	7.97	8.81	8.04
83.6	59	75	70	83.6	54	74	65	83.5	55	77	80
8.33	8.62	8.03	7.92	8.30	8.70	8.07	7.61	8.38	8.81	7.97	7.59
<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	4.3	<2.0	2.4	2.9	3.1
81	46	65	69	81	48	65	64	80	41	64	80
<0.010	0.030	0.212	0.160	0.019	0.030	0.145	0.113	0.372	0.047	0.562	0.210
49.6	51.6	51.6	48.9	49.6	53.4	51.1	53.7	50.2	51.8	51.7	51.5
<0.020	<0.020	<0.020	0.206	<0.020	<0.020	<0.020	0.258	<0.020	<0.020	<0.020	0.299
0.53	0.57	0.46	0.82	0.50	0.64	0.46	0.81	0.71	0.63	0.65	1.02
0.0111	0.0135	0.0097	0.0182	0.0114	0.0157	0.0050	0.0714	0.0133	0.0255	0.0441	0.151
1.84	1.67	1.54	2.04	1.86	1.13	1.62	2.23	1.86	1.61	1.68	2.52
4.89	6.47	5.98	5.56	4.85	7.68	5.87	6.36	5.30	7.31	6.19	8.23
0	10	1	0	0	4	1	0	3	2	3	14
1	6	3	0	0	6	2	0	2	4	10	21
0.5	0.5	0.5	4	0.5	12	1	4	1	31	20	59
0.5	49	0.5	0.5	0.5	62	0.5	0.5	14	0.5	0.5	0.5
2.55	3.98	4.30	4.65	2.65	2.76	4.02	10.20	5.72	8.44	7.63	9.23
0.0066	0.0139		0.0101	0.0059	0.0077		0.0350	0.0093	0.0272		0.0658
<0.00010	<0.00010		0.00013	<0.00010	<0.00010		0.00011	<0.00010	<0.00010		0.00016
0.00048	0.00065		0.00069	0.00046	0.00060		0.00047	0.00053	0.00070		0.00059
0.0155	0.0143		0.0151	0.0158	0.0144		0.0149	0.0159	0.0134		0.0187
<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
<0.000050	<0.000050		<0.000050	<0.000050	<0.000050		<0.000050	<0.000050	<0.000050		<0.000050
<0.010	<0.010		<0.010	<0.010	<0.010		<0.010	<0.010	<0.010		0.010
<0.0000050	<0.0000050		0.0000144	<0.0000050	<0.0000050		0.0000297	<0.0000050	<0.0000050		0.0000519
28.9	18.8	25.4	24.1	28.8	16.7	24.7	22.0	28.6	17.2	26.1	27.1
<0.000010	<0.000010		<0.000010	<0.000010	<0.000010		<0.000010	<0.000010	<0.000010		<0.000010
<0.00050	<0.00050		<0.00050	0.00055	<0.00050		<0.00050	0.00139	<0.00050		<0.00050
<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		0.00011
0.0013	<0.0010		0.0014	<0.0010	<0.0010		0.0049	<0.0010	<0.0010		0.0024
0.019	0.012	<0.050	0.012	0.018	0.044	<0.050	0.062	0.044	0.046	<0.050	0.091
0.000051	<0.000050		0.000090	<0.000050	<0.000050		0.000093	<0.000050	<0.000050		0.000162
<0.0010	<0.0010		<0.0010	<0.0010	<0.0010		<0.0010	<0.0010	<0.0010		<0.0010
2.76	3.05	2.85	2.50	2.84	2.91	2.93	2.40	2.90	2.97	2.87	2.92
0.00509	0.00412		0.00342	0.00504	0.0142		0.0101	0.0101	0.00609		0.0390
0.000124	0.000082		0.000098	0.000102	<0.000050		0.000141	0.000123	0.000083		0.000217
<0.00050	<0.00050		<0.00050	<0.00050	<0.00050		<0.00050	<0.00050	<0.00050		<0.00050
<0.050	<0.050		<0.050	<0.050	<0.050		0.092	<0.050	<0.050		0.201
1.86	1.44		1.63	1.74	1.80		2.27	1.70	1.51		4.38
0.00146	0.00128		0.00121	0.00125	0.00136		0.00173	0.00132	0.00129		0.00210
<0.000050	<0.000050		0.000064	<0.000050	<0.000050		0.000066	<0.000050	<0.000050		0.000094
<0.10	0.11		<0.10	<0.10	0.16		0.22	<0.10	0.13		0.43
<0.000050	<0.000050		<0.000050	<0.000050	<0.000050		<0.000050	<0.000050	<0.000050		<0.000050
27.5	30.1		25.7	27.6	31.3		30.7	28.6	30.6		29.8
0.0650	0.0557		0.0579	0.0643	0.0555		0.0527	0.0659	0.0579		0.0638
0.83	0.83		0.79	0.71	0.68		1.11	0.84	0.85		0.96
<0.00020	<0.00020		<0.00020	<0.00020	<0.00020		<0.00020	<0.00020	<0.00020		<0.00020
<0.000010	<0.000010		<0.000010	<0.000010	<0.000010		<0.000010	<0.000010	<0.000010		<0.000010
<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
0.00032	<0.00030		0.00036	<0.00030	<0.00030		0.00128	<0.00030	0.00037		0.00281
<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010	<0.00010	<0.00010		<0.00010
0.000029	0.000019		0.000020	0.000030	<0.000010		0.000027	0.000034	0.000027		0.000050
<0.00050	<0.00050		<0.00050	<0.00050	<0.00050		<0.00050	<0.00050	<0.00050		<0.00050
0.0057	<0.0030		0.0035	0.0033	<0.0030		0.0039	<0.0030	<0.0030		0.0103
<0.00030	<0.00030		<0.00030	<0.00030	<0.00030		<0.00030	<0.00030	<0.00030		<0.00030
<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.9	<2.0	<2.0	<2.0	2.7

OL-9	TRIB-2	TRIB 4	TRIB 4	TRIB-4	TRIB 5	TRIB 5	TRIB-5	OL-1 BOTTOM	OL-1- BOTTOME	OL-1- BOTTOM	OL-1- BOTTOM
8-May-2019	8-May-2019	11-Feb-2019	28-Mar-2019	8-May-2019	11-Feb-2019	28-Mar-2019	8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019
L2270097-5	L2270097-6	L2232152-13	L2250927-1	L2270097-7	L2232152-14	L2250927-2	L2270097-8	L2148866-12	L2189621-12	L2232152-12	L2270255-9
Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
12.9	14.85	0.67	1.65	8.32	0.07	2.98	12.62				
330	335	251	254	607	246	311	589				
254	270	134	140	413	128	179	449				
115.3	112.5	44.4	47.2	94	47.5	45.4	132				
12.19	11.63	6.41	6.53	10.71	6.79	6.1	14.17				
8.35	8.38	8.77	7.95	8.2	7.97	8.15	8.24				
87.9	84.8	97	287	280	96	256	279				
8.27	8.23	7.03	7.56	7.63	7.15	7.67	7.98				
<2.0	<2.0	10.5	10.3	15.3	5.5	4.6	<2.0		2.7	<2.0	<2.0
83	83	108	280	267	109	270	262				
0.738	0.026	0.94	2.21	1.19	0.81	1.58	0.641				
49.3	51.1	6.69	12.2	10.1	6.75	14.4	10.2				
0.027	<0.020	0.843	0.786	6.72	0.718	0.491	6.58				
0.78	0.37	2.37	3.45	2.33	2.25	2.71	1.60				
0.0215	0.0197	0.572	0.329	0.153	0.512	0.398	0.148	0.0321	0.0070	0.0193	0.0137
1.88	1.85	3.65	6.59	8.28	3.39	7.21	7.97				
5.02	5.20	22.9	11.3	6.53	22.1	9.01	6.69				
1	22	4	3	19	1	3	12				
0	50	5	7	20	2	8	11				
2	2	66	>200	7	74	>200	6				
16	3	<1	16	43	<1	20	41				
3.40	6.09			14.2			16.0				
0.0083	0.0108	0.169	0.278	0.0495	0.128	0.0605	0.0224				
<0.00010	<0.00010	0.00013	0.00014	0.00011	0.00013	0.00012	0.00012				
0.00053	0.00053	0.00053	0.00139	0.00087	0.00062	0.00121	0.00080				
0.0158	0.0157	0.0251	0.0534	0.0442	0.0218	0.0415	0.0427				
<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010				
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050				
<0.010	<0.010	0.011	0.031	0.018	0.011	0.023	0.020				
<0.0000050	<0.0000050	0.0000294	0.0000313	0.0000110	0.0000238	0.0000150	0.0000122				
30.3	29.2	32.5	100	99.0	32.6	88.9	98.5				
<0.000010	<0.000010	0.000011	0.000013	<0.000010	<0.000010	<0.000010	<0.000010				
<0.00050	0.00140	0.00055	0.00082	0.00053	0.00160	<0.00050	0.00058				
<0.00010	<0.00010	0.00047	0.00126	0.00030	0.00046	0.00115	0.00023				
<0.0010	<0.0010	0.0052	0.0017	0.0015	0.0052	0.0013	0.0015				
0.020	0.065	0.206	0.967	0.246	0.180	0.826	0.133	0.096		0.059	<0.05
<0.000050	<0.000050	0.000167	0.000172	0.000100	0.000137	0.000106	0.000054				
<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010				
2.99	2.90	3.72	8.93	7.92	3.61	8.28	7.93				
0.00652	0.00965	0.156	0.860	0.194	0.239	1.31	0.112				
0.000103	0.000133	0.000509	0.000690	0.000491	0.000561	0.000589	0.000558				
<0.00050	<0.00050	<0.00050	0.00110	0.00056	0.00056	0.00079	0.00051				
<0.050	<0.050	0.635	0.314	0.146	0.587	0.413	0.136				
1.78	1.72	11.3	7.28	6.38	11.5	7.54	6.48				
0.00130	0.00133	0.00236	0.00197	0.00159	0.00255	0.00217	0.00152				
<0.000050	0.000051	0.000198	0.000218	0.000223	0.000215	0.000168	0.000230				
<0.10	<0.10	2.00	4.51	3.35	1.85	3.72	2.70				
<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050				
28.2	29.3	3.18	6.79	6.75	3.45	8.50	7.10				
0.0671	0.0673	0.0599	0.170	0.183	0.0589	0.158	0.183				
0.82	0.81	1.32	2.48	2.97	1.25	2.54	2.86				
<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020				
<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010				
<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010				
<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010				
<0.00030	0.00037	0.00680	0.0123	0.00228	0.00484	<0.0030	0.00093				
<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010				
0.000035	0.000031	0.000289	0.00282	0.000714	0.000245	0.00169	0.000737				
<0.00050	<0.00050	0.00116	0.00222	0.00134	0.00125	0.00109	0.00121				
<0.0030	<0.0030	0.0081	0.0116	0.0040	0.0137	0.0189	0.0049				
<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030				
<2.0	<3.0	12.6	4.9	<2.0	11.1	2.9	<3.0				

	OL-3	OL-3	OL-3	OL-3	OL-5	OL-5	OL-5	OL-5	OL-6
	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018
	L2148866-6	L2189621-6	L2232152-5	L2270097-10	L2148866-7	L2189621-7	L2232152-5	L2270097-11	L2148866-8
	Water	Water	Water	Water	Water	Water	Water	Water	Water

Bacteriological Tests (Water)

E. Coli	2	1	1	1	6	0	2	1	2
Fecal Coliforms	4	0	0.5	1	4	2	0.5	0	2
Fecal Streptococcus	19	0.5	37	0.5	3	3	4	1	4
Pseudomonas aeruginosa	29			0.5	21			4	58

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OL-6	OL-6	OL-6	OL-8	OL-8	OL-8	OL-8	OL-10	OL-10	OL-10	OL-10	OL-11
29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018	29-Oct-2018	11-Feb-2019	8-May-2019	16-Aug-2018
L2189621-8	L2232152-5	L2270097-12	L2148866-9	L2189621-9	L2232152-5	L2270097-13	L2148866-10	L2189621-10	L2232152-5	L2270097-14	L2148866-11
Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
1	4	0	2	1	6	0	1	0	18	0	14
0	2	0	2	0	<1	1	1	0	7	0	14
15	26	0.5	1	1	51	3	34	13	113	3	4
		4	117			4	12			3	16

OL-11	OL-11	OL-11
29-Oct-2018	11-Feb-2019	8-May-2019
L2189621-11	L2232152-5	L2270097-15
Water	Water	Water
0	1	0
1	0.5	0
2	0.5	0.5
		1

Appendix C. Water Quality Chain of Custody, Sample Receipt Confirmation and Certificate of Analysis





HUTCHINSON ENVIRONMENTAL SCIENCES
LTD
ATTN: Brent Parsons
501 Krug St.
Suite 202
Kitchener ON N2B 1L3

Date Received: 17-AUG-18
Report Date: 12-JAN-19 13:04 (MT)
Version: FINAL REV. 2

Client Phone: 519-576-1711

Certificate of Analysis

Lab Work Order #: L2148874
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Comments: ADDITIONAL 05-SEP-18 10:19

Gayle Braun
Senior Account Manager

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

ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148874-1 OL-1 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix: Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Taxonomy Phytoplankton Plant Pigments Chlorophyll a	 3 4 See attached. 4.40		 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 17-AUG-18 17-AUG-18 17-AUG-18	 17-AUG-18 17-AUG-18 09-JAN-19 17-AUG-18	 R4176309 R4178007 R4434807 R4180109
L2148874-2 OL-2 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix: Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	 4 11 4.01		 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 17-AUG-18 17-AUG-18 17-AUG-18	 17-AUG-18 17-AUG-18 17-AUG-18	 R4176309 R4178007 R4180109
L2148874-3 OL-4 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix: Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	 <1 49 3.98		 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 17-AUG-18 17-AUG-18 17-AUG-18	 17-AUG-18 17-AUG-18 17-AUG-18	 R4176309 R4178007 R4180109
L2148874-4 OL-7 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix: Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	 12 62 2.76		 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 17-AUG-18 17-AUG-18 17-AUG-18	 17-AUG-18 17-AUG-18 17-AUG-18	 R4176309 R4178007 R4180109
L2148874-5 OL-9 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix: Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	 31 <1 8.44		 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 17-AUG-18 17-AUG-18 17-AUG-18	 17-AUG-18 17-AUG-18 17-AUG-18	 R4176309 R4178007 R4180109
L2148874-6 OL-3 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix: Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa	 19 29		 1 1	 CFU/100mL CFU/100mL	 17-AUG-18 17-AUG-18	 17-AUG-18 17-AUG-18	 R4176309 R4178007

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148874-7 OL-5 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix: Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa	 3 21			 CFU/100mL CFU/100mL		17-AUG-18 17-AUG-18	R4176309 R4178007
L2148874-8 OL-6 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix: Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa	 4 58			 CFU/100mL CFU/100mL		17-AUG-18 17-AUG-18	R4176309 R4178007
L2148874-9 OL-8 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix: Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa	 1 117			 CFU/100mL CFU/100mL		17-AUG-18 17-AUG-18	R4176309 R4178007
L2148874-10 OL-10 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix: Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa	 34 12			 CFU/100mL CFU/100mL		17-AUG-18 17-AUG-18	R4176309 R4178007
L2148874-11 OL-11 Sampled By: CLIENT on 16-AUG-18 @ 09:00 Matrix: Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa	 4 16			 CFU/100mL CFU/100mL		17-AUG-18 17-AUG-18	R4176309 R4178007

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CHL/A-ACET-FLUORO-WP	Water	Chlorophyll a by fluorometry	EPA 445.0 ACET
This analysis is done using procedures modified from EPA method 445.0. Chlorophyll a is determined by a 90 % acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
FECALSTREP-MF-WP	Water	Fecal streptococcus	APHA 9230C (modified)
An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on selective media and incubated at 35°C for 47 +/- 1 hour. Colonies exhibiting characteristic morphology for the target group on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed.			
Due to taxonomic fluidity, the term "Fecal Streptococcus" is applied here to include all members of genus names Streptococcus and Enterococcus as described in the reference method.			
PHYTO-WP	Water	Phytoplankton	APHA 10200 C & F
Samples are prepared by sedimentation/settling and examined using a compound phase contrast inverted microscope. Phytoplankters are identified to species where possible and enumerated.			
PSA-MF-WP	Water	Pseudomonas aeruginosa	APHA 9213E
A known volume of sample (typically 100 mL) is filtered through a 0.45 micron membrane filter. The filter is placed on the surface of a selective agar plate and incubated for 72 hours at 41.5 +/- 0.5 C. Plates are examined under low magnification and colonies exhibiting typical morphology are counted. Results are reported as the number of presumptive P. aeruginosa CFU/100 mL. Additional confirmation tests can be performed upon request.			

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

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

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

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

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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

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

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

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



Quality Control Report

Workorder: L2148874

Report Date: 12-JAN-19

Page 1 of 2

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CHL/A-ACET-FLUORO-WP Water								
Batch	R4180109							
WG2856479-3	DUP	L2148700-1						
Chlorophyll a		37.8	39.0		ug/L	3.1	35	17-AUG-18
WG2856479-4	DUP	L2149112-2						
Chlorophyll a		16.7	15.6		ug/L	6.3	35	18-AUG-18
WG2856479-5	LCS							
Chlorophyll a			107.2		%		80-120	22-AUG-18
WG2856479-1	MB							
Chlorophyll a			<0.10		ug/L		0.1	17-AUG-18
WG2856479-2	MB							
Chlorophyll a			<0.10		ug/L		0.1	18-AUG-18
FECALSTREP-MF-WP Water								
Batch	R4176309							
WG2852921-1	MB							
Fecal Streptococcus			<1		CFU/100mL		1	17-AUG-18
PSA-MF-WP Water								
Batch	R4178007							
WG2852918-1	MB							
Pseudomonas aeruginosa			<1		CFU/100mL		1	17-AUG-18

Quality Control Report

Workorder: L2148874

Report Date: 12-JAN-19

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3
Contact: Brent Parsons

Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



ALS Environmental
1329 Niakwa Road E - Unit 12
Winnipeg, Manitoba R2J 3T4
(204) 255-9720

Phytoplankton Sample Results

Lab Number: L2148874-1

Work Order L2148874

Sample Type WATER

Date Sampled: August 16, 2018

Submitter:

Sample ID: OL-1

Class	Genus	Species	Unit:	Units/L	Biovolume	
					Unit	Total
					μm^3	μm^3
Bacillariophyceae	<i>Fragilaria</i>	<i>sp.</i>	Single Cell	90000	0	0
Chlorophyceae	<i>Oocystis</i>	<i>sp.</i>	Colony	12000	0	0
Chlorophyceae	<i>Schroederia</i>	<i>sp.</i>	Single Cell	6000	0	0
Chlorophyceae	<i>Tetraedron</i>	<i>minimum</i>	Single Cell	6000	0	0
Chlorophyceae	<i>Unidentified</i>		Colony	9000	0	0
Chlorophyceae	<i>Unidentified</i>		Single Cell	37000	0	0
Chrysophyceae	<i>small chrysophytes</i>		Single Cell	297000	0	0
Cryptophyceae	<i>Cryptomonas</i>	<i>sp.</i>	Single Cell	99000	0	0
Cryptophyceae	<i>Unidentified</i>		Single Cell	396000	0	0
Cyanophyceae	<i>Anabaena</i>	<i>sp.</i>	Filament	118000	0	0
Cyanophyceae	<i>Aphanizomenon</i>	<i>sp.</i>	Filament	12000	0	0
Cyanophyceae	<i>Aphanocapsa</i>	<i>sp.</i>	Colony	6000	0	0
Cyanophyceae	<i>Aphanothece</i>	<i>sp.</i>	Colony	6000	0	0
Cyanophyceae	<i>Chroococcus</i>	<i>sp.</i>	Single Cell	397000	0	0
Cyanophyceae	<i>Gomphosphaeria</i>	<i>sp.</i>	Colony	12000	0	0
Cyanophyceae	<i>Planktolyngbya</i>	<i>sp.</i>	Filament	31000	0	0
Cyanophyceae	<i>Pseudanabaena</i>	<i>sp.</i>	Filament	19000	0	0

Date Printed: January 09, 2019

Lab Number:	L2148874-1	Work Order	L2148874	Sample Type	WATER		
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Date Sampled:	August 16, 2018
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Submitter:	
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Sample ID:	OL-1
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					Biovolume		Biovolume	
Class	Genus	Species	Unit:	Units/L	Unit	μ m3	Total	μ m3
Dinophyceae	<i>Ceratium</i>	<i>hirundinella</i>	Single Cell	2000	0		0	
Dinophyceae	<i>Gymnodinium</i>	<i>sp.</i>	Single Cell	4000	0		0	

Date Printed: January 09, 2019

Chain of Custody
Report

Canada To

www.alsglobal.com



L2148874-COFC

Barcode label here
(lab use only)

COC Number: 17 -

Page of

L2148874

Report To Contact and company name below will appear on the final report			Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)		
Company: HUTCHINSON ESL			Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply		
Contact: BRENT PARSONS			Priority (Business Days) 4 day [P4-20%] <input type="checkbox"/> 3 day [P3-25%] <input type="checkbox"/> 2 day [P2-50%] <input type="checkbox"/>		
Phone: 519-576-1711			EMERGENCY 1 Business day [E1 - 100%] <input type="checkbox"/>		
Company address below will appear on the final report			Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply) <input type="checkbox"/>		
Street: 50 KRUG ST, STE202			Date and Time Required for all E&P TATs: dd-mm-yy hh:mm		
City/Province: KITCHENER			For tests that can not be performed according to the service level selected, you will be contacted.		
Postal Code: N2B 1L3			Analysis Request		
Invoice To: Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below		
Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			CHLOROPHYLL A		
Company:			FECAL STEPP/SA		
Contact:			PHYTOPLANKTON ID		
Project Information			SAMPLES ON HOLD		
ALS Account # / Quote #: Q69890			Sample is hazardous (please provide further detail)		
Job #:			NUMBER OF CONTAINERS		
PO / AFE:					
LSD:					
ALS Lab Work Order # (lab use only):					
ALS Contact: GAYLE BRAUN					
Sampler:					
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	
	OL-1	16-15-18	9am	Water	R R R
	OL-2			Water	R R
	OL-4			Water	R R
	OL-7			Water	R R
	OL-9			Water	R R
	OL-3			Water	R
	OL-5			Water	R
	OL-6			Water	R
	OL-8			Water	R
	OL-10			Water	R
	OL-11			Water	
Drinking Water (DW) Samples ¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)			
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO		SAMPLE CONDITION AS RECEIVED (lab use only)			
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO		Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>			
		Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>			
		Cooling Initiated <input type="checkbox"/>			
		INITIAL COOLER TEMPERATURES °C			
		FINAL COOLER TEMPERATURES °C			
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)	
Released by:	Date:	Time:	Received by:	Date:	Time:
			C 8 17	08-18	8:45am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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

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

SEP 17 2017 FRONT



Sample Receipt Confirmation

Report Distribution:

Company Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: Brent Parsons
Address: 501 Krug St., Suite 202
Kitchener, ON, N2B 1L3
Phone: 519-576-1711
Fax: 866-205-7766
Email: deborah.sinclair@environmentalsciences.ca
brent.parsons@environmentalsciences.ca
EDD Email: --
Distribution: Hard Copy: N Email: Y Fax: N EDD: N

Invoice Distribution:

Acct Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: ACCOUNTS PAYABLE
Address: 1-5 Chancery Lane,
Bracebridge, ON, P1L 2E3
Phone: 705-645-0021
Fax: 705-457-5811
Invoice Email: deborah.sinclair@environmentalsciences.ca
accounting@environmentalsciences.ca
Project #: N/A
Account #: 20126

Client Information:

Job Reference #:
Project PO #:
Legal Site Description: N/A
Quote #: Q69690

Date Sampled: 16-AUG-18
Date Received: 17-AUG-18
Sampled By:
Chain Of Custody: --

Workorder Summary:

Lab Work Order #: L2148874
Estimated completion date: 28-DEC-18
11 Samples received at ALS in LONDON

Account Manager: Gayle Braun
Estimated sample disposal date: See Sample Disposal Information section below.

Lab Sample ID	Client Sample ID	Date Sampled	Date Received	Sample Due Date	Priority Flag	Sample Type	Client Job#
L2148874-1	OL-1	16-AUG-18 09:00	17-AUG-18 08:45	28-DEC-18			
L2148874-2	OL-2	16-AUG-18 09:00	17-AUG-18 08:45	28-DEC-18			
L2148874-3	OL-4	16-AUG-18 09:00	17-AUG-18 08:45	28-DEC-18			
L2148874-4	OL-7	16-AUG-18 09:00	17-AUG-18 08:45	28-DEC-18			
L2148874-5	OL-9	16-AUG-18 09:00	17-AUG-18 08:45	28-DEC-18			
L2148874-6	OL-3	16-AUG-18 09:00	17-AUG-18 08:45	28-DEC-18			
L2148874-7	OL-5	16-AUG-18 09:00	17-AUG-18 08:45	28-DEC-18			
L2148874-8	OL-6	16-AUG-18 09:00	17-AUG-18 08:45	28-DEC-18			
L2148874-9	OL-8	16-AUG-18 09:00	17-AUG-18 08:45	28-DEC-18			
L2148874-10	OL-10	16-AUG-18 09:00	17-AUG-18 08:45	28-DEC-18			
L2148874-11	OL-11	16-AUG-18 09:00	17-AUG-18 08:45	28-DEC-18			



**Analysis
Requested :**

	Chlorophyll a by fluorometry	Fecal streptococcus	Phytoplankton	Pseudomonas aeruginosa	Sample Handling and Disposal Fee
OL-1	✓	✓	✓	✓	✓
OL-2	✓	✓		✓	✓
OL-4	✓	✓		✓	✓
OL-7	✓	✓		✓	✓
OL-9	✓	✓		✓	✓
OL-3		✓		✓	✓
OL-5		✓		✓	✓
OL-6		✓		✓	✓
OL-8		✓		✓	✓
OL-10		✓		✓	✓
OL-11		✓		✓	✓

Analysis Completion Date (if different than sample due date):

Analysis Requested	Matrix	Due Date	Lab Sample ID
Phytoplankton	Water	16-JAN-19	L2148874-1
Pseudomonas aeruginosa	Water	24-AUG-18	L2148874-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Sample Integrity Observations: No observations were identified for this work order submission.

Notice of Sub-contract Laboratory Service

Please be advised that the following tests will be subcontracted to the corresponding laboratory:

Phytoplankton subcontracted to: ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA
Chlorophyll a by fluorometry subcontracted to: ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA
Pseudomonas aeruginosa subcontracted to: ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA
Fecal streptococcus subcontracted to: ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Please contact your Account Manager immediately should you have questions or concerns regarding this arrangement. Approval of this arrangement shall be implied unless otherwise notified by you.



Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.

Chain of Custody
Report

Canada To

www.alsglobal.com



L2148874-COFC

Barcode label here
(lab use only)

COC Number: 17 -

Page of

L2148874

Report To Contact and company name below will appear on the final report			Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)		
Company: HUTCHINSON ESL			Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply		
Contact: BRENT PARSONS			Priority (Business Days) 4 day [P4-20%] <input type="checkbox"/> 3 day [P3-25%] <input type="checkbox"/> 2 day [P2-50%] <input type="checkbox"/>		
Phone: 519-576-1711			EMERGENCY 1 Business day [E1 - 100%] <input type="checkbox"/>		
Company address below will appear on the final report			Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply) <input type="checkbox"/>		
Street: 50 KRUG ST, STE202			Date and Time Required for all E&P TATs: dd-mm-yy hh:mm		
City/Province: KITCHENER			For tests that can not be performed according to the service level selected, you will be contacted.		
Postal Code: N2B 1L3			Analysis Request		
Invoice To: Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below		
Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			CHLOROPHYLL A		
Company:			FECAL STERIPSA		
Contact:			PHYTOPLANKTON ID		
Project Information			SAMPLES ON HOLD		
ALS Account # / Quote #: Q69890			Sample is hazardous (please provide further detail)		
Job #:			NUMBER OF CONTAINERS		
PO / AFE:					
LSD:					
ALS Lab Work Order # (lab use only):					
ALS Contact: GAYLE BRAUN					
Sampler:					
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	
	OL-1	16-15-18	9am	Water	R R R
	OL-2			Water	R R
	OL-4			Water	R R
	OL-7			Water	R R
	OL-9			Water	R R
	OL-3			Water	R
	OL-5			Water	R
	OL-6			Water	R
	OL-8			Water	R
	OL-10			Water	R
	OL-11			Water	
Drinking Water (DW) Samples ¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)	
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>	
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO				Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>	
				Cooling Initiated <input type="checkbox"/>	
				INITIAL COOLER TEMPERATURES °C	
				FINAL COOLER TEMPERATURES °C	
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)	
Released by:	Date:	Time:	Received by: C 8 17	Date: 08-18	Time: 8:45am

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

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Barcode label here
(lab use only)

COC Number: 17 -

Page of

L2148874

Report To Contact and company name below will appear on the final report			Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)		
Company: HUTCHINSON ESL			Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply		
Contact: BRENT PARSONS			4 day [P4-20%] <input type="checkbox"/>		
Phone: 519-576-1711			3 day [P3-25%] <input type="checkbox"/>		
Company address below will appear on the final report			2 day [P2-50%] <input type="checkbox"/>		
Street: 50 KRUG ST, STE202			1 Business day [E1 - 100%] <input type="checkbox"/>		
City/Province: KITCHENER			Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply) <input type="checkbox"/>		
Postal Code: N2B 1L3			Date and Time Required for all E&P TATs: dd-mm-yy hh:mm		
Invoice To: Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			For tests that can not be performed according to the service level selected, you will be contacted.		
Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			Analysis Request		
Company:			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below		
Contact:			CHLOROPHYLL A		
Project Information			FECAL STERIPSA		
ALS Account # / Quote #: Q69890			PHYTOPLANKTON ID		
Job #:			SAMPLES ON HOLD		
PO / AFE:			Sample is hazardous (please provide further detail)		
LSD:			NUMBER OF CONTAINERS		
ALS Lab Work Order # (lab use only):			Oil and Gas Required Fields (client use)		
ALS Contact: GAYLE BRAUN			SAMPLER:		
ALS Sample # (lab use only)			Date (dd-mm-yy)		
Sample Identification and/or Coordinates (This description will appear on the report)			Time (hh:mm)		
Sample Type			Sample Type		
OL-1			Water		
OL-2			Water		
OL-4			Water		
OL-7			Water		
OL-9			Water		
OL-3			Water		
OL-5			Water		
OL-6			Water		
OL-8			Water		
OL-10			Water		
OL-11			Water		
Drinking Water (DW) Samples ¹ (client use)			Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO			Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>		
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO			Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>		
SHIPMENT RELEASE (client use)			Cooling Initiated <input type="checkbox"/>		
Released by:			INITIAL SHIPMENT RECEPTION (lab use only)		
Date:			Date:		
Time:			Time:		
Received by:			Received by:		
Date:			Date:		
Time:			Time:		
SHIPMENT RELEASE (client use)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:			Received by:		
Date:			Date:		
Time:			Time:		
Received by:			Received by:		
Date:			Date:		
Time:			Time:		

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Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L2148866-COFC

DC Number: 17 -

Page 1 of 2

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Report To			Report Format / Distribution			Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)															
Company: HUTCHINSON ESL			Select Report Format: <input type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply															
Contact: BRENT PARSONS			Quality Control (QC) Report with Report <input type="checkbox"/> YES <input type="checkbox"/> NO			Priority (Business Days) 4 day [P4-20%] <input type="checkbox"/> 3 day [P3-25%] <input type="checkbox"/> 2 day [P2-50%] <input type="checkbox"/>															
Phone: 519-576-1711			<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked			EMERGENCY 1 Business day [E1 - 100%] <input type="checkbox"/>															
Company address below will appear on the final report			Select Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply) <input type="checkbox"/>															
Street: 50 KRUG ST, STE202			Email 1 or Fax			Date and Time Required for all E&P TATs: dd-mm-yy hh:mm															
City/Province: KITCHENER			Email 2			For tests that can not be performed according to the service level selected, you will be contacted.															
Postal Code: N2B 1L3			Email 3			Analysis Request															
Invoice To: Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below															
Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			Select Invoice Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																		
Company:			Email 1 or Fax																		
Contact:			Email 2																		
Project Information			Oil and Gas Required Fields (client use)																		
ALS Account # / Quote #: Q69690			AFE/Cost Center: PO#																		
Job #:			Major/Minor Code: Routing Code:																		
PO / AFE:			Requisitioner:																		
LSD:			Location:																		
ALS Lab Work Order # (lab use only): L2148866			ALS Contact: GAYLE BRAUN			Sampler:															
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	ALKALINITY	BOD	DOC	CI, NO3, SO4	E. COLI/FECAL COLIFORM	METALS + HARDNESS	NH3/TKN/TP	PH	TSS	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS					
OL-1		16-Aug-18		Water	R	R	R	R	R	R	R	R	R			5					
OL-2		16-Aug-18		Water	R	R	R	R	R	R	R	R	R			5					
OL-4		16-Aug-18		Water	R	R	R	R	R	R	R	R	R			5					
OL-7		16-Aug-18		Water	R	R	R	R	R	R	R	R	R			5					
OL-9		16-Aug-18		Water	R	R	R	R	R	R	R	R	R			5					
OL-3		16-Aug-18		Water				R	R							1					
OL-5		16-Aug-18		Water				R								1					
OL-6		16-Aug-18		Water				R								1					
OL-8		16-Aug-18		Water				R								1					
OL-10		16-Aug-18		Water				R								1					
OL-11		16-Aug-18		Water				R								1					
Drinking Water (DW) Samples ¹ (client use)					Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)					SAMPLE CONDITION AS RECEIVED (lab use only)											
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO										Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/>											
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO										INITIAL COOLER TEMPERATURES °C: 2.1 FINAL COOLER TEMPERATURES °C: 9.15											
SHIPMENT RELEASE (client use)					INITIAL SHIPMENT RECEPTION (lab use only)					FINAL SHIPMENT RECEPTION (lab use only)											
Released by:		Date:		Time:	Received by:		Date:		Time:	Received by:		Date:		Time:							

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Report To Contact and company name below will appear on the final report			Report Format / Distrib			your AM to confirm all E&P TATs (surcharges may apply)																																																																																							
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Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			Select Invoice Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>ALKALINITY</td><td>BOD</td><td>DOC</td><td>CI, NO3, SO4</td><td>E.COLIFECAL COLIFORM</td><td>METALS + HARDNESS</td><td>NH3/TKN/TP</td><td>PH</td><td>TSS</td><td>% Moisture</td><td>TP/TN</td><td>Metals</td><td>TP</td><td>Iron</td><td>SAMPLES ON HOLD</td><td>Sample is hazardous (please provide further detail)</td><td>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><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>			ALKALINITY	BOD	DOC	CI, NO3, SO4	E.COLIFECAL COLIFORM	METALS + HARDNESS	NH3/TKN/TP	PH	TSS	% Moisture	TP/TN	Metals	TP	Iron	SAMPLES ON HOLD	Sample is hazardous (please provide further detail)	NUMBER OF CONTAINERS																																																																				
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HUTCHINSON ENVIRONMENTAL SCIENCES
LTD
ATTN: Brent Parsons
501 Krug St.
Suite 202
Kitchener ON N2B 1L3

Date Received: 17-AUG-18
Report Date: 24-MAY-19 14:22 (MT)
Version: FINAL REV. 2

Client Phone: 519-576-1711

Certificate of Analysis

Lab Work Order #: L2148866
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Comments:

24-MAY-2019 Metals added

Gayle Braun
Senior Account Manager

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ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-1 OL-1 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	59	HTC	10	mg/L		22-AUG-18	
pH	8.60		0.10	pH units		18-AUG-18	R4176306
Total Suspended Solids	<2.0		2.0	mg/L	21-AUG-18	22-AUG-18	R4179971
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	50		10	mg/L		20-AUG-18	R4177268
Ammonia, Total (as N)	0.130		0.020	mg/L		20-AUG-18	R4178491
Chloride (Cl)	51.6		0.50	mg/L		21-AUG-18	R4180266
Nitrate (as N)	<0.020		0.020	mg/L		21-AUG-18	R4180266
Total Kjeldahl Nitrogen	0.50		0.15	mg/L	21-AUG-18	22-AUG-18	R4181476
Phosphorus, Total	0.0108		0.0030	mg/L	21-AUG-18	22-AUG-18	R4180808
Sulfate (SO4)	1.68		0.30	mg/L		21-AUG-18	R4180266
Organic / Inorganic Carbon							
Dissolved Organic Carbon	6.19		0.50	mg/L		20-AUG-18	R4179909
Bacteriological Tests							
E. Coli	<2	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	2	DLM	2	CFU/100mL		18-AUG-18	R4176081
Total Metals							
Aluminum (Al)-Total	0.0196		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Antimony (Sb)-Total	0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Arsenic (As)-Total	0.00062		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Barium (Ba)-Total	0.0147		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Boron (B)-Total	<0.010		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Cadmium (Cd)-Total	<0.0000050		0.0000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Calcium (Ca)-Total	18.8		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Chromium (Cr)-Total	0.00909		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Copper (Cu)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Iron (Fe)-Total	0.043		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Lead (Pb)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Lithium (Li)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Magnesium (Mg)-Total	2.82		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Manganese (Mn)-Total	0.00599		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Molybdenum (Mo)-Total	0.000207		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Nickel (Ni)-Total	0.00238		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Phosphorus (P)-Total	<0.050		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Potassium (K)-Total	1.40		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Rubidium (Rb)-Total	0.00130		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Selenium (Se)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Silicon (Si)-Total	0.12		0.10	mg/L	21-AUG-18	21-AUG-18	R4179823

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-1 OL-1 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Total Metals							
Silver (Ag)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Sodium (Na)-Total	29.2		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Strontium (Sr)-Total	0.0578		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Sulfur (S)-Total	0.71		0.50	mg/L	21-AUG-18	21-AUG-18	R4179823
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Thorium (Th)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Tin (Sn)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Titanium (Ti)-Total	<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
Tungsten (W)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Uranium (U)-Total	0.000018		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Vanadium (V)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	21-AUG-18	21-AUG-18	R4179823
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
Aggregate Organics							
BOD	<2.0		2.0	mg/L	18-AUG-18	23-AUG-18	R4181493
L2148866-2 OL-2 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	61	HTC	10	mg/L		22-AUG-18	
pH	8.66		0.10	pH units		18-AUG-18	R4176306
Total Suspended Solids	<2.0		2.0	mg/L	21-AUG-18	22-AUG-18	R4179971
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	49		10	mg/L		20-AUG-18	R4177268
Ammonia, Total (as N)	0.025		0.020	mg/L		20-AUG-18	R4178491
Chloride (Cl)	51.6		0.50	mg/L		21-AUG-18	R4180266
Nitrate (as N)	<0.020		0.020	mg/L		21-AUG-18	R4180266
Total Kjeldahl Nitrogen	0.57		0.15	mg/L	21-AUG-18	22-AUG-18	R4181476
Phosphorus, Total	0.0106		0.0030	mg/L	21-AUG-18	22-AUG-18	R4180808
Sulfate (SO4)	1.68		0.30	mg/L		21-AUG-18	R4180266
Organic / Inorganic Carbon							
Dissolved Organic Carbon	6.54		0.50	mg/L		20-AUG-18	R4179909
Bacteriological Tests							
E. Coli	<2	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	4	DLM	2	CFU/100mL		18-AUG-18	R4176081
Total Metals							
Aluminum (Al)-Total	0.0101		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Arsenic (As)-Total	0.00064		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Barium (Ba)-Total	0.0144		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-2 OL-2 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Total Metals							
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Boron (B)-Total	<0.010		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Cadmium (Cd)-Total	<0.0000050		0.0000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Calcium (Ca)-Total	19.6		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Copper (Cu)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Iron (Fe)-Total	0.012		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Lead (Pb)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Lithium (Li)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Magnesium (Mg)-Total	2.84		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Manganese (Mn)-Total	0.00392		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Molybdenum (Mo)-Total	0.000086		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Phosphorus (P)-Total	<0.050		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Potassium (K)-Total	1.40		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Rubidium (Rb)-Total	0.00126		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Selenium (Se)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Silicon (Si)-Total	0.11		0.10	mg/L	21-AUG-18	21-AUG-18	R4179823
Silver (Ag)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Sodium (Na)-Total	29.1		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Strontium (Sr)-Total	0.0583		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Sulfur (S)-Total	0.77		0.50	mg/L	21-AUG-18	21-AUG-18	R4179823
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Thorium (Th)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Tin (Sn)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Titanium (Ti)-Total	<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
Tungsten (W)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Uranium (U)-Total	0.000021		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Vanadium (V)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	21-AUG-18	21-AUG-18	R4179823
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
Aggregate Organics							
BOD	<2.0		2.0	mg/L	18-AUG-18	23-AUG-18	R4181493
L2148866-3 OL-4 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	59	HTC	10	mg/L		22-AUG-18	
pH	8.62		0.10	pH units		18-AUG-18	R4176306

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-3 OL-4 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Physical Tests							
Total Suspended Solids	<2.0		2.0	mg/L	21-AUG-18	22-AUG-18	R4179971
Anions and Nutrients							
Alkalinity, Total (as CaCO ₃)	46		10	mg/L		20-AUG-18	R4177268
Ammonia, Total (as N)	0.030		0.020	mg/L		20-AUG-18	R4178491
Chloride (Cl)	51.6		0.50	mg/L		21-AUG-18	R4180266
Nitrate (as N)	<0.020		0.020	mg/L		21-AUG-18	R4180266
Total Kjeldahl Nitrogen	0.57		0.15	mg/L	21-AUG-18	22-AUG-18	R4181476
Phosphorus, Total	0.0135		0.0030	mg/L	21-AUG-18	22-AUG-18	R4180808
Sulfate (SO ₄)	1.67		0.30	mg/L		21-AUG-18	R4180266
Organic / Inorganic Carbon							
Dissolved Organic Carbon	6.47		0.50	mg/L		20-AUG-18	R4179909
Bacteriological Tests							
E. Coli	10	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	6	DLM	2	CFU/100mL		18-AUG-18	R4176081
Total Metals							
Aluminum (Al)-Total	0.0139		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Arsenic (As)-Total	0.00065		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Barium (Ba)-Total	0.0143		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Boron (B)-Total	<0.010		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Cadmium (Cd)-Total	<0.0000050		0.0000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Calcium (Ca)-Total	18.8		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Copper (Cu)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Iron (Fe)-Total	0.012		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Lead (Pb)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Lithium (Li)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Magnesium (Mg)-Total	3.05		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Manganese (Mn)-Total	0.00412		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Molybdenum (Mo)-Total	0.000082		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Phosphorus (P)-Total	<0.050		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Potassium (K)-Total	1.44		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Rubidium (Rb)-Total	0.00128		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Selenium (Se)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Silicon (Si)-Total	0.11		0.10	mg/L	21-AUG-18	21-AUG-18	R4179823
Silver (Ag)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Sodium (Na)-Total	30.1		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-3 OL-4 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Total Metals							
Strontium (Sr)-Total	0.0557		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Sulfur (S)-Total	0.83		0.50	mg/L	21-AUG-18	21-AUG-18	R4179823
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Thorium (Th)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Tin (Sn)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Titanium (Ti)-Total	<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
Tungsten (W)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Uranium (U)-Total	0.000019		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Vanadium (V)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	21-AUG-18	21-AUG-18	R4179823
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
Aggregate Organics							
BOD	<2.0		2.0	mg/L	18-AUG-18	23-AUG-18	R4181493
L2148866-4 OL-7 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	54	HTC	10	mg/L		22-AUG-18	
pH	8.70		0.10	pH units		18-AUG-18	R4176306
Total Suspended Solids	<2.0		2.0	mg/L	21-AUG-18	22-AUG-18	R4179971
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	48		10	mg/L		20-AUG-18	R4177268
Ammonia, Total (as N)	0.030		0.020	mg/L		20-AUG-18	R4178491
Chloride (Cl)	53.4		0.50	mg/L		21-AUG-18	R4180266
Nitrate (as N)	<0.020		0.020	mg/L		21-AUG-18	R4180266
Total Kjeldahl Nitrogen	0.64		0.15	mg/L	21-AUG-18	22-AUG-18	R4181476
Phosphorus, Total	0.0157		0.0030	mg/L	21-AUG-18	22-AUG-18	R4180808
Sulfate (SO4)	1.13		0.30	mg/L		21-AUG-18	R4180266
Organic / Inorganic Carbon							
Dissolved Organic Carbon	7.68		0.50	mg/L		20-AUG-18	R4179909
Bacteriological Tests							
E. Coli	4	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	6	DLM	2	CFU/100mL		18-AUG-18	R4176081
Total Metals							
Aluminum (Al)-Total	0.0077		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Arsenic (As)-Total	0.00060		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Barium (Ba)-Total	0.0144		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Boron (B)-Total	<0.010		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-4 OL-7 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER								
Total Metals								
Cadmium (Cd)-Total		<0.0000050		0.0000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Calcium (Ca)-Total		16.7		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cesium (Cs)-Total		<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Chromium (Cr)-Total		<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cobalt (Co)-Total		<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Copper (Cu)-Total		<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Iron (Fe)-Total		0.044		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Lead (Pb)-Total		<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Lithium (Li)-Total		<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Magnesium (Mg)-Total		2.91		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Manganese (Mn)-Total		0.0142		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Molybdenum (Mo)-Total		<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Nickel (Ni)-Total		<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Phosphorus (P)-Total		<0.050		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Potassium (K)-Total		1.80		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Rubidium (Rb)-Total		0.00136		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Selenium (Se)-Total		<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Silicon (Si)-Total		0.16		0.10	mg/L	21-AUG-18	21-AUG-18	R4179823
Silver (Ag)-Total		<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Sodium (Na)-Total		31.3		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Strontium (Sr)-Total		0.0555		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Sulfur (S)-Total		0.68		0.50	mg/L	21-AUG-18	21-AUG-18	R4179823
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Thorium (Th)-Total		<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Tin (Sn)-Total		<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Titanium (Ti)-Total		<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
Tungsten (W)-Total		<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Uranium (U)-Total		<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Vanadium (V)-Total		<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Zinc (Zn)-Total		<0.0030		0.0030	mg/L	21-AUG-18	21-AUG-18	R4179823
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
Aggregate Organics								
BOD		<2.0		2.0	mg/L	18-AUG-18	23-AUG-18	R4181493
L2148866-5 OL-9 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER								
Physical Tests								
Hardness (as CaCO3)		55	HTC	10	mg/L		22-AUG-18	
pH		8.81		0.10	pH units		18-AUG-18	R4176306
Total Suspended Solids		2.4		2.0	mg/L	21-AUG-18	22-AUG-18	R4180114
Anions and Nutrients								

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-5 OL-9							
Sampled By: CLIENT on 16-AUG-18							
Matrix: WATER							
Anions and Nutrients							
Alkalinity, Total (as CaCO ₃)	41		10	mg/L		20-AUG-18	R4177268
Ammonia, Total (as N)	0.047		0.020	mg/L		21-AUG-18	R4180268
Chloride (Cl)	51.8		0.50	mg/L		21-AUG-18	R4180266
Nitrate (as N)	<0.020		0.020	mg/L		21-AUG-18	R4180266
Total Kjeldahl Nitrogen	0.63		0.15	mg/L	21-AUG-18	22-AUG-18	R4181476
Phosphorus, Total	0.0255		0.0030	mg/L	21-AUG-18	22-AUG-18	R4180808
Sulfate (SO ₄)	1.61		0.30	mg/L		21-AUG-18	R4180266
Organic / Inorganic Carbon							
Dissolved Organic Carbon	7.31		0.50	mg/L		20-AUG-18	R4179909
Bacteriological Tests							
E. Coli	2	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	4	DLM	2	CFU/100mL		18-AUG-18	R4176081
Total Metals							
Aluminum (Al)-Total	0.0272		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Arsenic (As)-Total	0.00070		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Barium (Ba)-Total	0.0134		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Boron (B)-Total	<0.010		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Cadmium (Cd)-Total	<0.0000050		0.0000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Calcium (Ca)-Total	17.2		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Copper (Cu)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Iron (Fe)-Total	0.046		0.010	mg/L	21-AUG-18	21-AUG-18	R4179823
Lead (Pb)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Lithium (Li)-Total	<0.0010		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Magnesium (Mg)-Total	2.97		0.0050	mg/L	21-AUG-18	21-AUG-18	R4179823
Manganese (Mn)-Total	0.00609		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Molybdenum (Mo)-Total	0.000083		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Phosphorus (P)-Total	<0.050		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Potassium (K)-Total	1.51		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Rubidium (Rb)-Total	0.00129		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Selenium (Se)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Silicon (Si)-Total	0.13		0.10	mg/L	21-AUG-18	21-AUG-18	R4179823
Silver (Ag)-Total	<0.000050		0.000050	mg/L	21-AUG-18	21-AUG-18	R4179823
Sodium (Na)-Total	30.6		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
Strontium (Sr)-Total	0.0579		0.0010	mg/L	21-AUG-18	21-AUG-18	R4179823
Sulfur (S)-Total	0.85		0.50	mg/L	21-AUG-18	21-AUG-18	R4179823

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-5 OL-9 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER								
Total Metals								
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	21-AUG-18	21-AUG-18	R4179823
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Thorium (Th)-Total		<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Tin (Sn)-Total		<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Titanium (Ti)-Total		0.00037		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
Tungsten (W)-Total		<0.00010		0.00010	mg/L	21-AUG-18	21-AUG-18	R4179823
Uranium (U)-Total		0.000027		0.000010	mg/L	21-AUG-18	21-AUG-18	R4179823
Vanadium (V)-Total		<0.00050		0.00050	mg/L	21-AUG-18	21-AUG-18	R4179823
Zinc (Zn)-Total		<0.0030		0.0030	mg/L	21-AUG-18	21-AUG-18	R4179823
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	21-AUG-18	21-AUG-18	R4179823
Aggregate Organics								
BOD		<2.0		2.0	mg/L	18-AUG-18	23-AUG-18	R4181493
L2148866-6 OL-3 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER								
Bacteriological Tests								
E. Coli		2	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms		4	DLM	2	CFU/100mL		18-AUG-18	R4176081
L2148866-7 OL-5 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER								
Bacteriological Tests								
E. Coli		6	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms		4	DLM	2	CFU/100mL		18-AUG-18	R4176081
L2148866-8 OL-6 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER								
Bacteriological Tests								
E. Coli		2	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms		2	DLM	2	CFU/100mL		18-AUG-18	R4176081
L2148866-9 OL-8 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER								
Bacteriological Tests								
E. Coli		2	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms		2	DLM	2	CFU/100mL		18-AUG-18	R4176081
L2148866-10 OL-10 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER								
Bacteriological Tests								
E. Coli		<2	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms		<2	DLM	2	CFU/100mL		18-AUG-18	R4176081
L2148866-11 OL-11 Sampled By: CLIENT on 16-AUG-18								

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2148866-11 OL-11 Sampled By: CLIENT on 16-AUG-18 Matrix: WATER Bacteriological Tests							
E. Coli	14	DLM	2	CFU/100mL		18-AUG-18	R4176074
Fecal Coliforms	14	DLM	2	CFU/100mL		18-AUG-18	R4176081
L2148866-12 OL-1 BOTTOM Sampled By: CLIENT on 16-AUG-18 Matrix: WATER Anions and Nutrients							
Phosphorus, Total	0.0321		0.0030	mg/L	21-AUG-18	22-AUG-18	R4180808
Total Metals							
Iron (Fe)-Total	0.096		0.050	mg/L	21-AUG-18	21-AUG-18	R4179823
L2148866-13 SED-1 Sampled By: CLIENT on 16-AUG-18 Matrix: SOIL Leachable Anions & Nutrients							
Total Kjeldahl Nitrogen	2.34	DLHC	0.40	%	22-AUG-18	23-AUG-18	R4181590
Metals							
Aluminum (Al)	18000		50	ug/g	22-AUG-18	22-AUG-18	R4180734
Antimony (Sb)	1.14		0.10	ug/g	22-AUG-18	22-AUG-18	R4180734
Arsenic (As)	8.59		0.10	ug/g	22-AUG-18	22-AUG-18	R4180734
Barium (Ba)	128		0.50	ug/g	22-AUG-18	22-AUG-18	R4180734
Beryllium (Be)	0.65		0.10	ug/g	22-AUG-18	22-AUG-18	R4180734
Bismuth (Bi)	0.49		0.20	ug/g	22-AUG-18	22-AUG-18	R4180734
Boron (B)	12.9		5.0	ug/g	22-AUG-18	22-AUG-18	R4180734
Cadmium (Cd)	1.70		0.020	ug/g	22-AUG-18	22-AUG-18	R4180734
Calcium (Ca)	8960		50	ug/g	22-AUG-18	22-AUG-18	R4180734
Chromium (Cr)	25.2		0.50	ug/g	22-AUG-18	22-AUG-18	R4180734
Cobalt (Co)	7.20		0.10	ug/g	22-AUG-18	22-AUG-18	R4180734
Copper (Cu)	25.5		0.50	ug/g	22-AUG-18	22-AUG-18	R4180734
Iron (Fe)	21800		50	ug/g	22-AUG-18	22-AUG-18	R4180734
Lead (Pb)	126		0.50	ug/g	22-AUG-18	22-AUG-18	R4180734
Lithium (Li)	15.4		2.0	ug/g	22-AUG-18	22-AUG-18	R4180734
Magnesium (Mg)	4350		20	ug/g	22-AUG-18	22-AUG-18	R4180734
Manganese (Mn)	283		1.0	ug/g	22-AUG-18	22-AUG-18	R4180734
Molybdenum (Mo)	1.29		0.10	ug/g	22-AUG-18	22-AUG-18	R4180734
Nickel (Ni)	17.2		0.50	ug/g	22-AUG-18	22-AUG-18	R4180734
Phosphorus (P)	1990		50	ug/g	22-AUG-18	22-AUG-18	R4180734
Potassium (K)	1630		100	ug/g	22-AUG-18	22-AUG-18	R4180734
Selenium (Se)	2.27		0.20	ug/g	22-AUG-18	22-AUG-18	R4180734
Silver (Ag)	0.27		0.10	ug/g	22-AUG-18	22-AUG-18	R4180734
Sodium (Na)	996		50	ug/g	22-AUG-18	22-AUG-18	R4180734
Strontium (Sr)	25.8		0.50	ug/g	22-AUG-18	22-AUG-18	R4180734
Sulfur (S)	13300		1000	ug/g	22-AUG-18	22-AUG-18	R4180734
Thallium (Tl)	0.275		0.050	ug/g	22-AUG-18	22-AUG-18	R4180734

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	E. Coli	DUP-H,J	L2148866-1, -10, -11, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Barium (Ba)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Boron (B)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Calcium (Ca)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Cobalt (Co)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Copper (Cu)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Iron (Fe)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Lithium (Li)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Nickel (Ni)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Potassium (K)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Rubidium (Rb)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Silicon (Si)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Sodium (Na)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Sulfur (S)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5
Matrix Spike	Uranium (U)-Total	MS-B	L2148866-1, -12, -2, -3, -4, -5

Sample Parameter Qualifier key listed:

Qualifier	Description
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).
DUP-H,J	Duplicate results outside ALS DQO, due to sample heterogeneity. Duplicate results and limits are expressed in terms of absolute difference.
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-WT	Water	Alkalinity, Total (as CaCO ₃)	EPA 310.2
This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.			
BOD-WT	Water	BOD	APHA 5210 B
This analysis is carried out using procedures adapted from APHA Method 5210B - "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.			
C-DIS-ORG-WT	Water	Dissolved Organic Carbon	APHA 5310B
Sample is filtered through a 0.45um filter, then injected into a heated reaction chamber which is packed with an oxidative catalyst. The water is vaporized and the organic carbon is oxidized to carbon dioxide. The carbon dioxide is transported in a carrier gas and is measured by a non-dispersive infrared detector.			
CL-IC-N-WT	Water	Chloride by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
EC-MF-WT	Water	E. coli	SM 9222D
A 100 mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at 44.5 –0.2 °C for 24 – 2 h. Method ID: WT-TM-1200			
FC-MF-WT	Water	Fecal Coliforms	SM 9222D
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC agar and incubated at 24–2h@44.5–0.2°C. Method ID: WT-TM-1200			
HARDNESS-CALC-WT	Water	Hardness	APHA 2340 B
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.			
MET-200.2-CCMS-WT	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A (mod)
Soil/sediment is dried, disaggregated, and sieved (2 mm). For tests intended to support Ontario regulations, the <2mm fraction is ground to pass			

Reference Information

through a 0.355 mm sieve. Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H₂S) may be excluded if lost during sampling, storage, or digestion.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

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

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen	CSSS (2008) 22.2.3
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The soil is digested with sulfuric acid in the presence of CuSO₄ and K₂SO₄ catalysts. Ammonia in the soil extract is determined colorimetrically at 660 nm.

NH ₃ -WT	Water	Ammonia, Total as N	EPA 350.1
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Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.

Total Ammonia (as N), refers to the sum of the un-ionized (NH₃) and ionized (NH₄⁺) ammonia species in the sample, expressed in units of milligrams of nitrogen per litre of sample.

NO ₃ -IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)
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Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
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This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colorimetrically after persulfate digestion of the sample.

PH-WT	Water	pH	APHA 4500 H-Electrode
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Water samples are analyzed directly by a calibrated pH meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days

SO ₄ -IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)
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Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

SOLIDS-TSS-WT	Water	Suspended solids	APHA 2540 D-Gravimetric
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A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 104–106°C for a minimum of four hours or until a constant weight is achieved.

TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-Norg D
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This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 Celsius with analysis using an automated colorimetric method.

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

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

Laboratory Definition Code	Laboratory Location
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SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
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WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
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Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

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

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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

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

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

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



Quality Control Report

Workorder: L2148866

Report Date: 24-MAY-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-N-WT		Water						
Batch	R4180266							
WG2855195-7	LCS							
Chloride (Cl)			100.9		%		90-110	21-AUG-18
WG2855195-6	MB							
Chloride (Cl)			<0.50		mg/L		0.5	21-AUG-18
WG2855195-10	MS	WG2855195-8						
Chloride (Cl)			105.7		%		75-125	21-AUG-18
EC-MF-WT		Water						
Batch	R4176074							
WG2852907-3	DUP	L2148866-7						
E. Coli		6	2	DUP-H,J	CFU/100mL	4	4	18-AUG-18
WG2852907-1	MB							
E. Coli			0		CFU/100mL		1	18-AUG-18
FC-MF-WT		Water						
Batch	R4176081							
WG2852951-3	DUP	L2148866-4						
Fecal Coliforms		6	4		CFU/100mL	40	65	18-AUG-18
WG2852951-1	MB							
Fecal Coliforms			0		CFU/100mL		1	18-AUG-18
MET-T-CCMS-WT		Water						
Batch	R4179823							
WG2854938-4	DUP	WG2854938-3						
Aluminum (Al)-Total		0.072	0.073		mg/L	1.6	20	21-AUG-18
Antimony (Sb)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	21-AUG-18
Arsenic (As)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	21-AUG-18
Barium (Ba)-Total		0.0220	0.0223		mg/L	1.3	20	21-AUG-18
Beryllium (Be)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	21-AUG-18
Bismuth (Bi)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	21-AUG-18
Boron (B)-Total		<0.10	<0.10	RPD-NA	mg/L	N/A	20	21-AUG-18
Cadmium (Cd)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	21-AUG-18
Calcium (Ca)-Total		365	360		mg/L	1.5	20	21-AUG-18
Chromium (Cr)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	21-AUG-18
Cesium (Cs)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	21-AUG-18
Cobalt (Co)-Total		0.0348	0.0360		mg/L	3.3	20	21-AUG-18
Copper (Cu)-Total		0.027	0.027		mg/L	0.9	20	21-AUG-18
Iron (Fe)-Total		2.71	2.80		mg/L	3.4	20	21-AUG-18



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4179823							
WG2854938-4	DUP	WG2854938-3						
Lead (Pb)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	21-AUG-18
Lithium (Li)-Total		0.063	0.056		mg/L	12	20	21-AUG-18
Magnesium (Mg)-Total		986	987		mg/L	0.2	20	21-AUG-18
Manganese (Mn)-Total		10.5	10.8		mg/L	2.1	20	21-AUG-18
Molybdenum (Mo)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	21-AUG-18
Nickel (Ni)-Total		0.0402	0.0408		mg/L	1.5	20	21-AUG-18
Phosphorus (P)-Total		<0.50	<0.50	RPD-NA	mg/L	N/A	20	21-AUG-18
Potassium (K)-Total		5.60	5.65		mg/L	0.8	20	21-AUG-18
Rubidium (Rb)-Total		0.0095	0.0101		mg/L	6.0	20	21-AUG-18
Selenium (Se)-Total		0.0100	0.0102		mg/L	1.4	20	21-AUG-18
Silicon (Si)-Total		<1.0	<1.0	RPD-NA	mg/L	N/A	20	21-AUG-18
Silver (Ag)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	21-AUG-18
Sodium (Na)-Total		5.81	5.78		mg/L	0.4	20	21-AUG-18
Strontium (Sr)-Total		0.751	0.750		mg/L	0.2	20	21-AUG-18
Sulfur (S)-Total		1780	1770		mg/L	0.6	25	21-AUG-18
Thallium (Tl)-Total		0.00017	0.00017		mg/L	1.7	20	21-AUG-18
Tellurium (Te)-Total		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	21-AUG-18
Thorium (Th)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	25	21-AUG-18
Tin (Sn)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	21-AUG-18
Titanium (Ti)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	21-AUG-18
Tungsten (W)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	21-AUG-18
Uranium (U)-Total		0.00061	0.00061		mg/L	0.8	20	21-AUG-18
Vanadium (V)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	21-AUG-18
Zinc (Zn)-Total		<0.030	<0.030	RPD-NA	mg/L	N/A	20	21-AUG-18
Zirconium (Zr)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	21-AUG-18
WG2854938-2	LCS							
Aluminum (Al)-Total			99.7		%		80-120	21-AUG-18
Antimony (Sb)-Total			100.6		%		80-120	21-AUG-18
Arsenic (As)-Total			99.5		%		80-120	21-AUG-18
Barium (Ba)-Total			104.2		%		80-120	21-AUG-18
Beryllium (Be)-Total			96.6		%		80-120	21-AUG-18
Bismuth (Bi)-Total			98.0		%		80-120	21-AUG-18
Boron (B)-Total			90.5		%		80-120	21-AUG-18



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4179823							
WG2854938-2	LCS							
Cadmium (Cd)-Total			101.5		%		80-120	21-AUG-18
Calcium (Ca)-Total			96.8		%		80-120	21-AUG-18
Chromium (Cr)-Total			101.1		%		80-120	21-AUG-18
Cesium (Cs)-Total			97.6		%		80-120	21-AUG-18
Cobalt (Co)-Total			98.8		%		80-120	21-AUG-18
Copper (Cu)-Total			100.4		%		80-120	21-AUG-18
Iron (Fe)-Total			95.0		%		80-120	21-AUG-18
Lead (Pb)-Total			94.8		%		80-120	21-AUG-18
Lithium (Li)-Total			90.2		%		80-120	21-AUG-18
Magnesium (Mg)-Total			110.0		%		80-120	21-AUG-18
Manganese (Mn)-Total			98.8		%		80-120	21-AUG-18
Molybdenum (Mo)-Total			97.0		%		80-120	21-AUG-18
Nickel (Ni)-Total			99.4		%		80-120	21-AUG-18
Phosphorus (P)-Total			98.8		%		70-130	21-AUG-18
Potassium (K)-Total			103.1		%		80-120	21-AUG-18
Rubidium (Rb)-Total			101.4		%		80-120	21-AUG-18
Selenium (Se)-Total			99.2		%		80-120	21-AUG-18
Silicon (Si)-Total			99.2		%		60-140	21-AUG-18
Silver (Ag)-Total			97.6		%		80-120	21-AUG-18
Sodium (Na)-Total			105.7		%		80-120	21-AUG-18
Strontium (Sr)-Total			101.1		%		80-120	21-AUG-18
Sulfur (S)-Total			102.3		%		80-120	21-AUG-18
Thallium (Tl)-Total			93.5		%		80-120	21-AUG-18
Tellurium (Te)-Total			97.4		%		80-120	21-AUG-18
Thorium (Th)-Total			95.5		%		70-130	21-AUG-18
Tin (Sn)-Total			95.6		%		80-120	21-AUG-18
Titanium (Ti)-Total			97.4		%		80-120	21-AUG-18
Tungsten (W)-Total			90.9		%		80-120	21-AUG-18
Uranium (U)-Total			95.5		%		80-120	21-AUG-18
Vanadium (V)-Total			102.4		%		80-120	21-AUG-18
Zinc (Zn)-Total			91.1		%		80-120	21-AUG-18
Zirconium (Zr)-Total			92.9		%		80-120	21-AUG-18
WG2854938-1	MB							
Aluminum (Al)-Total			<0.0050		mg/L		0.005	21-AUG-18



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4179823							
WG2854938-1	MB							
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	21-AUG-18
Arsenic (As)-Total			<0.00010		mg/L		0.0001	21-AUG-18
Barium (Ba)-Total			<0.00010		mg/L		0.0001	21-AUG-18
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	21-AUG-18
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	21-AUG-18
Boron (B)-Total			<0.010		mg/L		0.01	21-AUG-18
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	21-AUG-18
Calcium (Ca)-Total			<0.050		mg/L		0.05	21-AUG-18
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	21-AUG-18
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	21-AUG-18
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	21-AUG-18
Copper (Cu)-Total			<0.0010		mg/L		0.001	21-AUG-18
Iron (Fe)-Total			<0.010		mg/L		0.01	21-AUG-18
Lead (Pb)-Total			<0.000050		mg/L		0.00005	21-AUG-18
Lithium (Li)-Total			<0.0010		mg/L		0.001	21-AUG-18
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	21-AUG-18
Manganese (Mn)-Total			<0.00050		mg/L		0.0005	21-AUG-18
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	21-AUG-18
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	21-AUG-18
Phosphorus (P)-Total			<0.050		mg/L		0.05	21-AUG-18
Potassium (K)-Total			<0.050		mg/L		0.05	21-AUG-18
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	21-AUG-18
Selenium (Se)-Total			<0.000050		mg/L		0.00005	21-AUG-18
Silicon (Si)-Total			<0.10		mg/L		0.1	21-AUG-18
Silver (Ag)-Total			<0.000050		mg/L		0.00005	21-AUG-18
Sodium (Na)-Total			<0.050		mg/L		0.05	22-AUG-18
Strontium (Sr)-Total			<0.0010		mg/L		0.001	21-AUG-18
Sulfur (S)-Total			<0.50		mg/L		0.5	21-AUG-18
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	21-AUG-18
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	21-AUG-18
Thorium (Th)-Total			<0.00010		mg/L		0.0001	21-AUG-18
Tin (Sn)-Total			<0.00010		mg/L		0.0001	21-AUG-18
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	21-AUG-18



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4179823							
WG2854938-1 MB								
Tungsten (W)-Total			<0.00010		mg/L		0.0001	21-AUG-18
Uranium (U)-Total			<0.000010		mg/L		0.00001	21-AUG-18
Vanadium (V)-Total			<0.00050		mg/L		0.0005	21-AUG-18
Zinc (Zn)-Total			<0.0030		mg/L		0.003	21-AUG-18
Zirconium (Zr)-Total			<0.00030		mg/L		0.0003	21-AUG-18
WG2854938-5 MS		WG2854938-3						
Aluminum (Al)-Total			91.2		%		70-130	21-AUG-18
Antimony (Sb)-Total			97.9		%		70-130	21-AUG-18
Arsenic (As)-Total			101.2		%		70-130	21-AUG-18
Barium (Ba)-Total			N/A	MS-B	%		-	21-AUG-18
Beryllium (Be)-Total			92.3		%		70-130	21-AUG-18
Bismuth (Bi)-Total			91.4		%		70-130	21-AUG-18
Boron (B)-Total			N/A	MS-B	%		-	21-AUG-18
Cadmium (Cd)-Total			96.0		%		70-130	21-AUG-18
Calcium (Ca)-Total			N/A	MS-B	%		-	21-AUG-18
Chromium (Cr)-Total			103.0		%		70-130	21-AUG-18
Cesium (Cs)-Total			98.6		%		70-130	21-AUG-18
Cobalt (Co)-Total			N/A	MS-B	%		-	21-AUG-18
Copper (Cu)-Total			N/A	MS-B	%		-	21-AUG-18
Iron (Fe)-Total			N/A	MS-B	%		-	21-AUG-18
Lead (Pb)-Total			90.0		%		70-130	21-AUG-18
Lithium (Li)-Total			N/A	MS-B	%		-	21-AUG-18
Magnesium (Mg)-Total			N/A	MS-B	%		-	21-AUG-18
Manganese (Mn)-Total			N/A	MS-B	%		-	21-AUG-18
Molybdenum (Mo)-Total			102.8		%		70-130	21-AUG-18
Nickel (Ni)-Total			N/A	MS-B	%		-	21-AUG-18
Phosphorus (P)-Total			103.2		%		70-130	21-AUG-18
Potassium (K)-Total			N/A	MS-B	%		-	21-AUG-18
Rubidium (Rb)-Total			N/A	MS-B	%		-	21-AUG-18
Selenium (Se)-Total			105.3		%		70-130	21-AUG-18
Silicon (Si)-Total			N/A	MS-B	%		-	21-AUG-18
Silver (Ag)-Total			92.4		%		70-130	21-AUG-18
Sodium (Na)-Total			N/A	MS-B	%		-	21-AUG-18
Strontium (Sr)-Total			N/A	MS-B	%		-	21-AUG-18

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed	
NO3-IC-WT		Water							
Batch	R4180266								
WG2855195-7	LCS								
Nitrate (as N)			100.6		%		70-130	21-AUG-18	
WG2855195-6	MB								
Nitrate (as N)			<0.020		mg/L		0.02	21-AUG-18	
WG2855195-10	MS	WG2855195-8							
Nitrate (as N)			103.2		%		70-130	21-AUG-18	
P-T-COL-WT		Water							
Batch	R4180808								
WG2855686-3	DUP	L2148546-6							
Phosphorus, Total			0.0058	0.0048	mg/L	19	20	22-AUG-18	
WG2855916-3	DUP	L2149169-1							
Phosphorus, Total			0.0064	0.0061	J	mg/L	0.0017	0.006	22-AUG-18
WG2855686-2	LCS								
Phosphorus, Total			95.4		%		80-120	22-AUG-18	
WG2855916-2	LCS								
Phosphorus, Total			91.5		%		80-120	22-AUG-18	
WG2855686-1	MB								
Phosphorus, Total			<0.0030		mg/L		0.003	22-AUG-18	
WG2855916-1	MB								
Phosphorus, Total			<0.0030		mg/L		0.003	22-AUG-18	
WG2855686-4	MS	L2148546-6							
Phosphorus, Total			94.3		%		70-130	22-AUG-18	
WG2855916-4	MS	L2149169-1							
Phosphorus, Total			98.8		%		70-130	22-AUG-18	
PH-WT		Water							
Batch	R4176306								
WG2853284-8	DUP	WG2853284-7							
pH			7.96	8.01	J	pH units	0.05	0.2	18-AUG-18
WG2853284-6	LCS								
pH			7.00			pH units	6.9-7.1	18-AUG-18	
SO4-IC-N-WT		Water							
Batch	R4180266								
WG2855195-9	DUP	WG2855195-8							
Sulfate (SO4)			1.68	1.68	mg/L	0.4	20	21-AUG-18	
WG2855195-7	LCS								
Sulfate (SO4)			101.8		%		90-110	21-AUG-18	
WG2855195-6	MB								



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-N-WT		Water						
Batch	R4180266							
WG2855195-6 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	21-AUG-18
WG2855195-10 MS		WG2855195-8						
Sulfate (SO4)			106.5		%		75-125	21-AUG-18
SOLIDS-TSS-WT		Water						
Batch	R4179971							
WG2855057-3 DUP		L2148846-16						
Total Suspended Solids		2620	2590		mg/L	1.2	20	22-AUG-18
WG2855057-2 LCS								
Total Suspended Solids			98.8		%		85-115	22-AUG-18
WG2855057-1 MB								
Total Suspended Solids			<2.0		mg/L		2	22-AUG-18
Batch	R4180114							
WG2855061-3 DUP		L2149062-2						
Total Suspended Solids		1560	1710		mg/L	9.3	20	22-AUG-18
WG2855061-2 LCS								
Total Suspended Solids			99.7		%		85-115	22-AUG-18
WG2855061-1 MB								
Total Suspended Solids			<2.0		mg/L		2	22-AUG-18
TKN-WT		Water						
Batch	R4181476							
WG2855928-3 DUP		L2148866-1						
Total Kjeldahl Nitrogen		0.50	0.51		mg/L	1.4	20	22-AUG-18
WG2855928-2 LCS								
Total Kjeldahl Nitrogen			96.3		%		75-125	22-AUG-18
WG2855928-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	22-AUG-18
WG2855928-4 MS		L2148866-1						
Total Kjeldahl Nitrogen			102.4		%		70-130	22-AUG-18
MET-200.2-CCMS-WT		Soil						
Batch	R4180734							
WG2856089-2 CRM		WT-CANMET-TILL1						
Aluminum (Al)			90.2		%		70-130	22-AUG-18
Antimony (Sb)			101.7		%		70-130	22-AUG-18
Arsenic (As)			95.2		%		70-130	22-AUG-18
Barium (Ba)			96.6		%		70-130	22-AUG-18
Beryllium (Be)			92.6		%		70-130	22-AUG-18



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT		Soil						
Batch	R4180734							
WG2856089-2	CRM	WT-CANMET-TILL1						
Bismuth (Bi)			97.0		%		70-130	22-AUG-18
Boron (B)			2.9		mg/kg		0-8.2	22-AUG-18
Cadmium (Cd)			104.6		%		70-130	22-AUG-18
Calcium (Ca)			89.3		%		70-130	22-AUG-18
Chromium (Cr)			94.5		%		70-130	22-AUG-18
Cobalt (Co)			93.9		%		70-130	22-AUG-18
Copper (Cu)			95.6		%		70-130	22-AUG-18
Iron (Fe)			97.6		%		70-130	22-AUG-18
Lead (Pb)			95.8		%		70-130	22-AUG-18
Lithium (Li)			96.8		%		70-130	22-AUG-18
Magnesium (Mg)			89.9		%		70-130	22-AUG-18
Manganese (Mn)			95.3		%		70-130	22-AUG-18
Molybdenum (Mo)			95.4		%		70-130	22-AUG-18
Nickel (Ni)			95.3		%		70-130	22-AUG-18
Phosphorus (P)			96.8		%		70-130	22-AUG-18
Potassium (K)			92.6		%		70-130	22-AUG-18
Selenium (Se)			0.29		mg/kg		0.11-0.51	22-AUG-18
Silver (Ag)			0.24		mg/kg		0.13-0.33	22-AUG-18
Sodium (Na)			93.9		%		70-130	22-AUG-18
Strontium (Sr)			92.0		%		70-130	22-AUG-18
Thallium (Tl)			0.108		mg/kg		0.077-0.18	22-AUG-18
Tin (Sn)			1.1		mg/kg		0-3.1	22-AUG-18
Titanium (Ti)			93.6		%		70-130	22-AUG-18
Tungsten (W)			0.15		mg/kg		0-0.66	22-AUG-18
Uranium (U)			94.0		%		70-130	22-AUG-18
Vanadium (V)			94.8		%		70-130	22-AUG-18
Zinc (Zn)			93.7		%		70-130	22-AUG-18
Zirconium (Zr)			0.7		mg/kg		0-1.8	22-AUG-18
WG2856089-4	DUP	L2150100-1						
Aluminum (Al)		5720	6070		ug/g	5.8	40	22-AUG-18
Antimony (Sb)		0.21	0.22		ug/g	4.5	30	22-AUG-18
Arsenic (As)		2.97	3.03		ug/g	2.0	30	22-AUG-18
Barium (Ba)		35.1	34.7		ug/g	1.1	40	22-AUG-18
Beryllium (Be)		0.29	0.29					



Quality Control Report

Workorder: L2148866

Report Date: 24-MAY-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT		Soil						
Batch	R4180734							
WG2856089-4	DUP	L2150100-1						
Beryllium (Be)		0.29	0.29		ug/g	0.0	30	22-AUG-18
Bismuth (Bi)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	22-AUG-18
Boron (B)		6.0	6.3		ug/g	5.1	30	22-AUG-18
Cadmium (Cd)		0.152	0.161		ug/g	5.6	30	22-AUG-18
Calcium (Ca)		114000	115000		ug/g	0.9	30	22-AUG-18
Chromium (Cr)		10.6	10.6		ug/g	0.3	30	22-AUG-18
Cobalt (Co)		3.84	3.89		ug/g	1.3	30	22-AUG-18
Copper (Cu)		10.3	10.3		ug/g	0.0	30	22-AUG-18
Iron (Fe)		12800	12800		ug/g	0.2	30	22-AUG-18
Lead (Pb)		5.24	5.43		ug/g	3.6	40	22-AUG-18
Lithium (Li)		7.1	7.0		ug/g	1.2	30	22-AUG-18
Magnesium (Mg)		38100	39800		ug/g	4.5	30	22-AUG-18
Manganese (Mn)		388	376		ug/g	3.1	30	22-AUG-18
Molybdenum (Mo)		0.21	0.20		ug/g	5.8	40	22-AUG-18
Nickel (Ni)		8.64	8.80		ug/g	1.8	30	22-AUG-18
Phosphorus (P)		560	578		ug/g	3.2	30	22-AUG-18
Potassium (K)		890	940		ug/g	6.3	40	22-AUG-18
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	22-AUG-18
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	22-AUG-18
Sodium (Na)		232	263		ug/g	12	40	22-AUG-18
Strontium (Sr)		102	101		ug/g	0.6	40	22-AUG-18
Sulfur (S)		<1000	<1000	RPD-NA	ug/g	N/A	30	22-AUG-18
Thallium (Tl)		0.064	0.068		ug/g	6.9	30	22-AUG-18
Tin (Sn)		<2.0	<2.0	RPD-NA	ug/g	N/A	40	22-AUG-18
Titanium (Ti)		268	295		ug/g	9.6	40	22-AUG-18
Tungsten (W)		<0.50	<0.50	RPD-NA	ug/g	N/A	30	22-AUG-18
Uranium (U)		0.480	0.500		ug/g	4.0	30	22-AUG-18
Vanadium (V)		20.5	21.6		ug/g	5.0	30	22-AUG-18
Zinc (Zn)		27.6	28.2		ug/g	1.9	30	22-AUG-18
Zirconium (Zr)		7.0	7.1		ug/g	1.4	30	22-AUG-18
WG2856089-3	LCS							
Aluminum (Al)			97.4		%		80-120	22-AUG-18
Antimony (Sb)			108.9		%		80-120	22-AUG-18



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT		Soil						
Batch	R4180734							
WG2856089-3	LCS							
Arsenic (As)			98.9		%		80-120	22-AUG-18
Barium (Ba)			109.2		%		80-120	22-AUG-18
Beryllium (Be)			103.4		%		80-120	22-AUG-18
Bismuth (Bi)			102.1		%		80-120	22-AUG-18
Boron (B)			97.8		%		80-120	22-AUG-18
Cadmium (Cd)			105.9		%		80-120	22-AUG-18
Calcium (Ca)			101.3		%		80-120	22-AUG-18
Chromium (Cr)			95.6		%		80-120	22-AUG-18
Cobalt (Co)			95.8		%		80-120	22-AUG-18
Copper (Cu)			96.5		%		80-120	22-AUG-18
Iron (Fe)			99.6		%		80-120	22-AUG-18
Lead (Pb)			99.8		%		80-120	22-AUG-18
Lithium (Li)			108.9		%		80-120	22-AUG-18
Magnesium (Mg)			93.3		%		80-120	22-AUG-18
Manganese (Mn)			96.7		%		80-120	22-AUG-18
Molybdenum (Mo)			104.0		%		80-120	22-AUG-18
Nickel (Ni)			97.0		%		80-120	22-AUG-18
Phosphorus (P)			105.6		%		80-120	22-AUG-18
Potassium (K)			105.9		%		80-120	22-AUG-18
Selenium (Se)			100.3		%		80-120	22-AUG-18
Silver (Ag)			102.0		%		80-120	22-AUG-18
Sodium (Na)			96.2		%		80-120	22-AUG-18
Strontium (Sr)			100.7		%		80-120	22-AUG-18
Sulfur (S)			104.7		%		80-120	22-AUG-18
Thallium (Tl)			89.0		%		80-120	22-AUG-18
Tin (Sn)			106.2		%		80-120	22-AUG-18
Titanium (Ti)			95.6		%		80-120	22-AUG-18
Tungsten (W)			95.3		%		80-120	22-AUG-18
Uranium (U)			97.0		%		80-120	22-AUG-18
Vanadium (V)			101.1		%		80-120	22-AUG-18
Zinc (Zn)			91.3		%		80-120	22-AUG-18
Zirconium (Zr)			100.7		%		80-120	22-AUG-18
WG2856089-1	MB							
Aluminum (Al)			<50		mg/kg		50	22-AUG-18



Quality Control Report

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Client:

HUTCHINSON ENVIRONMENTAL SCIENCES LTD

501 Krug St. Suite 202

Kitchener ON N2B 1L3

Contact:

Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT		Soil						
Batch R4180734								
WG2856089-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	22-AUG-18
Arsenic (As)			<0.10		mg/kg		0.1	22-AUG-18
Barium (Ba)			<0.50		mg/kg		0.5	22-AUG-18
Beryllium (Be)			<0.10		mg/kg		0.1	22-AUG-18
Bismuth (Bi)			<0.20		mg/kg		0.2	22-AUG-18
Boron (B)			<5.0		mg/kg		5	22-AUG-18
Cadmium (Cd)			<0.020		mg/kg		0.02	22-AUG-18
Calcium (Ca)			<50		mg/kg		50	22-AUG-18
Chromium (Cr)			<0.50		mg/kg		0.5	22-AUG-18
Cobalt (Co)			<0.10		mg/kg		0.1	22-AUG-18
Copper (Cu)			<0.50		mg/kg		0.5	22-AUG-18
Iron (Fe)			<50		mg/kg		50	22-AUG-18
Lead (Pb)			<0.50		mg/kg		0.5	22-AUG-18
Lithium (Li)			<2.0		mg/kg		2	22-AUG-18
Magnesium (Mg)			<20		mg/kg		20	22-AUG-18
Manganese (Mn)			<1.0		mg/kg		1	22-AUG-18
Molybdenum (Mo)			<0.10		mg/kg		0.1	22-AUG-18
Nickel (Ni)			<0.50		mg/kg		0.5	22-AUG-18
Phosphorus (P)			<50		mg/kg		50	22-AUG-18
Potassium (K)			<100		mg/kg		100	22-AUG-18
Selenium (Se)			<0.20		mg/kg		0.2	22-AUG-18
Silver (Ag)			<0.10		mg/kg		0.1	22-AUG-18
Sodium (Na)			<50		mg/kg		50	22-AUG-18
Strontium (Sr)			<0.50		mg/kg		0.5	22-AUG-18
Sulfur (S)			<1000		mg/kg		1000	22-AUG-18
Thallium (Tl)			<0.050		mg/kg		0.05	22-AUG-18
Tin (Sn)			<2.0		mg/kg		2	22-AUG-18
Titanium (Ti)			<1.0		mg/kg		1	22-AUG-18
Tungsten (W)			<0.50		mg/kg		0.5	22-AUG-18
Uranium (U)			<0.050		mg/kg		0.05	22-AUG-18
Vanadium (V)			<0.20		mg/kg		0.2	22-AUG-18
Zinc (Zn)			<2.0		mg/kg		2	22-AUG-18
Zirconium (Zr)			<1.0		mg/kg		1	22-AUG-18



Quality Control Report

Workorder: L2148866

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
N-TOTKJ-COL-SK		Soil						
Batch	R4181590							
WG2855572-1	DUP	L2148514-5						
Total Kjeldahl Nitrogen		2.74	2.69		%	1.9	20	23-AUG-18
WG2855572-2	IRM	08-109_SOIL						
Total Kjeldahl Nitrogen			96.5		%		80-120	23-AUG-18
WG2855572-3	MB							
Total Kjeldahl Nitrogen			<0.020		%		0.02	23-AUG-18

Quality Control Report

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3
Contact: Brent Parsons

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Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DUP-H,J	Duplicate results outside ALS DQO, due to sample heterogeneity. Duplicate results and limits are expressed in terms of absolute difference.
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



Chain of Custody (COC) / Analytical Request Form



L2148866-COFC

DC Number: 17 -

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Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To Contact and company name below will appear on the final report			Report Format / Distribution			Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																																																																																																																																																																																																																							
Company: HUTCHINSON ESL			Select Report Format: <input type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply																																																																																																																																																																																																																							
Contact: BRENT PARSONS			Quality Control (QC) Report with Report <input type="checkbox"/> YES <input type="checkbox"/> NO			Priority (Business Days) 4 day [P4-20%] <input type="checkbox"/> 3 day [P3-25%] <input type="checkbox"/> 2 day [P2-50%] <input type="checkbox"/> EMERGENCY 1 Business day [E1 - 100%] <input type="checkbox"/>																																																																																																																																																																																																																							
Phone: 519-576-1711			<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked			Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply) <input type="checkbox"/>																																																																																																																																																																																																																							
Company address below will appear on the final report			Select Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			Date and Time Required for all E&P TATs: dd-mm-yy hh:mm																																																																																																																																																																																																																							
Street: 50 KRUG ST, STE202			Email 1 or Fax			For tests that can not be performed according to the service level selected, you will be contacted.																																																																																																																																																																																																																							
City/Province: KITCHENER			Email 2			Analysis Request																																																																																																																																																																																																																							
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<table border="1"><thead><tr><th>ALS Sample # (lab use only)</th><th>Sample Identification and/or Coordinates (This description will appear on the report)</th><th>Date (dd-mm-yy)</th><th>Time (hh:mm)</th><th>Sample Type</th><th>ALKALINITY</th><th>BOD</th><th>DOC</th><th>CI, NO3, SO4</th><th>E. COLI/FECAL COLIFORM</th><th>METALS + HARDNESS</th><th>NH3/TKN/TP</th><th>PH</th><th>TSS</th><th>SAMPLES ON HOLD</th><th>NUMBER OF CONTAINERS</th></tr></thead><tbody><tr><td>OL-1</td><td></td><td>16-Aug-18</td><td></td><td>Water</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td>5</td></tr><tr><td>OL-2</td><td></td><td>16-Aug-18</td><td></td><td>Water</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td>5</td></tr><tr><td>OL-4</td><td></td><td>16-Aug-18</td><td></td><td>Water</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td>5</td></tr><tr><td>OL-7</td><td></td><td>16-Aug-18</td><td></td><td>Water</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td>5</td></tr><tr><td>OL-9</td><td></td><td>16-Aug-18</td><td></td><td>Water</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td>5</td></tr><tr><td>OL-3</td><td></td><td>16-Aug-18</td><td></td><td>Water</td><td></td><td></td><td></td><td></td><td>R</td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr><tr><td>OL-5</td><td></td><td>16-Aug-18</td><td></td><td>Water</td><td></td><td></td><td></td><td></td><td>R</td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr><tr><td>OL-6</td><td></td><td>16-Aug-18</td><td></td><td>Water</td><td></td><td></td><td></td><td></td><td>R</td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr><tr><td>OL-8</td><td></td><td>16-Aug-18</td><td></td><td>Water</td><td></td><td></td><td></td><td></td><td>R</td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr><tr><td>OL-10</td><td></td><td>16-Aug-18</td><td></td><td>Water</td><td></td><td></td><td></td><td></td><td>R</td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr><tr><td>OL-11</td><td></td><td>16-Aug-18</td><td></td><td>Water</td><td></td><td></td><td></td><td></td><td>R</td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr></tbody></table>															ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	ALKALINITY	BOD	DOC	CI, NO3, SO4	E. COLI/FECAL COLIFORM	METALS + HARDNESS	NH3/TKN/TP	PH	TSS	SAMPLES ON HOLD	NUMBER OF CONTAINERS	OL-1		16-Aug-18		Water	R	R	R	R	R	R	R	R	R		5	OL-2		16-Aug-18		Water	R	R	R	R	R	R	R	R	R		5	OL-4		16-Aug-18		Water	R	R	R	R	R	R	R	R	R		5	OL-7		16-Aug-18		Water	R	R	R	R	R	R	R	R	R		5	OL-9		16-Aug-18		Water	R	R	R	R	R	R	R	R	R		5	OL-3		16-Aug-18		Water					R						1	OL-5		16-Aug-18		Water					R						1	OL-6		16-Aug-18		Water					R						1	OL-8		16-Aug-18		Water					R						1	OL-10		16-Aug-18		Water					R						1	OL-11		16-Aug-18		Water					R						1															
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	ALKALINITY	BOD	DOC	CI, NO3, SO4	E. COLI/FECAL COLIFORM	METALS + HARDNESS	NH3/TKN/TP	PH	TSS	SAMPLES ON HOLD	NUMBER OF CONTAINERS																																																																																																																																																																																																														
OL-1		16-Aug-18		Water	R	R	R	R	R	R	R	R	R		5																																																																																																																																																																																																														
OL-2		16-Aug-18		Water	R	R	R	R	R	R	R	R	R		5																																																																																																																																																																																																														
OL-4		16-Aug-18		Water	R	R	R	R	R	R	R	R	R		5																																																																																																																																																																																																														
OL-7		16-Aug-18		Water	R	R	R	R	R	R	R	R	R		5																																																																																																																																																																																																														
OL-9		16-Aug-18		Water	R	R	R	R	R	R	R	R	R		5																																																																																																																																																																																																														
OL-3		16-Aug-18		Water					R						1																																																																																																																																																																																																														
OL-5		16-Aug-18		Water					R						1																																																																																																																																																																																																														
OL-6		16-Aug-18		Water					R						1																																																																																																																																																																																																														
OL-8		16-Aug-18		Water					R						1																																																																																																																																																																																																														
OL-10		16-Aug-18		Water					R						1																																																																																																																																																																																																														
OL-11		16-Aug-18		Water					R						1																																																																																																																																																																																																														
Drinking Water (DW) Samples¹ (client use)					Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)										SAMPLE CONDITION AS RECEIVED (lab use only)																																																																																																																																																																																																														
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO															Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																																																																																																																														
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO															Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																																																																																																																														
															Cooling Initiated <input type="checkbox"/>																																																																																																																																																																																																														
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SHIPMENT RELEASE (client use)					INITIAL SHIPMENT RECEPTION (lab use only)										FINAL SHIPMENT RECEPTION (lab use only)																																																																																																																																																																																																														
Released by: Date: Time:					Received by: Date: Time:										Received by: Date: 8/17/18 Time: 9:15																																																																																																																																																																																																														

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

SEPT 2017 FRM01

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

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

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

COC Number: 17 -

Page 2 of 2

L2148866-COFC

Report To						Contact and company name below will appear on the final report						Report Format / Distri						your AM to confirm all E&P TATs (surcharges may apply)																	
Company:						HUTCHINSON ESL						Select Report Format: <input type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)						ceived by 3 pm - business days - no surcharges apply																	
Contact:						BRENT PARSONS						Quality Control (QC) Report with Report <input type="checkbox"/> YES <input type="checkbox"/> NO						1 Business day [E1 - 100%]																	
Phone:						519-576-1711						<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked						Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)]																	
												Company address below will appear on the final report												Select Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX											
Street:						50 KRUG ST, STE202						Email 1 or Fax						Date and Time Required for all E&P TATs: dd-mm-yy hh:mm																	
City/Province:						KITCHENER						Email 2						For tests that can not be performed according to the service level selected, you will be contacted.																	
Postal Code:						N2B 1L3						Email 3						Analysis Request																	
Invoice To						Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO						Invoice Distribution						Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																	
						Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO						Select Invoice Distribution: <input type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																							
Company:												Email 1 or Fax																							
Contact:												Email 2																							
Project Information												Oil and Gas Required Fields (client use)																							
ALS Account # / Quote #:												Q69690						AFE/Cost Center:						PO#											
Job #:																		Major/Minor Code:						Routing Code:											
PO / AFE:																		Requisitioner:																	
LSD:																		Location:																	
ALS Lab Work Order # (lab use only):												L2148866						ALS Contact: GAYLE BRAUN						Sampler:											
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)								Date (dd-mm-yy)		Time (hh:mm)		Sample Type																					
		OL-1-Bottom								16-Aug-18				Water																					
		SED-1								16-Aug-18		Soil		Water																					
										16-Aug-18				Water																					
										16-Aug-18				Water																					
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Drinking Water (DW) Samples ¹ (client use)												Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)																							
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO																																			
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO																																			
SHIPMENT RELEASE (client use)												INITIAL SHIPMENT RECEPTION (lab use only)																							
Released by:				Date:				Time:				Received by:				Date:				Time:															
SAMPLE CONDITION AS RECEIVED (lab use only)																																			
Frozen <input type="checkbox"/>												SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																							
Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/>												Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																							
Cooling Initiated <input type="checkbox"/>																																			
INITIAL COOLER TEMPERATURES °C												FINAL COOLER TEMPERATURES °C																							
FINAL SHIPMENT RECEPTION (lab use only)																																			
Received by:				Date:				Time:				Received by:				Date:				Time:															

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

SEPT 2017 FRONT

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

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

Submitted By:

Client ID: **1786194****HUTCHINSON ENVIRONMENTAL SCIENCES LTD**

BRENT PARSON

1-5 CHANCERY LANE

BRACEBRIDGE, ON P1L ZE3

Owner:

BRENT PARSON

Phone: 705 645-0021

Sampling Date: 2018-Aug-16

Received Date: 2018-Sep-05

Other Method ID:Non-routine

Date Authorized: 2018-Sep-27 11:27

Sample ID	Client Sample ID	Specimen type	Sampling date / time	Test	Result	Units	Note
0001	OL-1 OAK LAKE	Soil	18-Aug-16 11:00	Other	see attached report		

Supervisor: Nicolaas Schrier MSc, Animal Health Laboratory 519 823 1268 ext. 57215 nschrier@uoguelph.ca



HUTCHINSON ENVIRONMENTAL SCIENCES
LTD

ATTN: Brent Parsons

501 Krug St.

Suite 202

Kitchener ON N2B 1L3

Date Received: 31-OCT-18

Report Date: 14-NOV-18 07:37 (MT)

Version: FINAL

Client Phone: 519-576-1711

Certificate of Analysis

Lab Work Order #: L2189633

Project P.O. #: NOT SUBMITTED

Job Reference:

C of C Numbers:

Legal Site Desc:

Hua Wo
Chemistry Laboratory Manager

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

ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721

ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2189633-1 OL-1 Sampled By: CLIENT on 29-OCT-18 @ 01:30 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	 <1 <1 6.92	 PEHR PEHR	 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 31-OCT-18	 31-OCT-18 31-OCT-18 31-OCT-18	 R4313337 R4316210 R4330309
L2189633-2 OL-2 Sampled By: CLIENT on 29-OCT-18 @ 12:45 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	 5 <1 6.74	 PEHR PEHR	 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 31-OCT-18	 31-OCT-18 31-OCT-18 31-OCT-18	 R4313337 R4316210 R4330309
L2189633-3 OL-4 Sampled By: CLIENT on 29-OCT-18 @ 01:22 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	 <1 <1 4.30	 PEHR PEHR	 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 31-OCT-18	 31-OCT-18 31-OCT-18 31-OCT-18	 R4313337 R4316210 R4330309
L2189633-4 OL-7 Sampled By: CLIENT on 29-OCT-18 @ 01:10 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	 1 <1 4.02	 PEHR PEHR	 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 31-OCT-18	 31-OCT-18 31-OCT-18 31-OCT-18	 R4313337 R4316210 R4330309
L2189633-5 OL-9 Sampled By: CLIENT on 29-OCT-18 @ 13:00 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	 20 <1 7.63	 PEHR PEHR	 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 31-OCT-18	 31-OCT-18 31-OCT-18 31-OCT-18	 R4313337 R4316210 R4330309
L2189633-6 OL-3 Sampled By: CLIENT on 29-OCT-18 @ 01:24 Matrix: WATER Bacteriological Tests Fecal Streptococcus	 <1	 PEHR	 1	 CFU/100mL	 31-OCT-18	 31-OCT-18	 R4313337
L2189633-7 OL-5 Sampled By: CLIENT on 29-OCT-18 @ 01:20 Matrix: WATER Bacteriological Tests							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2189633-7	OL-5 Sampled By: CLIENT on 29-OCT-18 @ 01:20 Matrix: WATER Bacteriological Tests Fecal Streptococcus	3	PEHR	1	CFU/100mL		31-OCT-18	R4313337
L2189633-8	OL-6 Sampled By: CLIENT on 29-OCT-18 @ 01:15 Matrix: WATER Bacteriological Tests Fecal Streptococcus	15	PEHR	1	CFU/100mL		31-OCT-18	R4313337
L2189633-9	OL-8 Sampled By: CLIENT on 29-OCT-18 @ 01:05 Matrix: WATER Bacteriological Tests Fecal Streptococcus	1	PEHR	1	CFU/100mL		31-OCT-18	R4313337
L2189633-10	OL-10 Sampled By: CLIENT on 29-OCT-18 @ 12:55 Matrix: WATER Bacteriological Tests Fecal Streptococcus	13	PEHR	1	CFU/100mL		31-OCT-18	R4313337
L2189633-11	OL-11 Sampled By: CLIENT on 29-OCT-18 @ 12:50 Matrix: WATER Bacteriological Tests Fecal Streptococcus	2	PEHR	1	CFU/100mL		31-OCT-18	R4313337

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
PEHR	Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CHL/A-ACET-FLUORO-WP	Water	Chlorophyll a by fluorometry	EPA 445.0 ACET
This analysis is done using procedures modified from EPA method 445.0. Chlorophyll a is determined by a 90 % acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
FECALSTREP-MF-WP	Water	Fecal streptococcus	APHA 9230C (modified)
An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on selective media and incubated at 35°C for 47 +/- 1 hour. Colonies exhibiting characteristic morphology for the target group on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed.			
Due to taxonomic fluidity, the term "Fecal Streptococcus" is applied here to include all members of genus names Streptococcus and Enterococcus as described in the reference method.			
PSA-MF-WP	Water	Pseudomonas aeruginosa	APHA 9213E
A known volume of sample (typically 100 mL) is filtered through a 0.45 micron membrane filter. The filter is placed on the surface of a selective agar plate and incubated for 72 hours at 41.5 +/- 0.5 C. Plates are examined under low magnification and colonies exhibiting typical morphology are counted. Results are reported as the number of presumptive P. aeruginosa CFU/100 mL. Additional confirmation tests can be performed upon request.			

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

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

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

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

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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

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

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

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



Quality Control Report

Workorder: L2189633

Report Date: 14-NOV-18

Page 1 of 3

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CHL/A-ACET-FLUORO-WP Water								
Batch	R4330309							
WG2929404-2	DUP	L2189938-1						
Chlorophyll a		1.06	1.04		ug/L	1.1	35	31-OCT-18
WG2929404-3	LCS							
Chlorophyll a			108.3		%		80-120	13-NOV-18
WG2929404-1	MB							
Chlorophyll a			<0.10		ug/L		0.1	31-OCT-18
FECALSTREP-MF-WP Water								
Batch	R4313337							
WG2919299-2	DUP	L2189633-7						
Fecal Streptococcus		3	3		CFU/100mL	0.0	65	31-OCT-18
WG2919299-1	MB							
Fecal Streptococcus			<1		CFU/100mL		1	31-OCT-18
PSA-MF-WP Water								
Batch	R4316210							
WG2919301-1	MB							
Pseudomonas aeruginosa			<1		CFU/100mL		1	31-OCT-18

Quality Control Report

Workorder: L2189633

Report Date: 14-NOV-18

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Page 2 of 3

Contact: Brent Parsons

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Quality Control Report

Workorder: L2189633

Report Date: 14-NOV-18

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3
Contact: Brent Parsons

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Bacteriological Tests							
Fecal streptococcus	1	29-OCT-18 01:30	31-OCT-18 12:35	30	59	hours	EHTR
	2	29-OCT-18 12:45	31-OCT-18 12:35	30	48	hours	EHTR
	3	29-OCT-18 01:22	31-OCT-18 12:35	30	59	hours	EHTR
	4	29-OCT-18 01:10	31-OCT-18 12:35	30	60	hours	EHTR
	5	29-OCT-18 13:00	31-OCT-18 12:35	30	48	hours	EHTR
	6	29-OCT-18 01:24	31-OCT-18 12:35	30	59	hours	EHTR
	7	29-OCT-18 01:20	31-OCT-18 12:35	30	59	hours	EHTR
	8	29-OCT-18 01:15	31-OCT-18 12:35	30	59	hours	EHTR
	9	29-OCT-18 01:05	31-OCT-18 12:35	30	60	hours	EHTR
	10	29-OCT-18 12:55	31-OCT-18 12:35	30	48	hours	EHTR
	11	29-OCT-18 12:50	31-OCT-18 12:35	30	48	hours	EHTR
Pseudomonas aeruginosa	1	29-OCT-18 01:30	31-OCT-18 12:35	30	59	hours	EHTR
	2	29-OCT-18 12:45	31-OCT-18 12:35	30	48	hours	EHTR
	3	29-OCT-18 01:22	31-OCT-18 12:35	30	59	hours	EHTR
	4	29-OCT-18 01:10	31-OCT-18 12:35	30	60	hours	EHTR
	5	29-OCT-18 13:00	31-OCT-18 12:35	30	48	hours	EHTR
Plant Pigments							
Chlorophyll a by fluorometry	1	29-OCT-18 01:30	31-OCT-18 14:12	48	61	hours	EHTR
	2	29-OCT-18 12:45	31-OCT-18 14:12	48	49	hours	EHTL
	3	29-OCT-18 01:22	31-OCT-18 14:12	48	61	hours	EHTR
	4	29-OCT-18 01:10	31-OCT-18 14:12	48	61	hours	EHTR
	5	29-OCT-18 13:00	31-OCT-18 14:12	48	49	hours	EHTL

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2189633 were received on 31-OCT-18 09:00.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L2189633-COFC

COC Number: 17-0050

Page 1 of 1

12189633

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																																																																					
Company: HUTCHINSON ENV		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)		Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply																																																																					
Contact: BRENT PARSONS		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		PRIORITY (Business Days) 4 day [P4-20%] <input type="checkbox"/> 3 day [P3-25%] <input type="checkbox"/> 2 day [P2-50%] <input type="checkbox"/>		EMERGENCY 1 Business day [E - 100%] Same Day, Weekend or Statutory holiday [E2 - 200%] (Laboratory opening fees may apply) <input type="checkbox"/>																																																																			
Phone: 519-576-1711		<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked																																																																							
Company address below will appear on the final report		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm																																																																					
Street: 501 KRUG ST ST 202		Email 1 or Fax: deborah.sindair@environmentalsciences.ca		For tests that can not be performed according to the service level selected, you will be contacted.																																																																					
City/Province: KITCHENER, ON		Email 2: brent.parsons@environmentalsciences.ca		Analysis Request																																																																					
Postal Code: N2B 1L3		Email 3:		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																																					
Invoice To Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Invoice Distribution		<table border="1"> <tr><td colspan="10">NUMBER OF CONTAINERS</td></tr> <tr><td colspan="10">FECAL STREP</td></tr> <tr><td colspan="10">PSEUDOMONAS</td></tr> <tr><td colspan="10">CHLOROPHYLL A</td></tr> <tr><td colspan="10">TOTAL COLIFORMS</td></tr> <tr><td colspan="10">SUSPECTED HAZARD (see Special Instructions)</td></tr> </table>										NUMBER OF CONTAINERS										FECAL STREP										PSEUDOMONAS										CHLOROPHYLL A										TOTAL COLIFORMS										SUSPECTED HAZARD (see Special Instructions)									
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Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																																																																							
Company:		Email 1 or Fax: accounting@environmentalsciences.ca																																																																							
Contact:		Email 2:																																																																							
Project Information		Oil and Gas Required Fields (client use)																																																																							
ALS Account # / Quote #: Q69690		AFE/Cost Center:		PO#																																																																					
Job #:		Major/Minor Code:		Routing Code:																																																																					
PO / AFE:		Requisitioner:																																																																							
LSD:		Location:																																																																							
ALS Lab Work Order # (lab use only):		ALS Contact: Gayle		Sampler:																																																																					
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																																																																					
OL-1		29-10-18	13:30	WATER	3	R	R	R	R																																																																
OL-2			12:45	WATER	2	R	R	R	R																																																																
OL-4			13:22	WATER	2	R	R	R	R																																																																
OL-7			13:10	WATER	2	R	R	R	R																																																																
OL-9			13:00	WATER	2	R	R	R	R																																																																
OL-3			13:24	WATER	1	R																																																																			
OL-5			13:20	WATER	1	R																																																																			
OL-6			13:15	WATER	1	R																																																																			
OL-8			13:05	WATER	1	R																																																																			
OL-10			12:55	WATER	1	R																																																																			
OL-11			12:50	WATER	1	R																																																																			
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)																																																																					
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																					
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO				Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																					
				Cooling Initiated <input type="checkbox"/>																																																																					
				INITIAL COOLER TEMPERATURES °C																																																																					
				FINAL COOLER TEMPERATURES °C																																																																					
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																																																																					
Released by: Charlie Heidner	Date: 30-10-2018	Time: 11:30	Received by: [Signature]	Date: 10/31/18	Time: 9:00	Received by:					Date:																																																														

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY

YELLOW - CLIENT COPY

OCT 2016 FRONT

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

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



HUTCHINSON ENVIRONMENTAL SCIENCES
LTD

ATTN: Brent Parsons

501 Krug St.

Suite 202

Kitchener ON N2B 1L3

Date Received: 31-OCT-18

Report Date: 07-NOV-18 13:24 (MT)

Version: FINAL

Client Phone: 519-576-1711

Certificate of Analysis

Lab Work Order #: L2189621

Project P.O. #: NOT SUBMITTED

Job Reference:

C of C Numbers:

Legal Site Desc:

Gayle Braun
Senior Account Manager

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

ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671

ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2189621-1 OL-1 Sampled By: CLIENT on 29-OCT-18 @ 13:30 Matrix: WATER							
Physical Tests							
Hardness (as CaCO ₃)	73	HTC	10	mg/L		31-OCT-18	
pH	7.99		0.10	pH units		01-NOV-18	R4312622
Total Suspended Solids	<2.0		2.0	mg/L	01-NOV-18	02-NOV-18	R4312609
Anions and Nutrients							
Alkalinity, Total (as CaCO ₃)	62		10	mg/L		01-NOV-18	R4310407
Chloride (Cl)	51.4		0.50	mg/L		01-NOV-18	R4314670
Nitrate (as N)	<0.020		0.020	mg/L		01-NOV-18	R4314670
Total Kjeldahl Nitrogen	0.65	RRV	0.15	mg/L	01-NOV-18	02-NOV-18	R4315710
Phosphorus, Total	0.0086		0.0030	mg/L	31-OCT-18	02-NOV-18	R4312508
Sulfate (SO ₄)	1.54		0.30	mg/L		01-NOV-18	R4314670
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					01-NOV-18	R4310750
Dissolved Organic Carbon	5.92		0.50	mg/L	01-NOV-18	06-NOV-18	R4323022
Bacteriological Tests							
E. Coli	0		0	CFU/100mL		01-NOV-18	R4309936
Fecal Coliforms	0		0	CFU/100mL		01-NOV-18	R4309947
Total Metals							
Calcium (Ca)-Total	24.7		0.50	mg/L	31-OCT-18	31-OCT-18	R4308238
Iron (Fe)-Total	<0.050		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Magnesium (Mg)-Total	2.85		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Aggregate Organics							
BOD	<2.0		2.0	mg/L	31-OCT-18	05-NOV-18	R4319070
L2189621-2 OL-2 Sampled By: CLIENT on 29-OCT-18 @ 12:45 Matrix: WATER							
Physical Tests							
Hardness (as CaCO ₃)	70	HTC	10	mg/L		31-OCT-18	
pH	8.04		0.10	pH units		01-NOV-18	R4312622
Total Suspended Solids	<2.0		2.0	mg/L	01-NOV-18	02-NOV-18	R4312609
Anions and Nutrients							
Alkalinity, Total (as CaCO ₃)	65		10	mg/L		01-NOV-18	R4310407
Ammonia, Total (as N)	0.539		0.020	mg/L		05-NOV-18	R4322287
Chloride (Cl)	51.4		0.50	mg/L		01-NOV-18	R4314670
Nitrate (as N)	<0.020		0.020	mg/L		01-NOV-18	R4314670
Total Kjeldahl Nitrogen	0.59	RRV	0.15	mg/L	01-NOV-18	02-NOV-18	R4315710
Phosphorus, Total	0.0084		0.0030	mg/L	31-OCT-18	02-NOV-18	R4312508
Sulfate (SO ₄)	1.55		0.30	mg/L		01-NOV-18	R4314670
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					01-NOV-18	R4310750
Dissolved Organic Carbon	5.94		0.50	mg/L	01-NOV-18	06-NOV-18	R4323022
Bacteriological Tests							
E. Coli	0		0	CFU/100mL		01-NOV-18	R4309936
Fecal Coliforms	0		0	CFU/100mL		01-NOV-18	R4309947

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2189621-2 OL-2 Sampled By: CLIENT on 29-OCT-18 @ 12:45 Matrix: WATER Bacteriological Tests Total Metals Calcium (Ca)-Total Iron (Fe)-Total Magnesium (Mg)-Total Aggregate Organics BOD								
		23.4		0.50	mg/L	31-OCT-18	31-OCT-18	R4308238
		<0.050		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
		2.82		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
		<2.0		2.0	mg/L	31-OCT-18	05-NOV-18	R4319070
L2189621-3 OL-4 Sampled By: CLIENT on 29-OCT-18 @ 13:22 Matrix: WATER Physical Tests Hardness (as CaCO3) pH Total Suspended Solids Anions and Nutrients Alkalinity, Total (as CaCO3) Ammonia, Total (as N) Chloride (Cl) Nitrate (as N) Total Kjeldahl Nitrogen Phosphorus, Total Sulfate (SO4) Organic / Inorganic Carbon Dissolved Carbon Filtration Location Dissolved Organic Carbon Bacteriological Tests E. Coli Fecal Coliforms Total Metals Calcium (Ca)-Total Iron (Fe)-Total Magnesium (Mg)-Total Aggregate Organics BOD		HTC						
			75	10	mg/L		31-OCT-18	
			8.03	0.10	pH units		01-NOV-18	R4312622
			<2.0	2.0	mg/L	01-NOV-18	02-NOV-18	R4312609
			65	10	mg/L		01-NOV-18	R4310407
			0.212	0.020	mg/L		31-OCT-18	R4308451
			51.6	0.50	mg/L		01-NOV-18	R4314670
			<0.020	0.020	mg/L		01-NOV-18	R4314670
			0.46	0.15	mg/L	01-NOV-18	02-NOV-18	R4315710
			0.0097	0.0030	mg/L	31-OCT-18	02-NOV-18	R4312508
			1.54	0.30	mg/L		01-NOV-18	R4314670
			LAB				01-NOV-18	R4310750
			5.98	0.50	mg/L	01-NOV-18	06-NOV-18	R4323022
			1	0	CFU/100mL		01-NOV-18	R4309936
			3	0	CFU/100mL		01-NOV-18	R4309947
			25.4	0.50	mg/L	31-OCT-18	31-OCT-18	R4308238
			<0.050	0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
			2.85	0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
	<2.0		2.0	mg/L	31-OCT-18	05-NOV-18	R4319070	
L2189621-4 OL-7 Sampled By: CLIENT on 29-OCT-18 @ 13:10 Matrix: WATER Physical Tests Hardness (as CaCO3) pH Total Suspended Solids Anions and Nutrients Alkalinity, Total (as CaCO3) Ammonia, Total (as N)		HTC						
			74	10	mg/L		31-OCT-18	
			8.07	0.10	pH units		01-NOV-18	R4312622
			<2.0	2.0	mg/L	01-NOV-18	02-NOV-18	R4312609
			65	10	mg/L		01-NOV-18	R4310407
			0.145	0.020	mg/L		31-OCT-18	R4308451

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2189621-4 OL-7 Sampled By: CLIENT on 29-OCT-18 @ 13:10 Matrix: WATER							
Anions and Nutrients							
Chloride (Cl)	51.1		0.50	mg/L		01-NOV-18	R4314670
Nitrate (as N)	<0.020		0.020	mg/L		01-NOV-18	R4314670
Total Kjeldahl Nitrogen	0.46		0.15	mg/L	02-NOV-18	02-NOV-18	R4314469
Phosphorus, Total	0.0050		0.0030	mg/L	31-OCT-18	02-NOV-18	R4312508
Sulfate (SO4)	1.62		0.30	mg/L		01-NOV-18	R4314670
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					01-NOV-18	R4310750
Dissolved Organic Carbon	5.87		0.50	mg/L	01-NOV-18	06-NOV-18	R4323022
Bacteriological Tests							
E. Coli	1		0	CFU/100mL		01-NOV-18	R4309936
Fecal Coliforms	2		0	CFU/100mL		01-NOV-18	R4309947
Total Metals							
Calcium (Ca)-Total	24.7		0.50	mg/L	31-OCT-18	31-OCT-18	R4308238
Iron (Fe)-Total	<0.050		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Magnesium (Mg)-Total	2.93		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Aggregate Organics							
BOD	<2.0		2.0	mg/L	31-OCT-18	05-NOV-18	R4319070
L2189621-5 OL-9 Sampled By: CLIENT on 29-OCT-18 @ 13:00 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	77	HTC	10	mg/L		31-OCT-18	
pH	7.97		0.10	pH units		01-NOV-18	R4312622
Total Suspended Solids	2.9		2.0	mg/L	01-NOV-18	02-NOV-18	R4312609
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	64		10	mg/L		01-NOV-18	R4310407
Ammonia, Total (as N)	0.562		0.020	mg/L		05-NOV-18	R4322287
Chloride (Cl)	51.7		0.50	mg/L		01-NOV-18	R4314670
Nitrate (as N)	<0.020		0.020	mg/L		01-NOV-18	R4314670
Total Kjeldahl Nitrogen	0.65		0.15	mg/L	05-NOV-18	06-NOV-18	R4322883
Phosphorus, Total	0.0441		0.0030	mg/L	31-OCT-18	02-NOV-18	R4312508
Sulfate (SO4)	1.68		0.30	mg/L		01-NOV-18	R4314670
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					01-NOV-18	R4310750
Dissolved Organic Carbon	6.19		0.50	mg/L	01-NOV-18	06-NOV-18	R4323022
Bacteriological Tests							
E. Coli	3		0	CFU/100mL		01-NOV-18	R4309936
Fecal Coliforms	10		0	CFU/100mL		01-NOV-18	R4309947
Total Metals							
Calcium (Ca)-Total	26.1		0.50	mg/L	31-OCT-18	31-OCT-18	R4308238
Iron (Fe)-Total	<0.050		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Magnesium (Mg)-Total	2.87		0.050	mg/L	31-OCT-18	31-OCT-18	R4308238
Aggregate Organics							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2189621-5 OL-9 Sampled By: CLIENT on 29-OCT-18 @ 13:00 Matrix: WATER Aggregate Organics BOD Report Remarks : re-run for TKN, results confirmed with re-analysis	<2.0		2.0	mg/L	31-OCT-18	05-NOV-18	R4319070
L2189621-6 OL-3 Sampled By: CLIENT on 29-OCT-18 @ 13:24 Matrix: WATER Bacteriological Tests E. Coli Fecal Coliforms	1 0		0 0	CFU/100mL CFU/100mL		01-NOV-18 01-NOV-18	R4309936 R4309947
L2189621-7 OL-5 Sampled By: CLIENT on 29-OCT-18 @ 13:20 Matrix: WATER Bacteriological Tests E. Coli Fecal Coliforms	0 2		0 0	CFU/100mL CFU/100mL		01-NOV-18 01-NOV-18	R4309936 R4309947
L2189621-8 OL-6 Sampled By: CLIENT on 29-OCT-18 @ 13:15 Matrix: WATER Bacteriological Tests E. Coli Fecal Coliforms	1 0		0 0	CFU/100mL CFU/100mL		01-NOV-18 01-NOV-18	R4309936 R4309947
L2189621-9 OL-8 Sampled By: CLIENT on 29-OCT-18 @ 13:05 Matrix: WATER Bacteriological Tests E. Coli Fecal Coliforms	1 0		0 0	CFU/100mL CFU/100mL		01-NOV-18 01-NOV-18	R4309936 R4309947
L2189621-10 OL-10 Sampled By: CLIENT on 29-OCT-18 @ 12:55 Matrix: WATER Bacteriological Tests E. Coli Fecal Coliforms	0 0		0 0	CFU/100mL CFU/100mL		01-NOV-18 01-NOV-18	R4309936 R4309947
L2189621-11 OL-11 Sampled By: CLIENT on 29-OCT-18 @ 12:50 Matrix: WATER Bacteriological Tests E. Coli Fecal Coliforms	0 1		0 0	CFU/100mL CFU/100mL		01-NOV-18 01-NOV-18	R4309936 R4309947
L2189621-12 OL-1-BOTTOM Sampled By: CLIENT on 29-OCT-18 @ 13:30 Matrix: WATER Physical Tests Total Suspended Solids Anions and Nutrients Phosphorus, Total	2.7 0.0070		2.0 0.0030	mg/L mg/L	01-NOV-18 31-OCT-18	02-NOV-18 02-NOV-18	R4313367 R4312508

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Total	MS-B	L2189621-1, -2, -3, -4, -5
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2189621-1, -2, -3, -4, -5

Sample Parameter Qualifier key listed:

Qualifier	Description
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-WT	Water	Alkalinity, Total (as CaCO ₃)	EPA 310.2
This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.			
BOD-WT	Water	BOD	APHA 5210 B
This analysis is carried out using procedures adapted from APHA Method 5210B - "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-WT	Water	Chloride by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
DOC-WT	Water	Dissolved Organic Carbon	APHA 5310B
Sample is filtered through a 0.45µm filter, then injected into a heated reaction chamber which is packed with an oxidative catalyst. The water is vaporized and the organic carbon is oxidized to carbon dioxide. The carbon dioxide is transported in a carrier gas and is measured by a non-dispersive infrared detector.			
EC-MF-WT	Water	E. coli	SM 9222D
A 100 mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at 44.5 – 0.2 °C for 24 – 2 h. Method ID: WT-TM-1200			
FC-MF-WT	Water	Fecal Coliforms	SM 9222D
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC agar and incubated at 24–2h@44.5–0.2°C. Method ID: WT-TM-1200			
HARDNESS-CALC-WT	Water	Hardness	APHA 2340 B
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.			
MET-T-CCMS-WT	Water	Total Metals in Water by CRC	EPA 200.2/6020A (mod)
Water samples are digested with nitric and perchloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
NH3-WT	Water	Ammonia, Total as N	EPA 350.1
Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.			
NO3-IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
PH-WT	Water	pH	APHA 4500 H-Electrode
Water samples are analyzed directly by a calibrated pH meter.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days			
SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

Reference Information

SOLIDS-TSS-WT Water Suspended solids APHA 2540 D-Gravimetric

A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 104–1°C for a minimum of four hours or until a constant weight is achieved.

TKN-WT Water Total Kjeldahl Nitrogen APHA 4500-Norg D

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 Celsius with analysis using an automated colorimetric method.

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

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

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

WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
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Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

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

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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

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

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

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



Quality Control Report

Workorder: L2189621

Report Date: 07-NOV-18

Page 2 of 6

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-MF-WT Water								
Batch	R4309936							
WG2919207-1 MB								
E. Coli			0		CFU/100mL		1	01-NOV-18
FC-MF-WT Water								
Batch	R4309947							
WG2919195-1 MB								
Fecal Coliforms			0		CFU/100mL		1	01-NOV-18
MET-T-CCMS-WT Water								
Batch	R4308238							
WG2919062-4 DUP		WG2919062-3						
Calcium (Ca)-Total		29.6	30.4		mg/L	2.7	20	31-OCT-18
Iron (Fe)-Total		0.797	0.781		mg/L	2.1	20	31-OCT-18
Magnesium (Mg)-Total		8.81	8.87		mg/L	0.7	20	31-OCT-18
WG2919062-2 LCS								
Calcium (Ca)-Total			99.5		%		80-120	31-OCT-18
Iron (Fe)-Total			99.2		%		80-120	31-OCT-18
Magnesium (Mg)-Total			98.6		%		80-120	31-OCT-18
WG2919062-1 MB								
Calcium (Ca)-Total			<0.050		mg/L		0.05	31-OCT-18
Iron (Fe)-Total			<0.010		mg/L		0.01	31-OCT-18
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	31-OCT-18
WG2919062-5 MS		WG2919062-6						
Calcium (Ca)-Total			N/A	MS-B	%		-	31-OCT-18
Iron (Fe)-Total			96.8		%		70-130	31-OCT-18
Magnesium (Mg)-Total			N/A	MS-B	%		-	31-OCT-18
NH3-WT Water								
Batch	R4308451							
WG2918875-11 DUP		L2188939-6						
Ammonia, Total (as N)		<0.020	<0.020	RPD-NA	mg/L	N/A	20	31-OCT-18
WG2918875-10 LCS								
Ammonia, Total (as N)			101.4		%		85-115	31-OCT-18
WG2918875-9 MB								
Ammonia, Total (as N)			<0.020		mg/L		0.02	31-OCT-18
WG2918875-12 MS		L2188939-6						
Ammonia, Total (as N)			97.5		%		75-125	31-OCT-18

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-N-WT		Water						
Batch	R4314670							
WG2920678-19	DUP	L2189468-1						
Sulfate (SO4)		<0.30	<0.30	RPD-NA	mg/L	N/A	20	01-NOV-18
WG2920678-17	LCS		98.3		%		90-110	01-NOV-18
Sulfate (SO4)								
WG2920678-16	MB		<0.30		mg/L		0.3	01-NOV-18
Sulfate (SO4)								
WG2920678-20	MS	L2189468-1	99.8		%		75-125	01-NOV-18
Sulfate (SO4)								
SOLIDS-TSS-WT		Water						
Batch	R4312609							
WG2920008-3	DUP	L2189291-1						
Total Suspended Solids		2950	3070		mg/L	4.0	20	02-NOV-18
WG2920008-2	LCS		100.1		%		85-115	02-NOV-18
Total Suspended Solids								
WG2920008-1	MB		<2.0		mg/L		2	02-NOV-18
Total Suspended Solids								
Batch	R4313367							
WG2920448-3	DUP	L2189260-7						
Total Suspended Solids		5200	5380		mg/L	3.4	20	02-NOV-18
WG2920448-2	LCS		101.7		%		85-115	02-NOV-18
Total Suspended Solids								
WG2920448-1	MB		<2.0		mg/L		2	02-NOV-18
Total Suspended Solids								
TKN-WT		Water						
Batch	R4314469							
WG2921071-7	DUP	L2189465-1						
Total Kjeldahl Nitrogen		<0.15	0.17	RPD-NA	mg/L	N/A	20	02-NOV-18
WG2921071-6	LCS		86.0		%		75-125	02-NOV-18
Total Kjeldahl Nitrogen								
WG2921071-5	MB		<0.15		mg/L		0.15	02-NOV-18
Total Kjeldahl Nitrogen								
WG2921071-8	MS	L2189465-1	108.2		%		70-130	02-NOV-18
Total Kjeldahl Nitrogen								
Batch	R4315710							
WG2920880-3	DUP	L2188939-3						
Total Kjeldahl Nitrogen		0.67	0.66		mg/L	1.8	20	02-NOV-18
WG2920880-2	LCS							



Quality Control Report

Workorder: L2189621
 Report Date: 07-NOV-18
 Page 5 of 6

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
 501 Krug St. Suite 202
 Kitchener ON N2B 1L3
 Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT	Water							
Batch R4315710								
WG2920880-2 LCS								
Total Kjeldahl Nitrogen			98.8		%		75-125	02-NOV-18
WG2920880-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	02-NOV-18
WG2920880-4 MS		L2188939-3						
Total Kjeldahl Nitrogen			84.0		%		70-130	02-NOV-18
Batch R4322883								
WG2923477-3 DUP		L2190310-6						
Total Kjeldahl Nitrogen		0.72	0.71		mg/L	1.4	20	06-NOV-18
WG2923477-2 LCS								
Total Kjeldahl Nitrogen			107.6		%		75-125	06-NOV-18
WG2923477-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	06-NOV-18
WG2923477-4 MS		L2190310-6						
Total Kjeldahl Nitrogen			117.1		%		70-130	06-NOV-18

Quality Control Report

Workorder: L2189621

Report Date: 07-NOV-18

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3
Contact: Brent Parsons

Page 6 of 6

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



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Request Form

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L2189621-COFC

COC Number: 17 -

Page of

Report To		Contact and company name below will appear on the final report		Report Format		
Company:	HUTCHINSON ENV			Select Report Format:	<input checked="" type="checkbox"/> PDF <input type="checkbox"/> Other	
Contact:	BRENT PARSONS			Quality Control (QC) Report with Report	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
Phone:	519-576-1711			<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked		
Company address below will appear on the final report				Select Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	
Street:	501 KRUG ST ST 202			Email 1 or Fax:	deborah.sindair@environmentalsciences.ca	
City/Province:	KTICHENER, ON			Email 2:	brent.parsons@environmentalsciences.ca	
Postal Code:	N2B 1L3			Email 3:		
Invoice To	Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			Invoice Distribution		
	Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		
Company:				Email 1 or Fax: accounting@environmentalsciences.ca		
Contact:				Email 2:		
Project Information				Oil and Gas Required Fields (client use)		
ALS Account # / Quote #:		Q69690		AFE/Cost Center: PO#		
Job #:				Major/Minor Code: Routing Code:		
PO / AFE:				Requisitioner:		
LSD:				Location:		
ALS Lab Work Order # (lab use only): L2189621				ALS Contact:	Gayle	
				Sampler:		
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	ANALYSIS REQUEST
1	OL-1	29-10-18	13:30	WATER	5	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
2	OL-2		12:46	WATER	4	
3	OL-4		13:22	WATER	4	
4	OL-7		13:10	WATER	4	
5	OL-9		13:05	WATER	4	
6	OL-3		13:24	WATER	1	
7	OL-5		13:20	WATER	1	
8	OL-6		13:15	WATER	1	
9	OL-8		13:05	WATER	1	
10	OL-10		12:55	WATER	1	
11	OL-11		12:50	WATER	1	
12	OL-1-BOTTOM		13:20	WATER	3	
Drinking Water (DW) Samples (client use)				Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>		
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO				Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>		
				Cooling Initiated <input type="checkbox"/>		
				INITIAL COOLER TEMPERATURES °C		
				FINAL COOLER TEMPERATURES °C		
SHIPMENT RELEASE (client use)				FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:
Narke Heidman	30-10-18	11:30		31-10-18	9:00	

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY

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

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



Sample Receipt Confirmation

Report Distribution:

Company Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: Brent Parsons
Address: 501 Krug St., Suite 202
Kitchener, ON, N2B 1L3
Phone: 519-576-1711
Fax: 866-205-7766
Email: deborah.sinclair@environmentalsciences.ca
brent.parsons@environmentalsciences.ca
EDD Email: --
Distribution: Hard Copy: N Email: Y Fax: N EDD: N

Invoice Distribution:

Acct Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: ACCOUNTS PAYABLE
Address: 1-5 Chancery Lane,
Bracebridge, ON, P1L 2E3
Phone: 705-645-0021
Fax: 705-457-5811
Invoice Email: deborah.sinclair@environmentalsciences.ca
accounting@environmentalsciences.ca
Project #: N/A
Account #: 20126

Client Information:

Job Reference #:
Project PO #:
Legal Site Description: N/A
Quote #: Q69690

Date Sampled: 29-OCT-18
Date Received: 31-OCT-18
Sampled By: CLIENT
Chain Of Custody: --

Workorder Summary:

Lab Work Order #: L2189621
Estimated completion date: 07-NOV-18
12 Samples received at ALS in LONDON

Account Manager: Gayle Braun
Estimated sample disposal date: See Sample Disposal Information section below.

Lab Sample ID	Client Sample ID	Date Sampled	Date Received	Sample Due Date	Priority Flag	Sample Type	Client Job#
L2189621-1	OL-1	29-OCT-18 13:30	31-OCT-18 09:00	07-NOV-18		WATER	
L2189621-2	OL-2	29-OCT-18 12:45	31-OCT-18 09:00	07-NOV-18		WATER	
L2189621-3	OL-4	29-OCT-18 13:22	31-OCT-18 09:00	07-NOV-18		WATER	
L2189621-4	OL-7	29-OCT-18 13:10	31-OCT-18 09:00	07-NOV-18		WATER	
L2189621-5	OL-9	29-OCT-18 13:00	31-OCT-18 09:00	07-NOV-18		WATER	
L2189621-6	OL-3	29-OCT-18 13:24	31-OCT-18 09:00	07-NOV-18		WATER	
L2189621-7	OL-5	29-OCT-18 13:20	31-OCT-18 09:00	07-NOV-18		WATER	
L2189621-8	OL-6	29-OCT-18 13:15	31-OCT-18 09:00	07-NOV-18		WATER	
L2189621-9	OL-8	29-OCT-18 13:05	31-OCT-18 09:00	07-NOV-18		WATER	
L2189621-10	OL-10	29-OCT-18 12:55	31-OCT-18 09:00	07-NOV-18		WATER	
L2189621-11	OL-11	29-OCT-18 12:50	31-OCT-18 09:00	07-NOV-18		WATER	
L2189621-12	OL-1-BOTTOM	29-OCT-18 13:30	31-OCT-18 09:00	07-NOV-18		WATER	



**Analysis
Requested :**

	Alkalinity, Total [as CaCO ₃]	BOD	Chloride by IC	Dissolved Organic Carbon	E. coli	Fecal Coliforms	Hardness	One Metal in Water by ICPMS [Total]	Total Metals in Water by CRC ICPMS	Ammonia, Total as N	Nitrate in Water by IC	Total P in Water by Colour	pH	Sulfate in Water by IC	Suspended solids	TKN and Total Phosphorus	Sample Handling and Disposal Fee
OL-1	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-2	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-4	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-7	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-9	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-3					✓	✓											✓
OL-5					✓	✓											✓
OL-6					✓	✓											✓
OL-8					✓	✓											✓
OL-10					✓	✓											✓
OL-11					✓	✓											✓
OL-1-BOTTOM								✓				✓			✓		✓

Login Comments:

Your samples were at 7.4 °C when unpacked at the laboratory.

Sample Integrity Observations: No observations were identified for this work order submission.



Notice of Sub-contract Laboratory Service

Please be advised that the following tests will be subcontracted to the corresponding laboratory:

E. coli subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Alkalinity, Total (as CaCO₃) subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Suspended solids subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Total P in Water by Colour subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
pH subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Nitrate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Hardness subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Total Kjeldahl Nitrogen subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Fecal Coliforms subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Ammonia, Total as N subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Chloride by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
BOD subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Dissolved Organic Carbon subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Total Metals in Water by CRC ICPMS subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Please contact your Account Manager immediately should you have questions or concerns regarding this arrangement. Approval of this arrangement shall be implied unless otherwise notified by you.

Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



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Request Form

Canada Toll Free: 1 800 668 9878



L2189621-COFC

COC Number: 17 -

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Report To		Contact and company name below will appear on the final report		Report Format		
Company:	HUTCHINSON ENV			Select Report Format:	<input checked="" type="checkbox"/> PDF <input type="checkbox"/> Other	
Contact:	BRENT PARSONS			Quality Control (QC) Report with Report	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
Phone:	519-576-1711			<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked		
Company address below will appear on the final report				Select Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	
Street:	501 KRUG ST ST 202			Email 1 or Fax:	deborah.sindair@environmentalsciences.ca	
City/Province:	KTICHENER, ON			Email 2:	brent.parsons@environmentalsciences.ca	
Postal Code:	N2B 1L3			Email 3:		
Invoice To	Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			Invoice Distribution		
	Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			Select Invoice Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	
Company:				Email 1 or Fax:	accounting@environmentalsciences.ca	
Contact:				Email 2:		
Project Information				Oil and Gas Required Fields (client use)		
ALS Account # / Quote #:	Q69690			AFE/Cost Center:	PO#	
Job #:				Major/Minor Code:	Routing Code:	
PO / AFE:				Requisitioner:		
LSD:				Location:		
ALS Lab Work Order # (lab use only): L2189621				ALS Contact:	Gayle	
				Sampler:		
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	ANALYSIS REQUEST
1	OL-1	29-10-18	13:30	WATER	5	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
2	OL-2		12:46	WATER	4	
3	OL-4		13:22	WATER	4	
4	OL-7		13:10	WATER	4	
5	OL-9		13:03	WATER	4	
6	OL-3		13:24	WATER	1	
7	OL-5		13:20	WATER	1	
8	OL-6		13:15	WATER	1	
9	OL-8		13:05	WATER	1	
10	OL-10		12:55	WATER	1	
11	OL-11		12:50	WATER	1	
12	OL-1-BOTTOM		13:20	WATER	3	
Drinking Water (DW) Samples (client use)				Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO						
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO						
SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)		
Released by: Mark Heidman		Date: 30-10-18	Time: 11:30	Received by:		Date: 31-10-18
				Time:		Time: 9:00
SAMPLE CONDITION AS RECEIVED (lab use only)						
Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>						
Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>						
Cooling Initiated <input type="checkbox"/>						
INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C		
				7.4		

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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



Sample Receipt Confirmation

Report Distribution:

Company Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: Brent Parsons
Address: 501 Krug St., Suite 202
Kitchener, ON, N2B 1L3
Phone: 519-576-1711
Fax: 866-205-7766
Email: deborah.sinclair@environmentalsciences.ca
brent.parsons@environmentalsciences.ca
EDD Email: --
Distribution: Hard Copy: N Email: Y Fax: N EDD: N

Invoice Distribution:

Acct Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: ACCOUNTS PAYABLE
Address: 1-5 Chancery Lane,
Bracebridge, ON, P1L 2E3
Phone: 705-645-0021
Fax: 705-457-5811
Invoice Email: deborah.sinclair@environmentalsciences.ca
accounting@environmentalsciences.ca
Project #: N/A
Account #: 20126

Client Information:

Job Reference #:
Project PO #:
Legal Site Description: N/A
Quote #: Q69690

Date Sampled: 29-OCT-18
Date Received: 31-OCT-18
Sampled By:
Chain Of Custody: --

Workorder Summary:

Lab Work Order #: L2189633
Estimated completion date: 15-NOV-18
11 Samples received at ALS in LONDON

Account Manager: Gayle Braun
Estimated sample disposal date: See Sample Disposal Information section below.

Lab Sample ID	Client Sample ID	Date Sampled	Date Received	Sample Due Date	Priority Flag	Sample Type	Client Job#
L2189633-1	OL-1	29-OCT-18 01:30	31-OCT-18 09:00	15-NOV-18		WATER	
L2189633-2	OL-2	29-OCT-18 12:45	31-OCT-18 09:00	15-NOV-18		WATER	
L2189633-3	OL-4	29-OCT-18 01:32	31-OCT-18 09:00	15-NOV-18		WATER	
L2189633-4	OL-7	29-OCT-18 01:10	31-OCT-18 09:00	15-NOV-18		WATER	
L2189633-5	OL-9	29-OCT-18 13:00	31-OCT-18 09:00	15-NOV-18		WATER	
L2189633-6	OL-3	29-OCT-18 01:24	31-OCT-18 09:00	06-NOV-18		WATER	
L2189633-7	OL-5	29-OCT-18 01:20	31-OCT-18 09:00	06-NOV-18		WATER	
L2189633-8	OL-6	29-OCT-18 01:15	31-OCT-18 09:00	06-NOV-18		WATER	
L2189633-9	OL-8	29-OCT-18 01:05	31-OCT-18 09:00	06-NOV-18		WATER	
L2189633-10	OL-10	29-OCT-18 12:55	31-OCT-18 09:00	06-NOV-18		WATER	
L2189633-11	OL-11	29-OCT-18 12:50	31-OCT-18 09:00	06-NOV-18		WATER	



**Analysis
Requested :**

	Chlorophyll a by fluorometry	Fecal streptococcus	Pseudomonas aeruginosa	Sample Handling and Disposal Fee
OL-1	✓	✓	✓	✓
OL-2	✓	✓	✓	✓
OL-4	✓	✓	✓	✓
OL-7	✓	✓	✓	✓
OL-9	✓	✓	✓	✓
OL-3		✓		✓
OL-5		✓		✓
OL-6		✓		✓
OL-8		✓		✓
OL-10		✓		✓
OL-11		✓		✓

Hold Time Exceedences: The following samples have exceeded recommended holding times prior to sample receipt.

Analysis Requested	Lab Sample ID	Recommended Hold Time	Date Sampled	Date Received
Chlorophyll a by fluorometry	L2189633-1, 3, 4	48 hours	29-OCT-18	31-OCT-18
Fecal streptococcus	L2189633-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	30 hours	29-OCT-18	31-OCT-18
Pseudomonas aeruginosa	L2189633-1, 2, 3, 4, 5	30 hours	29-OCT-18	31-OCT-18

Sample Integrity Observations: No observations were identified for this work order submission.

Notice of Sub-contract Laboratory Service

Please be advised that the following tests will be subcontracted to the corresponding laboratory:

Pseudomonas aeruginosa subcontracted to: ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA
Chlorophyll a by fluorometry subcontracted to: ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA
Fecal streptococcus subcontracted to: ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Please contact your Account Manager immediately should you have questions or concerns regarding this arrangement. Approval of this arrangement shall be implied unless otherwise notified by you.



Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



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L2189633-COFC

COC Number: 17-0050

Page 1 of 1

12189633

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																																																																					
Company: HUTCHINSON ENV		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)		Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply																																																																					
Contact: BRENT PARSONS		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		PRIORITY (Business Days) 4 day [P4-20%] <input type="checkbox"/> 3 day [P3-25%] <input type="checkbox"/> 2 day [P2-50%] <input type="checkbox"/>		EMERGENCY 1 Business day [E - 100%] Same Day, Weekend or Statutory holiday [E2 - 200%] (Laboratory opening fees may apply) <input type="checkbox"/>																																																																			
Phone: 519-576-1711		<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked																																																																							
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Street: 501 KRUG ST ST 202		Email 1 or Fax: deborah.sindair@environmentalsciences.ca		For tests that can not be performed according to the service level selected, you will be contacted.																																																																					
City/Province: KITCHENER, ON		Email 2: brent.parsons@environmentalsciences.ca		Analysis Request																																																																					
Postal Code: N2B 1L3		Email 3:		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																																					
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Drinking Water (DW) Samples ¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		Frozen <input type="checkbox"/>		SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>		Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/>		Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>		Cooling Initiated <input type="checkbox"/>																																																													
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Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO				SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)		Released by: Charlie Heidner		Date: 30-10-2018																																																													
				Received by: [Signature]		Date: 10/31/18		Received by: [Signature]		Date: 9:00																																																															

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OCT 2016 FRONT

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

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



www.alsglobal.com

Chain of Custody (COC) / Analytical
Request Form

Canada Toll Free: 1 800 668 9878



L2189621-COFC

COC Number: 17 -

Page of

Report To Contact and company name below will appear on the final report		Report Format		Emergency																																																																									
Company:	HUTCHINSON ENV	Select Report Format:	<input checked="" type="checkbox"/> PDF <input type="checkbox"/> Other	- Contact your AM to confirm all E&P TATs (surcharges may apply)																																																																									
Contact:	BRENT PARSONS	Quality Control (QC) Report with Report	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	TAT if received by 3 pm - business days - no surcharges apply																																																																									
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City/Province:	KTICHENER, ON	Email 2:	brent.parsons@environmentalsciences.ca	For tests that can not be performed according to the service level selected, you will be contacted.																																																																									
Postal Code:	N2B 1L3	Email 3:		Analysis Request																																																																									
Invoice To:	Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Invoice Distribution		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th colspan="12">Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below</th> </tr> <tr> <th colspan="12"> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td colspan="12">NUMBER OF CONTAINERS</td> </tr> <tr> <td>IE COLIFORM</td> <td>ALKALINITY</td> <td>BOD</td> <td>DOC</td> <td>CL NO3, SO4</td> <td>TOTAL METALS + HARDNESS</td> <td>NH3/TKN/TP</td> <td>pH/TSS</td> <td>TP, Fe, TSS</td> <td></td> <td></td> <td></td> </tr> </table> </th> </tr> <tr> <td colspan="12">SAMPLES ON HOLD</td> </tr> <tr> <td colspan="12">SUSPECTED HAZARD (see Special Instructions)</td> </tr> </table>		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below												<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td colspan="12">NUMBER OF CONTAINERS</td> </tr> <tr> <td>IE COLIFORM</td> <td>ALKALINITY</td> <td>BOD</td> <td>DOC</td> <td>CL NO3, SO4</td> <td>TOTAL METALS + HARDNESS</td> <td>NH3/TKN/TP</td> <td>pH/TSS</td> <td>TP, Fe, TSS</td> <td></td> <td></td> <td></td> </tr> </table>												NUMBER OF CONTAINERS												IE COLIFORM	ALKALINITY	BOD	DOC	CL NO3, SO4	TOTAL METALS + HARDNESS	NH3/TKN/TP	pH/TSS	TP, Fe, TSS				SAMPLES ON HOLD												SUSPECTED HAZARD (see Special Instructions)											
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LSD:		Location:																																																																											
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ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																																																																									
1	OL-1	29-10-18	13:30	WATER	5																																																																								
2	OL-2		12:46	WATER	4																																																																								
3	OL-4		13:22	WATER	4																																																																								
4	OL-7		13:10	WATER	4																																																																								
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Narke Heidman	30-10-18	11:30		31-10-18	9:00																																																																								

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



HUTCHINSON ENVIRONMENTAL SCIENCES
LTD
ATTN: Brent Parsons
501 Krug St.
Suite 202
Kitchener ON N2B 1L3

Date Received: 14-FEB-19
Report Date: 27-FEB-19 13:03 (MT)
Version: FINAL

Client Phone: 519-576-1711

Certificate of Analysis

Lab Work Order #: L2232740
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Comments: ADDITIONAL 14-FEB-19 11:39

Connor Cattani
Account Manager

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ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch	
L2232740-1	TRIB 4								
	Sampled By: CLIENT on 11-FEB-19								
	Matrix: WATER								
	Bacteriological Tests								
	Fecal Streptococcus	66	PEHR	1	CFU/100mL		14-FEB-19	R4511527	
L2232740-2	Pseudomonas aeruginosa	<1		1	CFU/100mL		14-FEB-19	R4511940	
	Plant Pigments								
	Chlorophyll a	<0.10		0.10	ug/L	14-FEB-19	14-FEB-19	R4530568	
	L2232740-2	TRIB 5							
		Sampled By: CLIENT on 11-FEB-19							
Matrix: WATER									
Bacteriological Tests									
Fecal Streptococcus		74	PEHR	1	CFU/100mL		14-FEB-19	R4511527	
L2232740-3	Pseudomonas aeruginosa	<1		1	CFU/100mL		14-FEB-19	R4511940	
	Plant Pigments								
	Chlorophyll a	0.90		0.10	ug/L	14-FEB-19	14-FEB-19	R4530568	

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Qualifiers for Individual Samples Listed:

Sample Number	Client ID	Qualifier	Description
L2232740-1	TRIB 4	UIC	Unreliable: Improper Container
L2232740-2	TRIB 5	UIC	Unreliable: Improper Container

Sample Parameter Qualifier key listed:

Qualifier	Description
PEHR	Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CHL/A-ACET-FLUORO-WP	Water	Chlorophyll a by fluorometry	EPA 445.0 ACET
This analysis is done using procedures modified from EPA method 445.0. Chlorophyll a is determined by a 90 % acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
FECALSTREP-MF-WP	Water	Fecal streptococcus	APHA 9230C (modified)
An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on selective media and incubated at 35°C for 47 +/- 1 hour. Colonies exhibiting characteristic morphology for the target group on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed.			
Due to taxonomic fluidity, the term "Fecal Streptococcus" is applied here to include all members of genus names Streptococcus and Enterococcus as described in the reference method.			
PSA-MF-WP	Water	Pseudomonas aeruginosa	APHA 9213E
A known volume of sample (typically 100 mL) is filtered through a 0.45 micron membrane filter. The filter is placed on the surface of a selective agar plate and incubated for 72 hours at 41.5 +/- 0.5 C. Plates are examined under low magnification and colonies exhibiting typical morphology are counted. Results are reported as the number of presumptive P. aeruginosa CFU/100 mL. Additional confirmation tests can be performed upon request.			

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

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

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

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

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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

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

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

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



Quality Control Report

Workorder: L2232740

Report Date: 27-FEB-19

Page 1 of 3

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CHL/A-ACET-FLUORO-WP Water								
Batch	R4530568							
WG2996476-3	DUP	L2232473-1						
Chlorophyll a		20.8	20.9		ug/L	0.5	35	14-FEB-19
WG2996476-2	LCS							
Chlorophyll a			101.1		%		80-120	27-FEB-19
WG2996476-1	MB							
Chlorophyll a			<0.10		ug/L		0.1	14-FEB-19
FECALSTREP-MF-WP Water								
Batch	R4511527							
WG2989022-1	MB							
Fecal Streptococcus			<1		CFU/100mL		1	14-FEB-19
PSA-MF-WP Water								
Batch	R4511940							
WG2989035-1	MB							
Pseudomonas aeruginosa			<1		CFU/100mL		1	14-FEB-19

Quality Control Report

Workorder: L2232740

Report Date: 27-FEB-19

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Page 2 of 3

Contact: Brent Parsons

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Quality Control Report

Workorder: L2232740

Report Date: 27-FEB-19

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3
Contact: Brent Parsons

Page 3 of 3

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Bacteriological Tests							
Fecal streptococcus	1	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	2	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
Pseudomonas aeruginosa	1	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	2	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
Plant Pigments							
Chlorophyll a by fluorometry	1	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	2	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2232740 were received on 14-FEB-19 09:00.

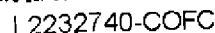
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



Canada Toll Free: 1 800 668 9878



COC Number: 14 - 501529

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NA-EM-03284-DS-Ex-0004 January 2017

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

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



HUTCHINSON ENVIRONMENTAL SCIENCES
LTD
ATTN: Brent Parsons
501 Krug St.
Suite 202
Kitchener ON N2B 1L3

Date Received: 13-FEB-19
Report Date: 20-FEB-19 12:50 (MT)
Version: FINAL

Client Phone: 519-576-1711

Certificate of Analysis

Lab Work Order #: L2232152
Project P.O. #: NOT SUBMITTED
Job Reference: 180050
C of C Numbers: LON-180129
Legal Site Desc:

Gayle Braun
Senior Account Manager

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

ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-1 OL-1 Sampled By: CLIENT on 11-FEB-19 @ 16:04 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	74	HTC	10	mg/L		14-FEB-19	
pH	7.97		0.10	pH units		14-FEB-19	R4508730
Total Suspended Solids	<2.0		2.0	mg/L	15-FEB-19	16-FEB-19	R4511468
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	73		10	mg/L		14-FEB-19	R4508730
Ammonia, Total (as N)	0.071		0.010	mg/L		14-FEB-19	R4508876
Chloride (Cl)	51.6		0.50	mg/L		14-FEB-19	R4509769
Nitrate (as N)	0.080		0.020	mg/L		14-FEB-19	R4509769
Total Kjeldahl Nitrogen	0.37		0.15	mg/L	14-FEB-19	15-FEB-19	R4509192
Phosphorus, Total	0.0532		0.0030	mg/L	15-FEB-19	19-FEB-19	R4512420
Sulfate (SO4)	2.04		0.30	mg/L		14-FEB-19	R4509769
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					13-FEB-19	R4505827
Dissolved Organic Carbon	5.88		0.50	mg/L	13-FEB-19	19-FEB-19	R4515112
Bacteriological Tests							
E. Coli	0		0	CFU/100mL		14-FEB-19	R4507107
Fecal Coliforms	0		0	CFU/100mL		14-FEB-19	R4507113
Total Metals							
Aluminum (Al)-Total	0.0155		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Antimony (Sb)-Total	0.00011		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Arsenic (As)-Total	0.00054		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Barium (Ba)-Total	0.0159		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Boron (B)-Total	<0.010		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Cadmium (Cd)-Total	0.0000061		0.0000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Calcium (Ca)-Total	25.1		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Copper (Cu)-Total	<0.0010		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Iron (Fe)-Total	0.013		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Lead (Pb)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Lithium (Li)-Total	<0.0010		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Magnesium (Mg)-Total	2.66		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Manganese (Mn)-Total	0.00374		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Molybdenum (Mo)-Total	0.000183		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Phosphorus (P)-Total	0.068		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Potassium (K)-Total	2.20		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Rubidium (Rb)-Total	0.00168		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Selenium (Se)-Total	0.000070		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-1 OL-1 Sampled By: CLIENT on 11-FEB-19 @ 16:04 Matrix: WATER								
Total Metals								
Silicon (Si)-Total		0.15		0.10	mg/L	14-FEB-19	14-FEB-19	R4506908
Silver (Ag)-Total		<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Sodium (Na)-Total		28.3		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Strontium (Sr)-Total		0.0626		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Sulfur (S)-Total		0.84		0.50	mg/L	14-FEB-19	14-FEB-19	R4506908
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Thorium (Th)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Tin (Sn)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Titanium (Ti)-Total		0.00035		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Tungsten (W)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Uranium (U)-Total		0.000022		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Vanadium (V)-Total		<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Zinc (Zn)-Total		<0.0030		0.0030	mg/L	14-FEB-19	14-FEB-19	R4506908
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Aggregate Organics								
BOD		<2.0		2.0	mg/L	13-FEB-19	18-FEB-19	R4513593
L2232152-2 OL-2 Sampled By: CLIENT on 11-FEB-19 @ 13:35 Matrix: WATER								
Physical Tests								
Hardness (as CaCO3)		78	HTC	10	mg/L		14-FEB-19	
pH		7.95		0.10	pH units		14-FEB-19	R4508730
Total Suspended Solids		<2.0		2.0	mg/L	14-FEB-19	15-FEB-19	R4509378
Anions and Nutrients								
Alkalinity, Total (as CaCO3)		78		10	mg/L		14-FEB-19	R4508730
Ammonia, Total (as N)		0.051		0.010	mg/L		14-FEB-19	R4508876
Chloride (Cl)		57.9		0.50	mg/L		14-FEB-19	R4509769
Nitrate (as N)		0.090		0.020	mg/L		14-FEB-19	R4509769
Total Kjeldahl Nitrogen		0.74		0.15	mg/L	14-FEB-19	15-FEB-19	R4509192
Phosphorus, Total		0.0372		0.0030	mg/L	15-FEB-19	19-FEB-19	R4512420
Sulfate (SO4)		2.17		0.30	mg/L		14-FEB-19	R4509769
Organic / Inorganic Carbon								
Dissolved Carbon Filtration Location		LAB					13-FEB-19	R4505827
Dissolved Organic Carbon		5.76		0.50	mg/L	13-FEB-19	19-FEB-19	R4515112
Bacteriological Tests								
E. Coli		1	PEHT	0	CFU/100mL		14-FEB-19	R4507107
Fecal Coliforms		0	PEHT	0	CFU/100mL		14-FEB-19	R4507113
Total Metals								
Aluminum (Al)-Total		0.0252		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Antimony (Sb)-Total		0.00011		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Arsenic (As)-Total		0.00054		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-2 OL-2 Sampled By: CLIENT on 11-FEB-19 @ 13:35 Matrix: WATER								
Total Metals								
Barium (Ba)-Total		0.0171		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Beryllium (Be)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Bismuth (Bi)-Total		<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Boron (B)-Total		<0.010		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Cadmium (Cd)-Total		0.0000169		0.0000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Calcium (Ca)-Total		26.4		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cesium (Cs)-Total		<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Chromium (Cr)-Total		<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cobalt (Co)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Copper (Cu)-Total		0.0013		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Iron (Fe)-Total		0.027		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Lead (Pb)-Total		0.000057		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Lithium (Li)-Total		<0.0010		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Magnesium (Mg)-Total		2.83		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Manganese (Mn)-Total		0.00341		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Molybdenum (Mo)-Total		0.000109		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Nickel (Ni)-Total		<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Phosphorus (P)-Total		<0.050		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Potassium (K)-Total		1.83		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Rubidium (Rb)-Total		0.00151		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Selenium (Se)-Total		0.000053		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Silicon (Si)-Total		<0.10		0.10	mg/L	14-FEB-19	14-FEB-19	R4506908
Silver (Ag)-Total		<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Sodium (Na)-Total		32.1		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Strontium (Sr)-Total		0.0667		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Sulfur (S)-Total		0.87		0.50	mg/L	14-FEB-19	14-FEB-19	R4506908
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Thorium (Th)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Tin (Sn)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Titanium (Ti)-Total		<0.0080	DLUI	0.0080	mg/L	14-FEB-19	14-FEB-19	R4506908
Tungsten (W)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Uranium (U)-Total		0.000023		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Vanadium (V)-Total		<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Zinc (Zn)-Total		0.0047		0.0030	mg/L	14-FEB-19	14-FEB-19	R4506908
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Aggregate Organics								
BOD		2.0		2.0	mg/L	13-FEB-19	18-FEB-19	R4513593
L2232152-3 OL-4 Sampled By: CLIENT on 11-FEB-19 @ 15:25 Matrix: WATER								
Physical Tests								

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-3 OL-4 Sampled By: CLIENT on 11-FEB-19 @ 15:25 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	70	HTC	10	mg/L		14-FEB-19	
pH	7.92		0.10	pH units		14-FEB-19	R4508730
Total Suspended Solids	<2.0		2.0	mg/L	14-FEB-19	15-FEB-19	R4509378
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	69		10	mg/L		14-FEB-19	R4508730
Ammonia, Total (as N)	0.160		0.010	mg/L		14-FEB-19	R4508876
Chloride (Cl)	48.9		0.50	mg/L		14-FEB-19	R4509769
Nitrate (as N)	0.206		0.020	mg/L		14-FEB-19	R4509769
Total Kjeldahl Nitrogen	0.82		0.15	mg/L	15-FEB-19	15-FEB-19	R4509888
Phosphorus, Total	0.0182		0.0030	mg/L	15-FEB-19	19-FEB-19	R4512420
Sulfate (SO4)	2.04		0.30	mg/L		14-FEB-19	R4509769
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					13-FEB-19	R4505827
Dissolved Organic Carbon	5.56		0.50	mg/L	13-FEB-19	19-FEB-19	R4515112
Bacteriological Tests							
E. Coli	0	PEHT	0	CFU/100mL		14-FEB-19	R4507107
Fecal Coliforms	0	PEHT	0	CFU/100mL		14-FEB-19	R4507113
Total Metals							
Aluminum (Al)-Total	0.0101		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Antimony (Sb)-Total	0.00013		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Arsenic (As)-Total	0.00069		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Barium (Ba)-Total	0.0151		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Boron (B)-Total	<0.010		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Cadmium (Cd)-Total	0.0000144		0.0000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Calcium (Ca)-Total	24.1		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Chromium (Cr)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Copper (Cu)-Total	0.0014		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Iron (Fe)-Total	0.012		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Lead (Pb)-Total	0.000090		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Lithium (Li)-Total	<0.0010		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Magnesium (Mg)-Total	2.50		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Manganese (Mn)-Total	0.00342		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Molybdenum (Mo)-Total	0.000098		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Nickel (Ni)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Phosphorus (P)-Total	<0.050		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Potassium (K)-Total	1.63		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Rubidium (Rb)-Total	0.00121		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Selenium (Se)-Total	0.000064		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-4 OL-7 Sampled By: CLIENT on 11-FEB-19 @ 14:40 Matrix: WATER								
Total Metals								
Barium (Ba)-Total		0.0149		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Beryllium (Be)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Bismuth (Bi)-Total		<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Boron (B)-Total		<0.010		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Cadmium (Cd)-Total		0.0000297		0.0000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Calcium (Ca)-Total		22.0		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cesium (Cs)-Total		<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Chromium (Cr)-Total		<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cobalt (Co)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Copper (Cu)-Total		0.0049		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Iron (Fe)-Total		0.062		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Lead (Pb)-Total		0.000093		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Lithium (Li)-Total		<0.0010		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Magnesium (Mg)-Total		2.40		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Manganese (Mn)-Total		0.0101		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Molybdenum (Mo)-Total		0.000141		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Nickel (Ni)-Total		<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Phosphorus (P)-Total		0.092		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Potassium (K)-Total		2.27		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Rubidium (Rb)-Total		0.00173		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Selenium (Se)-Total		0.000066		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Silicon (Si)-Total		0.22		0.10	mg/L	14-FEB-19	14-FEB-19	R4506908
Silver (Ag)-Total		<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Sodium (Na)-Total		30.7		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Strontium (Sr)-Total		0.0527		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Sulfur (S)-Total		1.11		0.50	mg/L	14-FEB-19	14-FEB-19	R4506908
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Thorium (Th)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Tin (Sn)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Titanium (Ti)-Total		0.00128		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Tungsten (W)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Uranium (U)-Total		0.000027		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Vanadium (V)-Total		<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Zinc (Zn)-Total		0.0039		0.0030	mg/L	14-FEB-19	14-FEB-19	R4506908
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Aggregate Organics								
BOD		2.9		2.0	mg/L	14-FEB-19	19-FEB-19	R4513627
L2232152-5 OL-9 Sampled By: CLIENT on 11-FEB-19 @ 14:16 Matrix: WATER								
Physical Tests								

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-5 OL-9 Sampled By: CLIENT on 11-FEB-19 @ 14:16 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	80	HTC	10	mg/L		14-FEB-19	
pH	7.59		0.10	pH units		14-FEB-19	R4508730
Total Suspended Solids	3.1		2.0	mg/L	14-FEB-19	15-FEB-19	R4509378
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	80		10	mg/L		14-FEB-19	R4508730
Ammonia, Total (as N)	0.210		0.010	mg/L		14-FEB-19	R4508876
Chloride (Cl)	51.5		0.50	mg/L		14-FEB-19	R4509769
Nitrate (as N)	0.299		0.020	mg/L		14-FEB-19	R4509769
Total Kjeldahl Nitrogen	1.02		0.15	mg/L	15-FEB-19	15-FEB-19	R4509888
Phosphorus, Total	0.151		0.0030	mg/L	15-FEB-19	19-FEB-19	R4512420
Sulfate (SO4)	2.52		0.30	mg/L		14-FEB-19	R4509769
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					13-FEB-19	R4505827
Dissolved Organic Carbon	8.23		0.50	mg/L	13-FEB-19	19-FEB-19	R4515112
Bacteriological Tests							
E. Coli	14	PEHT	0	CFU/100mL		14-FEB-19	R4507107
Fecal Coliforms	21	PEHT	0	CFU/100mL		14-FEB-19	R4507113
Total Metals							
Aluminum (Al)-Total	0.0658		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Antimony (Sb)-Total	0.00016		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Arsenic (As)-Total	0.00059		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Barium (Ba)-Total	0.0187		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Boron (B)-Total	0.010		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Cadmium (Cd)-Total	0.0000519		0.0000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Calcium (Ca)-Total	27.1		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cobalt (Co)-Total	0.00011		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Copper (Cu)-Total	0.0024		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Iron (Fe)-Total	0.091		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Lead (Pb)-Total	0.000162		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Lithium (Li)-Total	<0.0010		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Magnesium (Mg)-Total	2.92		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Manganese (Mn)-Total	0.0390		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Molybdenum (Mo)-Total	0.000217		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Phosphorus (P)-Total	0.201		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Potassium (K)-Total	4.38		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Rubidium (Rb)-Total	0.00210		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Selenium (Se)-Total	0.000094		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-5 OL-9 Sampled By: CLIENT on 11-FEB-19 @ 14:16 Matrix: WATER								
Total Metals								
Silicon (Si)-Total		0.43		0.10	mg/L	14-FEB-19	14-FEB-19	R4506908
Silver (Ag)-Total		<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Sodium (Na)-Total		29.8		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Strontium (Sr)-Total		0.0638		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Sulfur (S)-Total		0.96		0.50	mg/L	14-FEB-19	14-FEB-19	R4506908
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Thorium (Th)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Tin (Sn)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Titanium (Ti)-Total		0.00281		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Tungsten (W)-Total		<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Uranium (U)-Total		0.000050		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Vanadium (V)-Total		<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Zinc (Zn)-Total		0.0103		0.0030	mg/L	14-FEB-19	14-FEB-19	R4506908
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Aggregate Organics								
BOD		2.7		2.0	mg/L	14-FEB-19	19-FEB-19	R4513627
L2232152-12 OL-1-BOTTOM Sampled By: CLIENT on 11-FEB-19 Matrix: WATER								
Physical Tests								
Total Suspended Solids		<2.0		2.0	mg/L	15-FEB-19	16-FEB-19	R4511468
Anions and Nutrients								
Phosphorus, Total		0.0193		0.0030	mg/L	15-FEB-19	19-FEB-19	R4512420
Total Metals								
Iron (Fe)-Total		0.059		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
L2232152-13 TRIB 4 Sampled By: CLIENT on 11-FEB-19 @ 13:00 Matrix: WATER								
Physical Tests								
Hardness (as CaCO3)		97	HTC	10	mg/L		14-FEB-19	
pH		7.03		0.10	pH units		14-FEB-19	R4508730
Total Suspended Solids		10.5		2.0	mg/L	14-FEB-19	15-FEB-19	R4509378
Anions and Nutrients								
Alkalinity, Total (as CaCO3)		108		10	mg/L		14-FEB-19	R4508730
Ammonia, Total (as N)		0.94	DLHC	0.10	mg/L		14-FEB-19	R4508876
Chloride (Cl)		6.69		0.50	mg/L		14-FEB-19	R4509769
Nitrate (as N)		0.843		0.020	mg/L		14-FEB-19	R4509769
Total Kjeldahl Nitrogen		2.37		0.15	mg/L	15-FEB-19	15-FEB-19	R4509888
Phosphorus, Total		0.572		0.0030	mg/L	15-FEB-19	19-FEB-19	R4512420
Sulfate (SO4)		3.65		0.30	mg/L		14-FEB-19	R4509769
Organic / Inorganic Carbon								
Dissolved Carbon Filtration Location		LAB					13-FEB-19	R4505827

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-13 TRIB 4 Sampled By: CLIENT on 11-FEB-19 @ 13:00 Matrix: WATER							
Organic / Inorganic Carbon							
Dissolved Organic Carbon	22.9		0.50	mg/L	13-FEB-19	19-FEB-19	R4515112
Bacteriological Tests							
E. Coli	4	PEHT	0	CFU/100mL		14-FEB-19	R4507107
Fecal Coliforms	5	PEHT	0	CFU/100mL		14-FEB-19	R4507113
Total Metals							
Aluminum (Al)-Total	0.169		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Antimony (Sb)-Total	0.00013		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Arsenic (As)-Total	0.00053		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Barium (Ba)-Total	0.0251		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Boron (B)-Total	0.011		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Cadmium (Cd)-Total	0.0000294		0.0000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Calcium (Ca)-Total	32.5		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cesium (Cs)-Total	0.000011		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Chromium (Cr)-Total	0.00055		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Cobalt (Co)-Total	0.00047		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Copper (Cu)-Total	0.0052		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Iron (Fe)-Total	0.206		0.010	mg/L	14-FEB-19	14-FEB-19	R4506908
Lead (Pb)-Total	0.000167		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Lithium (Li)-Total	<0.0010		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Magnesium (Mg)-Total	3.72		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Manganese (Mn)-Total	0.156		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Molybdenum (Mo)-Total	0.000509		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Phosphorus (P)-Total	0.635		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Potassium (K)-Total	11.3		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Rubidium (Rb)-Total	0.00236		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Selenium (Se)-Total	0.000198		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Silicon (Si)-Total	2.00		0.10	mg/L	14-FEB-19	14-FEB-19	R4506908
Silver (Ag)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Sodium (Na)-Total	3.18		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Strontium (Sr)-Total	0.0599		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Sulfur (S)-Total	1.32		0.50	mg/L	14-FEB-19	14-FEB-19	R4506908
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Thorium (Th)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Tin (Sn)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Titanium (Ti)-Total	0.00680		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Tungsten (W)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Uranium (U)-Total	0.000289		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232152-14 TRIB 5 Sampled By: CLIENT on 11-FEB-19 @ 13:11 Matrix: WATER							
Total Metals							
Lithium (Li)-Total	<0.0010		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Magnesium (Mg)-Total	3.61		0.0050	mg/L	14-FEB-19	14-FEB-19	R4506908
Manganese (Mn)-Total	0.239		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Molybdenum (Mo)-Total	0.000561		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Nickel (Ni)-Total	0.00056		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Phosphorus (P)-Total	0.587		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Potassium (K)-Total	11.5		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Rubidium (Rb)-Total	0.00255		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Selenium (Se)-Total	0.000215		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Silicon (Si)-Total	1.85		0.10	mg/L	14-FEB-19	14-FEB-19	R4506908
Silver (Ag)-Total	<0.000050		0.000050	mg/L	14-FEB-19	14-FEB-19	R4506908
Sodium (Na)-Total	3.45		0.050	mg/L	14-FEB-19	14-FEB-19	R4506908
Strontium (Sr)-Total	0.0589		0.0010	mg/L	14-FEB-19	14-FEB-19	R4506908
Sulfur (S)-Total	1.25		0.50	mg/L	14-FEB-19	14-FEB-19	R4506908
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	14-FEB-19	14-FEB-19	R4506908
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Thorium (Th)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Tin (Sn)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Titanium (Ti)-Total	0.00484		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Tungsten (W)-Total	<0.00010		0.00010	mg/L	14-FEB-19	14-FEB-19	R4506908
Uranium (U)-Total	0.000245		0.000010	mg/L	14-FEB-19	14-FEB-19	R4506908
Vanadium (V)-Total	0.00125		0.00050	mg/L	14-FEB-19	14-FEB-19	R4506908
Zinc (Zn)-Total	0.0137		0.0030	mg/L	14-FEB-19	14-FEB-19	R4506908
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	14-FEB-19	14-FEB-19	R4506908
Aggregate Organics							
BOD	11.1		2.0	mg/L	14-FEB-19	19-FEB-19	R4513627

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Fecal Coliforms	DUP-H	L2232152-1, -13, -14, -2, -3, -4, -5

Sample Parameter Qualifier key listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLUI	Detection Limit Raised: Unknown Interference generated an apparent false positive test result.
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
PEHT	Parameter Exceeded Recommended Holding Time Prior to Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-WT	Water	Alkalinity, Total (as CaCO3)	EPA 310.2
This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.			
BOD-WT	Water	BOD	APHA 5210 B
This analysis is carried out using procedures adapted from APHA Method 5210B - "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-WT	Water	Chloride by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
DOC-WT	Water	Dissolved Organic Carbon	APHA 5310B
Sample is filtered through a 0.45um filter, then injected into a heated reaction chamber which is packed with an oxidative catalyst. The water is vaporized and the organic carbon is oxidized to carbon dioxide. The carbon dioxide is transported in a carrier gas and is measured by a non-dispersive infrared detector.			
EC-MF-WT	Water	E. coli	SM 9222D
A 100 mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at 44.5 –0 .2 °C for 24 – 2 h. Method ID: WT-TM-1200			
FC-MF-WT	Water	Fecal Coliforms	SM 9222D
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC agar and incubated at 24–2h@44.5–0.2°C. Method ID: WT-TM-1200			
HARDNESS-CALC-WT	Water	Hardness	APHA 2340 B
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.			
MET-T-CCMS-WT	Water	Total Metals in Water by CRC	EPA 200.2/6020A (mod)
Water samples are digested with nitric and/or perchloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
NH3-F-WT	Water	Ammonia in Water by Fluorescence	EPA 350.1
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-WT	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.			
NO3-IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is deteremined colourimetrically after persulphate digestion of the sample.			

PH-WT	Water	pH	APHA 4500 H-Electrode
Water samples are analyzed directly by a calibrated pH meter.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days			
SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
SOLIDS-TSS-WT	Water	Suspended solids	APHA 2540 D-Gravimetric
A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 104–1°C for a minimum of four hours or until a constant weight is achieved.			
TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-Norg D
This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 Celsius with analysis using an automated colorimetric method.			

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

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

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

LON-180129

GLOSSARY OF REPORT TERMS
Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

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



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-WT		Water						
Batch	R4508730							
WG2988667-16	DUP	WG2988667-15						
Alkalinity, Total (as CaCO3)		95	95		mg/L	0.2	20	14-FEB-19
WG2988667-14	LCS							
Alkalinity, Total (as CaCO3)			108.3		%		85-115	14-FEB-19
WG2988667-13	MB							
Alkalinity, Total (as CaCO3)			<10		mg/L		10	14-FEB-19
BOD-WT		Water						
Batch	R4513593							
WG2988229-2	DUP	L2231330-3						
BOD		<2.0	<2.0	RPD-NA	mg/L	N/A	20	18-FEB-19
WG2988229-3	LCS							
BOD			99.0		%		85-115	18-FEB-19
WG2988229-1	MB							
BOD			<2.0		mg/L		2	18-FEB-19
Batch	R4513627							
WG2989072-2	DUP	L2232371-1						
BOD		<2.0	<2.0	RPD-NA	mg/L	N/A	20	19-FEB-19
WG2989072-3	LCS							
BOD			96.0		%		85-115	19-FEB-19
WG2989072-1	MB							
BOD			<2.0		mg/L		2	19-FEB-19
CL-IC-N-WT		Water						
Batch	R4509769							
WG2988849-14	DUP	WG2988849-13						
Chloride (Cl)		6.76	6.69		mg/L	1.0	20	14-FEB-19
WG2988849-4	DUP	WG2988849-3						
Chloride (Cl)		20.0	20.0		mg/L	0.1	20	14-FEB-19
WG2988849-12	LCS							
Chloride (Cl)			102.3		%		90-110	14-FEB-19
WG2988849-2	LCS							
Chloride (Cl)			102.3		%		90-110	14-FEB-19
WG2988849-1	MB							
Chloride (Cl)			<0.50		mg/L		0.5	14-FEB-19
WG2988849-11	MB							
Chloride (Cl)			<0.50		mg/L		0.5	14-FEB-19
WG2988849-15	MS	WG2988849-13						
Chloride (Cl)			104.5		%		75-125	14-FEB-19
WG2988849-5	MS	WG2988849-3						



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-N-WT								
Water								
Batch	R4509769							
WG2988849-5	MS	WG2988849-3						
Chloride (Cl)			105.9		%		75-125	14-FEB-19
DOC-WT								
Water								
Batch	R4515112							
WG2988513-3	DUP	L2232152-1						
Dissolved Organic Carbon		5.88	6.03		mg/L	2.6	25	19-FEB-19
WG2988513-2	LCS							
Dissolved Organic Carbon			96.2		%		70-130	19-FEB-19
WG2988513-1	MB							
Dissolved Organic Carbon			<0.50		mg/L		0.5	19-FEB-19
WG2988513-4	MS	L2232152-1						
Dissolved Organic Carbon			100.2		%		70-130	19-FEB-19
EC-MF-WT								
Water								
Batch	R4507107							
WG2988279-3	DUP	L2232152-3						
E. Coli		0	<10	RPD-NA	CFU/100mL	N/A	65	14-FEB-19
WG2988279-1	MB							
E. Coli			0		CFU/100mL		1	14-FEB-19
FC-MF-WT								
Water								
Batch	R4507113							
WG2988283-3	DUP	L2232152-5						
Fecal Coliforms		21	<10	DUP-H	CFU/100mL	N/A	65	14-FEB-19
WG2988283-1	MB							
Fecal Coliforms			0		CFU/100mL		1	14-FEB-19
MET-T-CCMS-WT								
Water								
Batch	R4506908							
WG2988595-4	DUP	WG2988595-3						
Aluminum (Al)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	14-FEB-19
Antimony (Sb)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	14-FEB-19
Arsenic (As)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	14-FEB-19
Barium (Ba)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	14-FEB-19
Beryllium (Be)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	14-FEB-19
Bismuth (Bi)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	14-FEB-19
Boron (B)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	14-FEB-19
Cadmium (Cd)-Total		<0.0000050	<0.0000050	RPD-NA	mg/L	N/A	20	14-FEB-19



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4506908							
WG2988595-4	DUP	WG2988595-3						
Calcium (Ca)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-FEB-19
Chromium (Cr)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	14-FEB-19
Cesium (Cs)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	14-FEB-19
Cobalt (Co)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	14-FEB-19
Copper (Cu)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	14-FEB-19
Iron (Fe)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	14-FEB-19
Lead (Pb)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	14-FEB-19
Lithium (Li)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	14-FEB-19
Magnesium (Mg)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	14-FEB-19
Manganese (Mn)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	14-FEB-19
Molybdenum (Mo)-Total		0.000072	0.000068		mg/L	5.3	20	14-FEB-19
Nickel (Ni)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	14-FEB-19
Phosphorus (P)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-FEB-19
Potassium (K)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-FEB-19
Rubidium (Rb)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	14-FEB-19
Selenium (Se)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	14-FEB-19
Silicon (Si)-Total		<0.10	<0.10	RPD-NA	mg/L	N/A	20	14-FEB-19
Silver (Ag)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	14-FEB-19
Sodium (Na)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-FEB-19
Strontium (Sr)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	14-FEB-19
Sulfur (S)-Total		<0.50	<0.50	RPD-NA	mg/L	N/A	25	14-FEB-19
Thallium (Tl)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	14-FEB-19
Tellurium (Te)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	14-FEB-19
Thorium (Th)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	25	14-FEB-19
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	14-FEB-19
Titanium (Ti)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	14-FEB-19
Tungsten (W)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	14-FEB-19
Uranium (U)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	14-FEB-19
Vanadium (V)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	14-FEB-19
Zinc (Zn)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	14-FEB-19
Zirconium (Zr)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	14-FEB-19
WG2988595-2	LCS							
Aluminum (Al)-Total			97.8		%		80-120	14-FEB-19



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4506908							
WG2988595-2	LCS							
Antimony (Sb)-Total			99.3		%		80-120	14-FEB-19
Arsenic (As)-Total			95.1		%		80-120	14-FEB-19
Barium (Ba)-Total			95.4		%		80-120	14-FEB-19
Beryllium (Be)-Total			95.5		%		80-120	14-FEB-19
Bismuth (Bi)-Total			102.6		%		80-120	14-FEB-19
Boron (B)-Total			95.1		%		80-120	14-FEB-19
Cadmium (Cd)-Total			93.9		%		80-120	14-FEB-19
Calcium (Ca)-Total			97.3		%		80-120	14-FEB-19
Chromium (Cr)-Total			96.5		%		80-120	14-FEB-19
Cesium (Cs)-Total			98.1		%		80-120	14-FEB-19
Cobalt (Co)-Total			94.0		%		80-120	14-FEB-19
Copper (Cu)-Total			94.4		%		80-120	14-FEB-19
Iron (Fe)-Total			95.1		%		80-120	14-FEB-19
Lead (Pb)-Total			103.8		%		80-120	14-FEB-19
Lithium (Li)-Total			99.5		%		80-120	14-FEB-19
Magnesium (Mg)-Total			94.4		%		80-120	14-FEB-19
Manganese (Mn)-Total			94.4		%		80-120	14-FEB-19
Molybdenum (Mo)-Total			98.2		%		80-120	14-FEB-19
Nickel (Ni)-Total			94.0		%		80-120	14-FEB-19
Phosphorus (P)-Total			99.0		%		70-130	14-FEB-19
Potassium (K)-Total			95.0		%		80-120	14-FEB-19
Rubidium (Rb)-Total			97.2		%		80-120	14-FEB-19
Selenium (Se)-Total			96.8		%		80-120	14-FEB-19
Silicon (Si)-Total			100.0		%		60-140	14-FEB-19
Silver (Ag)-Total			97.5		%		80-120	14-FEB-19
Sodium (Na)-Total			95.6		%		80-120	14-FEB-19
Strontium (Sr)-Total			100.6		%		80-120	14-FEB-19
Sulfur (S)-Total			83.4		%		80-120	14-FEB-19
Thallium (Tl)-Total			103.3		%		80-120	14-FEB-19
Tellurium (Te)-Total			96.5		%		80-120	14-FEB-19
Thorium (Th)-Total			101.1		%		70-130	14-FEB-19
Tin (Sn)-Total			95.4		%		80-120	14-FEB-19
Titanium (Ti)-Total			91.8		%		80-120	14-FEB-19



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4506908							
WG2988595-2	LCS							
Tungsten (W)-Total			104.8		%		80-120	14-FEB-19
Uranium (U)-Total			103.9		%		80-120	14-FEB-19
Vanadium (V)-Total			98.0		%		80-120	14-FEB-19
Zinc (Zn)-Total			94.0		%		80-120	14-FEB-19
Zirconium (Zr)-Total			94.0		%		80-120	14-FEB-19
WG2988595-1	MB							
Aluminum (Al)-Total			<0.0050		mg/L		0.005	14-FEB-19
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	14-FEB-19
Arsenic (As)-Total			<0.00010		mg/L		0.0001	14-FEB-19
Barium (Ba)-Total			<0.00010		mg/L		0.0001	14-FEB-19
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	14-FEB-19
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	14-FEB-19
Boron (B)-Total			<0.010		mg/L		0.01	14-FEB-19
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	14-FEB-19
Calcium (Ca)-Total			<0.050		mg/L		0.05	14-FEB-19
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	14-FEB-19
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	14-FEB-19
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	14-FEB-19
Copper (Cu)-Total			<0.0010		mg/L		0.001	14-FEB-19
Iron (Fe)-Total			<0.010		mg/L		0.01	14-FEB-19
Lead (Pb)-Total			<0.000050		mg/L		0.00005	14-FEB-19
Lithium (Li)-Total			<0.0010		mg/L		0.001	14-FEB-19
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	14-FEB-19
Manganese (Mn)-Total			<0.00050		mg/L		0.0005	14-FEB-19
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	14-FEB-19
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	14-FEB-19
Phosphorus (P)-Total			<0.050		mg/L		0.05	14-FEB-19
Potassium (K)-Total			<0.050		mg/L		0.05	14-FEB-19
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	14-FEB-19
Selenium (Se)-Total			<0.000050		mg/L		0.00005	14-FEB-19
Silicon (Si)-Total			<0.10		mg/L		0.1	14-FEB-19
Silver (Ag)-Total			<0.000050		mg/L		0.00005	14-FEB-19
Sodium (Na)-Total			<0.050		mg/L		0.05	14-FEB-19
Strontium (Sr)-Total			<0.0010		mg/L		0.001	14-FEB-19



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4506908							
WG2988595-1	MB							
Sulfur (S)-Total			<0.50		mg/L		0.5	14-FEB-19
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	14-FEB-19
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	14-FEB-19
Thorium (Th)-Total			<0.00010		mg/L		0.0001	14-FEB-19
Tin (Sn)-Total			<0.00010		mg/L		0.0001	14-FEB-19
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	14-FEB-19
Tungsten (W)-Total			<0.00010		mg/L		0.0001	14-FEB-19
Uranium (U)-Total			<0.000010		mg/L		0.00001	14-FEB-19
Vanadium (V)-Total			<0.00050		mg/L		0.0005	14-FEB-19
Zinc (Zn)-Total			<0.0030		mg/L		0.003	14-FEB-19
Zirconium (Zr)-Total			<0.00030		mg/L		0.0003	14-FEB-19
WG2988595-5	MS	WG2988595-3						
Aluminum (Al)-Total			96.0		%		70-130	14-FEB-19
Antimony (Sb)-Total			96.5		%		70-130	14-FEB-19
Arsenic (As)-Total			93.3		%		70-130	14-FEB-19
Barium (Ba)-Total			93.3		%		70-130	14-FEB-19
Beryllium (Be)-Total			91.8		%		70-130	14-FEB-19
Bismuth (Bi)-Total			100.3		%		70-130	14-FEB-19
Boron (B)-Total			93.8		%		70-130	14-FEB-19
Cadmium (Cd)-Total			93.9		%		70-130	14-FEB-19
Calcium (Ca)-Total			94.2		%		70-130	14-FEB-19
Chromium (Cr)-Total			95.5		%		70-130	14-FEB-19
Cesium (Cs)-Total			95.9		%		70-130	14-FEB-19
Cobalt (Co)-Total			94.5		%		70-130	14-FEB-19
Copper (Cu)-Total			96.3		%		70-130	14-FEB-19
Iron (Fe)-Total			93.6		%		70-130	14-FEB-19
Lead (Pb)-Total			100.2		%		70-130	14-FEB-19
Lithium (Li)-Total			96.0		%		70-130	14-FEB-19
Magnesium (Mg)-Total			91.4		%		70-130	14-FEB-19
Manganese (Mn)-Total			93.8		%		70-130	14-FEB-19
Molybdenum (Mo)-Total			95.4		%		70-130	14-FEB-19
Nickel (Ni)-Total			94.5		%		70-130	14-FEB-19
Phosphorus (P)-Total			102.3		%		70-130	14-FEB-19
Potassium (K)-Total			92.1		%		70-130	14-FEB-19



Quality Control Report

Workorder: L2232152

Report Date: 20-FEB-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4506908							
WG2988595-5 MS		WG2988595-3						
Rubidium (Rb)-Total			93.8		%		70-130	14-FEB-19
Selenium (Se)-Total			95.3		%		70-130	14-FEB-19
Silicon (Si)-Total			95.3		%		70-130	14-FEB-19
Silver (Ag)-Total			95.2		%		70-130	14-FEB-19
Sodium (Na)-Total			95.1		%		70-130	14-FEB-19
Strontium (Sr)-Total			97.9		%		70-130	14-FEB-19
Sulfur (S)-Total			82.9		%		70-130	14-FEB-19
Thallium (Tl)-Total			98.1		%		70-130	14-FEB-19
Tellurium (Te)-Total			90.2		%		70-130	14-FEB-19
Thorium (Th)-Total			97.7		%		70-130	14-FEB-19
Tin (Sn)-Total			94.4		%		70-130	14-FEB-19
Titanium (Ti)-Total			90.6		%		70-130	14-FEB-19
Tungsten (W)-Total			102.4		%		70-130	14-FEB-19
Uranium (U)-Total			98.3		%		70-130	14-FEB-19
Vanadium (V)-Total			96.8		%		70-130	14-FEB-19
Zirconium (Zr)-Total			93.8		%		70-130	14-FEB-19
NH3-F-WT		Water						
Batch	R4508876							
WG2988797-3 DUP		L2231483-1						
Ammonia, Total (as N)		0.024	0.041	J	mg/L	0.017	0.02	14-FEB-19
WG2988797-2 LCS								
Ammonia, Total (as N)			90.7		%		85-115	14-FEB-19
WG2988797-1 MB								
Ammonia, Total (as N)			<0.010		mg/L		0.01	14-FEB-19
WG2988797-4 MS		L2231483-1						
Ammonia, Total (as N)			112.8		%		75-125	14-FEB-19
NO3-IC-WT		Water						
Batch	R4509769							
WG2988849-14 DUP		WG2988849-13						
Nitrate (as N)		0.719	0.718		mg/L	0.0	20	14-FEB-19
WG2988849-4 DUP		WG2988849-3						
Nitrate (as N)		<0.020	<0.020	RPD-NA	mg/L	N/A	20	14-FEB-19
WG2988849-12 LCS								
Nitrate (as N)			102.0		%		90-110	14-FEB-19
WG2988849-2 LCS								



Quality Control Report

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Report Date: 20-FEB-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-WT		Water						
Batch	R4509769							
WG2988849-2	LCS							
Nitrate (as N)			101.6		%		90-110	14-FEB-19
WG2988849-1	MB							
Nitrate (as N)			<0.020		mg/L		0.02	14-FEB-19
WG2988849-11	MB							
Nitrate (as N)			<0.020		mg/L		0.02	14-FEB-19
WG2988849-15	MS	WG2988849-13						
Nitrate (as N)			103.8		%		75-125	14-FEB-19
WG2988849-5	MS	WG2988849-3						
Nitrate (as N)			104.5		%		75-125	14-FEB-19
P-T-COL-WT		Water						
Batch	R4512420							
WG2990010-3	DUP	L2232152-2						
Phosphorus, Total		0.0372	0.0359		mg/L	3.6	20	19-FEB-19
WG2990010-2	LCS							
Phosphorus, Total			97.3		%		80-120	19-FEB-19
WG2990010-1	MB							
Phosphorus, Total			<0.0030		mg/L		0.003	19-FEB-19
WG2990010-4	MS	L2232152-2						
Phosphorus, Total			83.4		%		70-130	19-FEB-19
PH-WT		Water						
Batch	R4508730							
WG2988667-16	DUP	WG2988667-15						
pH		7.66	7.64	J	pH units	0.02	0.2	14-FEB-19
WG2988667-14	LCS							
pH			6.99		pH units		6.9-7.1	14-FEB-19
SO4-IC-N-WT		Water						
Batch	R4509769							
WG2988849-14	DUP	WG2988849-13						
Sulfate (SO4)		3.39	3.40		mg/L	0.4	20	14-FEB-19
WG2988849-4	DUP	WG2988849-3						
Sulfate (SO4)		1.96	1.93		mg/L	1.5	20	14-FEB-19
WG2988849-12	LCS							
Sulfate (SO4)			103.1		%		90-110	14-FEB-19
WG2988849-2	LCS							
Sulfate (SO4)			103.2		%		90-110	14-FEB-19
WG2988849-1	MB							



Quality Control Report

Workorder: L2232152

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-N-WT		Water						
Batch	R4509769							
WG2988849-1 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	14-FEB-19
WG2988849-11 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	14-FEB-19
WG2988849-15 MS		WG2988849-13						
Sulfate (SO4)			104.3		%		75-125	14-FEB-19
WG2988849-5 MS		WG2988849-3						
Sulfate (SO4)			105.4		%		75-125	14-FEB-19
SOLIDS-TSS-WT		Water						
Batch	R4509378							
WG2989110-3 DUP		L2232240-1						
Total Suspended Solids		81	71		mg/L	13	20	15-FEB-19
WG2989110-2 LCS								
Total Suspended Solids			100.9		%		85-115	15-FEB-19
WG2989110-1 MB								
Total Suspended Solids			<2.0		mg/L		2	15-FEB-19
Batch	R4511468							
WG2989483-2 LCS								
Total Suspended Solids			101.2		%		85-115	16-FEB-19
WG2989483-1 MB								
Total Suspended Solids			<2.0		mg/L		2	16-FEB-19
TKN-WT		Water						
Batch	R4509192							
WG2989114-3 DUP		L2232152-1						
Total Kjeldahl Nitrogen		0.37	0.45		mg/L	19	20	15-FEB-19
WG2989114-2 LCS								
Total Kjeldahl Nitrogen			110.9		%		75-125	15-FEB-19
WG2989114-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	15-FEB-19
WG2989114-4 MS		L2232152-1						
Total Kjeldahl Nitrogen			112.3		%		70-130	15-FEB-19
Batch	R4509888							
WG2989423-3 DUP		L2232152-3						
Total Kjeldahl Nitrogen		0.82	0.63	J	mg/L	0.19	0.3	15-FEB-19
WG2989423-2 LCS								
Total Kjeldahl Nitrogen			84.4		%		75-125	15-FEB-19
WG2989423-1 MB							0.15	



Quality Control Report

Workorder: L2232152 Report Date: 20-FEB-19 Page 10 of 12

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3
Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT	Water							
Batch	R4509888							
WG2989423-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	15-FEB-19
WG2989423-4 MS		L2232152-3						
Total Kjeldahl Nitrogen			110.0		%		70-130	15-FEB-19

Quality Control Report

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

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Contact: Brent Parsons

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L2232152

Report Date: 20-FEB-19

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3
Contact: Brent Parsons

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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Bacteriological Tests							
E. coli	2	11-FEB-19 13:35	13-FEB-19 15:45	48	50	hours	EHTL
	4	11-FEB-19 14:40	13-FEB-19 15:45	48	49	hours	EHTL
	5	11-FEB-19 14:16	13-FEB-19 15:45	48	49	hours	EHTL
	13	11-FEB-19 13:00	13-FEB-19 15:45	48	51	hours	EHTL
	14	11-FEB-19 13:11	13-FEB-19 15:45	48	51	hours	EHTL
Fecal Coliforms	2	11-FEB-19 13:35	13-FEB-19 15:45	48	50	hours	EHTL
	4	11-FEB-19 14:40	13-FEB-19 15:45	48	49	hours	EHTL
	5	11-FEB-19 14:16	13-FEB-19 15:45	48	49	hours	EHTL
	13	11-FEB-19 13:00	13-FEB-19 15:45	48	51	hours	EHTL
	14	11-FEB-19 13:11	13-FEB-19 15:45	48	51	hours	EHTL

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2232152 were received on 13-FEB-19 10:30.

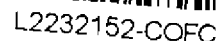
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



Canada Toll Free: 1 800 668 9878



COC Number: LON-180129

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

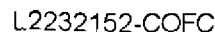
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NA-FM-GE26a v09 E-mail: [redacted] January 2014

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

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HUTCHINSON ENVIRONMENTAL SCIENCES
LTD
ATTN: Brent Parsons
501 Krug St.
Suite 202
Kitchener ON N2B 1L3

Date Received: 14-FEB-19
Report Date: 18-MAR-19 12:54 (MT)
Version: DRAFT

Client Phone: 519-576-1711

Certificate of Analysis

Lab Work Order #: L2232735
Project P.O. #: NOT SUBMITTED
Job Reference: 180050
C of C Numbers:
Legal Site Desc:

Gayle Braun
Senior Account Manager

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ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232735-1 OL-1 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a		 1 <1 1.63	 PEHR 	 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 14-FEB-19	 14-FEB-19 14-FEB-19 14-FEB-19	 R4511527 R4511940 R4530568
L2232735-2 OL-2 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a		 3 <1 13.5	 PEHR 	 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 14-FEB-19	 14-FEB-19 14-FEB-19 14-FEB-19	 R4511527 R4511940 R4530568
L2232735-3 OL-4 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a		 4 <1 4.65	 PEHR 	 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 14-FEB-19	 14-FEB-19 14-FEB-19 14-FEB-19	 R4511527 R4511940 R4530568
L2232735-4 OL-7 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a		 4 <1 10.2	 PEHR 	 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 14-FEB-19	 14-FEB-19 14-FEB-19 14-FEB-19	 R4511527 R4511940 R4530568
L2232735-5 OL-9 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a		 59 <1 9.23	 PEHR 	 1 1 0.10	 CFU/100mL CFU/100mL ug/L	 14-FEB-19	 14-FEB-19 14-FEB-19 14-FEB-19	 R4511527 R4511940 R4530568
L2232735-6 OL-3 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Escherichia Coli Fecal Coliforms Fecal Streptococcus		 1 <1 37	 PEHR PEHR PEHR	 1 1 1	 CFU/100mL CFU/100mL CFU/100mL	 14-FEB-19	 14-FEB-19 14-FEB-19 14-FEB-19	 R4510407 R4510391 R4511527
L2232735-7 OL-5								

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232735-7 OL-5 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests								
Escherichia Coli		2		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms		<1	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus		4	PEHR	1	CFU/100mL		14-FEB-19	R4511527
L2232735-8 OL-6 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests								
Escherichia Coli		4		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms		2	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus		26	PEHR	1	CFU/100mL		14-FEB-19	R4511527
L2232735-9 OL-8 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests								
Escherichia Coli		6		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms		<1	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus		51	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Report Remarks : Approximate result: suspected interference (EC>FC)								
Report Remarks : Approximate result, interference suspected (EC>FC).								
L2232735-10 OL-10 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests								
Escherichia Coli		18		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms		7	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus		113	PEHR	1	CFU/100mL		14-FEB-19	R4511527
Report Remarks : Approximate result: suspected interference (EC>FC)								
Report Remarks : Approximate result, interference suspected (EC>FC).								
L2232735-11 OL-11 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests								
Escherichia Coli		1		1	CFU/100mL		14-FEB-19	R4510407
Fecal Coliforms		<1	PEHR	1	CFU/100mL		14-FEB-19	R4510391
Fecal Streptococcus		<1	PEHR	1	CFU/100mL		14-FEB-19	R4511527

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Qualifiers for Individual Samples Listed:

Sample Number	Client ID	Qualifier	Description
L2232735-1	OL-1	UIC	Unreliable: Improper Container
L2232735-2	OL-2	UIC	Unreliable: Improper Container
L2232735-3	OL-4	UIC	Unreliable: Improper Container
L2232735-4	OL-7	UIC	Unreliable: Improper Container
L2232735-5	OL-9	UIC	Unreliable: Improper Container

Sample Parameter Qualifier key listed:

Qualifier	Description
PEHR	Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CHL/A-ACET-FLUORO-WP	Water	Chlorophyll a by fluorometry	EPA 445.0 ACET
This analysis is done using procedures modified from EPA method 445.0. Chlorophyll a is determined by a 90 % acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
EC-DCMF-WP	Water	E. coli by DC agar	APHA 9222 J (modified)
An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on media which contains lactose and a nonselective dye, plus a chromogenic agent (BCIG) to differentiate E. coli spp. from other coliforms. Samples are incubated at 35 C for 23 +/- 1 hours. Colonies exhibiting the expected metabolic reactions for the target groups on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. For this test, E. coli will appear blue to purple and other coliforms will appear reddish-pink. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed.			
FC-MF-WP	Water	Fecal Coliform	APHA 9222D
An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on selective media and incubated at 44.5°C for 24 – 2 hours. Colonies exhibiting characteristic morphology for the target group on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed.			
FECALSTREP-MF-WP	Water	Fecal streptococcus	APHA 9230C (modified)
An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on selective media and incubated at 35°C for 47 +/- 1 hour. Colonies exhibiting characteristic morphology for the target group on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed. Due to taxonomic fluidity, the term "Fecal Streptococcus" is applied here to include all members of genus names Streptococcus and Enterococcus as described in the reference method.			
PSA-MF-WP	Water	Pseudomonas aeruginosa	APHA 9213E
A known volume of sample (typically 100 mL) is filtered through a 0.45 micron membrane filter. The filter is placed on the surface of a selective agar plate and incubated for 72 hours at 41.5 +/- 0.5 C. Plates are examined under low magnification and colonies exhibiting typical morphology are counted. Results are reported as the number of presumptive P. aeruginosa CFU/100 mL. Additional confirmation tests can be performed upon request.			

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

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

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

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

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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

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

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

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

DRAFT



Quality Control Report

Workorder: L2232735

Report Date: 18-MAR-19

Page 1 of 4

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CHL/A-ACET-FLUORO-WP Water								
Batch	R4530568							
WG2996476-3	DUP	L2232473-1						
Chlorophyll a		20.8	20.9		ug/L	0.5	35	14-FEB-19
WG2996476-2	LCS							
Chlorophyll a			101.1		%		80-120	27-FEB-19
WG2996476-1	MB							
Chlorophyll a			<0.10		ug/L		0.1	14-FEB-19
EC-DCMF-WP Water								
Batch	R4510407							
WG2989200-1	MB							
Escherichia Coli			<1		CFU/100mL		1	14-FEB-19
FC-MF-WP Water								
Batch	R4510391							
WG2989036-2	DUP	L2232735-6						
Fecal Coliforms		<1	<1	RPD-NA	CFU/100mL	N/A	65	14-FEB-19
WG2989036-1	MB							
Fecal Coliforms			<1		CFU/100mL		1	14-FEB-19
FECALSTREP-MF-WP Water								
Batch	R4511527							
WG2989022-1	MB							
Fecal Streptococcus			<1		CFU/100mL		1	14-FEB-19
PSA-MF-WP Water								
Batch	R4511940							
WG2989035-1	MB							
Pseudomonas aeruginosa			<1		CFU/100mL		1	14-FEB-19

Quality Control Report

Workorder: L2232735

Report Date: 18-MAR-19

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
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Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L2232735

Report Date: 18-MAR-19

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3
Contact: Brent Parsons

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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Bacteriological Tests							
E. coli by DC agar							
	6	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	7	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	8	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	9	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	10	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	11	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
Fecal Coliform							
	6	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	7	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	8	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	9	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	10	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	11	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
Fecal streptococcus							
	1	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	2	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	3	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	4	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	5	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	6	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	7	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	8	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	9	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	10	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	11	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
Pseudomonas aeruginosa							
	1	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	2	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	3	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	4	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	5	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
Plant Pigments							
Chlorophyll a by fluorometry							
	1	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	2	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	3	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	4	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	5	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2232735 were received on 14-FEB-19 09:00.

Quality Control Report

Workorder: L2232735

Report Date: 18-MAR-19

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Page 4 of 4

Contact: Brent Parsons

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

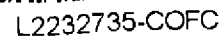
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

DRAFT



Canada Toll Free: 1 800 668 9878



COC Number: LON-190128/

Page of

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)															
Company: HUTCHINSON ENV		Select Report Format: <input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)		Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply															
Contact: BRENT PARSONS		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		PRIORITY (Business Days) 4 day [P4-20%] <input type="checkbox"/> 3 day [P3-25%] <input type="checkbox"/> 2 day [P2-50%] <input type="checkbox"/> EMERGENCY 1 Business day [E - 100%] <input type="checkbox"/> Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply) <input type="checkbox"/>															
Phone: 519-576-1711		<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked		Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm															
Company address below will appear on the final report		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		For tests that can not be performed according to the service level selected, you will be contacted.															
Street: 501 KRUG ST ST 202		Email 1 or Fax: deborah.sinclair@environmentalsciences.ca		Analysis Request															
City/Province: KITCHENER, ON		Email 2: brent.parsons@environmentalsciences.ca		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below															
Postal Code: N2B 1L3		Email 3:		NUMBER OF CONTAINERS															
Invoice To: Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Invoice Distribution		FECAL STREP															
Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		PSEUDOMONAS															
Company:		Email 1 or Fax: accounting@environmentalsciences.ca		CHLOROPHYLL A															
Contact:		Email 2:		PHYTOPLANKTON															
Project Information		Oil and Gas Required Fields (client use)		SAMPLES ON HOLD															
ALS Account # / Quote #: Q69690		AFE/Cost Center: PO#:		SUSPECTED HAZARD (see Special Instructions)															
Job #: 180050		Major/Minor Code: Routing Code:																	
PO / AFE:		Requisitioner:																	
LSD:		Location:																	
ALS Lab Work Order # (lab use only):		ALS Contact: Gayle		Sampler:															
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mmm-yy)		Time (hh:mm)		Sample Type											
OL-1				11-02-19				WATER											
OL-2								WATER											
OL-4								WATER											
OL-7								WATER											
OL-9								WATER											
OL-3								WATER											
OL-5								WATER											
OL-6								WATER											
OL-8								WATER											
OL-10								WATER											
OL-11								WATER											
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)															
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>															
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO				Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>															
				Cooling Initiated <input type="checkbox"/>															
				INITIAL COOLER TEMPERATURES °C															
				FINAL COOLER TEMPERATURES °C															
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)															
Released by:		Date:		Time:		Received by: M4		Date: 11-2-19		Time: 900		Received by:		Date:		Time:			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

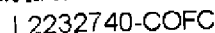
OCT 2014 SAT

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

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



Canada Toll Free: 1 800 668 9878



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NA-EM-03284-DS-Ex-001M January 2017

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

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



Sample Receipt Confirmation

Report Distribution:

Company Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: Brent Parsons
Address: 501 Krug St., Suite 202
Kitchener, ON, N2B 1L3
Phone: 519-576-1711
Fax: 866-205-7766
Email: deborah.sinclair@environmentalsciences.ca
brent.parsons@environmentalsciences.ca
EDD Email: --
Distribution: Hard Copy: N Email: Y Fax: N EDD: N

Invoice Distribution:

Acct Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: ACCOUNTS PAYABLE
Address: 1-5 Chancery Lane,
Bracebridge, ON, P1L 2E3
Phone: 705-645-0021
Fax: 705-457-5811
Invoice Email: deborah.sinclair@environmentalsciences.ca
accounting@environmentalsciences.ca
Project #: N/A
Account #: 20126

Client Information:

Job Reference #: 180050
Project PO #:
Legal Site Description: N/A
Quote #: Q69690

Date Sampled: 11-FEB-19
Date Received: 13-FEB-19
Sampled By: CLIENT
Chain Of Custody: LON-180129

Workorder Summary:

Lab Work Order #: L2232152
Estimated completion date: 21-FEB-19
14 Samples received at ALS in LONDON

Client Job #: 180050
Account Manager: Gayle Braun
Estimated sample disposal date: See Sample Disposal Information section below.

Lab Sample ID	Client Sample ID	Date Sampled	Date Received	Sample Due Date	Priority Flag	Sample Type
L2232152-1	OL-1	11-FEB-19 16:04	13-FEB-19 10:30	21-FEB-19		WATER
L2232152-2	OL-2	11-FEB-19 13:35	13-FEB-19 10:30	21-FEB-19		WATER
L2232152-3	OL-4	11-FEB-19 15:25	13-FEB-19 10:30	21-FEB-19		WATER
L2232152-4	OL-7	11-FEB-19 14:40	13-FEB-19 10:30	21-FEB-19		WATER
L2232152-5	OL-9	11-FEB-19 14:16	13-FEB-19 10:30	21-FEB-19		WATER
L2232152-6	OL-3	11-FEB-19 15:37	13-FEB-19 10:30	21-FEB-19		WATER
L2232152-7	OL-5	11-FEB-19 15:00	13-FEB-19 10:30	21-FEB-19		WATER
L2232152-8	OL-6	11-FEB-19 14:50	13-FEB-19 10:30	21-FEB-19		WATER
L2232152-9	OL-8	11-FEB-19 14:29	13-FEB-19 10:30	21-FEB-19		WATER
L2232152-10	OL-10	11-FEB-19 14:02	13-FEB-19 10:30	21-FEB-19		WATER
L2232152-11	OL-11	11-FEB-19 13:44	13-FEB-19 10:30	21-FEB-19		WATER
L2232152-12	OL-1-BOTTOM	11-FEB-19 00:00	13-FEB-19 10:30	21-FEB-19		WATER
L2232152-13	TRIB 4	11-FEB-19 13:00	13-FEB-19 10:30	21-FEB-19		WATER
L2232152-14	TRIB 5	11-FEB-19 13:11	13-FEB-19 10:30	21-FEB-19		WATER



**Analysis
Requested :**

	Alkalinity, Total [as CaCO ₃]	BOD	Chloride by IC	Dissolved Organic Carbon	E. coli	Fecal Coliforms	Hardness	One Metal in Water by ICPMS [Total]	Total Metals in Water by CRC ICPMS	Ammonia in Water by Fluorescence	Nitrate in Water by IC	Total P in Water by Colour	pH	Sulfate in Water by IC	Suspended solids	TKN and Total Phosphorus	Sample Handling and Disposal Fee
OL-1	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-2	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-4	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-7	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-9	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-3					✓	✓											✓
OL-5					✓	✓											✓
OL-6					✓	✓											✓
OL-8					✓	✓											✓
OL-10					✓	✓											✓
OL-11					✓	✓											✓
OL-1-BOTTOM								✓				✓			✓		✓
TRIB 4	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
TRIB 5	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓

Login Comments:

Your samples were at 1.4 °C when unpacked at the laboratory.

Sample Integrity Observations: No observations were identified for this work order submission.



Notice of Sub-contract Laboratory Service

Please be advised that the following tests will be subcontracted to the corresponding laboratory:

Ammonia in Water by Fluorescence subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Suspended solids subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
E. coli subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Alkalinity, Total (as CaCO₃) subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Total P in Water by Colour subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
pH subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Nitrate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Hardness subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Total Kjeldahl Nitrogen subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Fecal Coliforms subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Chloride by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
BOD subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Total Metals in Water by CRC ICPMS subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Dissolved Organic Carbon subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Please contact your Account Manager immediately should you have questions or concerns regarding this arrangement. Approval of this arrangement shall be implied unless otherwise notified by you.

Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L2232152-COFC

COC Number: LON-180129

Page of

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)													
Company: HUTCHINSON ENV		Select Report Format: <input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)		Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply													
Contact: BRENT PARSONS		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		4 day [P4-20%] <input type="checkbox"/> 1 Business day [E - 100%] <input type="checkbox"/>													
Phone: 519-576-1711		<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked		3 day [P3-25%] <input type="checkbox"/> Same Day, Weekend or Statutory holiday [E2 -200%] <input type="checkbox"/>													
Company address below will appear on the final report		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		2 day [P2-50%] <input type="checkbox"/> (Laboratory opening fees may apply) <input type="checkbox"/>													
Street: 501 KRUG ST ST 202		Email 1 or Fax: deborah.sindair@environmentalsciences.ca		Date and Time Required for all E&P TATs: dd-mm-yy hh:mm													
City/Province: KITCHENER, ON		Email 2: brent.parsons@environmentalsciences.ca		For tests that can not be performed according to the service level selected, you will be contacted.													
Postal Code: N2B 1L3		Email 3:		Analysis Request													
Invoice To: Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Invoice Distribution		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below													
Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX															
Company:		Email 1 or Fax: accounting@environmentalsciences.ca															
Contact:		Email 2:															
Project Information		Oil and Gas Required Fields (client use)															
ALS Account # / Quote #: Q69690		AFE/Cost Center:		PO#:													
Job #: 190050		Major/Minor Code:		Routing Code:													
PO / AFE:		Requisitioner:															
LSD:		Location:															
ALS Lab Work Order # (lab use only): L0032150138		ALS Contact: Gayle		Sampler:													
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	E. COLIFORM	ALCALINITY	BOD	DOC	CI, NO3, SO4	TOTAL METALS + HARDNESS	NH3TKN/TP	pH/TSS	TP, Fe, TSS	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)	
OL-1		11-02-19		WATER	4	R	R	R	R	R	R	R	R				
OL-2				WATER	3	R	R	R	R	R	R	R	R				
OL-4				WATER	3	R	R	R	R	R	R	R	R				
OL-7				WATER	3	R	R	R	R	R	R	R	R				
OL-9				WATER	3	R	R	R	R	R	R	R	R				
OL-3				WATER	1	R											
OL-5				WATER	1	R											
OL-6				WATER	1	R											
OL-8				WATER	1	R											
OL-10				WATER	1	R											
OL-11				WATER	1	R											
OL-1-BOTTOM				WATER	3									R			
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)													
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>													
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO				Ice Packs <input checked="" type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>													
				Cooling Initiated <input type="checkbox"/>													
				INITIAL COOLER TEMPERATURES °C: 14 FINAL COOLER TEMPERATURES °C: 14													
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)													
Released by:		Date:		Time:		Received by:		Date:		Time:		Received by:		Date:		Time:	

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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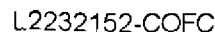
1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

OCT 2016 FRONT

SIF.



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Page of

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NA-FM-GE26a v09 E-mail: [redacted] January 2014

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

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

SIF.



Sample Receipt Confirmation

Report Distribution:

Company Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: Brent Parsons
Address: 501 Krug St., Suite 202
Kitchener, ON, N2B 1L3
Phone: 519-576-1711
Fax: 866-205-7766
Email: deborah.sinclair@environmentalsciences.ca
brent.parsons@environmentalsciences.ca
EDD Email: --
Distribution: Hard Copy: N Email: Y Fax: N EDD: N

Invoice Distribution:

Acct Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: ACCOUNTS PAYABLE
Address: 1-5 Chancery Lane,
Bracebridge, ON, P1L 2E3
Phone: 705-645-0021
Fax: 705-457-5811
Invoice Email: deborah.sinclair@environmentalsciences.ca
accounting@environmentalsciences.ca
Project #: N/A
Account #: 20126

Client Information:

Job Reference #: 180050
Project PO #:
Legal Site Description: N/A
Quote #: Q69690

Date Sampled: 11-FEB-19
Date Received: 14-FEB-19
Sampled By:
Chain Of Custody: --

Workorder Summary:

Lab Work Order #: L2232735
Estimated completion date: 25-JUN-19
11 Samples received at ALS in WINNIPEG

Client Job #: 180050
Account Manager: Connor Cattani
Estimated sample disposal date: See Sample Disposal Information section below.

Lab Sample ID	Client Sample ID	Date Sampled	Date Received	Sample Due Date	Priority Flag	Sample Type
L2232735-1	OL-1	11-FEB-19 00:00	14-FEB-19 09:00	25-JUN-19		WATER
L2232735-2	OL-2	11-FEB-19 00:00	14-FEB-19 09:00	25-JUN-19		WATER
L2232735-3	OL-4	11-FEB-19 00:00	14-FEB-19 09:00	25-JUN-19		WATER
L2232735-4	OL-7	11-FEB-19 00:00	14-FEB-19 09:00	25-JUN-19		WATER
L2232735-5	OL-9	11-FEB-19 00:00	14-FEB-19 09:00	25-JUN-19		WATER
L2232735-6	OL-3	11-FEB-19 00:00	14-FEB-19 09:00	25-JUN-19		WATER
L2232735-7	OL-5	11-FEB-19 00:00	14-FEB-19 09:00	25-JUN-19		WATER
L2232735-8	OL-6	11-FEB-19 00:00	14-FEB-19 09:00	25-JUN-19		WATER
L2232735-9	OL-8	11-FEB-19 00:00	14-FEB-19 09:00	25-JUN-19		WATER
L2232735-10	OL-10	11-FEB-19 00:00	14-FEB-19 09:00	25-JUN-19		WATER
L2232735-11	OL-11	11-FEB-19 00:00	14-FEB-19 09:00	25-JUN-19		WATER



**Analysis
Requested :**

	Chlorophyll a by fluorometry	E. coli by DC agar	Fecal Coliform	Fecal streptococcus	Phytoplankton	Pseudomonas aeruginosa	Sample Handling and Disposal Fee
OL-1	✓			✓	✓	✓	✓
OL-2	✓			✓		✓	✓
OL-4	✓			✓		✓	✓
OL-7	✓			✓		✓	✓
OL-9	✓			✓		✓	✓
OL-3		✓	✓	✓			✓
OL-5		✓	✓	✓			✓
OL-6		✓	✓	✓			✓
OL-8		✓	✓	✓			✓
OL-10		✓	✓	✓			✓
OL-11		✓	✓	✓			✓

Hold Time Exceedences: The following samples have exceeded recommended holding times prior to sample receipt.

Analysis Requested	Lab Sample ID	Recommended Hold Time	Date Sampled	Date Received
Chlorophyll a by fluorometry	L2232735-1, 2, 3, 4, 5	48 hours	11-FEB-19	14-FEB-19
E. coli by DC agar	L2232735-6, 7, 8, 9, 10, 11	30 hours	11-FEB-19	14-FEB-19
Fecal Coliform	L2232735-6, 7, 8, 9, 10, 11	30 hours	11-FEB-19	14-FEB-19
Fecal streptococcus	L2232735-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	30 hours	11-FEB-19	14-FEB-19
Pseudomonas aeruginosa	L2232735-1, 2, 3, 4, 5	30 hours	11-FEB-19	14-FEB-19

Sample Integrity Observations: No observations were identified for this work order submission.



Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

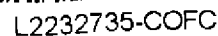
For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



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COC Number: LON-190128/

Page of

Report To		Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)															
Company: HUTCHINSON ENV		Contact: BRENT PARSONS		Select Report Format: <input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)		Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply															
Phone: 519-576-1711		Company address below will appear on the final report		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		PROPERTY (Business Days)			EMERGENCY			1 Business day [E - 100%] Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply) <input type="checkbox"/>									
				<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked																	
Street: 501 KRUG ST ST 202				Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																	
City/Province: KITCHENER, ON				Email 1 or Fax: deborah.sinclair@environmentalsciences.ca		Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm															
Postal Code: N2B 1L3				Email 2: brent.parsons@environmentalsciences.ca		For tests that can not be performed according to the service level selected, you will be contacted.															
Email 3:																					
Invoice To		Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Invoice Distribution		Analysis Request															
Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO				Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below															
Company:				Email 1 or Fax: accounting@environmentalsciences.ca		NUMBER OF CONTAINERS															
Contact:				Email 2:																	
Project Information				Oil and Gas Required Fields (client use)				SAMPLES ON HOLD													
ALS Account # / Quote #: Q69690				AFE/Cost Center: PO#:																	
Job #: 180050				Major/Minor Code: Routing Code:																	
PO / AFE:				Requisitioner:																	
LSD:				Location:				SUSPECTED HAZARD (see Special Instructions)													
ALS Lab Work Order # (lab use only):				ALS Contact: Gayle Sampler:																	
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mmm-yy)		Time (hh:mm)		Sample Type													
OL-1				11-02-19				WATER													
OL-2								WATER													
OL-4								WATER													
OL-7								WATER													
OL-9								WATER													
OL-3								WATER													
OL-5								WATER													
OL-6								WATER													
OL-8								WATER													
OL-10								WATER													
OL-11								WATER													
Drinking Water (DW) Samples¹ (client use)				Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)				SAMPLE CONDITION AS RECEIVED (lab use only)													
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO								Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>													
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO								Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>													
								Cooling Initiated <input type="checkbox"/>													
								INITIAL COOLER TEMPERATURES °C: 1.7 FINAL COOLER TEMPERATURES °C:													
SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)													
Released by:		Date:		Time:		Received by: MY		Date: 11-2-19		Time: 900		Received by:		Date:		Time:					

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OCT 20th 1968

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



Sample Receipt Confirmation

Report Distribution:

Company Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: Brent Parsons
Address: 501 Krug St., Suite 202
Kitchener, ON, N2B 1L3
Phone: 519-576-1711
Fax: 866-205-7766
Email: deborah.sinclair@environmentalsciences.ca
brent.parsons@environmentalsciences.ca
EDD Email: --

Distribution: Hard Copy: N Email: Y Fax: N EDD: N

Invoice Distribution:

Acct Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: ACCOUNTS PAYABLE
Address: 1-5 Chancery Lane,
Bracebridge, ON, P1L 2E3
Phone: 705-645-0021
Fax: 705-457-5811
Invoice Email: deborah.sinclair@environmentalsciences.ca
accounting@environmentalsciences.ca
Project #: N/A
Account #: 20126

Client Information:

Job Reference #:
Project PO #:
Legal Site Description: N/A
Quote #: Q69690

Date Sampled: 11-FEB-19
Date Received: 14-FEB-19
Sampled By:
Chain Of Custody: --

Workorder Summary:

Lab Work Order #: L2232740
Estimated completion date: 22-FEB-19
2 Samples received at ALS in WINNIPEG

Account Manager: Connor Cattani
Estimated sample disposal date: See Sample Disposal Information section below.

Lab Sample ID	Client Sample ID	Date Sampled	Date Received	Sample Due Date	Priority Flag	Sample Type	Client Job#
L2232740-1	TRIB 4	11-FEB-19 00:00	14-FEB-19 09:00	22-FEB-19		WATER	
L2232740-2	TRIB 5	11-FEB-19 00:00	14-FEB-19 09:00	22-FEB-19		WATER	

Analysis Requested:

Chlorophyll a by fluorometry	Fecal streptococcus	Pseudomonas aeruginosa	Sample Handling and Disposal Fee
TRIB 4	✓	✓	✓
TRIB 5	✓	✓	✓

Analysis Completion Date (if different than sample due date):

Analysis Requested	Matrix	Due Date	Lab Sample ID
Chlorophyll a by fluorometry	Water	01-MAR-19	L2232740-1, 2
Fecal streptococcus	Water	21-FEB-19	L2232740-1, 2

Hold Time Exceedences:

 The following samples have exceeded recommended holding times prior to sample receipt.

Analysis Requested	Lab Sample ID	Recommended Hold Time	Date Sampled	Date Received
--------------------	---------------	-----------------------	--------------	---------------



Hold Time Exceedences:

Analysis Requested	Lab Sample ID	Recommended Hold Time	Date Sampled	Date Received
Chlorophyll a by fluorometry	L2232740-1, 2	48 hours	11-FEB-19	14-FEB-19
Fecal streptococcus	L2232740-1, 2	30 hours	11-FEB-19	14-FEB-19
Pseudomonas aeruginosa	L2232740-1, 2	30 hours	11-FEB-19	14-FEB-19

Sample Integrity Observations: No observations were identified for this work order submission.

Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

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1 2232740-COFC

COC Number: 14 - 501529

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NA-EM-03284-09, E-00000000, JANUARY 2011

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



HUTCHINSON ENVIRONMENTAL SCIENCES
LTD

ATTN: Brent Parsons

501 Krug St.

Suite 202

Kitchener ON N2B 1L3

Date Received: 29-MAR-19

Report Date: 01-APR-19 15:05 (MT)

Version: DRAFT

Client Phone: 519-576-1711

Certificate of Analysis

Lab Work Order #: L2250922

Project P.O. #: 180050

Job Reference: 180050

C of C Numbers:

Legal Site Desc:

Gayle Braun
Senior Account Manager

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ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721

ALS CANADA LTD Part of the ALS Group An ALS Limited Company

		20		1	CF
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* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
FECALSTREP-MF-WP	Water	Fecal streptococcus	APHA 9230C (modified)
An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on selective media and incubated at 35°C for 47 +/- 1 hour. Colonies exhibiting characteristic morphology for the target group on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed. Due to taxonomic fluidity, the term "Fecal Streptococcus" is applied here to include all members of genus names Streptococcus and Enterococcus as described in the reference method.			
PSA-MF-WP	Water	Pseudomonas aeruginosa	APHA 9213E
A known volume of sample (typically 100 mL) is filtered through a 0.45 micron membrane filter. The filter is placed on the surface of a selective agar plate and incubated for 72 hours at 41.5 +/- 0.5 C. Plates are examined under low magnification and colonies exhibiting typical morphology are counted. Results are reported as the number of presumptive P. aeruginosa CFU/100 mL. Additional confirmation tests can be performed upon request.			

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

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

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

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



Quality Control Report

Workorder: L2250922

Report Date: 01-APR-19

Page 1 of 2

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
FECALSTREP-MF-WP	Water							
Batch	R4587850							
WG3017215-1 MB								
Fecal Streptococcus			<1		CFU/100mL		1	29-MAR-19
PSA-MF-WP	Water							
Batch	R4588376							
WG3017218-1 MB								
Pseudomonas aeruginosa			<1		CFU/100mL		1	29-MAR-19

Quality Control Report

Workorder: L2250922

Report Date: 01-APR-19

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3
Contact: Brent Parsons

Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



Canada Toll Free: 1 800 668 9878



L2250922-COFC

COC Number: LON-190128/

Page of

Report To		Contact and company name below will appear on the final report	
Company:	HUTCHINSON ENV	Select Report Format:	<input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)
Contact:	BRENT PARSONS	Quality Control (QC) Report with Report	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Phone:	519-576-1711	<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked	
Company address below will appear on the final report		Select Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX
Street:	501 KRUG ST ST 202	Email 1 or Fax:	deborah.sindain@environmentalsciences.ca
City/Province:	KTICHENER, ON	Email 2:	brent.parsons@environmentalsciences.ca
Postal Code:	N2B 1L3	Email 3:	
Invoice To:	Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Invoice Distribution	
	Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Select Invoice Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX
Company:		Email 1 or Fax:	accounting@environmentalsciences.ca
Contact:		Email 2:	
Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	Q69690	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact:	Gayle
		Sampler:	
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)
OL-1	Trib 4	28-03-19	10:00
OL-2	Trib 5	28-03-19	16:00
OL-3			
OL-4			
OL-5			
OL-6			
OL-7			
OL-8			
OL-9			
OL-10			
OL-11			
Drinking Water (DW) Samples ¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)	
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO			
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO			
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)	
Released by:	Date:	Received by:	Date:
			MAR 29 2019
SAMPLE CONDITION AS RECEIVED (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)	
Frozen <input type="checkbox"/>	SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>	Received by:	Date:
Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/>	Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>		
Cooling Initiated <input type="checkbox"/>			
INITIAL COOLER TEMPERATURES °C		FINAL COOLER TEMPERATURES °C	

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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

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DCT 2018 FRC



HUTCHINSON ENVIRONMENTAL SCIENCES
LTD
ATTN: Brent Parsons
501 Krug St.
Suite 202
Kitchener ON N2B 1L3

Date Received: 29-MAR-19
Report Date: 08-APR-19 13:41 (MT)
Version: FINAL

Client Phone: 519-576-1711

Certificate of Analysis

Lab Work Order #: L2250927
Project P.O. #: NOT SUBMITTED
Job Reference: 180050
C of C Numbers: LON-180129
Legal Site Desc:

Gayle Braun
Senior Account Manager

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ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2250927-1 TRIB 4 Sampled By: CLIENT on 28-MAR-19 @ 16:00 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	287	HTC	0.50	mg/L		01-APR-19	
pH	7.56		0.10	pH units		29-MAR-19	R4587561
Total Suspended Solids	10.3		2.0	mg/L	03-APR-19	04-APR-19	R4590119
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	280		10	mg/L		29-MAR-19	R4587561
Ammonia, Total (as N)	2.21	DLHC	0.10	mg/L		02-APR-19	R4589327
Chloride (Cl)	12.2		0.50	mg/L		01-APR-19	R4589001
Nitrate (as N)	0.786		0.020	mg/L		01-APR-19	R4589001
Total Kjeldahl Nitrogen	3.45		0.15	mg/L	03-APR-19	03-APR-19	R4589872
Phosphorus, Total	0.329		0.0030	mg/L	02-APR-19	03-APR-19	R4589414
Sulfate (SO4)	6.59		0.30	mg/L		01-APR-19	R4589001
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					01-APR-19	R4588141
Dissolved Organic Carbon	11.3		0.50	mg/L	01-APR-19	02-APR-19	R4589378
Bacteriological Tests							
E. Coli	3		0	CFU/100mL		30-MAR-19	R4587629
Fecal Coliforms	7		0	CFU/100mL		30-MAR-19	R4587630
Total Metals							
Aluminum (Al)-Total	0.278		0.0050	mg/L	29-MAR-19	29-MAR-19	R4587923
Antimony (Sb)-Total	0.00014		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Arsenic (As)-Total	0.00139		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Barium (Ba)-Total	0.0534		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Boron (B)-Total	0.031		0.010	mg/L	29-MAR-19	29-MAR-19	R4587923
Cadmium (Cd)-Total	0.0000313		0.0000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Calcium (Ca)-Total	100		0.050	mg/L	29-MAR-19	29-MAR-19	R4587923
Cesium (Cs)-Total	0.000013		0.000010	mg/L	29-MAR-19	29-MAR-19	R4587923
Chromium (Cr)-Total	0.00082		0.00050	mg/L	29-MAR-19	29-MAR-19	R4587923
Cobalt (Co)-Total	0.00126		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Copper (Cu)-Total	0.0017		0.0010	mg/L	29-MAR-19	29-MAR-19	R4587923
Iron (Fe)-Total	0.967		0.010	mg/L	29-MAR-19	29-MAR-19	R4587923
Lead (Pb)-Total	0.000172		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Lithium (Li)-Total	<0.0010		0.0010	mg/L	29-MAR-19	29-MAR-19	R4587923
Magnesium (Mg)-Total	8.93		0.0050	mg/L	29-MAR-19	29-MAR-19	R4587923
Manganese (Mn)-Total	0.860		0.00050	mg/L	29-MAR-19	29-MAR-19	R4587923
Molybdenum (Mo)-Total	0.000690		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Nickel (Ni)-Total	0.00110		0.00050	mg/L	29-MAR-19	29-MAR-19	R4587923
Phosphorus (P)-Total	0.314		0.050	mg/L	29-MAR-19	29-MAR-19	R4587923
Potassium (K)-Total	7.28		0.050	mg/L	29-MAR-19	29-MAR-19	R4587923
Rubidium (Rb)-Total	0.00197		0.00020	mg/L	29-MAR-19	29-MAR-19	R4587923
Selenium (Se)-Total	0.000218		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2250927-1 TRIB 4 Sampled By: CLIENT on 28-MAR-19 @ 16:00 Matrix: WATER								
Total Metals								
Silicon (Si)-Total		4.51		0.10	mg/L	29-MAR-19	29-MAR-19	R4587923
Silver (Ag)-Total		<0.000050		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Sodium (Na)-Total		6.79		0.050	mg/L	29-MAR-19	29-MAR-19	R4587923
Strontium (Sr)-Total		0.170		0.0010	mg/L	29-MAR-19	29-MAR-19	R4587923
Sulfur (S)-Total		2.48		0.50	mg/L	29-MAR-19	29-MAR-19	R4587923
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	29-MAR-19	29-MAR-19	R4587923
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	29-MAR-19	29-MAR-19	R4587923
Thorium (Th)-Total		<0.00010		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Tin (Sn)-Total		<0.00010		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Titanium (Ti)-Total		0.0123		0.00030	mg/L	29-MAR-19	29-MAR-19	R4587923
Tungsten (W)-Total		<0.00010		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Uranium (U)-Total		0.00282		0.000010	mg/L	29-MAR-19	29-MAR-19	R4587923
Vanadium (V)-Total		0.00222		0.00050	mg/L	29-MAR-19	29-MAR-19	R4587923
Zinc (Zn)-Total		0.0116		0.0030	mg/L	29-MAR-19	29-MAR-19	R4587923
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	29-MAR-19	29-MAR-19	R4587923
Aggregate Organics								
BOD		4.9		2.0	mg/L	03-APR-19	08-APR-19	R4592350
L2250927-2 TRIB 5 Sampled By: CLIENT on 28-MAR-19 @ 16:00 Matrix: WATER								
Physical Tests								
Hardness (as CaCO3)		256	HTC	0.50	mg/L		01-APR-19	
pH		7.67		0.10	pH units		29-MAR-19	R4587561
Total Suspended Solids		4.6		2.0	mg/L	03-APR-19	04-APR-19	R4590119
Anions and Nutrients								
Alkalinity, Total (as CaCO3)		270		10	mg/L		29-MAR-19	R4587561
Ammonia, Total (as N)		1.58	DLHC	0.10	mg/L		02-APR-19	R4589327
Chloride (Cl)		14.4		0.50	mg/L		01-APR-19	R4589001
Nitrate (as N)		0.491		0.020	mg/L		01-APR-19	R4589001
Total Kjeldahl Nitrogen		2.71		0.15	mg/L	03-APR-19	03-APR-19	R4589872
Phosphorus, Total		0.398		0.0030	mg/L	03-APR-19	04-APR-19	R4590253
Sulfate (SO4)		7.21		0.30	mg/L		01-APR-19	R4589001
Organic / Inorganic Carbon								
Dissolved Carbon Filtration Location		LAB					01-APR-19	R4588141
Dissolved Organic Carbon		9.01		0.50	mg/L	01-APR-19	02-APR-19	R4589378
Bacteriological Tests								
E. Coli		3		0	CFU/100mL		30-MAR-19	R4587629
Fecal Coliforms		8		0	CFU/100mL		30-MAR-19	R4587630
Total Metals								
Aluminum (Al)-Total		0.0605		0.0050	mg/L	29-MAR-19	29-MAR-19	R4587923
Antimony (Sb)-Total		0.00012		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Arsenic (As)-Total		0.00121		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2250927-2 TRIB 5								
Sampled By: CLIENT on 28-MAR-19 @ 16:00								
Matrix: WATER								
Total Metals								
Barium (Ba)-Total		0.0415		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Beryllium (Be)-Total		<0.00010		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Bismuth (Bi)-Total		<0.000050		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Boron (B)-Total		0.023		0.010	mg/L	29-MAR-19	29-MAR-19	R4587923
Cadmium (Cd)-Total		0.0000150		0.0000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Calcium (Ca)-Total		88.9		0.050	mg/L	29-MAR-19	29-MAR-19	R4587923
Cesium (Cs)-Total		<0.000010		0.000010	mg/L	29-MAR-19	29-MAR-19	R4587923
Chromium (Cr)-Total		<0.00050		0.00050	mg/L	29-MAR-19	29-MAR-19	R4587923
Cobalt (Co)-Total		0.00115		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Copper (Cu)-Total		0.0013		0.0010	mg/L	29-MAR-19	29-MAR-19	R4587923
Iron (Fe)-Total		0.826		0.010	mg/L	29-MAR-19	29-MAR-19	R4587923
Lead (Pb)-Total		0.000106		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Lithium (Li)-Total		<0.0010		0.0010	mg/L	29-MAR-19	29-MAR-19	R4587923
Magnesium (Mg)-Total		8.28		0.0050	mg/L	29-MAR-19	29-MAR-19	R4587923
Manganese (Mn)-Total		1.31		0.00050	mg/L	29-MAR-19	29-MAR-19	R4587923
Molybdenum (Mo)-Total		0.000589		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Nickel (Ni)-Total		0.00079		0.00050	mg/L	29-MAR-19	29-MAR-19	R4587923
Phosphorus (P)-Total		0.413		0.050	mg/L	29-MAR-19	29-MAR-19	R4587923
Potassium (K)-Total		7.54		0.050	mg/L	29-MAR-19	29-MAR-19	R4587923
Rubidium (Rb)-Total		0.00217		0.00020	mg/L	29-MAR-19	29-MAR-19	R4587923
Selenium (Se)-Total		0.000168		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Silicon (Si)-Total		3.72		0.10	mg/L	29-MAR-19	29-MAR-19	R4587923
Silver (Ag)-Total		<0.000050		0.000050	mg/L	29-MAR-19	29-MAR-19	R4587923
Sodium (Na)-Total		8.50		0.050	mg/L	29-MAR-19	29-MAR-19	R4587923
Strontium (Sr)-Total		0.158		0.0010	mg/L	29-MAR-19	29-MAR-19	R4587923
Sulfur (S)-Total		2.54		0.50	mg/L	29-MAR-19	29-MAR-19	R4587923
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	29-MAR-19	29-MAR-19	R4587923
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	29-MAR-19	29-MAR-19	R4587923
Thorium (Th)-Total		<0.00010		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Tin (Sn)-Total		<0.00010		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Titanium (Ti)-Total		<0.0030	DLUI	0.0030	mg/L	29-MAR-19	29-MAR-19	R4587923
Tungsten (W)-Total		<0.00010		0.00010	mg/L	29-MAR-19	29-MAR-19	R4587923
Uranium (U)-Total		0.00169		0.000010	mg/L	29-MAR-19	29-MAR-19	R4587923
Vanadium (V)-Total		0.00109		0.00050	mg/L	29-MAR-19	29-MAR-19	R4587923
Zinc (Zn)-Total		0.0189		0.0030	mg/L	29-MAR-19	29-MAR-19	R4587923
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	29-MAR-19	29-MAR-19	R4587923
Aggregate Organics								
BOD		2.9		2.0	mg/L	03-APR-19	08-APR-19	R4592350

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Total	MS-B	L2250927-1, -2
Matrix Spike	Calcium (Ca)-Total	MS-B	L2250927-1, -2
Matrix Spike	Iron (Fe)-Total	MS-B	L2250927-1, -2
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2250927-1, -2
Matrix Spike	Manganese (Mn)-Total	MS-B	L2250927-1, -2
Matrix Spike	Potassium (K)-Total	MS-B	L2250927-1, -2
Matrix Spike	Silicon (Si)-Total	MS-B	L2250927-1, -2
Matrix Spike	Sodium (Na)-Total	MS-B	L2250927-1, -2
Matrix Spike	Strontium (Sr)-Total	MS-B	L2250927-1, -2
Matrix Spike	Sulfur (S)-Total	MS-B	L2250927-1, -2
Matrix Spike	Uranium (U)-Total	MS-B	L2250927-1, -2
Matrix Spike	Ammonia, Total (as N)	MS-B	L2250927-1, -2

Sample Parameter Qualifier key listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLUI	Detection Limit Raised: Unknown Interference generated an apparent false positive test result.
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-WT	Water	Alkalinity, Total (as CaCO3)	EPA 310.2
This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.			
BOD-WT	Water	BOD	APHA 5210 B
This analysis is carried out using procedures adapted from APHA Method 5210B - "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-WT	Water	Chloride by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
DOC-WT	Water	Dissolved Organic Carbon	APHA 5310B
Sample is filtered through a 0.45um filter, then injected into a heated reaction chamber which is packed with an oxidative catalyst. The water is vaporized and the organic carbon is oxidized to carbon dioxide. The carbon dioxide is transported in a carrier gas and is measured by a non-dispersive infrared detector.			
EC-MF-WT	Water	E. coli	SM 9222D
A 100 mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at 44.5 –0 .2 °C for 24 – 2 h. Method ID: WT-TM-1200			
FC-MF-WT	Water	Fecal Coliforms	SM 9222D
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC agar and incubated at 24–2h@44.5–0.2°C. Method ID: WT-TM-1200			
HARDNESS-CALC-WT	Water	Hardness	APHA 2340 B
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.			
MET-T-CCMS-WT	Water	Total Metals in Water by CRC	EPA 200.2/6020A (mod)
Water samples are digested with nitric and perchloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
NH3-F-WT	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.			

NO3-IC-WT	Water	Nitrate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is deteremined colourimetrically after persulphate digestion of the sample.			
PH-WT	Water	pH	APHA 4500 H-Electrode
Water samples are analyzed directly by a calibrated pH meter.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days			
SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
SOLIDS-TSS-WT	Water	Suspended solids	APHA 2540 D-Gravimetric
A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 104–1°C for a minimum of four hours or until a constant weight is achieved.			
TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-Norg D
This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 Celsius with analysis using an automated colorimetric method.			

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

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

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

LON-180129

GLOSSARY OF REPORT TERMS
Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

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



Quality Control Report

Workorder: L2250927

Report Date: 08-APR-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-MF-WT		Water						
Batch	R4587629							
WG3017270-3	DUP	L2250901-3						
E. Coli		0	0		CFU/100mL	0.0	65	30-MAR-19
WG3017270-1	MB		0		CFU/100mL		1	30-MAR-19
E. Coli								
FC-MF-WT		Water						
Batch	R4587630							
WG3017278-3	DUP	L2250927-2						
Fecal Coliforms		8	<10	RPD-NA	CFU/100mL	N/A	65	30-MAR-19
WG3017278-1	MB		0		CFU/100mL		1	30-MAR-19
Fecal Coliforms								
MET-T-CCMS-WT		Water						
Batch	R4587923							
WG3017454-4	DUP	WG3017454-3						
Aluminum (Al)-Total		0.278	0.273		mg/L	1.7	20	29-MAR-19
Antimony (Sb)-Total		0.00014	0.00014		mg/L	0.4	20	29-MAR-19
Arsenic (As)-Total		0.00139	0.00132		mg/L	5.7	20	29-MAR-19
Barium (Ba)-Total		0.0534	0.0512		mg/L	4.2	20	29-MAR-19
Beryllium (Be)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	29-MAR-19
Bismuth (Bi)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	29-MAR-19
Boron (B)-Total		0.031	0.028		mg/L	8.8	20	29-MAR-19
Cadmium (Cd)-Total		0.0000313	0.0000271		mg/L	14	20	29-MAR-19
Calcium (Ca)-Total		100	92.4		mg/L	7.9	20	29-MAR-19
Chromium (Cr)-Total		0.00082	0.00082		mg/L	0.5	20	29-MAR-19
Cesium (Cs)-Total		0.000013	0.000012		mg/L	3.2	20	29-MAR-19
Cobalt (Co)-Total		0.00126	0.00126		mg/L	0.0	20	29-MAR-19
Copper (Cu)-Total		0.0017	0.0017		mg/L	2.5	20	29-MAR-19
Iron (Fe)-Total		0.967	0.966		mg/L	0.0	20	29-MAR-19
Lead (Pb)-Total		0.000172	0.000170		mg/L	0.9	20	29-MAR-19
Lithium (Li)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	29-MAR-19
Magnesium (Mg)-Total		8.93	8.90		mg/L	0.2	20	29-MAR-19
Manganese (Mn)-Total		0.860	0.845		mg/L	1.7	20	29-MAR-19
Molybdenum (Mo)-Total		0.000690	0.000622		mg/L	10	20	29-MAR-19
Nickel (Ni)-Total		0.00110	0.00112		mg/L	1.5	20	29-MAR-19
Phosphorus (P)-Total		0.314	0.279		mg/L	12	20	29-MAR-19
Potassium (K)-Total		7.28	7.47		mg/L			



Quality Control Report

Workorder: L2250927

Report Date: 08-APR-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4587923							
WG3017454-4	DUP	WG3017454-3						
Potassium (K)-Total		7.28	7.47		mg/L	2.5	20	29-MAR-19
Rubidium (Rb)-Total		0.00197	0.00197		mg/L	0.1	20	29-MAR-19
Selenium (Se)-Total		0.000218	0.000244		mg/L	11	20	29-MAR-19
Silicon (Si)-Total		4.51	4.45		mg/L	1.2	20	29-MAR-19
Silver (Ag)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	29-MAR-19
Sodium (Na)-Total		6.79	6.57		mg/L	3.2	20	29-MAR-19
Strontium (Sr)-Total		0.170	0.158		mg/L	7.2	20	29-MAR-19
Sulfur (S)-Total		2.48	2.50		mg/L	1.0	25	29-MAR-19
Thallium (Tl)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	29-MAR-19
Tellurium (Te)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	29-MAR-19
Thorium (Th)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	25	29-MAR-19
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	29-MAR-19
Titanium (Ti)-Total		0.0123	0.0121		mg/L	1.3	20	29-MAR-19
Tungsten (W)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	29-MAR-19
Uranium (U)-Total		0.00282	0.00283		mg/L	0.3	20	29-MAR-19
Vanadium (V)-Total		0.00222	0.00221		mg/L	0.5	20	29-MAR-19
Zinc (Zn)-Total		0.0116	0.0112		mg/L	3.4	20	29-MAR-19
Zirconium (Zr)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	29-MAR-19
WG3017454-2	LCS							
Aluminum (Al)-Total			99.4		%		80-120	29-MAR-19
Antimony (Sb)-Total			103.8		%		80-120	29-MAR-19
Arsenic (As)-Total			97.2		%		80-120	29-MAR-19
Barium (Ba)-Total			98.9		%		80-120	29-MAR-19
Beryllium (Be)-Total			95.0		%		80-120	29-MAR-19
Bismuth (Bi)-Total			103.3		%		80-120	29-MAR-19
Boron (B)-Total			94.3		%		80-120	29-MAR-19
Cadmium (Cd)-Total			95.3		%		80-120	29-MAR-19
Calcium (Ca)-Total			97.2		%		80-120	29-MAR-19
Chromium (Cr)-Total			97.6		%		80-120	29-MAR-19
Cesium (Cs)-Total			94.4		%		80-120	29-MAR-19
Cobalt (Co)-Total			96.7		%		80-120	29-MAR-19
Copper (Cu)-Total			98.0		%		80-120	29-MAR-19
Iron (Fe)-Total			93.1		%		80-120	29-MAR-19



Quality Control Report

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4587923							
WG3017454-2	LCS							
Lead (Pb)-Total			99.6		%		80-120	29-MAR-19
Lithium (Li)-Total			88.9		%		80-120	29-MAR-19
Magnesium (Mg)-Total			97.6		%		80-120	29-MAR-19
Manganese (Mn)-Total			97.5		%		80-120	29-MAR-19
Molybdenum (Mo)-Total			101.3		%		80-120	29-MAR-19
Nickel (Ni)-Total			96.9		%		80-120	29-MAR-19
Phosphorus (P)-Total			104.5		%		70-130	29-MAR-19
Potassium (K)-Total			91.9		%		80-120	29-MAR-19
Rubidium (Rb)-Total			95.8		%		80-120	29-MAR-19
Selenium (Se)-Total			96.8		%		80-120	29-MAR-19
Silicon (Si)-Total			98.2		%		60-140	29-MAR-19
Silver (Ag)-Total			95.9		%		80-120	29-MAR-19
Sodium (Na)-Total			101.0		%		80-120	29-MAR-19
Strontium (Sr)-Total			101.3		%		80-120	29-MAR-19
Sulfur (S)-Total			97.3		%		80-120	29-MAR-19
Thallium (Tl)-Total			103.1		%		80-120	29-MAR-19
Tellurium (Te)-Total			95.8		%		80-120	29-MAR-19
Thorium (Th)-Total			93.8		%		70-130	29-MAR-19
Tin (Sn)-Total			96.5		%		80-120	29-MAR-19
Titanium (Ti)-Total			94.3		%		80-120	29-MAR-19
Tungsten (W)-Total			96.6		%		80-120	29-MAR-19
Uranium (U)-Total			95.4		%		80-120	29-MAR-19
Vanadium (V)-Total			99.1		%		80-120	29-MAR-19
Zinc (Zn)-Total			95.0		%		80-120	29-MAR-19
Zirconium (Zr)-Total			93.9		%		80-120	29-MAR-19
WG3017454-1	MB							
Aluminum (Al)-Total			<0.0050		mg/L		0.005	29-MAR-19
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	29-MAR-19
Arsenic (As)-Total			<0.00010		mg/L		0.0001	29-MAR-19
Barium (Ba)-Total			<0.00010		mg/L		0.0001	29-MAR-19
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	29-MAR-19
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	29-MAR-19
Boron (B)-Total			<0.010		mg/L		0.01	29-MAR-19
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	29-MAR-19



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4587923							
WG3017454-1 MB								
Calcium (Ca)-Total			<0.050		mg/L		0.05	29-MAR-19
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	29-MAR-19
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	29-MAR-19
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	29-MAR-19
Copper (Cu)-Total			<0.0010		mg/L		0.001	29-MAR-19
Iron (Fe)-Total			<0.010		mg/L		0.01	29-MAR-19
Lead (Pb)-Total			<0.000050		mg/L		0.00005	29-MAR-19
Lithium (Li)-Total			<0.0010		mg/L		0.001	29-MAR-19
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	29-MAR-19
Manganese (Mn)-Total			<0.00050		mg/L		0.0005	29-MAR-19
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	29-MAR-19
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	29-MAR-19
Phosphorus (P)-Total			<0.050		mg/L		0.05	29-MAR-19
Potassium (K)-Total			<0.050		mg/L		0.05	29-MAR-19
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	29-MAR-19
Selenium (Se)-Total			<0.000050		mg/L		0.00005	29-MAR-19
Silicon (Si)-Total			<0.10		mg/L		0.1	29-MAR-19
Silver (Ag)-Total			<0.000050		mg/L		0.00005	29-MAR-19
Sodium (Na)-Total			<0.050		mg/L		0.05	29-MAR-19
Strontium (Sr)-Total			<0.0010		mg/L		0.001	29-MAR-19
Sulfur (S)-Total			<0.50		mg/L		0.5	29-MAR-19
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	29-MAR-19
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	29-MAR-19
Thorium (Th)-Total			<0.00010		mg/L		0.0001	29-MAR-19
Tin (Sn)-Total			<0.00010		mg/L		0.0001	29-MAR-19
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	29-MAR-19
Tungsten (W)-Total			<0.00010		mg/L		0.0001	29-MAR-19
Uranium (U)-Total			<0.000010		mg/L		0.00001	29-MAR-19
Vanadium (V)-Total			<0.00050		mg/L		0.0005	29-MAR-19
Zinc (Zn)-Total			<0.0030		mg/L		0.003	29-MAR-19
Zirconium (Zr)-Total			<0.00030		mg/L		0.0003	29-MAR-19
WG3017454-5 MS		WG3017454-6						
Aluminum (Al)-Total			103.2		%		70-130	29-MAR-19
Antimony (Sb)-Total			99.9		%		70-130	29-MAR-19



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4587923							
WG3017454-5 MS		WG3017454-6						
Arsenic (As)-Total			97.9		%		70-130	29-MAR-19
Barium (Ba)-Total			N/A	MS-B	%		-	29-MAR-19
Beryllium (Be)-Total			96.2		%		70-130	29-MAR-19
Bismuth (Bi)-Total			96.6		%		70-130	29-MAR-19
Boron (B)-Total			90.8		%		70-130	29-MAR-19
Cadmium (Cd)-Total			96.8		%		70-130	29-MAR-19
Calcium (Ca)-Total			N/A	MS-B	%		-	29-MAR-19
Chromium (Cr)-Total			99.4		%		70-130	29-MAR-19
Cesium (Cs)-Total			93.9		%		70-130	29-MAR-19
Cobalt (Co)-Total			95.8		%		70-130	29-MAR-19
Copper (Cu)-Total			94.5		%		70-130	29-MAR-19
Iron (Fe)-Total			N/A	MS-B	%		-	29-MAR-19
Lead (Pb)-Total			94.3		%		70-130	29-MAR-19
Lithium (Li)-Total			90.5		%		70-130	29-MAR-19
Magnesium (Mg)-Total			N/A	MS-B	%		-	29-MAR-19
Manganese (Mn)-Total			N/A	MS-B	%		-	29-MAR-19
Molybdenum (Mo)-Total			106.4		%		70-130	29-MAR-19
Nickel (Ni)-Total			95.2		%		70-130	29-MAR-19
Phosphorus (P)-Total			95.8		%		70-130	29-MAR-19
Potassium (K)-Total			N/A	MS-B	%		-	29-MAR-19
Rubidium (Rb)-Total			100.2		%		70-130	29-MAR-19
Selenium (Se)-Total			99.4		%		70-130	29-MAR-19
Silicon (Si)-Total			N/A	MS-B	%		-	29-MAR-19
Silver (Ag)-Total			91.4		%		70-130	29-MAR-19
Sodium (Na)-Total			N/A	MS-B	%		-	29-MAR-19
Strontium (Sr)-Total			N/A	MS-B	%		-	29-MAR-19
Sulfur (S)-Total			N/A	MS-B	%		-	29-MAR-19
Thallium (Tl)-Total			97.7		%		70-130	29-MAR-19
Tellurium (Te)-Total			92.6		%		70-130	29-MAR-19
Thorium (Th)-Total			88.4		%		70-130	29-MAR-19
Tin (Sn)-Total			94.3		%		70-130	29-MAR-19
Titanium (Ti)-Total			100.4		%		70-130	29-MAR-19
Tungsten (W)-Total			95.8		%		70-130	29-MAR-19



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4587923							
WG3017454-5 MS		WG3017454-6						
Uranium (U)-Total			N/A	MS-B	%		-	29-MAR-19
Vanadium (V)-Total			102.0		%		70-130	29-MAR-19
Zinc (Zn)-Total			87.4		%		70-130	29-MAR-19
Zirconium (Zr)-Total			84.9		%		70-130	29-MAR-19
NH3-F-WT		Water						
Batch	R4589327							
WG3019106-3 DUP		L2251616-1						
Ammonia, Total (as N)		0.304	0.292		mg/L	3.9	20	02-APR-19
WG3019106-2 LCS								
Ammonia, Total (as N)			108.8		%		85-115	02-APR-19
WG3019106-1 MB								
Ammonia, Total (as N)			<0.010		mg/L		0.01	02-APR-19
WG3019106-4 MS		L2251616-1						
Ammonia, Total (as N)			N/A	MS-B	%		-	02-APR-19
NO3-IC-WT		Water						
Batch	R4589001							
WG3018591-19 DUP		WG3018591-18						
Nitrate (as N)		0.054	0.056		mg/L	2.4	20	01-APR-19
WG3018591-17 LCS								
Nitrate (as N)			101.3		%		90-110	01-APR-19
WG3018591-16 MB								
Nitrate (as N)			<0.020		mg/L		0.02	01-APR-19
WG3018591-20 MS		WG3018591-18						
Nitrate (as N)			100.9		%		75-125	01-APR-19
P-T-COL-WT		Water						
Batch	R4589414							
WG3019585-3 DUP		L2251223-1						
Phosphorus, Total		0.0114	0.0121		mg/L	6.7	20	03-APR-19
WG3019585-2 LCS								
Phosphorus, Total			103.0		%		80-120	03-APR-19
WG3019585-1 MB								
Phosphorus, Total			<0.0030		mg/L		0.003	03-APR-19
WG3019585-4 MS		L2251223-1						
Phosphorus, Total			93.7		%		70-130	03-APR-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
P-T-COL-WT		Water						
Batch	R4590253							
WG3020446-3	DUP	L2251227-1						
Phosphorus, Total		0.0065	0.0087	J	mg/L	0.0022	0.006	04-APR-19
WG3020446-2	LCS		99.3		%		80-120	04-APR-19
Phosphorus, Total								
WG3020446-1	MB		<0.0030		mg/L		0.003	04-APR-19
Phosphorus, Total								
WG3020446-4	MS	L2251227-1	93.0		%		70-130	04-APR-19
Phosphorus, Total								
PH-WT		Water						
Batch	R4587561							
WG3016874-20	DUP	WG3016874-19						
pH		7.56	7.56	J	pH units	0.00	0.2	29-MAR-19
WG3016874-18	LCS		6.99		pH units		6.9-7.1	29-MAR-19
pH								
SO4-IC-N-WT		Water						
Batch	R4589001							
WG3018591-19	DUP	WG3018591-18						
Sulfate (SO4)		14.3	14.3		mg/L	0.3	20	01-APR-19
WG3018591-17	LCS		102.4		%		90-110	01-APR-19
Sulfate (SO4)								
WG3018591-16	MB		<0.30		mg/L		0.3	01-APR-19
Sulfate (SO4)								
WG3018591-20	MS	WG3018591-18	102.2		%		75-125	01-APR-19
Sulfate (SO4)								
SOLIDS-TSS-WT		Water						
Batch	R4590119							
WG3019915-3	DUP	L2251141-10						
Total Suspended Solids		297	338		mg/L	13	20	04-APR-19
WG3019915-2	LCS		100.9		%		85-115	04-APR-19
Total Suspended Solids								
WG3019915-1	MB		<2.0		mg/L		2	04-APR-19
Total Suspended Solids								
TKN-WT		Water						
Batch	R4589872							
WG3019767-3	DUP	L2250927-1						
Total Kjeldahl Nitrogen		3.45	3.43		mg/L	0.7	20	03-APR-19
WG3019767-2	LCS							



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT	Water							
Batch	R4589872							
WG3019767-2	LCS							
Total Kjeldahl Nitrogen			99.6		%		75-125	03-APR-19
WG3019767-1	MB							
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	03-APR-19
WG3019767-4	MS	L2250927-1						
Total Kjeldahl Nitrogen			100.5		%		70-130	03-APR-19

Quality Control Report

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

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Contact: Brent Parsons

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3
Contact: Brent Parsons

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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Aggregate Organics							
BOD	1	28-MAR-19 16:00	08-APR-19 12:00	4	11	days	EHT
	2	28-MAR-19 16:00	08-APR-19 12:00	4	11	days	EHT

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2250927 were received on 29-MAR-19 10:00.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



www.alsglobal.com

Chain of Custody (COC) / Analytical
Request Form

Canada Toll Free: 1 800 668 9878



L2250927-COFC

COC Number: LON-180129

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Report To		Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level below - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Company:	HUTCHINSON ENV			Select Report Format:	<input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)	Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply	
Contact:	BRENT PARSONS			Quality Control (QC) Report with Report	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	<div> <div> 4 day [P4-20%] <input type="checkbox"/> 3 day [P3-25%] <input type="checkbox"/> 2 day [P2-50%] <input type="checkbox"/> </div> <div> 1 Business day [E - 100%] Same Day, Weekend or Statutory holiday [E2 - 200%] (Laboratory opening fees may apply) </div> </div>	
Phone:	519-576-1711			<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked		<div> <div> Date and Time Required for all E&P TATs: </div> <div> dd-mm-yy hh:mm </div> </div>	
Company address below will appear on the final report				Select Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	For tests that can not be performed according to the service level selected, you will be contacted.	
Street:	501 KRUG ST ST 202			Email 1 or Fax:	deborah.sincclair@environmentalsciences.ca		
City/Province:	KTICHENER, ON			Email 2:	brent.parsons@environmentalsciences.ca		
Postal Code:	N2B 1L3			Email 3:			
Invoice To	Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			Invoice Distribution		Analysis Request	
	Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			Select Invoice Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	
Company:				Email 1 or Fax:	accounting@environmentalsciences.ca		
Contact:				Email 2:			
Project Information				Oil and Gas Required Fields (client use)			
ALS Account # / Quote #: Q69690				AFE/Cost Center:		PO#	
Job #: 180050				Major/Minor Code:		Routing Code:	
PO / AFE:				Requisitioner:			
LSD:				Location:			
ALS Lab Work Order # (lab use only): L2250927				ALS Contact: Gayle		Sampler:	
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mm-yy)	Time (hh:mm)	Sample Type	
OL-1	Trib 4			28-03-19	16:00	WATER	
OL-2	Trib 5			28-03-19	16:00	WATER	
OL-4						WATER	
OL-9						WATER	
OL-5						WATER	
OL-6						WATER	
OL-8						WATER	
OL-10						WATER	
OL-11						WATER	
OL-1-BOTTOM						WATER	
Drinking Water (DW) Samples ¹ (client use)				Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)			
Are samples taken from a Regulated DW System?				<div> <div> Frozen <input type="checkbox"/> Ice Packs <input type="checkbox"/> Ice Cubes <input checked="" type="checkbox"/> </div> <div> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> </div> </div>			
Are samples for human consumption/ use?				<div> <div> Cooling Initiated <input type="checkbox"/> </div> <div> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> </div> </div>			
<div> <div> INITIAL COOLER TEMPERATURES °C </div> <div> FINAL COOLER TEMPERATURES °C </div> </div>				<div> <div> INITIAL SHIPMENT RECEPTION (lab use only) </div> <div> FINAL SHIPMENT RECEPTION (lab use only) </div> </div>			
Released by:				Received by:			
Date:				Date:			
Time:				Time:			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY

YELLOW - CLIENT COPY

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

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

OCT 2018 FRONT



Sample Receipt Confirmation

Report Distribution:

Company Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: Brent Parsons
Address: 501 Krug St., Suite 202
Kitchener, ON, N2B 1L3
Phone: 519-576-1711
Fax: 866-205-7766
Email: deborah.sinclair@environmentalsciences.ca
brent.parsons@environmentalsciences.ca
EDD Email: --

Distribution: Hard Copy: N Email: Y Fax: N EDD: N

Invoice Distribution:

Acct Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: ACCOUNTS PAYABLE
Address: 1-5 Chancery Lane,
Bracebridge, ON, P1L 2E3
Phone: 705-645-0021
Fax: 705-457-5811
Invoice Email: deborah.sinclair@environmentalsciences.ca
accounting@environmentalsciences.ca
Project #: N/A
Account #: 20126

Client Information:

Job Reference #:
Project PO #:
Legal Site Description: N/A
Quote #: Q69690

Date Sampled: 28-MAR-19
Date Received: 29-MAR-19
Sampled By:
Chain Of Custody: --

Workorder Summary:

Lab Work Order #: L2250922
Estimated completion date: 12-APR-19
2 Samples received at ALS in WINNIPEG

Account Manager: Gayle Braun
Estimated sample disposal date: See Sample Disposal Information section below.

Lab Sample ID	Client Sample ID	Date Sampled	Date Received	Sample Due Date	Priority Flag	Sample Type	Client Job#
L2250922-1	TRIB 4	28-MAR-19 16:00	29-MAR-19 09:00	12-APR-19		WATER	
L2250922-2	TRIB 5	28-MAR-19 16:00	29-MAR-19 09:00	12-APR-19		WATER	

Analysis Requested:

Chlorophyll a by fluorometry	Fecal streptococcus	Pseudomonas aeruginosa	Sample Handling and Disposal Fee
TRIB 4	✓	✓	✓
TRIB 5	✓	✓	✓

Sample Integrity Observations: No observations were identified for this work order submission.



Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



www.alsglobal.com

Chain of Custody (COC) / Analytical
Request Form

Canada Toll Free: 1 800 668 9878



L2250922-COFC

COC Number: LON-190128/

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Report To Contact and company name below will appear on the final report		Report Format / Distribution		Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply																																																																																																																																			
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Contact: BRENT PARSONS		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Same Day, Weekend or Statutory holiday [E2 - 200%] (Laboratory opening fees may apply) <input type="checkbox"/>																																																																																																																																			
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Street: 501 KRUG ST ST 202		Email 1 or Fax: deborah.sindair@environmentalsciences.ca		Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm																																																																																																																																			
City/Province: KITCHENER, ON		Email 2: brent.parsons@environmentalsciences.ca		For tests that can not be performed according to the service level selected, you will be contacted.																																																																																																																																			
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ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																																																																																																																																			
OL-1	Trib 4	28-03-19	10:00	WATER																																																																																																																																			
OL-2	Trib 5	28-03-19	16:00	WATER																																																																																																																																			
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REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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2.1E



Sample Receipt Confirmation

Report Distribution:

Company Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: Brent Parsons
Address: 501 Krug St., Suite 202
Kitchener, ON, N2B 1L3
Phone: 519-576-1711
Fax: 866-205-7766
Email: deborah.sinclair@environmentalsciences.ca
brent.parsons@environmentalsciences.ca
EDD Email: --
Distribution: Hard Copy: N Email: Y Fax: N EDD: N

Invoice Distribution:

Acct Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: ACCOUNTS PAYABLE
Address: 1-5 Chancery Lane,
Bracebridge, ON, P1L 2E3
Phone: 705-645-0021
Fax: 705-457-5811
Invoice Email: deborah.sinclair@environmentalsciences.ca
accounting@environmentalsciences.ca
Project #: N/A
Account #: 20126

Client Information:

Job Reference #: 180050
Project PO #:
Legal Site Description: N/A
Quote #: Q69690

Date Sampled: 28-MAR-19
Date Received: 29-MAR-19
Sampled By: CLIENT
Chain Of Custody: LON-180129

Workorder Summary:

Lab Work Order #: L2250927
Estimated completion date: 05-APR-19
2 Samples received at ALS in LONDON

Client Job #: 180050
Account Manager: Gayle Braun
Estimated sample disposal date: See Sample Disposal Information section below.

Lab Sample ID	Client Sample ID	Date Sampled	Date Received	Sample Due Date	Priority Flag	Sample Type
L2250927-1	TRIB 4	28-MAR-19 16:00	29-MAR-19 10:00	05-APR-19		WATER
L2250927-2	TRIB 5	28-MAR-19 16:00	29-MAR-19 10:00	05-APR-19		WATER

Analysis Requested:

Alkalinity, Total [as CaCO ₃]	BOD	Chloride by IC	Dissolved Organic Carbon	E. coli	Fecal Coliforms	Hardness	Total Metals in Water by CRC ICPMS	Ammonia in Water by Fluorescence	Nitrate in Water by IC	pH	Sulfate in Water by IC	Suspended solids	TKN and Total Phosphorus	Sample Handling and Disposal Fee
TRIB 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TRIB 5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Login Comments:

Your samples were at 0.4 °C when unpacked at the laboratory.

Sample Integrity Observations: No observations were identified for this work order submission.



Notice of Sub-contract Laboratory Service

Please be advised that the following tests will be subcontracted to the corresponding laboratory:

E. coli subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Alkalinity, Total (as CaCO₃) subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Ammonia in Water by Fluorescence subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Suspended solids subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Total P in Water by Colour subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
pH subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Nitrate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Hardness subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Total Kjeldahl Nitrogen subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Fecal Coliforms subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Chloride by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
BOD subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Dissolved Organic Carbon subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Total Metals in Water by CRC ICPMS subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Please contact your Account Manager immediately should you have questions or concerns regarding this arrangement. Approval of this arrangement shall be implied unless otherwise notified by you.

Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



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Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L2250927-COFC

COC Number: LON-180129

Page of

Report To Contact and company name below will appear on the final report Company: HUTCHINSON ENV Contact: BRENT PARSONS Phone: 519-576-1711 Company address below will appear on the final report Street: 501 KRUG ST ST 202 City/Province: KITCHENER, ON Postal Code: N2B 1L3		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: deborah.sinclair@environmentalsciences.ca Email 2: brent.parsons@environmentalsciences.ca Email 3:		Select Service Level below - Contact your AM to confirm all E&P TATs (surcharges may apply) Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply 4 day [P4-20%] <input type="checkbox"/> 3 day [P3-25%] <input type="checkbox"/> 2 day [P2-50%] <input type="checkbox"/> 1 Business day [E - 100%] Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] <input type="checkbox"/> Date and Time Required for all E&P TATs: dd-mm-yy hh:mm For tests that can not be performed according to the service level selected, you will be contacted.																																																																																																																																																																																																																																																																											
Invoice To Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO Company: Contact:		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: accounting@environmentalsciences.ca Email 2:		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th rowspan="2">NUMBER OF CONTAINERS</th> <th rowspan="2">E. COLI/FECAL COLIFORM</th> <th rowspan="2">ALKALINITY</th> <th rowspan="2">BOD</th> <th rowspan="2">DOC</th> <th rowspan="2">CI, NO3, SO4</th> <th rowspan="2">TOTAL METALS + HARDNESS</th> <th rowspan="2">NH3/TKN/TP</th> <th rowspan="2">pH/TSS</th> <th rowspan="2">TR-As</th> <th rowspan="2">TR-Cd</th> <th rowspan="2">TR-Cr</th> <th rowspan="2">TR-Cu</th> <th rowspan="2">TR-Hg</th> <th rowspan="2">TR-Mn</th> <th rowspan="2">TR-Ni</th> <th rowspan="2">TR-Pb</th> <th rowspan="2">TR-Sb</th> <th rowspan="2">TR-Se</th> <th rowspan="2">TR-Tl</th> <th rowspan="2">TR-V</th> <th rowspan="2">TR-Zn</th> <th rowspan="2">SUSPECTED HAZARD (see Special Instructions)</th> </tr> <tr> <th>Filtered (F)</th> <th>Preserved (P)</th> <th>Filtered and Preserved (F/P)</th> </tr> <tr><td>4</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>4</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>4</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>4</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>4</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>1</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>1</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>1</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>1</td><td>R</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>		NUMBER OF CONTAINERS	E. COLI/FECAL COLIFORM	ALKALINITY	BOD	DOC	CI, NO3, SO4	TOTAL METALS + HARDNESS	NH3/TKN/TP	pH/TSS	TR-As	TR-Cd	TR-Cr	TR-Cu	TR-Hg	TR-Mn	TR-Ni	TR-Pb	TR-Sb	TR-Se	TR-Tl	TR-V	TR-Zn	SUSPECTED HAZARD (see Special Instructions)	Filtered (F)	Preserved (P)	Filtered and Preserved (F/P)	4	R	R	R	R	R	R	R	R																4	R	R	R	R	R	R	R	R																4	R	R	R	R	R	R	R	R																4	R	R	R	R	R	R	R	R																4	R	R	R	R	R	R	R	R																1	R																							1	R																							1	R																							1	R																							3																							
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L2250922-COFC

COC Number: LON-190128/

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Report To Contact and company name below will appear on the final report		Report Format / Distribution		Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply																																																																																																					
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Street: 501 KRUG ST ST 202		Email 1 or Fax: deborah.sindair@environmentalsciences.ca		Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm																																																																																																					
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OL-1	Trib 4	28-03-19	10:00	WATER																																																																																																					
OL-2	Trib 5	28-03-19	16:00	WATER																																																																																																					
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Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)																																																																																																					
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																					
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO				Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																					
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REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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

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

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2019



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L2250927-COFC

COC Number: LON-180129

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HUTCHINSON ENVIRONMENTAL SCIENCES
LTD
ATTN: Brent Parsons
501 Krug St.
Suite 202
Kitchener ON N2B 1L3

Date Received: 14-FEB-19
Report Date: 28-MAY-19 12:48 (MT)
Version: FINAL

Client Phone: 519-576-1711

Certificate of Analysis

Lab Work Order #: L2232735
Project P.O. #: NOT SUBMITTED
Job Reference: 180050
C of C Numbers:
Legal Site Desc:

Gayle Braun
Senior Account Manager

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ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232735-1 OL-1 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Taxonomy Phytoplankton Plant Pigments Chlorophyll a	1 <1 See attached. 1.63	PEHR	1 1 0.10	CFU/100mL CFU/100mL ug/L	 14-FEB-19	14-FEB-19 14-FEB-19 28-MAY-19 14-FEB-19	R4511527 R4511940 R4645585 R4530568
L2232735-2 OL-2 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	3 <1 13.5	PEHR	1 1 0.10	CFU/100mL CFU/100mL ug/L	 14-FEB-19	14-FEB-19 14-FEB-19 14-FEB-19	R4511527 R4511940 R4530568
L2232735-3 OL-4 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	4 <1 4.65	PEHR	1 1 0.10	CFU/100mL CFU/100mL ug/L	 14-FEB-19	14-FEB-19 14-FEB-19 14-FEB-19	R4511527 R4511940 R4530568
L2232735-4 OL-7 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	4 <1 10.2	PEHR	1 1 0.10	CFU/100mL CFU/100mL ug/L	 14-FEB-19	14-FEB-19 14-FEB-19 14-FEB-19	R4511527 R4511940 R4530568
L2232735-5 OL-9 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	59 <1 9.23	PEHR	1 1 0.10	CFU/100mL CFU/100mL ug/L	 14-FEB-19	14-FEB-19 14-FEB-19 14-FEB-19	R4511527 R4511940 R4530568
L2232735-6 OL-3 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Escherichia Coli Fecal Coliforms	1 <1	PEHR	1 1	CFU/100mL CFU/100mL	 14-FEB-19	14-FEB-19 14-FEB-19	R4510407 R4510391

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2232735-6OL-3 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Fecal Streptococcus	37	PEHR	1	CFU/100mL		14-FEB-19	R4511527
L2232735-7OL-5 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Escherichia Coli Fecal Coliforms Fecal Streptococcus	2 <1 4	 PEHR PEHR	 1 1 1	 CFU/100mL CFU/100mL CFU/100mL		14-FEB-19 14-FEB-19 14-FEB-19	R4510407 R4510391 R4511527
L2232735-8OL-6 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Escherichia Coli Fecal Coliforms Fecal Streptococcus	4 2 26	 PEHR PEHR	 1 1 1	 CFU/100mL CFU/100mL CFU/100mL		14-FEB-19 14-FEB-19 14-FEB-19	R4510407 R4510391 R4511527
L2232735-9OL-8 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Escherichia Coli Fecal Coliforms Fecal Streptococcus Report Remarks : Approximate result: suspected interference (EC>FC) Report Remarks : Approximate result, interference suspected (EC>FC).	6 <1 51	 PEHR PEHR	 1 1 1	 CFU/100mL CFU/100mL CFU/100mL		14-FEB-19 14-FEB-19 14-FEB-19	R4510407 R4510391 R4511527
L2232735-10OL-10 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Escherichia Coli Fecal Coliforms Fecal Streptococcus Report Remarks : Approximate result: suspected interference (EC>FC) Report Remarks : Approximate result, interference suspected (EC>FC).	18 7 113	 PEHR PEHR	 1 1 1	 CFU/100mL CFU/100mL CFU/100mL		14-FEB-19 14-FEB-19 14-FEB-19	R4510407 R4510391 R4511527
L2232735-11OL-11 Sampled By: CLIENT on 11-FEB-19 Matrix: WATER Bacteriological Tests Escherichia Coli Fecal Coliforms Fecal Streptococcus	1 <1 <1	 PEHR PEHR	 1 1 1	 CFU/100mL CFU/100mL CFU/100mL		14-FEB-19 14-FEB-19 14-FEB-19	R4510407 R4510391 R4511527

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Qualifiers for Individual Samples Listed:

Sample Number	Client ID	Qualifier	Description
L2232735-1	OL-1	UIC	Unreliable: Improper Container
L2232735-2	OL-2	UIC	Unreliable: Improper Container
L2232735-3	OL-4	UIC	Unreliable: Improper Container
L2232735-4	OL-7	UIC	Unreliable: Improper Container
L2232735-5	OL-9	UIC	Unreliable: Improper Container

Sample Parameter Qualifier key listed:

Qualifier	Description
PEHR	Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CHL/A-ACET-FLUORO-WP	Water	Chlorophyll a by fluorometry	EPA 445.0 ACET
This analysis is done using procedures modified from EPA method 445.0. Chlorophyll a is determined by a 90 % acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
EC-DCMF-WP	Water	E. coli by DC agar	APHA 9222 J (modified)
An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on media which contains lactose and a nonselective dye, plus a chromogenic agent (BCIG) to differentiate E. coli spp. from other coliforms. Samples are incubated at 35 C for 23 +/- 1 hours. Colonies exhibiting the expected metabolic reactions for the target groups on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. For this test, E. coli will appear blue to purple and other coliforms will appear reddish-pink. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed.			
FC-MF-WP	Water	Fecal Coliform	APHA 9222D
An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on selective media and incubated at 35C for 23 +/- 1 hours. Colonies exhibiting characteristic morphology for the target group on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. Additional confirmation tests can be performed upon request. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed.			
FECALSTREP-MF-WP	Water	Fecal streptococcus	APHA 9230C (modified)
An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on selective media and incubated at 35°C for 47 +/- 1 hour. Colonies exhibiting characteristic morphology for the target group on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed. Due to taxonomic fluidity, the term "Fecal Streptococcus" is applied here to include all members of genus names Streptococcus and Enterococcus as described in the reference method.			
PHYTO-WP	Water	Phytoplankton	APHA 10200 C & F
Samples are prepared by sedimentation/settling and examined using a compound phase contrast inverted microscope. Phytoplankters are identified to species where possible and enumerated.			
PSA-MF-WP	Water	Pseudomonas aeruginosa	APHA 9213E
A known volume of sample (typically 100 mL) is filtered through a 0.45 micron membrane filter. The filter is placed on the surface of a selective agar plate and incubated for 72 hours at 41.5 +/- 0.5 C. Plates are examined under low magnification and colonies exhibiting typical morphology are counted. Results are reported as the number of presumptive P. aeruginosa CFU/100 mL. Additional confirmation tests can be performed upon request.			

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

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

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

- mg/kg - milligrams per kilogram based on dry weight of sample*
- mg/kg ww_t - milligrams per kilogram based on wet weight of sample*
- mg/kg lwt - milligrams per kilogram based on lipid weight of sample*
- mg/L - unit of concentration based on volume, parts per million.*
- < - Less than.*
- D.L. - The reporting limit.*
- N/A - Result not available. Refer to qualifier code and definition for explanation.*

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



Quality Control Report

Workorder: L2232735

Report Date: 28-MAY-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CHL/A-ACET-FLUORO-WP Water								
Batch	R4530568							
WG2996476-3	DUP	L2232473-1						
Chlorophyll a		20.8	20.9		ug/L	0.5	35	14-FEB-19
WG2996476-2	LCS							
Chlorophyll a			101.1		%		80-120	27-FEB-19
WG2996476-1	MB							
Chlorophyll a			<0.10		ug/L		0.1	14-FEB-19
EC-DCMF-WP Water								
Batch	R4510407							
WG2989200-1	MB							
Escherichia Coli			<1		CFU/100mL		1	14-FEB-19
FC-MF-WP Water								
Batch	R4510391							
WG2989036-2	DUP	L2232735-6						
Fecal Coliforms		<1	<1	RPD-NA	CFU/100mL	N/A	65	14-FEB-19
WG2989036-1	MB							
Fecal Coliforms			<1		CFU/100mL		1	14-FEB-19
FECALSTREP-MF-WP Water								
Batch	R4511527							
WG2989022-1	MB							
Fecal Streptococcus			<1		CFU/100mL		1	14-FEB-19
PSA-MF-WP Water								
Batch	R4511940							
WG2989035-1	MB							
Pseudomonas aeruginosa			<1		CFU/100mL		1	14-FEB-19

Quality Control Report

Workorder: L2232735

Report Date: 28-MAY-19

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Kitchener ON N2B 1L3

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Contact: Brent Parsons

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L2232735

Report Date: 28-MAY-19

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501 Krug St. Suite 202
Kitchener ON N2B 1L3
Contact: Brent Parsons

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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Bacteriological Tests							
E. coli by DC agar							
	6	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	7	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	8	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	9	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	10	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
	11	11-FEB-19	14-FEB-19 16:55	30	77	hours	EHTR
Fecal Coliform							
	6	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	7	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	8	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	9	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	10	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
	11	11-FEB-19	14-FEB-19 16:10	30	76	hours	EHTR
Fecal streptococcus							
	1	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	2	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	3	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	4	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	5	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	6	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	7	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	8	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	9	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	10	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
	11	11-FEB-19	14-FEB-19 15:10	30	75	hours	EHTR
Pseudomonas aeruginosa							
	1	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	2	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	3	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	4	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
	5	11-FEB-19	14-FEB-19 14:50	30	75	hours	EHTR
Plant Pigments							
Chlorophyll a by fluorometry							
	1	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	2	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	3	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	4	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR
	5	11-FEB-19	14-FEB-19 13:05	48	73	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2232735 were received on 14-FEB-19 09:00.

Quality Control Report

Workorder: L2232735

Report Date: 28-MAY-19

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

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Contact: Brent Parsons

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



ALS Environmental
1329 Niakwa Road E - Unit 12
Winnipeg, Manitoba R2J 3T4
(204) 255-9720

Phytoplankton Sample Results

Lab Number: L2232735-1

Work Order L2232735

Sample Type WATER

Date Sampled: February 11, 2019

Submitter:

Sample ID: OL-1

Class	Genus	Species	Unit:	Units/L	Biovolume		Biovolume	
					Unit	µ m3	Total	µ m3
Chlorophyceae	<i>Schroederia</i>	<i>sp.</i>	Single Cell	4000	0		0	
Chlorophyceae	<i>Unidentified</i>		Single Cell	6000	0		0	
Chrysophyceae	<i>small chrysophytes</i>		Single Cell	158000	0		0	
Cryptophyceae	<i>Cryptomonas</i>	<i>sp.</i>	Single Cell	55000	0		0	
Cryptophyceae	<i>Unidentified</i>		Single Cell	198000	0		0	
Cyanophyceae	<i>Aphanizomenon</i>	<i>sp.</i>	Filament	200	0		0	
Dinophyceae	<i>Peridinium</i>	<i>sp.</i>	Single Cell	2000	0		0	

Date Printed: May 28, 2019



www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L2232735-COFC

COC Number: LON-190128/

Page of

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																																																																																																																																																																																																																																																														
Company: HUTCHINSON ENV		Select Report Format: <input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)		Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply																																																																																																																																																																																																																																																														
Contact: BRENT PARSONS		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		PRIORITY (Business Days) 4 day [P4-20%] <input type="checkbox"/> 3 day [P3-25%] <input type="checkbox"/> 2 day [P2-50%] <input type="checkbox"/>		EMERGENCY 1 Business day [E - 100%] Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply)																																																																																																																																																																																																																																																												
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Street: 501 KRUG ST ST 202		Email 1 or Fax: deborah.sinclair@environmentalsciences.ca		For tests that can not be performed according to the service level selected, you will be contacted.																																																																																																																																																																																																																																																														
City/Province: KITCHENER, ON		Email 2: brent.parsons@environmentalsciences.ca		Analysis Request																																																																																																																																																																																																																																																														
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OL-1		11-02-19		WATER	3	R	R	R	R																																																																																																																																																																																																																																																									
OL-2				WATER	2	R	R	R																																																																																																																																																																																																																																																										
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OL-10				WATER	1	R																																																																																																																																																																																																																																																												
OL-11				WATER	1	R																																																																																																																																																																																																																																																												
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)																																																																																																																																																																																																																																																																
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO																																																																																																																																																																																																																																																																		
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO																																																																																																																																																																																																																																																																		
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)																																																																																																																																																																																																																																																																
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REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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OCT 2016 FORM

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



HUTCHINSON ENVIRONMENTAL SCIENCES
LTD

ATTN: Brent Parsons

501 Krug St.

Suite 202

Kitchener ON N2B 1L3

Date Received: 09-MAY-19

Report Date: 17-MAY-19 09:16 (MT)

Version: DRAFT

Client Phone: 519-576-1711

Certificate of Analysis

Lab Work Order #: L2270097

Project P.O. #: NOT SUBMITTED

Job Reference: 180050

C of C Numbers:

Legal Site Desc:

Gayle Braun
Senior Account Manager

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ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270097-1 OL-1 Sampled By: CLIENT on 08-MAY-19 @ 12:20 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a								
		<1		1	CFU/100mL		09-MAY-19	R4631229
		<1		1	CFU/100mL		09-MAY-19	R4631399
		2.68		0.10	ug/L	09-MAY-19	09-MAY-19	R4636627
L2270097-2 OL-2 Sampled By: CLIENT on 08-MAY-19 @ 11:25 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a								
		<1		1	CFU/100mL		09-MAY-19	R4631229
		<1		1	CFU/100mL		09-MAY-19	R4631399
		2.55		0.10	ug/L	09-MAY-19	09-MAY-19	R4636627
L2270097-3 OL-4 Sampled By: CLIENT on 08-MAY-19 @ 11:57 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a								
		<1		1	CFU/100mL		09-MAY-19	R4631229
		<1		1	CFU/100mL		09-MAY-19	R4631399
		2.65		0.10	ug/L	09-MAY-19	09-MAY-19	R4636627
L2270097-4 OL-7 Sampled By: CLIENT on 08-MAY-19 @ 11:45 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a								
		1		1	CFU/100mL		09-MAY-19	R4631229
		14		1	CFU/100mL		09-MAY-19	R4631399
		5.72		0.10	ug/L	09-MAY-19	09-MAY-19	R4636627
L2270097-5 OL-9 Sampled By: CLIENT on 08-MAY-19 @ 11:36 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a								
		2		1	CFU/100mL		09-MAY-19	R4631229
		16		1	CFU/100mL		09-MAY-19	R4631399
		3.40		0.10	ug/L	09-MAY-19	09-MAY-19	R4636627
L2270097-6 TRIB-2 Sampled By: CLIENT on 08-MAY-19 @ 13:25 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a								
		2		1	CFU/100mL		09-MAY-19	R4631229
		3		1	CFU/100mL		09-MAY-19	R4631399
		6.09		0.10	ug/L	09-MAY-19	09-MAY-19	R4636627

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270097-7 TRIB-4 Sampled By: CLIENT on 08-MAY-19 @ 13:15 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	 7 43 14.2	 	 0.10	 CFU/100mL CFU/100mL ug/L	 09-MAY-19 09-MAY-19 09-MAY-19	 09-MAY-19 09-MAY-19 09-MAY-19	 R4631229 R4631399 R4636627
L2270097-8 TRIB-5 Sampled By: CLIENT on 08-MAY-19 @ 13:10 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa Plant Pigments Chlorophyll a	 6 41 16.0	 	 0.10	 CFU/100mL CFU/100mL ug/L	 09-MAY-19 09-MAY-19 09-MAY-19	 09-MAY-19 09-MAY-19 09-MAY-19	 R4631229 R4631399 R4636627
L2270097-10 OL-3 Sampled By: CLIENT on 08-MAY-19 @ 12:04 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa	 <1 <1	 	 1	 CFU/100mL CFU/100mL	 09-MAY-19 09-MAY-19	 09-MAY-19 09-MAY-19	 R4631229 R4631399
L2270097-11 OL-5 Sampled By: CLIENT on 08-MAY-19 @ 11:52 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa	 1 4	 	 1	 CFU/100mL CFU/100mL	 09-MAY-19 09-MAY-19	 09-MAY-19 09-MAY-19	 R4631229 R4631399
L2270097-12 OL-6 Sampled By: CLIENT on 08-MAY-19 @ 11:49 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa	 <1 4	 	 1	 CFU/100mL CFU/100mL	 09-MAY-19 09-MAY-19	 09-MAY-19 09-MAY-19	 R4631229 R4631399
L2270097-13 OL-8 Sampled By: CLIENT on 08-MAY-19 @ 11:40 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa	 3 4	 	 1	 CFU/100mL CFU/100mL	 09-MAY-19 09-MAY-19	 09-MAY-19 09-MAY-19	 R4631229 R4631399
L2270097-14 OL-10 Sampled By: CLIENT on 08-MAY-19 @ 11:33 Matrix: WATER Bacteriological Tests Fecal Streptococcus Pseudomonas aeruginosa	 3 3	 	 1	 CFU/100mL CFU/100mL	 09-MAY-19 09-MAY-19	 09-MAY-19 09-MAY-19	 R4631229 R4631399
L2270097-15 OL-11 Sampled By: CLIENT on 08-MAY-19 @ 11:30 Matrix: WATER							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

DRAFT

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CHL/A-ACET-FLUORO-WP	Water	Chlorophyll a by fluorometry	EPA 445.0 ACET
This analysis is done using procedures modified from EPA method 445.0. Chlorophyll a is determined by a 90 % acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.			
FECALSTREP-MF-WP	Water	Fecal streptococcus	APHA 9230C (modified)
An aliquot of sample water (usually 100 mL) is passed through a sterile .45 micron membrane filter. The filter is placed on selective media and incubated at 35°C for 47 +/- 1 hour. Colonies exhibiting characteristic morphology for the target group on the filter after incubation are counted and results are reported as Colony Forming Units (CFU) per 100 mL. The detection limit for this test is 1 when 100 mL of sample is processed, and is adjusted accordingly, with report notes as required, when less than 100 mL is processed.			
Due to taxonomic fluidity, the term "Fecal Streptococcus" is applied here to include all members of genus names Streptococcus and Enterococcus as described in the reference method.			
PSA-MF-WP	Water	Pseudomonas aeruginosa	APHA 9213E
A known volume of sample (typically 100 mL) is filtered through a 0.45 micron membrane filter. The filter is placed on the surface of a selective agar plate and incubated for 72 hours at 41.5 +/- 0.5 C. Plates are examined under low magnification and colonies exhibiting typical morphology are counted. Results are reported as the number of presumptive P. aeruginosa CFU/100 mL. Additional confirmation tests can be performed upon request.			

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

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

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

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

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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

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

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

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



Quality Control Report

Workorder: L2270097

Report Date: 17-MAY-19

Page 1 of 2

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CHL/A-ACET-FLUORO-WP Water								
Batch	R4636627							
WG3051786-3	DUP	L2270097-2						
Chlorophyll a		2.55	2.78		ug/L	8.9	35	09-MAY-19
WG3051786-2	LCS							
Chlorophyll a			108.1		%		80-120	16-MAY-19
WG3051786-1	MB							
Chlorophyll a			<0.10		ug/L		0.1	09-MAY-19
FECALSTREP-MF-WP Water								
Batch	R4631229							
WG3045740-1	MB							
Fecal Streptococcus			<1		CFU/100mL		1	09-MAY-19
PSA-MF-WP Water								
Batch	R4631399							
WG3045737-1	MB							
Pseudomonas aeruginosa			<1		CFU/100mL		1	09-MAY-19

Quality Control Report

Workorder: L2270097

Report Date: 17-MAY-19

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3
Contact: Brent Parsons

Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



Canada Toll Free: 1 800 668 9878



L2270097-COFC

COC Number: LON-190128/

Page of

Report To		Contact and company name below will appear on the final report		Report Format / Di		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																		
Company:		HUTCHINSON ENV		Select Report Format: <input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)		Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply																		
Contact:		BRENT PARSONS		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		PRIORITY (Business Days) 4 day [P4-20%] <input type="checkbox"/> 3 day [P3-25%] <input type="checkbox"/> 2 day [P2-50%] <input type="checkbox"/> EMERGENCY 1 Business day [E - 100%] <input type="checkbox"/> Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply) <input type="checkbox"/>																		
Phone:		519-576-1711		<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked		Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm																		
		Company address below will appear on the final report		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		For tests that can not be performed according to the service level selected, you will be contacted.																		
Street:		501 KRUG ST ST 202		Email 1 or Fax: deborah.sinclair@environmentalsciences.ca		Analysis Request																		
City/Province:		KTICHENER, ON		Email 2: brent.parsons@environmentalsciences.ca		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																		
Postal Code:		N2B 1L3		Email 3:		NUMBER OF CONTAINERS																		
Invoice To:		Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Invoice Distribution		FECAL STREP PSEUDOMONAS CHLOROPHYLL A PHYTOPLANKTON																		
		Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		SAMPLES ON HOLD																		
Company:				Email 1 or Fax: accounting@environmentalsciences.ca		SUSPECTED HAZARD (see Special Instructions)																		
Contact:				Email 2:																				
Project Information				Oil and Gas Required Fields (client use)																				
ALS Account # / Quote #:				Q69690		AFE/Cost Center:		PO#:																
Job #:				180050		Major/Minor Code:		Routing Code:																
PO / AFE:						Requisitioner:																		
LSD:						Location:																		
ALS Lab Work Order # (lab use only):				ALS Contact:		Gayle		Sampler:																
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)		Time (hh:mm)		Sample Type															
1		OL-1			8-05-19		12:20		WATER															
2		OL-2			"		11:25		WATER															
3		OL-4			"		11:57		WATER															
4		OL-7			"		11:45		WATER															
5		OL-9			"		11:36		WATER															
6		TRIB-1			"		13:25		WATER															
7		TRIB-2			"		13:15		WATER															
8		TRIB-3			"		13:10		WATER															
9		Algae 1			"		12:45		WATER															
Drinking Water (DW) Samples (client use)				Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)				SAMPLE CONDITION AS RECEIVED (lab use only)																
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO								Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO								Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																
								Cooling Initiated <input type="checkbox"/>																
								INITIAL COOLER TEMPERATURES °C FINAL COOLER TEMPERATURES °C																
SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)																
Released by:		Date:		Time:		Received by:		Date:		Time:		Received by:		Date:		Time:								

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OCT 2018 FROM

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



Canada Toll Free: 1 800 668 9878

COC Number: LON-190128/

Page of



12270097-COFC

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OCT 2016 FROM

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



HUTCHINSON ENVIRONMENTAL SCIENCES
LTD

ATTN: Brent Parsons

501 Krug St.

Suite 202

Kitchener ON N2B 1L3

Date Received: 09-MAY-19

Report Date: 17-MAY-19 12:24 (MT)

Version: FINAL

Client Phone: 519-576-1711

Certificate of Analysis

Lab Work Order #: L2270255

Project P.O. #: NOT SUBMITTED

Job Reference: 180050

C of C Numbers: LON-190503

Legal Site Desc:

Gayle Braun
Senior Account Manager

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ADDRESS: 309 Exeter Road Unit #29, London, ON N6L 1C1 Canada | Phone: +1 519 652 6044 | Fax: +1 519 652 0671

ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-1 OL-1 Sampled By: CLIENT on 08-MAY-19 @ 12:20 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	85.6	HTC	0.50	mg/L		10-MAY-19	
pH	8.29		0.10	pH units		10-MAY-19	R4631164
Total Suspended Solids	<2.0		2.0	mg/L	11-MAY-19	12-MAY-19	R4631444
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	83		10	mg/L		10-MAY-19	R4631164
Ammonia, Total (as N)	0.134		0.010	mg/L		10-MAY-19	R4632460
Chloride (Cl)	49.6		0.50	mg/L		10-MAY-19	R4632137
Nitrate (as N)	<0.020		0.020	mg/L		10-MAY-19	R4632137
Total Kjeldahl Nitrogen	0.53		0.15	mg/L	14-MAY-19	15-MAY-19	R4635594
Phosphorus, Total	0.0104		0.0030	mg/L	13-MAY-19	14-MAY-19	R4634585
Sulfate (SO4)	1.85		0.30	mg/L		10-MAY-19	R4632137
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					10-MAY-19	R4630430
Dissolved Organic Carbon	5.91		0.50	mg/L	10-MAY-19	10-MAY-19	R4632322
Bacteriological Tests							
E. Coli	0		0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms	0		0	CFU/100mL		10-MAY-19	R4630489
Total Metals							
Aluminum (Al)-Total	0.0119		0.0050	mg/L	09-MAY-19	09-MAY-19	R4630240
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Arsenic (As)-Total	0.00050		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Barium (Ba)-Total	0.0162		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Boron (B)-Total	<0.010		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Cadmium (Cd)-Total	<0.0000050		0.0000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Calcium (Ca)-Total	29.6		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Copper (Cu)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Iron (Fe)-Total	0.033		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Lead (Pb)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Lithium (Li)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Magnesium (Mg)-Total	2.84		0.0050	mg/L	09-MAY-19	09-MAY-19	R4630240
Manganese (Mn)-Total	0.00560		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Molybdenum (Mo)-Total	0.000108		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Phosphorus (P)-Total	<0.050		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Potassium (K)-Total	1.75		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Rubidium (Rb)-Total	0.00132		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Selenium (Se)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-1 OL-1 Sampled By: CLIENT on 08-MAY-19 @ 12:20 Matrix: WATER								
Total Metals								
Silicon (Si)-Total		<0.10		0.10	mg/L	09-MAY-19	09-MAY-19	R4630240
Silver (Ag)-Total		<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Sodium (Na)-Total		27.9		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Strontium (Sr)-Total		0.0661		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Sulfur (S)-Total		0.78		0.50	mg/L	09-MAY-19	09-MAY-19	R4630240
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Thorium (Th)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Tin (Sn)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Titanium (Ti)-Total		<0.0070	DLUI	0.0070	mg/L	09-MAY-19	09-MAY-19	R4630240
Tungsten (W)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Uranium (U)-Total		0.000027		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Vanadium (V)-Total		<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Zinc (Zn)-Total		<0.0030		0.0030	mg/L	09-MAY-19	09-MAY-19	R4630240
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
Aggregate Organics								
BOD		<2.0		2.0	mg/L	10-MAY-19	15-MAY-19	R4635543
L2270255-2 OL-2 Sampled By: CLIENT on 08-MAY-19 @ 11:25 Matrix: WATER								
Physical Tests								
Hardness (as CaCO3)		83.6	HTC	0.50	mg/L		10-MAY-19	
pH		8.33		0.10	pH units		10-MAY-19	R4631164
Total Suspended Solids		<2.0		2.0	mg/L	11-MAY-19	12-MAY-19	R4631444
Anions and Nutrients								
Alkalinity, Total (as CaCO3)		81		10	mg/L		10-MAY-19	R4631164
Ammonia, Total (as N)		<0.010		0.010	mg/L		10-MAY-19	R4632460
Chloride (Cl)		49.6		0.50	mg/L		10-MAY-19	R4632137
Nitrate (as N)		<0.020		0.020	mg/L		10-MAY-19	R4632137
Total Kjeldahl Nitrogen		0.53		0.15	mg/L	14-MAY-19	15-MAY-19	R4635594
Phosphorus, Total		0.0111		0.0030	mg/L	13-MAY-19	14-MAY-19	R4634585
Sulfate (SO4)		1.84		0.30	mg/L		10-MAY-19	R4632137
Organic / Inorganic Carbon								
Dissolved Carbon Filtration Location		LAB					10-MAY-19	R4630430
Dissolved Organic Carbon		4.89		0.50	mg/L	10-MAY-19	10-MAY-19	R4632322
Bacteriological Tests								
E. Coli		0		0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms		1		0	CFU/100mL		10-MAY-19	R4630489
Total Metals								
Aluminum (Al)-Total		0.0066		0.0050	mg/L	09-MAY-19	09-MAY-19	R4630240
Antimony (Sb)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Arsenic (As)-Total		0.00048		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-2 OL-2 Sampled By: CLIENT on 08-MAY-19 @ 11:25 Matrix: WATER								
Total Metals								
Barium (Ba)-Total		0.0155		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Beryllium (Be)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Bismuth (Bi)-Total		<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Boron (B)-Total		<0.010		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Cadmium (Cd)-Total		<0.0000050		0.0000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Calcium (Ca)-Total		28.9		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cesium (Cs)-Total		<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Chromium (Cr)-Total		<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cobalt (Co)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Copper (Cu)-Total		0.0013		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Iron (Fe)-Total		0.019		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Lead (Pb)-Total		0.000051		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Lithium (Li)-Total		<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Magnesium (Mg)-Total		2.76		0.0050	mg/L	09-MAY-19	09-MAY-19	R4630240
Manganese (Mn)-Total		0.00509		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Molybdenum (Mo)-Total		0.000124		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Nickel (Ni)-Total		<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Phosphorus (P)-Total		<0.050		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Potassium (K)-Total		1.86		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Rubidium (Rb)-Total		0.00146		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Selenium (Se)-Total		<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Silicon (Si)-Total		<0.10		0.10	mg/L	09-MAY-19	09-MAY-19	R4630240
Silver (Ag)-Total		<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Sodium (Na)-Total		27.5		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Strontium (Sr)-Total		0.0650		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Sulfur (S)-Total		0.83		0.50	mg/L	09-MAY-19	09-MAY-19	R4630240
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Thorium (Th)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Tin (Sn)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Titanium (Ti)-Total		0.00032		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
Tungsten (W)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Uranium (U)-Total		0.000029		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Vanadium (V)-Total		<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Zinc (Zn)-Total		0.0057		0.0030	mg/L	09-MAY-19	09-MAY-19	R4630240
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
Aggregate Organics								
BOD		<2.0		2.0	mg/L	10-MAY-19	15-MAY-19	R4635543
L2270255-3 OL-4 Sampled By: CLIENT on 08-MAY-19 @ 11:57 Matrix: WATER								
Physical Tests								

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-3 OL-4 Sampled By: CLIENT on 08-MAY-19 @ 11:57 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	83.6	HTC	0.50	mg/L		10-MAY-19	
pH	8.30		0.10	pH units		10-MAY-19	R4631164
Total Suspended Solids	<2.0		2.0	mg/L	11-MAY-19	12-MAY-19	R4631444
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	81		10	mg/L		10-MAY-19	R4631164
Ammonia, Total (as N)	0.019		0.010	mg/L		10-MAY-19	R4632460
Chloride (Cl)	49.6		0.50	mg/L		10-MAY-19	R4632137
Nitrate (as N)	<0.020		0.020	mg/L		10-MAY-19	R4632137
Total Kjeldahl Nitrogen	0.50		0.15	mg/L	14-MAY-19	15-MAY-19	R4635594
Phosphorus, Total	0.0114		0.0030	mg/L	13-MAY-19	14-MAY-19	R4634585
Sulfate (SO4)	1.86		0.30	mg/L		10-MAY-19	R4632137
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					10-MAY-19	R4630430
Dissolved Organic Carbon	4.85		0.50	mg/L	10-MAY-19	10-MAY-19	R4632322
Bacteriological Tests							
E. Coli	0		0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms	0		0	CFU/100mL		10-MAY-19	R4630489
Total Metals							
Aluminum (Al)-Total	0.0059		0.0050	mg/L	09-MAY-19	10-MAY-19	R4630240
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Arsenic (As)-Total	0.00046		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Barium (Ba)-Total	0.0158		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Boron (B)-Total	<0.010		0.010	mg/L	09-MAY-19	10-MAY-19	R4630240
Cadmium (Cd)-Total	<0.0000050		0.0000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Calcium (Ca)-Total	28.8		0.050	mg/L	09-MAY-19	10-MAY-19	R4630240
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	09-MAY-19	10-MAY-19	R4630240
Chromium (Cr)-Total	0.00055		0.00050	mg/L	09-MAY-19	10-MAY-19	R4630240
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Copper (Cu)-Total	<0.0010		0.0010	mg/L	09-MAY-19	10-MAY-19	R4630240
Iron (Fe)-Total	0.018		0.010	mg/L	09-MAY-19	10-MAY-19	R4630240
Lead (Pb)-Total	<0.000050		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Lithium (Li)-Total	<0.0010		0.0010	mg/L	09-MAY-19	10-MAY-19	R4630240
Magnesium (Mg)-Total	2.84		0.0050	mg/L	09-MAY-19	10-MAY-19	R4630240
Manganese (Mn)-Total	0.00504		0.00050	mg/L	09-MAY-19	10-MAY-19	R4630240
Molybdenum (Mo)-Total	0.000102		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	09-MAY-19	10-MAY-19	R4630240
Phosphorus (P)-Total	<0.050		0.050	mg/L	09-MAY-19	10-MAY-19	R4630240
Potassium (K)-Total	1.74		0.050	mg/L	09-MAY-19	10-MAY-19	R4630240
Rubidium (Rb)-Total	0.00125		0.00020	mg/L	09-MAY-19	10-MAY-19	R4630240
Selenium (Se)-Total	<0.000050		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-3 OL-4 Sampled By: CLIENT on 08-MAY-19 @ 11:57 Matrix: WATER								
Total Metals								
Silicon (Si)-Total		<0.10		0.10	mg/L	09-MAY-19	10-MAY-19	R4630240
Silver (Ag)-Total		<0.000050		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Sodium (Na)-Total		27.6		0.050	mg/L	09-MAY-19	10-MAY-19	R4630240
Strontium (Sr)-Total		0.0643		0.0010	mg/L	09-MAY-19	10-MAY-19	R4630240
Sulfur (S)-Total		0.71		0.50	mg/L	09-MAY-19	10-MAY-19	R4630240
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	09-MAY-19	10-MAY-19	R4630240
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	09-MAY-19	10-MAY-19	R4630240
Thorium (Th)-Total		<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Tin (Sn)-Total		<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Titanium (Ti)-Total		<0.00030		0.00030	mg/L	09-MAY-19	10-MAY-19	R4630240
Tungsten (W)-Total		<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Uranium (U)-Total		0.000030		0.000010	mg/L	09-MAY-19	10-MAY-19	R4630240
Vanadium (V)-Total		<0.00050		0.00050	mg/L	09-MAY-19	10-MAY-19	R4630240
Zinc (Zn)-Total		0.0033		0.0030	mg/L	09-MAY-19	10-MAY-19	R4630240
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	09-MAY-19	10-MAY-19	R4630240
Aggregate Organics								
BOD		<2.0		2.0	mg/L	10-MAY-19	15-MAY-19	R4635543
L2270255-4 OL-7 Sampled By: CLIENT on 08-MAY-19 @ 11:45 Matrix: WATER								
Physical Tests								
Hardness (as CaCO3)		83.5	HTC	0.50	mg/L		10-MAY-19	
pH		8.38		0.10	pH units		10-MAY-19	R4631164
Total Suspended Solids		<2.0		2.0	mg/L	11-MAY-19	12-MAY-19	R4631444
Anions and Nutrients								
Alkalinity, Total (as CaCO3)		80		10	mg/L		10-MAY-19	R4631164
Ammonia, Total (as N)		0.372		0.010	mg/L		10-MAY-19	R4632460
Chloride (Cl)		50.2		0.50	mg/L		10-MAY-19	R4632137
Nitrate (as N)		<0.020		0.020	mg/L		10-MAY-19	R4632137
Total Kjeldahl Nitrogen		0.71		0.15	mg/L	14-MAY-19	15-MAY-19	R4635594
Phosphorus, Total		0.0133		0.0030	mg/L	13-MAY-19	14-MAY-19	R4634585
Sulfate (SO4)		1.86		0.30	mg/L		10-MAY-19	R4632137
Organic / Inorganic Carbon								
Dissolved Carbon Filtration Location		LAB					10-MAY-19	R4630430
Dissolved Organic Carbon		5.30		0.50	mg/L	10-MAY-19	10-MAY-19	R4632322
Bacteriological Tests								
E. Coli		3		0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms		2		0	CFU/100mL		10-MAY-19	R4630489
Total Metals								
Aluminum (Al)-Total		0.0093		0.0050	mg/L	09-MAY-19	09-MAY-19	R4630240
Antimony (Sb)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Arsenic (As)-Total		0.00053		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-4 OL-7 Sampled By: CLIENT on 08-MAY-19 @ 11:45 Matrix: WATER							
Total Metals							
Barium (Ba)-Total	0.0159		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Boron (B)-Total	<0.010		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Cadmium (Cd)-Total	<0.0000050		0.0000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Calcium (Ca)-Total	28.6		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Chromium (Cr)-Total	0.00139		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Copper (Cu)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Iron (Fe)-Total	0.044		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Lead (Pb)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Lithium (Li)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Magnesium (Mg)-Total	2.90		0.0050	mg/L	09-MAY-19	09-MAY-19	R4630240
Manganese (Mn)-Total	0.0101		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Molybdenum (Mo)-Total	0.000123		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Phosphorus (P)-Total	<0.050		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Potassium (K)-Total	1.70		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Rubidium (Rb)-Total	0.00132		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Selenium (Se)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Silicon (Si)-Total	<0.10		0.10	mg/L	09-MAY-19	09-MAY-19	R4630240
Silver (Ag)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Sodium (Na)-Total	28.6		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Strontium (Sr)-Total	0.0659		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Sulfur (S)-Total	0.84		0.50	mg/L	09-MAY-19	09-MAY-19	R4630240
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Thallium (Tl)-Total	<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Thorium (Th)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Tin (Sn)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Titanium (Ti)-Total	<0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
Tungsten (W)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Uranium (U)-Total	0.000034		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Vanadium (V)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	09-MAY-19	09-MAY-19	R4630240
Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
Aggregate Organics							
BOD	<2.0		2.0	mg/L	10-MAY-19	15-MAY-19	R4635543
L2270255-5 OL-9 Sampled By: CLIENT on 08-MAY-19 @ 11:36 Matrix: WATER							
Physical Tests							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-5 OL-9 Sampled By: CLIENT on 08-MAY-19 @ 11:36 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	87.9	HTC	0.50	mg/L		10-MAY-19	
pH	8.27		0.10	pH units		10-MAY-19	R4631164
Total Suspended Solids	<2.0		2.0	mg/L	11-MAY-19	12-MAY-19	R4631444
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	83		10	mg/L		10-MAY-19	R4631164
Ammonia, Total (as N)	0.738	DLHC	0.020	mg/L		10-MAY-19	R4632460
Chloride (Cl)	49.3		0.50	mg/L		10-MAY-19	R4632137
Nitrate (as N)	0.027		0.020	mg/L		10-MAY-19	R4632137
Total Kjeldahl Nitrogen	0.78		0.15	mg/L	14-MAY-19	15-MAY-19	R4635594
Phosphorus, Total	0.0215		0.0030	mg/L	13-MAY-19	14-MAY-19	R4634585
Sulfate (SO4)	1.88		0.30	mg/L		10-MAY-19	R4632137
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					10-MAY-19	R4630430
Dissolved Organic Carbon	5.02		0.50	mg/L	10-MAY-19	10-MAY-19	R4632322
Bacteriological Tests							
E. Coli	1		0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms	0		0	CFU/100mL		10-MAY-19	R4630489
Total Metals							
Aluminum (Al)-Total	0.0083		0.0050	mg/L	09-MAY-19	09-MAY-19	R4630240
Antimony (Sb)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Arsenic (As)-Total	0.00053		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Barium (Ba)-Total	0.0158		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Boron (B)-Total	<0.010		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Cadmium (Cd)-Total	<0.0000050		0.0000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Calcium (Ca)-Total	30.3		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cobalt (Co)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Copper (Cu)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Iron (Fe)-Total	0.020		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Lead (Pb)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Lithium (Li)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Magnesium (Mg)-Total	2.99		0.0050	mg/L	09-MAY-19	09-MAY-19	R4630240
Manganese (Mn)-Total	0.00652		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Molybdenum (Mo)-Total	0.000103		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Nickel (Ni)-Total	<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Phosphorus (P)-Total	<0.050		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Potassium (K)-Total	1.78		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Rubidium (Rb)-Total	0.00130		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Selenium (Se)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-5 OL-9 Sampled By: CLIENT on 08-MAY-19 @ 11:36 Matrix: WATER								
Total Metals								
Silicon (Si)-Total		<0.10		0.10	mg/L	09-MAY-19	09-MAY-19	R4630240
Silver (Ag)-Total		<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Sodium (Na)-Total		28.2		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Strontium (Sr)-Total		0.0671		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Sulfur (S)-Total		0.82		0.50	mg/L	09-MAY-19	09-MAY-19	R4630240
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Thorium (Th)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Tin (Sn)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Titanium (Ti)-Total		<0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
Tungsten (W)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Uranium (U)-Total		0.000035		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Vanadium (V)-Total		<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Zinc (Zn)-Total		<0.0030		0.0030	mg/L	09-MAY-19	09-MAY-19	R4630240
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
Aggregate Organics								
BOD		<2.0		2.0	mg/L	10-MAY-19	15-MAY-19	R4635543
L2270255-6 TRIB-2 Sampled By: CLIENT on 08-MAY-19 @ 13:25 Matrix: WATER								
Physical Tests								
Hardness (as CaCO3)		84.8	HTC	0.50	mg/L		10-MAY-19	
pH		8.23		0.10	pH units		10-MAY-19	R4631164
Total Suspended Solids		<2.0		2.0	mg/L	11-MAY-19	12-MAY-19	R4631444
Anions and Nutrients								
Alkalinity, Total (as CaCO3)		83		10	mg/L		10-MAY-19	R4631164
Ammonia, Total (as N)		0.026		0.010	mg/L		10-MAY-19	R4632460
Chloride (Cl)		51.1		0.50	mg/L		10-MAY-19	R4632137
Nitrate (as N)		<0.020		0.020	mg/L		10-MAY-19	R4632137
Total Kjeldahl Nitrogen		0.37		0.15	mg/L	14-MAY-19	15-MAY-19	R4635594
Phosphorus, Total		0.0197		0.0030	mg/L	13-MAY-19	14-MAY-19	R4634585
Sulfate (SO4)		1.85		0.30	mg/L		10-MAY-19	R4632137
Organic / Inorganic Carbon								
Dissolved Carbon Filtration Location		LAB					10-MAY-19	R4630430
Dissolved Organic Carbon		5.20		0.50	mg/L	10-MAY-19	10-MAY-19	R4632322
Bacteriological Tests								
E. Coli		22	DLM	0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms		50		10	CFU/100mL		10-MAY-19	R4630489
Total Metals								
Aluminum (Al)-Total		0.0108		0.0050	mg/L	09-MAY-19	09-MAY-19	R4630240
Antimony (Sb)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Arsenic (As)-Total		0.00053		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-6 TRIB-2 Sampled By: CLIENT on 08-MAY-19 @ 13:25 Matrix: WATER								
Total Metals								
Barium (Ba)-Total		0.0157		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Beryllium (Be)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Bismuth (Bi)-Total		<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Boron (B)-Total		<0.010		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Cadmium (Cd)-Total		<0.0000050		0.0000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Calcium (Ca)-Total		29.2		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cesium (Cs)-Total		<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Chromium (Cr)-Total		0.00140		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cobalt (Co)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Copper (Cu)-Total		<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Iron (Fe)-Total		0.065		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Lead (Pb)-Total		<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Lithium (Li)-Total		<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Magnesium (Mg)-Total		2.90		0.0050	mg/L	09-MAY-19	09-MAY-19	R4630240
Manganese (Mn)-Total		0.00965		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Molybdenum (Mo)-Total		0.000133		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Nickel (Ni)-Total		<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Phosphorus (P)-Total		<0.050		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Potassium (K)-Total		1.72		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Rubidium (Rb)-Total		0.00133		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Selenium (Se)-Total		0.000051		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Silicon (Si)-Total		<0.10		0.10	mg/L	09-MAY-19	09-MAY-19	R4630240
Silver (Ag)-Total		<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Sodium (Na)-Total		29.3		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Strontium (Sr)-Total		0.0673		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Sulfur (S)-Total		0.81		0.50	mg/L	09-MAY-19	09-MAY-19	R4630240
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Thorium (Th)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Tin (Sn)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Titanium (Ti)-Total		0.00037		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
Tungsten (W)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Uranium (U)-Total		0.000031		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Vanadium (V)-Total		<0.00050		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Zinc (Zn)-Total		<0.0030		0.0030	mg/L	09-MAY-19	09-MAY-19	R4630240
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
Aggregate Organics								
BOD		<3.0	BODL	3.0	mg/L	10-MAY-19	15-MAY-19	R4635543
L2270255-7 TRIB-4 Sampled By: CLIENT on 08-MAY-19 @ 13:15 Matrix: WATER								
Physical Tests								

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-7 TRIB-4 Sampled By: CLIENT on 08-MAY-19 @ 13:15 Matrix: WATER							
Physical Tests							
Hardness (as CaCO3)	280	HTC	0.50	mg/L		10-MAY-19	
pH	7.63		0.10	pH units		10-MAY-19	R4631164
Total Suspended Solids	15.3		2.0	mg/L	12-MAY-19	13-MAY-19	R4632319
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	267		10	mg/L		10-MAY-19	R4631164
Ammonia, Total (as N)	1.19	DLHC	0.10	mg/L		10-MAY-19	R4632460
Chloride (Cl)	10.1		0.50	mg/L		10-MAY-19	R4632137
Nitrate (as N)	6.72		0.020	mg/L		10-MAY-19	R4632137
Total Kjeldahl Nitrogen	2.33		0.15	mg/L	14-MAY-19	15-MAY-19	R4635594
Phosphorus, Total	0.153		0.0030	mg/L	13-MAY-19	14-MAY-19	R4634585
Sulfate (SO4)	8.28		0.30	mg/L		10-MAY-19	R4632137
Organic / Inorganic Carbon							
Dissolved Carbon Filtration Location	LAB					10-MAY-19	R4630430
Dissolved Organic Carbon	6.53		0.50	mg/L	10-MAY-19	10-MAY-19	R4632322
Bacteriological Tests							
E. Coli	19		0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms	20		0	CFU/100mL		10-MAY-19	R4630489
Total Metals							
Aluminum (Al)-Total	0.0495		0.0050	mg/L	09-MAY-19	09-MAY-19	R4630240
Antimony (Sb)-Total	0.00011		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Arsenic (As)-Total	0.00087		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Barium (Ba)-Total	0.0442		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Beryllium (Be)-Total	<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Boron (B)-Total	0.018		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Cadmium (Cd)-Total	0.0000110		0.0000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Calcium (Ca)-Total	99.0		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cesium (Cs)-Total	<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Chromium (Cr)-Total	0.00053		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Cobalt (Co)-Total	0.00030		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Copper (Cu)-Total	0.0015		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Iron (Fe)-Total	0.246		0.010	mg/L	09-MAY-19	09-MAY-19	R4630240
Lead (Pb)-Total	0.000100		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Lithium (Li)-Total	<0.0010		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Magnesium (Mg)-Total	7.92		0.0050	mg/L	09-MAY-19	09-MAY-19	R4630240
Manganese (Mn)-Total	0.194		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Molybdenum (Mo)-Total	0.000491		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Nickel (Ni)-Total	0.00056		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Phosphorus (P)-Total	0.146		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Potassium (K)-Total	6.38		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Rubidium (Rb)-Total	0.00159		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Selenium (Se)-Total	0.000223		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-7 TRIB-4 Sampled By: CLIENT on 08-MAY-19 @ 13:15 Matrix: WATER								
Total Metals								
Silicon (Si)-Total		3.35		0.10	mg/L	09-MAY-19	09-MAY-19	R4630240
Silver (Ag)-Total		<0.000050		0.000050	mg/L	09-MAY-19	09-MAY-19	R4630240
Sodium (Na)-Total		6.75		0.050	mg/L	09-MAY-19	09-MAY-19	R4630240
Strontium (Sr)-Total		0.183		0.0010	mg/L	09-MAY-19	09-MAY-19	R4630240
Sulfur (S)-Total		2.97		0.50	mg/L	09-MAY-19	09-MAY-19	R4630240
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	09-MAY-19	09-MAY-19	R4630240
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Thorium (Th)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Tin (Sn)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Titanium (Ti)-Total		0.00228		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
Tungsten (W)-Total		<0.00010		0.00010	mg/L	09-MAY-19	09-MAY-19	R4630240
Uranium (U)-Total		0.000714		0.000010	mg/L	09-MAY-19	09-MAY-19	R4630240
Vanadium (V)-Total		0.00134		0.00050	mg/L	09-MAY-19	09-MAY-19	R4630240
Zinc (Zn)-Total		0.0040		0.0030	mg/L	09-MAY-19	09-MAY-19	R4630240
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	09-MAY-19	09-MAY-19	R4630240
Aggregate Organics								
BOD		<2.0		2.0	mg/L	10-MAY-19	15-MAY-19	R4635543
L2270255-8 TRIB-5 Sampled By: CLIENT on 08-MAY-19 @ 13:10 Matrix: WATER								
Physical Tests								
Hardness (as CaCO3)		279	HTC	0.50	mg/L		10-MAY-19	
pH		7.98		0.10	pH units		10-MAY-19	R4631164
Total Suspended Solids		<2.0		2.0	mg/L	12-MAY-19	13-MAY-19	R4632319
Anions and Nutrients								
Alkalinity, Total (as CaCO3)		262		10	mg/L		10-MAY-19	R4631164
Ammonia, Total (as N)		0.641	DLHC	0.020	mg/L		10-MAY-19	R4632460
Chloride (Cl)		10.2		0.50	mg/L		10-MAY-19	R4632137
Nitrate (as N)		6.58		0.020	mg/L		10-MAY-19	R4632137
Total Kjeldahl Nitrogen		1.60		0.15	mg/L	16-MAY-19	16-MAY-19	R4636713
Phosphorus, Total		0.148		0.0030	mg/L	13-MAY-19	14-MAY-19	R4634585
Sulfate (SO4)		7.97		0.30	mg/L		10-MAY-19	R4632137
Organic / Inorganic Carbon								
Dissolved Carbon Filtration Location		LAB					10-MAY-19	R4630430
Dissolved Organic Carbon		6.69		0.50	mg/L	10-MAY-19	10-MAY-19	R4632322
Bacteriological Tests								
E. Coli		12		0	CFU/100mL		10-MAY-19	R4630483
Fecal Coliforms		11		0	CFU/100mL		10-MAY-19	R4630489
Total Metals								
Aluminum (Al)-Total		0.0224		0.0050	mg/L	09-MAY-19	10-MAY-19	R4630240
Antimony (Sb)-Total		0.00012		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Arsenic (As)-Total		0.00080		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-8 TRIB-5 Sampled By: CLIENT on 08-MAY-19 @ 13:10 Matrix: WATER								
Total Metals								
Barium (Ba)-Total		0.0427		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Beryllium (Be)-Total		<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Bismuth (Bi)-Total		<0.000050		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Boron (B)-Total		0.020		0.010	mg/L	09-MAY-19	10-MAY-19	R4630240
Cadmium (Cd)-Total		0.0000122		0.0000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Calcium (Ca)-Total		98.5		0.050	mg/L	09-MAY-19	10-MAY-19	R4630240
Cesium (Cs)-Total		<0.000010		0.000010	mg/L	09-MAY-19	10-MAY-19	R4630240
Chromium (Cr)-Total		0.00058		0.00050	mg/L	09-MAY-19	10-MAY-19	R4630240
Cobalt (Co)-Total		0.00023		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Copper (Cu)-Total		0.0015		0.0010	mg/L	09-MAY-19	10-MAY-19	R4630240
Iron (Fe)-Total		0.133		0.010	mg/L	09-MAY-19	10-MAY-19	R4630240
Lead (Pb)-Total		0.000054		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Lithium (Li)-Total		<0.0010		0.0010	mg/L	09-MAY-19	10-MAY-19	R4630240
Magnesium (Mg)-Total		7.93		0.0050	mg/L	09-MAY-19	10-MAY-19	R4630240
Manganese (Mn)-Total		0.112		0.00050	mg/L	09-MAY-19	10-MAY-19	R4630240
Molybdenum (Mo)-Total		0.000558		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Nickel (Ni)-Total		0.00051		0.00050	mg/L	09-MAY-19	10-MAY-19	R4630240
Phosphorus (P)-Total		0.136		0.050	mg/L	09-MAY-19	10-MAY-19	R4630240
Potassium (K)-Total		6.48		0.050	mg/L	09-MAY-19	10-MAY-19	R4630240
Rubidium (Rb)-Total		0.00152		0.00020	mg/L	09-MAY-19	10-MAY-19	R4630240
Selenium (Se)-Total		0.000230		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Silicon (Si)-Total		2.70		0.10	mg/L	09-MAY-19	10-MAY-19	R4630240
Silver (Ag)-Total		<0.000050		0.000050	mg/L	09-MAY-19	10-MAY-19	R4630240
Sodium (Na)-Total		7.10		0.050	mg/L	09-MAY-19	10-MAY-19	R4630240
Strontium (Sr)-Total		0.183		0.0010	mg/L	09-MAY-19	10-MAY-19	R4630240
Sulfur (S)-Total		2.86		0.50	mg/L	09-MAY-19	10-MAY-19	R4630240
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	09-MAY-19	10-MAY-19	R4630240
Thallium (Tl)-Total		<0.000010		0.000010	mg/L	09-MAY-19	10-MAY-19	R4630240
Thorium (Th)-Total		<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Tin (Sn)-Total		<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Titanium (Ti)-Total		0.00093		0.00030	mg/L	09-MAY-19	10-MAY-19	R4630240
Tungsten (W)-Total		<0.00010		0.00010	mg/L	09-MAY-19	10-MAY-19	R4630240
Uranium (U)-Total		0.000737		0.000010	mg/L	09-MAY-19	10-MAY-19	R4630240
Vanadium (V)-Total		0.00121		0.00050	mg/L	09-MAY-19	10-MAY-19	R4630240
Zinc (Zn)-Total		0.0049		0.0030	mg/L	09-MAY-19	10-MAY-19	R4630240
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	09-MAY-19	10-MAY-19	R4630240
Aggregate Organics								
BOD		<3.0	BODL	3.0	mg/L	10-MAY-19	15-MAY-19	R4635543
L2270255-9 OL-1-BOTTOM Sampled By: CLIENT on 08-MAY-19 @ 12:25 Matrix: WATER								
Physical Tests								

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2270255-9 OL-1-BOTTOM Sampled By: CLIENT on 08-MAY-19 @ 12:25 Matrix: WATER Physical Tests Total Suspended Solids Anions and Nutrients Phosphorus, Total Total Metals Iron (Fe)-Total		<2.0 0.0137 <0.050		2.0 0.0030 0.050	mg/L mg/L mg/L	12-MAY-19 13-MAY-19 10-MAY-19	13-MAY-19 14-MAY-19 10-MAY-19	R4632319 R4634585 R4630517
L2270255-10 OL-3 Sampled By: CLIENT on 08-MAY-19 @ 12:04 Matrix: WATER Bacteriological Tests E. Coli Fecal Coliforms		1 1		0 0	CFU/100mL CFU/100mL		10-MAY-19 10-MAY-19	R4630483 R4630489
L2270255-11 OL-5 Sampled By: CLIENT on 08-MAY-19 @ 11:52 Matrix: WATER Bacteriological Tests E. Coli Fecal Coliforms		1 0		0 0	CFU/100mL CFU/100mL		10-MAY-19 10-MAY-19	R4630483 R4630489
L2270255-12 OL-6 Sampled By: CLIENT on 08-MAY-19 @ 11:49 Matrix: WATER Bacteriological Tests E. Coli Fecal Coliforms		0 0		0 0	CFU/100mL CFU/100mL		10-MAY-19 10-MAY-19	R4630483 R4630489
L2270255-13 OL-8 Sampled By: CLIENT on 08-MAY-19 @ 11:40 Matrix: WATER Bacteriological Tests E. Coli Fecal Coliforms		0 1		0 0	CFU/100mL CFU/100mL		10-MAY-19 10-MAY-19	R4630483 R4630489
L2270255-14 OL-10 Sampled By: CLIENT on 08-MAY-19 @ 11:33 Matrix: WATER Bacteriological Tests E. Coli Fecal Coliforms		0 0		0 0	CFU/100mL CFU/100mL		10-MAY-19 10-MAY-19	R4630483 R4630489
L2270255-15 OL-11 Sampled By: CLIENT on 08-MAY-19 @ 11:30 Matrix: WATER Bacteriological Tests E. Coli Fecal Coliforms		0 0		0 0	CFU/100mL CFU/100mL		10-MAY-19 10-MAY-19	R4630483 R4630489

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Total	MS-B	L2270255-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Calcium (Ca)-Total	MS-B	L2270255-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Copper (Cu)-Total	MS-B	L2270255-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Iron (Fe)-Total	MS-B	L2270255-9
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2270255-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Silicon (Si)-Total	MS-B	L2270255-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Sodium (Na)-Total	MS-B	L2270255-1, -2, -3, -4, -5, -6, -7, -8
Matrix Spike	Strontium (Sr)-Total	MS-B	L2270255-1, -2, -3, -4, -5, -6, -7, -8

Sample Parameter Qualifier key listed:

Qualifier	Description
BODL	Limit of Reporting for BOD was increased to account for the largest volume of sample tested.
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).
DLUI	Detection Limit Raised: Unknown Interference generated an apparent false positive test result.
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-WT	Water	Alkalinity, Total (as CaCO3)	EPA 310.2
This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.			
BOD-WT	Water	BOD	APHA 5210 B
This analysis is carried out using procedures adapted from APHA Method 5210B - "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-WT	Water	Chloride by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
DOC-WT	Water	Dissolved Organic Carbon	APHA 5310B
Sample is filtered through a 0.45um filter, then injected into a heated reaction chamber which is packed with an oxidative catalyst. The water is vaporized and the organic carbon is oxidized to carbon dioxide. The carbon dioxide is transported in a carrier gas and is measured by a non-dispersive infrared detector.			
EC-MF-WT	Water	E. coli	SM 9222D
A 100 mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at 44.5 –0.2 °C for 24 – 2 h. Method ID: WT-TM-1200			
FC-MF-WT	Water	Fecal Coliforms	SM 9222D
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC agar and incubated at 24–2h@44.5–0.2°C. Method ID: WT-TM-1200			
HARDNESS-CALC-WT	Water	Hardness	APHA 2340 B
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.			
MET-T-CCMS-WT	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.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
NH3-F-WT	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.			
		Nitrate in Water by IC	EPA 300.1 (mod)

NO3-IC-WT	Water	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
P-T-COL-WT	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is deteremined colourimetrically after persulphate digestion of the sample.			
PH-WT	Water	pH	APHA 4500 H-Electrode
Water samples are analyzed directly by a calibrated pH meter.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days			
SO4-IC-N-WT	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
SOLIDS-TSS-WT	Water	Suspended solids	APHA 2540 D-Gravimetric
A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 104–1°C for a minimum of four hours or until a constant weight is achieved.			
TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-Norg D
This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 Celsius with analysis using an automated colorimetric method.			

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

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

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

LON-190503

GLOSSARY OF REPORT TERMS
Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

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



Quality Control Report

Workorder: L2270255

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-WT		Water						
Batch	R4631164							
WG3046162-12	DUP	WG3046162-11						
Alkalinity, Total (as CaCO ₃)		679	679		mg/L	0.0	20	10-MAY-19
WG3046162-8	DUP	WG3046162-7						
Alkalinity, Total (as CaCO ₃)		91	91		mg/L	0.2	20	10-MAY-19
WG3046162-10	LCS							
Alkalinity, Total (as CaCO ₃)			101.2		%		85-115	10-MAY-19
WG3046162-6	LCS							
Alkalinity, Total (as CaCO ₃)			102.2		%		85-115	10-MAY-19
WG3046162-5	MB							
Alkalinity, Total (as CaCO ₃)			<10		mg/L		10	10-MAY-19
WG3046162-9	MB							
Alkalinity, Total (as CaCO ₃)			<10		mg/L		10	10-MAY-19
BOD-WT		Water						
Batch	R4635543							
WG3046396-10	DUP	L2270255-5						
BOD		<2.0	<2.0	RPD-NA	mg/L	N/A	20	15-MAY-19
WG3046396-2	DUP	L2270255-1						
BOD		<2.0	<2.0	RPD-NA	mg/L	N/A	20	15-MAY-19
WG3046396-6	DUP	L2270255-4						
BOD		<2.0	<2.0	RPD-NA	mg/L	N/A	20	15-MAY-19
WG3046396-11	LCS							
BOD			92.4		%		85-115	15-MAY-19
WG3046396-3	LCS							
BOD			89.9		%		85-115	15-MAY-19
WG3046396-7	LCS							
BOD			94.9		%		85-115	15-MAY-19
WG3046396-1	MB							
BOD			<2.0		mg/L		2	15-MAY-19
WG3046396-5	MB							
BOD			<2.0		mg/L		2	15-MAY-19
WG3046396-9	MB							
BOD			<2.0		mg/L		2	15-MAY-19
CL-IC-N-WT		Water						
Batch	R4632137							
WG3046374-15	DUP	WG3046374-13						
Chloride (Cl)		10.6	10.6		mg/L	0.3	20	10-MAY-19
WG3046374-12	LCS							
Chloride (Cl)			101.9		%		90-110	10-MAY-19



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-N-WT								
Water								
Batch	R4632137							
WG3046374-11 MB								
Chloride (Cl)			<0.50		mg/L		0.5	10-MAY-19
WG3046374-14 MS		WG3046374-13						
Chloride (Cl)			102.9		%		75-125	10-MAY-19
DOC-WT								
Water								
Batch	R4632322							
WG3046454-3 DUP		L2269835-9						
Dissolved Organic Carbon		1.02	1.00		mg/L	1.3	25	10-MAY-19
WG3046454-2 LCS								
Dissolved Organic Carbon			97.3		%		70-130	10-MAY-19
WG3046454-1 MB								
Dissolved Organic Carbon			<0.50		mg/L		0.5	10-MAY-19
WG3046454-4 MS		L2269835-9						
Dissolved Organic Carbon			99.6		%		70-130	10-MAY-19
EC-MF-WT								
Water								
Batch	R4630483							
WG3045577-3 DUP		L2270255-10						
E. Coli		1	<10	RPD-NA	CFU/100mL	N/A	65	10-MAY-19
WG3045577-1 MB								
E. Coli			0		CFU/100mL		1	10-MAY-19
FC-MF-WT								
Water								
Batch	R4630489							
WG3045578-3 DUP		L2270255-6						
Fecal Coliforms		50	31		CFU/100mL	47	65	10-MAY-19
WG3045578-1 MB								
Fecal Coliforms			0		CFU/100mL		1	10-MAY-19
MET-T-CCMS-WT								
Water								
Batch	R4630240							
WG3045634-4 DUP		WG3045634-3						
Aluminum (Al)-Total		0.0226	0.0222		mg/L	1.6	20	09-MAY-19
Antimony (Sb)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	09-MAY-19
Arsenic (As)-Total		0.00025	0.00024		mg/L	2.6	20	09-MAY-19
Barium (Ba)-Total		0.0287	0.0294		mg/L	2.7	20	09-MAY-19
Beryllium (Be)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	09-MAY-19
Bismuth (Bi)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	09-MAY-19
Boron (B)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	09-MAY-19



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4630240							
WG3045634-2	LCS							
Aluminum (Al)-Total			104.2		%		80-120	10-MAY-19
Antimony (Sb)-Total			104.8		%		80-120	10-MAY-19
Arsenic (As)-Total			101.0		%		80-120	10-MAY-19
Barium (Ba)-Total			99.6		%		80-120	10-MAY-19
Beryllium (Be)-Total			104.4		%		80-120	10-MAY-19
Bismuth (Bi)-Total			102.2		%		80-120	10-MAY-19
Boron (B)-Total			102.7		%		80-120	10-MAY-19
Cadmium (Cd)-Total			100.9		%		80-120	10-MAY-19
Calcium (Ca)-Total			101.8		%		80-120	10-MAY-19
Chromium (Cr)-Total			102.2		%		80-120	10-MAY-19
Cesium (Cs)-Total			98.3		%		80-120	10-MAY-19
Cobalt (Co)-Total			98.7		%		80-120	10-MAY-19
Copper (Cu)-Total			98.7		%		80-120	10-MAY-19
Iron (Fe)-Total			101.9		%		80-120	10-MAY-19
Lead (Pb)-Total			101.9		%		80-120	10-MAY-19
Lithium (Li)-Total			103.8		%		80-120	10-MAY-19
Magnesium (Mg)-Total			105.0		%		80-120	10-MAY-19
Manganese (Mn)-Total			102.8		%		80-120	10-MAY-19
Molybdenum (Mo)-Total			101.8		%		80-120	10-MAY-19
Nickel (Ni)-Total			100.8		%		80-120	10-MAY-19
Phosphorus (P)-Total			104.8		%		70-130	10-MAY-19
Potassium (K)-Total			102.6		%		80-120	10-MAY-19
Rubidium (Rb)-Total			103.6		%		80-120	10-MAY-19
Selenium (Se)-Total			97.2		%		80-120	10-MAY-19
Silicon (Si)-Total			105.9		%		60-140	10-MAY-19
Silver (Ag)-Total			99.8		%		80-120	10-MAY-19
Sodium (Na)-Total			101.6		%		80-120	10-MAY-19
Strontium (Sr)-Total			104.2		%		80-120	10-MAY-19
Sulfur (S)-Total			97.6		%		80-120	10-MAY-19
Thallium (Tl)-Total			102.9		%		80-120	10-MAY-19
Tellurium (Te)-Total			99.3		%		80-120	10-MAY-19
Thorium (Th)-Total			99.3		%		70-130	10-MAY-19
Tin (Sn)-Total			101.0		%		80-120	10-MAY-19



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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4630240							
WG3045634-2	LCS							
Titanium (Ti)-Total			100.5		%		80-120	10-MAY-19
Tungsten (W)-Total			100.5		%		80-120	10-MAY-19
Uranium (U)-Total			100.8		%		80-120	10-MAY-19
Vanadium (V)-Total			102.8		%		80-120	10-MAY-19
Zinc (Zn)-Total			102.6		%		80-120	10-MAY-19
Zirconium (Zr)-Total			99.7		%		80-120	10-MAY-19
WG3045634-1	MB							
Aluminum (Al)-Total			<0.0050		mg/L		0.005	09-MAY-19
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	09-MAY-19
Arsenic (As)-Total			<0.00010		mg/L		0.0001	09-MAY-19
Barium (Ba)-Total			<0.00010		mg/L		0.0001	09-MAY-19
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	09-MAY-19
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	09-MAY-19
Boron (B)-Total			<0.010		mg/L		0.01	09-MAY-19
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	09-MAY-19
Calcium (Ca)-Total			<0.050		mg/L		0.05	09-MAY-19
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	09-MAY-19
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	09-MAY-19
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	09-MAY-19
Copper (Cu)-Total			<0.0010		mg/L		0.001	09-MAY-19
Iron (Fe)-Total			<0.010		mg/L		0.01	09-MAY-19
Lead (Pb)-Total			<0.000050		mg/L		0.00005	09-MAY-19
Lithium (Li)-Total			<0.0010		mg/L		0.001	09-MAY-19
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	09-MAY-19
Manganese (Mn)-Total			<0.00050		mg/L		0.0005	09-MAY-19
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	09-MAY-19
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	09-MAY-19
Phosphorus (P)-Total			<0.050		mg/L		0.05	09-MAY-19
Potassium (K)-Total			<0.050		mg/L		0.05	09-MAY-19
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	09-MAY-19
Selenium (Se)-Total			<0.000050		mg/L		0.00005	09-MAY-19
Silicon (Si)-Total			<0.10		mg/L		0.1	09-MAY-19
Silver (Ag)-Total			<0.000050		mg/L		0.00005	09-MAY-19
Sodium (Na)-Total			<0.050		mg/L		0.05	09-MAY-19



Quality Control Report

Workorder: L2270255

Report Date: 17-MAY-19

Page 6 of 11

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4630240							
WG3045634-1 MB								
Strontium (Sr)-Total			<0.0010		mg/L		0.001	09-MAY-19
Sulfur (S)-Total			<0.50		mg/L		0.5	09-MAY-19
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	09-MAY-19
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	09-MAY-19
Thorium (Th)-Total			<0.00010		mg/L		0.0001	09-MAY-19
Tin (Sn)-Total			<0.00010		mg/L		0.0001	09-MAY-19
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	09-MAY-19
Tungsten (W)-Total			<0.00010		mg/L		0.0001	09-MAY-19
Uranium (U)-Total			<0.000010		mg/L		0.00001	09-MAY-19
Vanadium (V)-Total			<0.00050		mg/L		0.0005	09-MAY-19
Zinc (Zn)-Total			<0.0030		mg/L		0.003	09-MAY-19
Zirconium (Zr)-Total			<0.00030		mg/L		0.0003	09-MAY-19
WG3045634-5 MS		WG3045634-3						
Aluminum (Al)-Total			96.6		%		70-130	09-MAY-19
Antimony (Sb)-Total			107.2		%		70-130	09-MAY-19
Arsenic (As)-Total			102.2		%		70-130	09-MAY-19
Barium (Ba)-Total			N/A	MS-B	%		-	09-MAY-19
Beryllium (Be)-Total			99.4		%		70-130	09-MAY-19
Bismuth (Bi)-Total			98.7		%		70-130	09-MAY-19
Boron (B)-Total			98.0		%		70-130	09-MAY-19
Cadmium (Cd)-Total			99.2		%		70-130	09-MAY-19
Calcium (Ca)-Total			N/A	MS-B	%		-	09-MAY-19
Chromium (Cr)-Total			100.1		%		70-130	09-MAY-19
Cesium (Cs)-Total			101.1		%		70-130	09-MAY-19
Cobalt (Co)-Total			100.3		%		70-130	09-MAY-19
Copper (Cu)-Total			N/A	MS-B	%		-	09-MAY-19
Iron (Fe)-Total			95.8		%		70-130	09-MAY-19
Lead (Pb)-Total			99.0		%		70-130	09-MAY-19
Lithium (Li)-Total			94.9		%		70-130	09-MAY-19
Magnesium (Mg)-Total			N/A	MS-B	%		-	09-MAY-19
Manganese (Mn)-Total			98.6		%		70-130	09-MAY-19
Molybdenum (Mo)-Total			106.0		%		70-130	09-MAY-19
Nickel (Ni)-Total			98.6		%		70-130	09-MAY-19
Phosphorus (P)-Total			105.8		%		70-130	09-MAY-19



Quality Control Report

Workorder: L2270255

Report Date: 17-MAY-19

Page 7 of 11

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-WT		Water						
Batch	R4630240							
WG3045634-5 MS		WG3045634-3						
Potassium (K)-Total			98.8		%		70-130	09-MAY-19
Rubidium (Rb)-Total			103.7		%		70-130	09-MAY-19
Selenium (Se)-Total			104.9		%		70-130	09-MAY-19
Silicon (Si)-Total			N/A	MS-B	%		-	09-MAY-19
Silver (Ag)-Total			98.2		%		70-130	09-MAY-19
Sodium (Na)-Total			N/A	MS-B	%		-	09-MAY-19
Strontium (Sr)-Total			N/A	MS-B	%		-	09-MAY-19
Sulfur (S)-Total			105.3		%		70-130	09-MAY-19
Thallium (Tl)-Total			99.1		%		70-130	09-MAY-19
Tellurium (Te)-Total			99.5		%		70-130	09-MAY-19
Thorium (Th)-Total			98.6		%		70-130	09-MAY-19
Tin (Sn)-Total			101.8		%		70-130	09-MAY-19
Titanium (Ti)-Total			98.5		%		70-130	09-MAY-19
Tungsten (W)-Total			99.3		%		70-130	09-MAY-19
Uranium (U)-Total			99.0		%		70-130	09-MAY-19
Vanadium (V)-Total			101.8		%		70-130	09-MAY-19
Zinc (Zn)-Total			86.5		%		70-130	09-MAY-19
Zirconium (Zr)-Total			100.2		%		70-130	09-MAY-19
Batch	R4630517							
WG3046043-4 DUP		WG3046043-3						
Iron (Fe)-Total		0.195	0.193		mg/L	0.7	20	10-MAY-19
WG3046043-2 LCS								
Iron (Fe)-Total			93.9		%		80-120	10-MAY-19
WG3046043-1 MB								
Iron (Fe)-Total			<0.010		mg/L		0.01	10-MAY-19
WG3046043-5 MS		WG3046043-6						
Iron (Fe)-Total			N/A	MS-B	%		-	10-MAY-19
NH3-F-WT		Water						
Batch	R4632460							
WG3046447-7 DUP		L2270255-2						
Ammonia, Total (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	20	10-MAY-19
WG3046447-6 LCS								
Ammonia, Total (as N)			96.5		%		85-115	10-MAY-19
WG3046447-5 MB								
Ammonia, Total (as N)			<0.010		mg/L		0.01	10-MAY-19



Quality Control Report

Workorder: L2270255

Report Date: 17-MAY-19

Page 8 of 11

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-F-WT	Water							
Batch R4632460								
WG3046447-8 MS		L2270255-2						
Ammonia, Total (as N)			99.2		%		75-125	10-MAY-19
NO3-IC-WT	Water							
Batch R4632137								
WG3046374-15 DUP		WG3046374-13						
Nitrate (as N)		0.396	0.393		mg/L	0.7	20	10-MAY-19
WG3046374-12 LCS								
Nitrate (as N)			100.7		%		90-110	10-MAY-19
WG3046374-11 MB								
Nitrate (as N)			<0.020		mg/L		0.02	10-MAY-19
WG3046374-14 MS		WG3046374-13						
Nitrate (as N)			101.5		%		75-125	10-MAY-19
P-T-COL-WT	Water							
Batch R4634585								
WG3048538-3 DUP		L2270255-5						
Phosphorus, Total		0.0215	0.0233		mg/L	8.1	20	14-MAY-19
WG3048538-2 LCS								
Phosphorus, Total			100.7		%		80-120	14-MAY-19
WG3048538-1 MB								
Phosphorus, Total			<0.0030		mg/L		0.003	14-MAY-19
WG3048538-4 MS		L2270255-5						
Phosphorus, Total			79.2		%		70-130	14-MAY-19
PH-WT	Water							
Batch R4631164								
WG3046162-12 DUP		WG3046162-11						
pH		7.66	7.67	J	pH units	0.01	0.2	10-MAY-19
WG3046162-8 DUP		WG3046162-7						
pH		7.68	7.65	J	pH units	0.03	0.2	10-MAY-19
WG3046162-10 LCS								
pH			7.01		pH units		6.9-7.1	10-MAY-19
WG3046162-6 LCS								
pH			7.03		pH units		6.9-7.1	10-MAY-19
SO4-IC-N-WT	Water							



Quality Control Report

Workorder: L2270255

Report Date: 17-MAY-19

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Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3

Contact: Brent Parsons

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT	Water							
Batch	R4636713							
WG3051128-2	LCS							
Total Kjeldahl Nitrogen			97.5		%		75-125	16-MAY-19
WG3051128-1	MB							
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	16-MAY-19
WG3051128-4	MS	L2273562-1						
Total Kjeldahl Nitrogen			109.2		%		70-130	16-MAY-19

Quality Control Report

Workorder: L2270255

Report Date: 17-MAY-19

Client: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
501 Krug St. Suite 202
Kitchener ON N2B 1L3
Contact: Brent Parsons

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Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L2270255-COFC

COC Number: LON-190503

Page 1 of 2

Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Company:	HUTCHINSON ENV	Select Report Format:	<input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)	Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply	
Contact:	BRENT PARSONS	Quality Control (QC) Report with Report	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Emergency [E] <input type="checkbox"/> 1 Business day [E - 100%]	
Phone:	519-576-1711	<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked		Same Day, Weekend or Statutory holiday [E2 - 200%] <input type="checkbox"/> (Laboratory opening fees may apply)	
Company address below will appear on the final report		Select Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	Date and Time Required for all E&P TATs: dd-mm-yy hh:mm	
Street:	501 KRUG ST ST 202	Email 1 or Fax:	deborah.sincclair@environmentalsciences.ca	For tests that can not be performed according to the service level selected, you will be contacted.	
City/Province:	KTICHENER, ON	Email 2:	brent.parsons@environmentalsciences.ca	Analysis Request	
Postal Code:	N2B 1L3	Email 3:		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	
Invoice To:	Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Invoice Distribution		NUMBER OF CONTAINERS	
	Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Select Invoice Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	SAMPLES ON HOLD	
Company:		Email 1 or Fax:	accounting@environmentalsciences.ca	SUSPECTED HAZARD (see Special Instructions)	
Contact:		Email 2:			
Project Information		Oil and Gas Required Fields (client use)			
ALS Account # / Quote #:	Q69690	AFE/Cost Center:		PO#	
Job #:	180050	Major/Minor Code:		Routing Code:	
PO / AFE:		Requisitioner:			
LSD:		Location:			
ALS Lab Work Order # (lab use only): <u>L2270255</u>		ALS Contact:	Gayle	Sampler:	
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	
1	OL-1	8-05-19	12:20	WATER	6
2	OL-2	"	11:25	WATER	6
3	OL-4	"	11:57	WATER	6
4	OL-7	"	11:45	WATER	6
5	OL-9	"	11:36	WATER	6
6	TRIB-1	"	"	WATER	6
7	TRIB-2	"	13:25	WATER	6
8	TRIB-4	"	13:15	WATER	6
9	TRIB-5	"	13:10	WATER	6
10	OL-1-BOTTOM	"	12:25	WATER	3
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)	
Are samples taken from a Regulated DW System?				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>	
<input type="checkbox"/> YES <input type="checkbox"/> NO				Ice Packs <input type="checkbox"/> Ice Cubes <input checked="" type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>	
Are samples for human consumption/ use?				Cooling Initiated <input type="checkbox"/>	
<input type="checkbox"/> YES <input type="checkbox"/> NO				INITIAL COOLER TEMPERATURES °C	
				6.8	
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)	
Released by:	Date:	Time:	Received by:	Date:	Time:
				May 9 2019	99

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY

YELLOW - CLIENT COPY

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

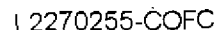
1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

SIF

OCT 2016 FRONT



Canada Toll Free: 1 800 668 9878



COC Number: **LON-190503**

Page 2 of 2

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCT 2014 (FRI)

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

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



Sample Receipt Confirmation

Report Distribution:

Company Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: Brent Parsons
Address: 501 Krug St., Suite 202
Kitchener, ON, N2B 1L3
Phone: 519-576-1711
Fax: 866-205-7766
Email: deborah.sinclair@environmentalsciences.ca
brent.parsons@environmentalsciences.ca
EDD Email: --
Distribution: Hard Copy: N Email: Y Fax: N EDD: N

Invoice Distribution:

Acct Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: ACCOUNTS PAYABLE
Address: 1-5 Chancery Lane,
Bracebridge, ON, P1L 2E3
Phone: 705-645-0021
Fax: 705-457-5811
Invoice Email: deborah.sinclair@environmentalsciences.ca
accounting@environmentalsciences.ca
Project #: N/A
Account #: 20126

Client Information:

Job Reference #: 180050
Project PO #:
Legal Site Description: N/A
Quote #: Q69690

Date Sampled: 08-MAY-19
Date Received: 09-MAY-19
Sampled By:
Chain Of Custody: --

Workorder Summary:

Lab Work Order #: L2270097
Estimated completion date: 18-SEP-19
15 Samples received at ALS in WINNIPEG

Client Job #: 180050
Account Manager: Connor Cattani
Estimated sample disposal date: See Sample Disposal Information section below.

Lab Sample ID	Client Sample ID	Date Sampled	Date Received	Sample Due Date	Priority Flag	Sample Type
L2270097-1	OL-1	08-MAY-19 12:20	09-MAY-19 09:00	18-SEP-19		WATER
L2270097-2	OL-2	08-MAY-19 11:25	09-MAY-19 09:00	24-MAY-19		WATER
L2270097-3	OL-4	08-MAY-19 11:57	09-MAY-19 09:00	24-MAY-19		WATER
L2270097-4	OL-7	08-MAY-19 11:45	09-MAY-19 09:00	24-MAY-19		WATER
L2270097-5	OL-9	08-MAY-19 11:36	09-MAY-19 09:00	24-MAY-19		WATER
L2270097-6	TRIB-2	08-MAY-19 13:25	09-MAY-19 09:00	24-MAY-19		WATER
L2270097-7	TRIB-4	08-MAY-19 13:15	09-MAY-19 09:00	24-MAY-19		WATER
L2270097-8	TRIB-5	08-MAY-19 13:10	09-MAY-19 09:00	24-MAY-19		WATER
L2270097-9	ALGAE 1	08-MAY-19 12:45	09-MAY-19 09:00	18-SEP-19		WATER
L2270097-10	OL-3	08-MAY-19 12:04	09-MAY-19 09:00	24-MAY-19		WATER
L2270097-11	OL-5	08-MAY-19 11:52	09-MAY-19 09:00	24-MAY-19		WATER
L2270097-12	OL-6	08-MAY-19 11:49	09-MAY-19 09:00	24-MAY-19		WATER
L2270097-13	OL-8	08-MAY-19 11:40	09-MAY-19 09:00	24-MAY-19		WATER
L2270097-14	OL-10	08-MAY-19 11:33	09-MAY-19 09:00	24-MAY-19		WATER
L2270097-15	OL-11	08-MAY-19 11:30	09-MAY-19 09:00	24-MAY-19		WATER



**Analysis
Requested :**

	Chlorophyll a by fluorometry	Fecal streptococcus	Phytoplankton	Pseudomonas aeruginosa	Sample Handling and Disposal Fee
OL-1	✓	✓	✓	✓	✓
OL-2	✓	✓		✓	✓
OL-4	✓	✓		✓	✓
OL-7	✓	✓		✓	✓
OL-9	✓	✓		✓	✓
TRIB-2	✓	✓		✓	✓
TRIB-4	✓	✓		✓	✓
TRIB-5	✓	✓		✓	✓
ALGAE 1			✓		✓
OL-3		✓		✓	✓
OL-5		✓		✓	✓
OL-6		✓		✓	✓
OL-8		✓		✓	✓
OL-10		✓		✓	✓
OL-11		✓		✓	✓

Sample Integrity Observations: No observations were identified for this work order submission.

Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



Canada Toll Free: 1 800 668 9878



L2270097-COFC

COC Number: LON-190128/

Page of

Report To		Contact and company name below will appear on the final report		Report Format / Di		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																	
Company:		HUTCHINSON ENV		Select Report Format: <input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)		Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply																	
Contact:		BRENT PARSONS		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		PRIORITY (Business Days) 4 day [P4-20%] <input type="checkbox"/> 3 day [P3-25%] <input type="checkbox"/> 2 day [P2-50%] <input type="checkbox"/> EMERGENCY 1 Business day [E - 100%] <input type="checkbox"/> Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply) <input type="checkbox"/>																	
Phone:		519-576-1711		<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked		Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm																	
		Company address below will appear on the final report		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		For tests that can not be performed according to the service level selected, you will be contacted.																	
Street:		501 KRUG ST ST 202		Email 1 or Fax: deborah.sinclair@environmentalsciences.ca		Analysis Request																	
City/Province:		KTICHENER, ON		Email 2: brent.parsons@environmentalsciences.ca		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																	
Postal Code:		N2B 1L3		Email 3:		NUMBER OF CONTAINERS																	
Invoice To:		Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Invoice Distribution		FECAL STREP PSEUDOMONAS CHLOROPHYLL A PHYTOPLANKTON																	
		Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		SAMPLES ON HOLD																	
Company:				Email 1 or Fax: accounting@environmentalsciences.ca		SUSPECTED HAZARD (see Special Instructions)																	
Contact:				Email 2:																			
Project Information				Oil and Gas Required Fields (client use)																			
ALS Account # / Quote #:				Q69690		AFE/Cost Center:		PO#:															
Job #:				180050		Major/Minor Code:		Routing Code:															
PO / AFE:						Requisitioner:																	
LSD:						Location:																	
ALS Lab Work Order # (lab use only):				ALS Contact:		Gayle		Sampler:															
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	FECAL STREP	PSEUDOMONAS	CHLOROPHYLL A	PHYTOPLANKTON											SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
1	OL-1			8-05-19	12:20	WATER	3	R	R	R	R												
2	OL-2			"	11:25	WATER	2	R	R	R													
3	OL-4			"	11:57	WATER	2	R	R	R													
4	OL-7			"	11:45	WATER	2	R	R	R													
5	OL-9			"	11:36	WATER	2	R	R	R													
6	TRIB-1					WATER	2	R	R	R													
6	TRIB-2			"	13:25	WATER	2	R	R	R													
7	TRIB-3					WATER	2	R	R	R													
7	TRIB-4			"	13:15	WATER	2	R	R	R													
8	TRIB-5			"	13:10	WATER	2	R	R	R													
9	Algae 1				12:45	WATER	1	R	R		R												
Drinking Water (DW) Samples (client use)				Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)				SAMPLE CONDITION AS RECEIVED (lab use only)															
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO								Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>															
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO								Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>															
								Cooling Initiated <input type="checkbox"/>															
								INITIAL COOLER TEMPERATURES °C															
								FINAL COOLER TEMPERATURES °C															
SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)															
Released by:		Date:		Time:		Received by:		Date:		Time:		Received by:		Date:		Time:							

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

~~MAY 09 2019~~

OCT 2018 FROM

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



Canada Toll Free: 1 800 668 9878

COC Number: LON-190128/

Page of



12270097-COFC

[illegible]

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



Sample Receipt Confirmation

Report Distribution:

Company Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: Brent Parsons
Address: 501 Krug St., Suite 202
Kitchener, ON, N2B 1L3
Phone: 519-576-1711
Fax: 866-205-7766
Email: deborah.sinclair@environmentalsciences.ca
brent.parsons@environmentalsciences.ca
EDD Email: --
Distribution: Hard Copy: N Email: Y Fax: N EDD: N

Invoice Distribution:

Acct Name: HUTCHINSON ENVIRONMENTAL SCIENCES LTD
Contact: ACCOUNTS PAYABLE
Address: 1-5 Chancery Lane,
Bracebridge, ON, P1L 2E3
Phone: 705-645-0021
Fax: 705-457-5811
Invoice Email: deborah.sinclair@environmentalsciences.ca
accounting@environmentalsciences.ca
Project #: N/A
Account #: 20126

Client Information:

Job Reference #: 180050
Project PO #:
Legal Site Description: N/A
Quote #: Q69690

Date Sampled: 08-MAY-19
Date Received: 09-MAY-19
Sampled By: CLIENT
Chain Of Custody: LON-190503

Workorder Summary:

Lab Work Order #: L2270255
Estimated completion date: 16-MAY-19
15 Samples received at ALS in LONDON

Client Job #: 180050
Account Manager: Gayle Braun
Estimated sample disposal date: See Sample Disposal Information section below.

Note: There are sample integrity issues with your samples submitted. Please see Sample Integrity Observations below for more details.

Lab Sample ID	Client Sample ID	Date Sampled	Date Received	Sample Due Date	Priority Flag	Sample Type
L2270255-1	OL-1	08-MAY-19 12:20	09-MAY-19 09:05	16-MAY-19		WATER
L2270255-2	OL-2	08-MAY-19 11:25	09-MAY-19 09:05	16-MAY-19		WATER
L2270255-3	OL-4	08-MAY-19 11:57	09-MAY-19 09:05	16-MAY-19		WATER
L2270255-4	OL-7	08-MAY-19 11:45	09-MAY-19 09:05	16-MAY-19		WATER
L2270255-5	OL-9	08-MAY-19 11:36	09-MAY-19 09:05	16-MAY-19		WATER
L2270255-6	TRIB-2	08-MAY-19 13:25	09-MAY-19 09:05	16-MAY-19		WATER
L2270255-7	TRIB-4	08-MAY-19 13:15	09-MAY-19 09:05	16-MAY-19		WATER
L2270255-8	TRIB-5	08-MAY-19 13:10	09-MAY-19 09:05	16-MAY-19		WATER
L2270255-9	OL-1-BOTTOM	08-MAY-19 12:25	09-MAY-19 09:05	16-MAY-19		WATER
L2270255-10	OL-3	08-MAY-19 12:04	09-MAY-19 09:05	16-MAY-19		WATER
L2270255-11	OL-5	08-MAY-19 11:52	09-MAY-19 09:05	16-MAY-19		WATER
L2270255-12	OL-6	08-MAY-19 11:49	09-MAY-19 09:05	16-MAY-19		WATER
L2270255-13	OL-8	08-MAY-19 11:40	09-MAY-19 09:05	16-MAY-19		WATER
L2270255-14	OL-10	08-MAY-19 11:33	09-MAY-19 09:05	16-MAY-19		WATER
L2270255-15	OL-11	08-MAY-19 11:30	09-MAY-19 09:05	16-MAY-19		WATER



**Analysis
Requested :**

	Alkalinity, Total [as CaCO ₃]	BOD	Chloride by IC	Dissolved Organic Carbon	E. coli	Fecal Coliforms	Hardness	One Metal in Water by ICPMS [Total]	Total Metals in Water by CRC ICPMS	Ammonia in Water by Fluorescence	Nitrate in Water by IC	Total P in Water by Colour	pH	Sulfate in Water by IC	Suspended solids	TKN and Total Phosphorus	Sample Handling and Disposal Fee
OL-1	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-2	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-4	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-7	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-9	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
TRIB-2	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
TRIB-4	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
TRIB-5	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓
OL-1-BOTTOM								✓				✓			✓		✓
OL-3					✓	✓											✓
OL-5					✓	✓											✓
OL-6					✓	✓											✓
OL-8					✓	✓											✓
OL-10					✓	✓											✓
OL-11					✓	✓											✓

Login Comments:

Your samples were at 6.6 °C when unpacked at the laboratory.

Sample Integrity Observations:

Observation	Details
Discrepancy between CofC and label	All three bottles for Fraction -09 (OL-1-BOTTOM) were packed in a bag labeled as OL-1-BOTTOM but the General Chemistry bottle within that bag was labeled OL-7. This fraction was logged in according to the label on the sealed bag (OL-1-BOTTOM).



Notice of Sub-contract Laboratory Service

Please be advised that the following tests will be subcontracted to the corresponding laboratory:

Ammonia in Water by Fluorescence subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Suspended solids subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
E. coli subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Alkalinity, Total (as CaCO₃) subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Total P in Water by Colour subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
pH subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Nitrate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Hardness subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Total Kjeldahl Nitrogen subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Fecal Coliforms subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Chloride by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Sulfate in Water by IC subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
BOD subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Total Metals in Water by CRC ICPMS subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
Dissolved Organic Carbon subcontracted to: ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Please contact your Account Manager immediately should you have questions or concerns regarding this arrangement. Approval of this arrangement shall be implied unless otherwise notified by you.

Sample Disposal Information:

Where possible, ALS will store samples for the following durations, measured from date of sample submission: 45 days for Soil and Water samples; 6 months for Tissue/Biota samples; 14 days for air samples collected on re-usable media; and 3 days for water samples submitted for microbiological testing. Longer storage times are available upon request.

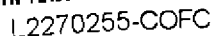
For information about ALS accreditations and certifications please contact your Account Manager or visit our webpage at www.alsglobal.com (see Canada downloads).

ALS Group strives to deliver on-time results to our clients at all times. However, there are times when due to capacity issues or other unforeseen circumstances we are unable to meet our expected turnaround times. The information above is related to a recent workorder you have submitted to our laboratory. In the event that you have an inquiry, please refer to the Lab Work Order # when calling your Account Manager.

ALS Group appreciates your business. Thank you for the opportunity to work with you.



Canada Toll Free: 1 800 668 9878



COC Number: LON-190503

Page 1 of 1

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Report To						Contact and company name below will appear on the final report													
Company:						HUTCHINSON ENV													
Contact:						BRENT PARSONS													
Phone:						519-576-1711													
						Company address below will appear on the final report													
Street:						501 KRUG ST ST 202													
City/Province:						KTICHENER, ON													
Postal Code:						N2B 1L3													
Invoice To						Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO													
						Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO													
Company:																			
Contact:																			
Project Information						Oil and Gas Required Fields (client use)													
ALS Account # / Quote #:						Q69890													
Job #:						180050													
PO / AFE:																			
LSD:																			
ALS Lab Work Order # (lab use only):						C2270255													
ALS Sample # (lab use only)						Sample Identification and/or Coordinates (This description will appear on the report)						Date (dd-mm-yy)		Time (hh:mm)		Sample Type			
1						OL-1						8-05-19		12:20		WATER			
2						OL-2						"		11:25		WATER			
3						OL-4						"		11:57		WATER			
4						OL-7						"		11:45		WATER			
5						OL-9						"		11:36		WATER			
6						TRIB-1						"		13:25		WATER			
7						TRIB-2						"		13:15		WATER			
8						TRIB-5						"		13:10		WATER			
9						OL-1-BOTTOM						"		12:25		WATER			
Drinking Water (DW) Samples ¹ (client use)						Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)													
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO						Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO													
SHIPMENT RELEASE (client use)						INITIAL SHIPMENT RECEPTION (lab use only)													
Released by:						Received by:						Received by:							
Date:						Date:						Date:							
Time:						Time:						Time:							
SAMPLE CONDITION AS RECEIVED (lab use only)						Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice Packs <input type="checkbox"/> Ice Cubes <input checked="" type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/>													
INITIAL COOLER TEMPERATURES °C						FINAL COOLER TEMPERATURES °C						6.8							
SHIPMENT RELEASE (client use)						FINAL SHIPMENT RECEPTION (lab use only)													
Released by:						Received by:						Received by:							
Date:						Date:						Date:							
Time:						Time:						Time:							

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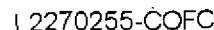
1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW CQC form**.

OCT 2016 FROM

SIF



Canada Toll Free: 1 800 668 9878



COC Number: LON-190503

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



www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L2232735-COFC

COC Number: LON-190128/

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Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																																																																																																						
Company: HUTCHINSON ENV		Select Report Format: <input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)		Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply																																																																																																						
Contact: BRENT PARSONS		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		4 day [P4-20%] <input type="checkbox"/> 1 Business day [E - 100%] <input type="checkbox"/>																																																																																																						
Phone: 519-576-1711		<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked		3 day [P3-25%] <input type="checkbox"/> Same Day, Weekend or Statutory holiday [E2 -200%] <input type="checkbox"/>																																																																																																						
Company address below will appear on the final report		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX		2 day [P2-50%] <input type="checkbox"/> (Laboratory opening fees may apply)																																																																																																						
Street: 501 KRUG ST ST 202		Email 1 or Fax: deborah.sinclair@environmentalsciences.ca		Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm																																																																																																						
City/Province: KITCHENER, ON		Email 2: brent.parsons@environmentalsciences.ca		For tests that can not be performed according to the service level selected, you will be contacted.																																																																																																						
Postal Code: N2B 1L3		Email 3:		Analysis Request																																																																																																						
Invoice To: Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Invoice Distribution		<table border="1"> <tr> <th colspan="12">Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below</th> </tr> <tr> <th rowspan="5">NUMBER OF CONTAINERS</th> <th rowspan="5">FECAL STREP</th> <th rowspan="5">PSEUDOMONAS</th> <th rowspan="5">CHLOROPHYLL A</th> <th rowspan="5">PHYTOPLANKTON</th> <th colspan="12"></th> </tr> <tr><td colspan="12"></td></tr> <tr><td colspan="12"></td></tr> <tr><td colspan="12"></td></tr> <tr><td colspan="12"></td></tr> <tr> <th colspan="12">SAMPLES ON HOLD</th> </tr> <tr> <th colspan="12">SUSPECTED HAZARD (see Special Instructions)</th> </tr> </table>		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below												NUMBER OF CONTAINERS	FECAL STREP	PSEUDOMONAS	CHLOROPHYLL A	PHYTOPLANKTON																																																													SAMPLES ON HOLD												SUSPECTED HAZARD (see Special Instructions)											
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ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																																																																																																						
OL-1		11-02-19		WATER	3 R R R R																																																																																																					
OL-2				WATER	2 R R R R																																																																																																					
OL-4				WATER	2 R R R R																																																																																																					
OL-7				WATER	2 R R R R																																																																																																					
OL-9				WATER	2 R R R R																																																																																																					
OL-3				WATER	1 R																																																																																																					
OL-5				WATER	1 R																																																																																																					
OL-6				WATER	1 R																																																																																																					
OL-8				WATER	1 R																																																																																																					
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SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																																																																																																						
Released by:	Date:	Time:	Received by: MH	Date: 14-2-19	Time: 900																																																																																																					

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



Canada Toll Free: 1 800 668 9878



L2270097-COFC

COC Number: LON-190128/

Page of

Report To Contact and company name below will appear on the final report		Report Format / Di		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)																									
Company: HUTCHINSON ENV		Select Report Format: <input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)		Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply																									
Contact: BRENT PARSONS		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		PRIORITY (Business Days)		4 day [P4-20%] <input type="checkbox"/>		EMERGENCY		1 Business day [E - 100%]																			
Phone: 519-576-1711		<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked				3 day [P3-25%] <input type="checkbox"/>				Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)]																			
Company address below will appear on the final report		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX				2 day [P2-50%] <input type="checkbox"/>																							
Street: 501 KRUG ST ST 202		Email 1 or Fax: deborah.sinclair@environmentalsciences.ca		Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm																									
City/Province: KITCHENER, ON		Email 2: brent.parsons@environmentalsciences.ca		For tests that can not be performed according to the service level selected, you will be contacted.																									
Postal Code: N2B 1L3		Email 3:		Analysis Request																									
Invoice To: Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Invoice Distribution		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																									
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Company:		Email 1 or Fax: accounting@environmentalsciences.ca		NUMBER OF CONTAINERS										SAMPLES ON HOLD															
Contact:		Email 2:																											
Project Information		Oil and Gas Required Fields (client use)																											
ALS Account # / Quote #: Q69690		AFE/Cost Center:																						PO#					
Job #: 180050		Major/Minor Code:		Routing Code:																									
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LSD:		Location:																											
ALS Lab Work Order # (lab use only):		ALS Contact: Gayle																						Sampler:					
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mmm-yy)		Time (hh:mm)		Sample Type																					
1		OL-1		8-05-19		12:20		WATER																					
2		OL-2		"		11:25		WATER																					
3		OL-4		"		11:57		WATER																					
4		OL-7		"		11:45		WATER																					
5		OL-9		"		11:36		WATER																					
6		TRIB-1		"		13:25		WATER																					
7		TRIB-2		"		13:15		WATER																					
8		TRIB-3		"		13:10		WATER																					
9		Algae 1		"		12:45		WATER																					
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)		SAMPLE CONDITION AS RECEIVED (lab use only)																									
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																									
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO				Ice Packs <input type="checkbox"/> Ice Cubes <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																									
				Cooling Initiated <input type="checkbox"/>																									
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SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)																									
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1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.



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COC Number: LON-190128/

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L2270255-COFC

COC Number: LON-190503

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Report To Contact and company name below will appear on the final report		Report Format / Distribution		Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Company:	HUTCHINSON ENV	Select Report Format:	<input checked="" type="checkbox"/> PDF <input type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)	Regular [R] <input checked="" type="checkbox"/> Standard TAT if received by 3 pm - business days - no surcharges apply	
Contact:	BRENT PARSONS	Quality Control (QC) Report with Report	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Emergency [E] <input type="checkbox"/> 1 Business day [E - 100%]	
Phone:	519-576-1711	<input type="checkbox"/> Compare Results to Criteria on Report - provide details below if box checked		Same Day, Weekend or Statutory holiday [E2 - 200%] <input type="checkbox"/> (Laboratory opening fees may apply)	
Company address below will appear on the final report		Select Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	Date and Time Required for all E&P TATs: dd-mm-yy hh:mm	
Street:	501 KRUG ST ST 202	Email 1 or Fax:	deborah.sincclair@environmentalsciences.ca	For tests that can not be performed according to the service level selected, you will be contacted.	
City/Province:	KTICHENER, ON	Email 2:	brent.parsons@environmentalsciences.ca	Analysis Request	
Postal Code:	N2B 1L3	Email 3:		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	
Invoice To:	Same as Report To <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Invoice Distribution		NUMBER OF CONTAINERS	
	Copy of Invoice with Report <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Select Invoice Distribution:	<input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	SAMPLES ON HOLD	
Company:		Email 1 or Fax:	accounting@environmentalsciences.ca	SUSPECTED HAZARD (see Special Instructions)	
Contact:		Email 2:			
Project Information		Oil and Gas Required Fields (client use)			
ALS Account # / Quote #:	Q69690	AFE/Cost Center:		PO#	
Job #:	180050	Major/Minor Code:		Routing Code:	
PO / AFE:		Requisitioner:			
LSD:		Location:			
ALS Lab Work Order # (lab use only): <u>L2270255</u>		ALS Contact:	Gayle	Sampler:	
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type	
1	OL-1	8-05-19	12:20	WATER	6
2	OL-2	"	11:25	WATER	6
3	OL-4	"	11:57	WATER	6
4	OL-7	"	11:45	WATER	6
5	OL-9	"	11:36	WATER	6
6	TRIB-1			WATER	6
7	TRIB-2	"	13:25	WATER	6
8	TRIB-3			WATER	6
9	TRIB-4	"	13:15	WATER	6
10	TRIB-5	"	13:10	WATER	6
11	OL-1-BOTTOM	"	12:25	WATER	3
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)			
Are samples taken from a Regulated DW System? <input type="checkbox"/> YES <input type="checkbox"/> NO					
Are samples for human consumption/ use? <input type="checkbox"/> YES <input type="checkbox"/> NO					
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			
Released by:	Date:	Time:	Received by:	Date:	Time:
FINAL SHIPMENT RECEPTION (lab use only)		SAMPLE CONDITION AS RECEIVED (lab use only)			
Received by:		Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>			
Date:		Ice Packs <input type="checkbox"/> Ice Cubes <input checked="" type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>			
Time:		Cooling Initiated <input type="checkbox"/>			
		INITIAL COOLER TEMPERATURES °C			
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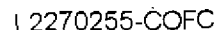
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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Appendix D. Landowner Comments and Responses



Date	Name	Question(s)	Response to Questions for HESL (where applicable)
August 2 nd , 2019	Bruce Kerr	<p>1. Are the 3 culverts mentioned at our discussion part of the overall scope of work being presented to council as presented?</p> <p>2. Assuming that QW is going to proceed, then I see an opportunity for another sales job to get people on side for a request for a septic bylaw. Would council be able to provide a mailing list for all the property owners being affected in let's say an area specific by law.</p> <p>3. Would you be able to produce a sheet of names of people for a canvassing campaign, asking for and against, that would be acceptable to council to pass or deny a septic bylaw specific to oak lake drainage area?</p> <p>4. could a by law, if available, include a period of time to complete any system changes?</p> <p>5. could a cost of system be added to tax bills for a time period for those requiring assistance.</p>	<p>These questions are procedural points on how Quinte West plans to move forward with implementing the recommendations of the HESL report, specifically the potential for and implementation of a septic system bylaw. These questions cannot be addressed by HESL.</p>
July, 11, 2019	Sandra Brett	<p>"The survey that Hutchinson is doing w/ re: to Oak Lake, does it include testing for anitoxins which are created by the algae? If testing is being done, what sort of parameters are being set for levels that are decreed to humans and to animals? We have an excess of algae this year and some people are getting reactions in the water. I would like to know if Hutchinson is pursuing this as any part of their investigation?"</p>	<p>Our proposal included the possibility of testing for microcystin (an algal toxin produced by cyanobacteria which can be harmful to animals and humans). The HESL workplan included microcystin sampling if a blue-green algal bloom on the lake was identified or suspected during our routine sampling. Microcystin analysis was completed during the July 2019 sampling event despite the fact that a blue-green algal bloom did not appear to be present as part of a conservative assessment.</p>
August 30, 2019	Chris Blackford	<p>1. In many places of the report, they reference earlier reports that made recommendations for improving water quality. For example, reports in 2002 called for restrictions to property development (pg. 55-56), development of a by-law to ensure proper septic system functioning (pg. 60), and restrictions on shoreline development (p.g.61-62). All of these issues were still cause for concern in this report, 17 years later. Since we have spent many years and a lot of money figuring out the environmental problems of Oak Lake, I urge council to act on enforcement in some capacity. In section 5.1.3 the report recommends one way in which enforcement can be carried out effectively (e.g. under the municipal act).</p>	<p>1. We agree enforcement and community support are key to the success of any plan moving forward.</p> <p>2. Pigeon Lake is a very different system from Oak Lake, which HESL has worked on in the past with the Alberta Government. The lakes differ not only in morphology and hydrology but also in sampling effort. Pigeon Lake is an intensively studied lake by the Government of Alberta with long term records on</p>



		<p>2. The phosphorus budget created by Hutchinson is a great tool for understanding Phosphorus inputs into the lake. However, the Phosphorus budget only quantified the different sources of phosphorus inputs into the lake and didn't estimate phosphorus moving out of the lake (i.e. output). Typically, major phosphorus outputs in lakes are from rivers flowing out of the lake, phosphorus settling into the sediment, or uptake by plants. Phosphorus outputs from the lake are also often looked at when creating phosphorus budgets (eg. Pidgeon lake in Alberta https://open.alberta.ca/publications/9780778598787). If the phosphorus outflow from the lake is significant it is useful to know to help manage phosphorus levels of the lake. Is it possible to get an estimate from Hutchinson on how much Phosphorus is leaving the lake?</p> <p>Additionally, phosphorus outflow from the lake is important to understand because it relates to the water level of the lake. If there is no route for phosphorus to flow out of the lake, this could increase phosphorus in the lake. The link between water levels in the lake and phosphorus was not made explicit in the report in my opinion. I recognize that public opinion is divided about appropriate water levels but I don't think there is recognition that the water level of the lake affects more than just flooding - it impacts the phosphorus concentrations of the lake.</p> <p>This is an area where I think the recommendation of creating a water budget (pg. 64 of the report) would be beneficial. There are differing opinions of how the water flows in/out of the lake and I believe measuring flow rates at the culverts would help get people on the same page in terms of appropriate lake levels. As council works with homeowners around the lake, it would be great to relay information to homeowners on water flow and the importance of phosphorus outflow while homeowners are ensuring they follow good environmental practices (i.e. ensuring proper septic system functioning and property development).</p> <p>3. Finally, the report mentions internal phosphorus loading as a significant contributor to the phosphorus input of the lake - i.e. 44%. (p.g. 40). Internal phosphorus loading means that even if external phosphorus inputs from the</p>	<p>stream inflow and outflow, and groundwater allowing a water budget to be created and phosphorus output load to be estimated. No such data exists for Oak Lake and collecting necessary data was outside of the scope of the RFP and our proposal so it is not possible to provide that estimate.</p> <p>We don't believe that an accurate estimation of phosphorus export is necessary since a) phosphorus sources have been characterized to influence management decisions, and b) phosphorus concentrations are relatively consistent throughout the lake so any changes associated with water level management will not directly affect the concentration of phosphorus concentrations in the lake (i.e. water remaining in the lake will have the same concentration). Water level management could indirectly affect phosphorus concentrations via a multitude of chemical and biological processes, but such multifactorial type assessments are beyond the scope of the study.</p> <p>3. Correct. Reducing phosphorus from the catchment coming into the lake will not reduce the internal load but will reduce the overall amount of phosphorus in the system which should benefit the lake over time. Natural flow through the lake should gradually flush some phosphorus out of the lake over time, however this, mechanism will be dependant on the flow of water through the system after the culvert changes have been completed.</p>
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		watershed are reduced (e.g. from septic systems and runoff), it may take some time for the phosphorus levels in the lake water to drop. This is because the phosphorus inputs from the sediment can compensate for reductions of phosphorus from the watershed.	
August 30, 2019	Carolyn Deeth	I am hopeful that Council will pass the recommendation to provide funding for tile rerouting as recommended by Hutchinson.	Thank you for the support.
August 30, 2019	David Muir	<p>Leave the water levels the same as they are now. Do not adjust the levels.</p> <p>Enforce the regulations on septic inspections, care and maintenance of the septic systems on Oak lake.</p> <p>Have a concerted effort on information going to residences of Oak Lake on the use of phosphates and commercially produced fertilizers (nitrogen phosphates).</p> <p>Address the flow of agricultural usage toward the lake (Quinte West is committed)</p>	We agree enforcement and community engagement are key to the success of any plan moving forward.
August 30, 2019	Rob and Jane Aman	<p>Thank you everyone at Quinte West Council for your interest in and actions to date for, our gem of a lake and area, Oak Lake. We really appreciate any TIME, EFFORT and FUNDS you are expending to help our very serious pollution situation from getting worse and worse. It is true the pig manure spill from the farm, alarmed people into realizing what can happen in a worse case scenario. It was so very hard to believe this happened and also the lack of initial action on the part of many was very discouraging. But nevertheless, we realized that there were actions that could be initiated and taken. One of these very important steps was to get your attention and ask for help. Your funding the Oak Lake Study was good in giving some facts. The presentation at Batawa was informative with some aspects of it being a repeat of things we have known for many years. It pointed out some action plans possible and dealt with facts of a lake ecosystem and how to improve it.</p> <p>We have to say that the thick algae blooms stayed ALL SUMMER LONG in the lake which is really unusual. The usual is that we have about up to a foot of dots of it on the shore in Spring for a week or so and then it is gone for the rest of the season. It sinks and is present but not in the major volume it is this season. We have not been able to swim off our shore AT ALL because it has been so full of thick algae and more weed growth. It measured up to 30 feet out from shore and floated on the surface on other parts of the lake. We read that with the SIGNIFICANT AMOUNT OF</p>	Thanks for the information and your actions to minimize impacts to Oak Lake.



		<p>THE MANURE SPILL that happened, the more devastating effect can show up in year two and later, after it happens. That may explain it. Redirection in the tiling of the farmers' field areas would help prevent this from ever happening again.</p> <p>Septic systems: I, Jane, was on the executive of the former Oak Lake Association when we were seeking a septic system bylaw. I know at the Batawa meeting it was shared that there wasn't enough good will agreement of the part of the lake lot owners to support it. The real reason, and two other former executive members concur with this, is that Quinte West Council did not want to endorse it because it would take follow-up and extra work for them. The proposed by-law as I remember it, was to require with the lot owner's tax bill possibly, proof of receipt that they had their septic system pumped out. It was to be every five years for seasonal dwelling cottage owners and every two years for permanent all year round dwellers. There was a lack of support from you for this initiative and after that point we gave up but feel we accomplished some essential things in our years of activity. We helped lake dwellers and Quinte West Council, in conjunction with the Lower Trent Conservation Authority, to become more aware of what actions needed to be taken to preserve the environmental integrity of the lake. We are so glad that the cause has been taken up again with a new organization to continue in this endeavour, of which I am a member.</p> <p>Yes, we have a buffer area on our shore, encouraged in the Batawa presentation. We do not use pesticides or fertilizers on our mixed grass and weed growing lawn areas. We have planted 25 trees and bushes on our property of less than an acre over the 20 years of living here to restore overdevelopment of this property in the past. Each day we enjoy looking out to see ducks, loons and wildlife aiming to keep coexisting with humans on this water body.</p> <p>It is our hope and request that you, Mr. Mayor and Quinte West Council continue to help in every way possible to continue cleaning up this water. It is our most valuable renewable resource.</p>	
July 1, 2019	Don MacInnes	<p>1. There are dozens of large slime "balls" floating at or near the surface of the lake. Some are at least 10 feet wide and at least five feet deep. I have never observed</p>	Thanks for the information. The filamentous green algae was sampled and is characterized as part of our



		<p>these before.</p> <p>2. There are extensive slime formations near the weed level of the lake. I have snorkeled here for almost 70 years and have never observed this problem before, either.</p>	<p>report.</p>
August 29, 2019	Beverly Shepard	<p>1) Water level - our home has been flooded for the past 2 years. We have had between 2-3 feet in our basement. I am quite certain that Jake Talsma did not build our home in the lake but rather, a safe distance from what was then the 'high water mark.'</p> <p>Any other concerns at this point are moot due to the fact that we cannot continue to live in our home (approximate value \$700 - 800,000.00) if the foundation continues to be destroyed by record water levels.</p> <p>We believe the level of the lake, although influenced by precipitation, is mainly affected by the ability to drain/exit through the culverts located by the highway. We have experienced a dramatic drop in water levels on both occasions when the culverts were cleared, indicating that they do indeed impede the outflow of the lake. When the culverts are blocked - we flood. When they are cleared - the flooding subsides.</p> <p>2) Water quality has been affected by the prevalence of weeds - our tap water tests were returned for the first time due to 'murky' readings - we have UV and filter systems at both of our residences. Hopefully if the agricultural runoff can be limited or diverted completely, we could address the weeds in a real way. We would welcome a collaborative approach to this. Also, we would welcome some assessments and advise on the septic systems around the lake.</p> <p>3) We would appreciate ongoing annual clearing of all culverts and ongoing monitoring of water levels and quality.</p>	<p>1) It did not appear that the culverts were restricted by sediment during our visual assessments, but our assessment was limited and we have recommended that sediment removal be completed as needed.</p> <p>2) and 3) We agree and have provided similar recommendations in the report.</p>
August 30, 2019	Mike Moffatt	<p>I am glad that your organisation has been contracted to address the very serious situation facing Oak Lake.</p> <p>I have enjoyed the lake for more than 35 years and cannot believe the impact the agricultural spill has had. I have always enjoyed swimming out from my dock to the deeper water and this year I cannot make it out through the weeds.</p>	<p>Thanks for your input. We are happy to make recommendations to both the landowners and City, however ensuring that they are carried out will require continued cooperation between the city and the landowners to better inform the community of steps they can take to improve the lake and to better enforce</p>



		<p>The growth is out of control and can be witnessed all over the lake. How is it possible for such a spill to have taken place? The possibility of this happening has been well documented by previous water quality studies conducted on the lake (early 2000). Why then are we in this situation at all? When will the City of Quinte West act?</p> <p>The City needs to remove from the equation all of the agricultural drainage tiles that act as a conduit for spills of this nature. In addition, the City needs to construct some sort of dam that will hold any future agricultural runoff from entering the lake in the event of another spill. If the City of Quinte West can spend 30-50 million dollars on waste management infrastructure in other parts of the city (as quoted by the Mayor in the 2018 budget presentation) when will the city direct some of these resources towards the residents in the Oak Lake basin? We are paying our taxes just like everyone else in Quinte West and we need assistance.</p> <p>Existing septic systems are also a problem and I am glad that a door to door inspection is scheduled to take place. It is essential that outdated systems be upgraded or at the very least replaced with holding tank systems.</p> <p>Finally, the illegal conversion of recreational residences to permanent residences cannot be allowed. There are bylaws currently in place restricting this type of development. However, they are not being enforced.</p> <p>Over the years my family has been very involved in working towards the preservation of the water quality of Oak Lake, by donating endless hours to this end. All of this earlier work and energy generated a necessary report at the time (early 2000) and only a few of the recommendations were followed.</p> <p>I sincerely hope that your Organisation will act, and be successful; not only by making recommendations, but by making sure that they are actually carried out.</p>	<p>the bylaws that have been in place on the lake since the early 2000's. We are planning on staying involved as much as possible.</p>
August 30, 2019	Heather Jackson	<p>As an Oak Lake resident, I'd like to express my concerns related to the environmental study.</p> <p>I believe strongly the runoff from the farms needs to be diverted:</p> <ol style="list-style-type: none"> 1. to ensure we don't have another catastrophe with dumping animal waste into the 	<p>Diverting the agricultural waste from Oak Lake via alteration of the tile drain has been identified as a potential course of action by the city.</p>



		<p>lake;</p> <p>2. to keep the farm sewage from, in general flowing to the lake.</p> <p>An assessment was done on household septic systems, I was here when the young man came to the house and it really wasn't much of an assessment. I'm concerned there are many systems not working appropriately.</p>	<p>Septic system inspections done on the lake were performed to be comparable to those performed in the early 2000's when the lake was last studied. More thorough testing of septic systems where necessary was recommended by our study, however these tests were not possible under the scope of work of the HESL report and require landowner permission so can be challenging to complete.</p>
July 18, 2018	David Muir	<p>Obtaining permits from the MOE to have weed harvester clean shoreline. Would the City of QW share cost for shoreline in front of road allowance? Also, MOE approved use of aquatic herbicide. Can someone please call and discuss w/ property owner?</p> <p>From Chris to Brent: I would appreciate your comment on the spraying and the weed cutting and if this will affect your study</p>	<p>We responded privately to Mr. Muir regarding the potential impacts of macrophyte removal on the study. The report also contains a section on Aquatic Vegetation Management.</p>
August 31 2019	Tyler Vivian	<p>I love the idea of replacing the culverts to try and fix some of the runoff as an immediate plan.</p> <p>I would like to see some 5-20-year plans put in place also. Then when the council has some extra money over the years these projects will be ready to go.</p> <p>I would like to see a bylaw that oak lake residents must submit their paperwork from a septic tank inspection and pump out at least once every 5 years.</p> <p>I would like to see a plan for the bubbler system to be implemented within the next 5 years when funds allow for it.</p> <p>My family and I want to use the lake that we live on and the weeds are so bad this year my 3 year old daughter won't swim in it and even when I go out in it the weeds are so bad you can get caught in them yourself. It could be a drowning hazard.</p> <p>I appreciate your time in the matter. Please help clean up the lake for my family. We want to enjoy it.</p>	<p>We agree long-term planning by the city and landowners would be a valuable strategy moving forward.</p> <p>New implementation, bylaws and enforcement strategies will need to be discussed between the city and the landowners moving forward as they will be a key component of the success of the management of Oak Lake in the future.</p>



August 30, 2019	Tony MacDonald	<p>As far as priorities for lake and drinking water improvement we would suggest the following:</p> <ol style="list-style-type: none"> 1. All residential (both year-round and seasonal) septic systems must be inspected and maintenance or replacement made where needed. No grandfathering of current systems!! In this day and age, this should be a "no-brainer" for those living on or near waterways, especially those waterways that can be used for drinking water. 2. Diverting the east farm tile drainage outlet away from the lake should be done, along with proposed culvert improvements on the Detlor/Barr farms. Sealing off the "cow tunnel" should also be part of this project. 3. Lake levels are acceptable, however culverts running east must be maintained annually. 4. On-going water quality stewardship programs should be reinstated. 5. An outboard motor horsepower restriction and/or motor ban should be considered. 	Thanks for your input.
August 30, 2019	Sandra Brett	<p>At the information night a proposal was put forward which would lead to the installation of irrigation tile on the Detlor farm area adjacent to highway 14 and draining into the wetland situated on that side of the highway. I would like to know if consideration has been made by either Hutchinson or Quinte West with regard to installing drainage tile on the land bordered by Highway 14, Oak Lake Road, The Pines and Detlor Lane. This piece of land has a natural swale which runs approximately North-west to South-east which leads to Oak Lake. It is my understanding that there may be some drainage tile in this field but that, in all likelihood, it drains either directly into Oak Lake or into a drainage ditch which leads to Oak Lake.</p> <p>I do not know if this land drainage has significant impact on Oak Lake but am curious about its disposition with regard to water quality.</p>	The agricultural lands on the west side of Foxboro Stirling Road across from the Detlor Farm contained crops during our assessment. There is a swale through that area which transits agricultural runoff from the farms east of Foxboro Stirling Road. The lands will not transmit agricultural runoff from the adjacent lands after the tile drain is re-routed. We learned that those lands recently changed ownership but do not know what the owner intends to do with the lands. Ideally those lands will be used in a manner that does not produce nutrient-rich runoff or mitigation measures will be used to reduce nutrient concentrations.
August 29, 2019	Sue and Brian Yuskow	<ol style="list-style-type: none"> 1. Is the tile drain being rerouted to an area that is outside of the oak lake watershed? 2. The bulk of the mass of phosphorus currently in the lake is stored in the sediment. The study authors recommended an aeration system be considered to reduce phosphate loading. <ol style="list-style-type: none"> a. Is this superior to other phosphate removal mechanisms? 	<ol style="list-style-type: none"> 1. The current plan being discussed reroutes the agricultural drainage to the wetland north of Oak Lake which is still within the watershed, but the wetland flows predominantly away from the lake and various wetland processes act to transform and store nutrients within the wetland.



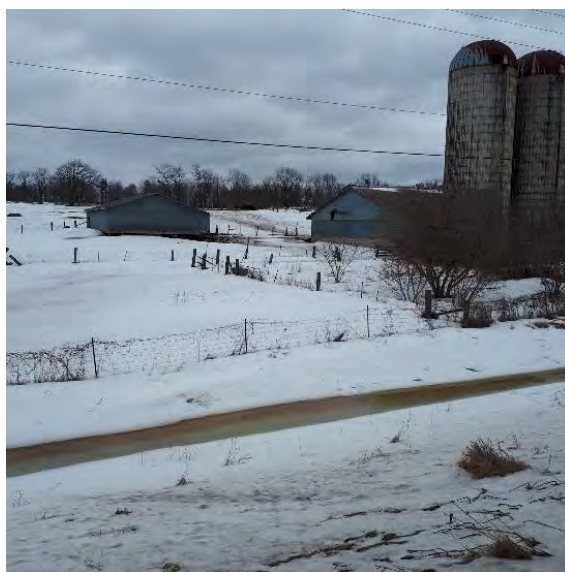
		<p>b. Are there other specific measures that are recommended to remove the phosphorus in the sediment?</p> <p>c. What near term targets can be used to see progress in phosphorus removal?</p> <p>d. Is the city able to assist with phosphorus removal?</p>	<p>2. HESL does not recommend active in lake management at this time. Aeration was described as a potential option in the future depending on the outcomes of the phosphorus reduction strategies recommended for more immediate action and we believe it is the most suitable active lake management technique for application in Oak Lake. Targets and implementation can be discussed in the future if active lake management is implemented.</p>
August 26, 2019	Heather Nash	<p>As Oak Lake residents we would like to see the city support inspection of household septic systems around the lake. We feel this should be a mandatory enforcement which has been adopted in many municipalities.</p> <p>We would like water levels and the health of the water to be routinely monitored.</p> <p>We feel strongly that the culverts need to be cleared yearly to allow the lake to breathe and drain into the wetlands. We would also like the city to consider dredging to promote better water flow.</p> <p>Lastly, we would like to see the city ensure water levels remain below most septic beds around the lake to divert all agricultural run off.</p>	<p>Thanks for your input.</p>
August 31, 2019	Mark and Trudy Matheson	<p>we believe that a long-range plan is required for the active and positive management of the lake. Specific concerns follow in descending order of priority:</p> <ul style="list-style-type: none"> • Algae and aquatic plant life explosion • Water levels (Close second) • Phosphorus loading (likely related to the above-mentioned explosion) <p>We support the recommendations of the report. Suggest that the proposal to realign the adjacent agricultural tile drain so it no longer drains into Oak Lake, should be given priority for quick implementation. Similarly, we believe an assessment as to whether the outflow culverts are of an adequate size & position to deal with run-off - especially relating to the spring melt - would be of value.</p>	<p>Thanks for your input.</p>
June 24, 2019	Glenn Bateman	<p>I noticed my water supply is smothered in Algae, I was wondering if my water system is damaged because of the inaction on septics and the continuous flow of manure into the lake will the city compensate me financially for the damage?</p>	<p>This question is best answered by the City.</p>



August 15, 2019	Rick Smith	<p>First of all, thanks for listening to the residents and initiating the environmental study. There are several recommendations in the report that I believe would be helpful going forth. Those being the continued sampling as indicated, the shoreline development and the individual septic system analysis. It's very discerning that not all property owners would allow the inspection, probably proof that we have some issues that need to be resolved. I'm also encouraged that the City will recommend to Council that the drainage culvert be re-routed to the north.</p>	Thanks for your support.
August 21, 2019	Ted Reid	<p>Oak Lake via water testing has significant improvement since the samples i.e. phosphorus, E. coli, nitrogen were taken in 2000/01 Why then have we got algae now and we did not have it in 2000/01?</p> <p>1) We understand that the decayed weed/silt is a major problem. Therefore, would it be logical to start removing the silt where possible?</p> <p>For example, could we have an annual program to remove silt from the cove at the corner of Neighbourly and John Meyers Rd, I understand the land on the north side of the cove is owned by Quinte West. Thus this site could house equipment required. Obviously, the hole would fill again, requiring dredging (annually ???) however, we would lower silt levels that will be increasing every year because of more decaying weeds.</p> <p>2) Weed Removal: The question of where do we put the weeds that we remove from the Lake. Could we ask for the City's help on this one to deliver a dumpster at scheduled times at various sites on the Lake i.e. on City owned land at corner of Neighbourly Rd, and John Meyers Rd? For example: The last weekend of June July and August (time intervals to be discussed) The dumpster then would unloaded at a City approved location. I know issues such as policing what goes in the dumpster and timelines would need to be discussed further.</p> <p>3) Septic Inspection</p>	<p>The main difference in water quality between the two studies was the reduction in bacteria concentrations (i.e. <i>E. Coli</i>, fecal coliforms and <i>fecal streptococcus</i>). The abundance of algae is related to a multitude of factors, such as climate, and it can't be easily attributed to differences in water quality between 2001 and 2018/19.</p> <p>1) Silt removal is not recommended as a management consideration. Removal of silt results in dispersion of fine-grained silt throughout the water column which increases nutrients and can negatively impact aquatic life.</p> <p>2) This question is best answered by the City.</p> <p>3) Thanks for your input.</p>



		<p>In 2019 it goes without question that mandatory sewage system inspection with appropriate action taken, if the test does not meet today's standards, is a priority action.</p> <p>Simply, where else can sewage go into other property owners front lawn (Oak Lake is our front lawn) without any consequence.</p>	
March 11, 2019	Bruce Kerr	<p>Here are photos of March 11 showing the water build up and the frozen underwater culverts. One at John Meyers and 14, one at Neighborly which can't be seen from snow cover and ice both under water. Note the water colour in the lake by 50 Oak Lake Rd is brown again as well as coming through underpass.</p>	Thanks for the information.



August 28, 2019	Jan Steel Moffatt	<p>It is our hope the 'Powers that be' will mandate the inspection of all septic systems bordering Oak Lake and decree the necessary upgrades be completed within two years...,</p> <p>and all of the ditches from the farms located on the opposite side of Hwy. 14, that have been for decades draining into Oak Lake, be damned and drained on the farmers' own property.</p> <p>Both of these predominant problems have been recognized for far too long.</p>	Thanks for your input.
August 30, 2019	Jan Steel Moffatt	<p>As an addendum, following the blocking of all the farm runoff and the upgrading all septic systems; the next effective steps could be to fix the culverts at the north end of the lake so that the early spring high water levels may be cleared away; and then, all the residents could leave the shoreline of their properties in a natural state for the flora and fauna to flourish and replenish the waters...</p> <p>With incoming pollutants stopped, and then spring high water drained off and a protective naturalized shoreline created, Oak Lake would be able to continue being a jewel for each and everyone of us...</p> <p>Thanks to all of the council members, for the dedication, and consideration in helping to protect and maintain this precious lake.</p>	Thanks for your input.
August 11, 2019	Bruce Kerr	<p>1/ Thank you for the meeting in Batawa it was well attended and quite informative. I came away very pleased with information by Chris D'Angelo that a meeting of the minds had been reached with the 2 farmers influencing the improvement of Oak Lake.</p> <p>2/ It was stated that the existing tile drain was to be rerouted to run north to the wetlands and not to the lake as it did previously. Removing this nutrient influence to the lake is wonderful.</p> <p>3/ The announcement additionally mentioned the removal of 3 culverts on the 2 farmers property which at present are actually inhibiting flow for the lake to effectively flush. Presently there is a large culvert of about 3ft under highway 14 and into the wetlands east of the highway where it immediately gets backed up by a 12" culvert on the first farm and then 2 more culverts on the 2nd farm. The govt act for lakes and rivers, downloaded to LTCA considers culverts as dams and is written in the act, consequently the lake levels due to the spring run off, rise significantly. It was also mentioned that there was likely enough room in the budget this year to get done</p>	<p>4) We have considered your input into the finalization of the report and considerations for water level management.</p> <p>Thanks for your input regarding #1-#3, #5 and #6.</p>



		<p>before another spring run off.</p> <p>4/ Why is this a problem? There are a number of properties in low areas with septic beds and holding tanks that are effected by high water flooding and thus influencing sewage waste directly to the lake and with reduced outflow to flush the lake we now have a lake suffering from high nutrient and phosphorus load creating a poor habitat for fish and great for weed growth.</p> <p>5/ There is, I believe, a legal condition being created that may leave the municipality in dangerous territory if it finds a challenge by injured parties due to negligence of their required maintenance of culverts under the act. Residents are being flooded in the spring mainly because of high water with lack of flush.</p> <p>6) The survey taken regarding water levels and the result of that survey I believe was stilted;</p> <p>A/ By residents reasonably new with little or no history of levels to provide a valid response.</p> <p>B/ Many property owners didn't want change since part of the change would have been scrutiny of their septic beds and holding tanks.</p> <p>C/ Many people were part time summer residents who had little understanding of the spring flooding and sewage leakage from their systems effecting sustainability of the lake's eco-system.</p> <p>D/ Properties have actually been reduced in size due to high levels and the once lovely sand beaches in front of many properties are now underwater and highly encroached on by weeds.</p> <p>E/ Quinte West tax base has increased significantly with many new and newly renovated expensive homes around the Oak Lake drainage area. This increase in tax base should also dictate a greater municipal responsibility to the taxpayers on the lake.</p>	
August 30, 2019	Debbie Hitchon	<p>I am a cottage owner who, along with a group of people, just purchased land along the north-east side of the lake. (Formerly owned by Doug Detlor). My concern is septic systems...or lack thereof. Of the the 20 properties that are involved in the newly formed corporation that bought this property, only TWO have properly registered septic systems. (Myself and my father). This concerns me greatly. How can we go about forcing these cottage/homeowners to be responsible and get proper septic? I am convinced this is an attributing cause to the weeds in the lake.</p>	<p>Septic system policy and enforcement will be a key part of lake management in Oak Lake moving forward. How that policy is shaped, implemented and enforced will be an engagement between the City of Quinte West, Council and the residents of the municipality.</p>



June 10, 2019	John Brewster	Perhaps you could send these photos to Hutchinson to review as part of their study. Note the brown on top of the algae bloom, plus the size of it. Blooms have begun very early this year and far more aggressively. The north end of the lake, adjacent to the highway, is really bad for this time of year. The spit alongside Neighbourly Way is quickly filling in with nasty looking stuff. Maybe it is time to recheck the culverts at this end?. They do not appear to be moving at all.	Thanks for the information.
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February 9, 2019	John Brewster	Quick flowing brown water coming down from the hill across the Detlor property from the Barr property. The water is brown and the lake open at that point of ingress, presumably, due to the warmth of what makes the water brown.	Thanks for the information.
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August 29, 2019	Scott Symons	<p>At Batawa on July 30, 2019, I was very pleased to hear Chris Angelo state that Quinte West had reached an understanding with local farmers which will stop the delivery of farm runoff by means of an existing agricultural tile drain. Stopping the daily delivery of agricultural by-product substances into Oak Lake will help to improve water quality, habitat and human health unequivocally.</p> <p>As stated by Hutchinson Environmental Services' final report, farm runoff accounts for 15% of total phosphorus entering Oak Lake annually. However, phosphorus from feces and urine is only one toxicity that has been flowing down hill from the farms and into Oak Lake for far too long. Other historical 'Nasties' include animal blood, saliva and puss, as well as, petrochemicals such as fertilizers, herbicides, pesticides, industrial oils, gasoline and diesel fuel. Quite a barbaric cocktail to say the least!</p> <p>Another advantage for Oak Lake as a result of the proposed re-routing of the tile drain is protection against future manure spills/accidents. In fact, the unreported 2017 manure spill is what began this journey to educate both myself and others as to the frailty of Oak Lake and its surrounding watershed. Without a doubt, 8000 gallons of hog manure is 8000 gallons too much!</p> <p>My hope is that when the tile drain is re-routed along the north side of HWY 14 as proposed, that it is done correctly, the first time. We do not want to waste the scarce resources of time, labour and money. This means at its base level, crews are using current and accurate topographical surveys and information of the proposed re-routing to ensure the proper construction of a working watercourse. Any work to be done to the numerous culverts within the defined area, and which enable fluidity, must be enhancements to the existing, erroneous drainage system. In addition, ensuring an annual maintenance schedule for these specific culverts, as well as, all culverts on Oak Lake, guarantees correct functionality. A half-ass, knee-jerk reaction is not what any of the stakeholders want here, and doing so, will simply pass this issue onto the agenda of Quinte West Council once again.</p> <p>I want to thank his Worship the Mayor and Members of Council for their continued interest and efforts on preserving one of Quinte West's most precious natural attractions, Oak Lake.</p>	Thanks for your input.
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Comment Forms from July 2019 Public Meeting	Wendy Emerson	<ol style="list-style-type: none"> 1. Would be interested in a public list of failed septic reviews. 2. Is there a summary of (management) activities taken on Oak Lake? 3. Septic systems should be reviewed for all lake residents and residents held accountable. 	<p>1. We have not publicly released information on individual septic systems. That information was provided to the City and they are responsible for managing it.</p> <p>2. The report includes previous recommendations related to lake management under various headings. Many previous recommendations have been incorporated into policy but completed activities are more uncommon and in many cases, difficult to summarize.</p> <p>3. We have provided recommendations regarding more detailed septic system inspections in the report.</p>
	Carolyn Deeth	Would be interested in more information regarding shoreline buffers and other community incentives.	The LTCA produced a report in 2002 on shoreline buffers and management actions that can be impactful, and community led.
	Ivan Clare and Marlene	Impaired water activities due to weeds. 90% more motorboats on the lake compared to 40 years ago.	Thanks for your input.
	Unknown	<ol style="list-style-type: none"> 1. The volume of water diverted from lake via the tile drain would impact water levels and lake characteristics of Oak Lake. 2. There is lots of dead vegetation in the bottom of the lake so a bubbler would stir that up and release those nutrients back into the water column. 	<p>1. It isn't possible to forecast how water levels will be altered after the tile drain is re-routed under the current scope of work. The wetland is located within the same watershed, so we anticipate that water levels won't be altered substantially. We anticipate that lake characteristics will improve after re-routing of the tile drain as mentioned in the report.</p> <p>2. Active lake management and installation of an oxygenation or aeration system are not recommended at this time. We recommended in the report that if a</p>



			system is utilized in the future, deep water conditions, including
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