Native Plant Solutions
Ducks Unlimited Canada
Unit A, 1238 Chevrier Blvd.
Winnipeg, MB R3T 1Y3
Phone: (204) 953-8200
Fax: (204) 953-8209
www.nativeplantsolutions.ca

September 3, 2020

Attention: Eric King, CPA, CGA, Chief Administrative Officer, Town of Niverville.

RE: Assessment of the water quality at the Fifth Avenue Estate lakes

Dear Mr. King,

The intent of this letter report is to summarize the findings of our assessment of the water quality of three lakes at the Fifth Avenue Estate in Niverville (Figure 1). Our assessment involved a visual inspection of the lakes on August 10 and August 21 as well as a water quality sampling campaign on August 21.

In addition to providing the results and a summary of our assessment this letter report also provides general recommendations on how to improve water quality in the lakes.

Figure 1. Fifth Avenue Estate lakes included in the water quality assessment.

Visual inspection

On August 10 and 21, 2020 two water quality specialists from Native Plant Solutions (NPS) conducted a visual inspection of the lakes and recorded the vegetation communities present (Table 1).

Table 1. Vegetation communities observed at Fifth Avenue Lakes (August 2020).

Community	Photos	Comments
Blue green algae (Cyanobacteria)	 	- Blue green algae can occur in high concentrations referred to as blue green algal blooms. - Blue green algal blooms are common in systems with elevated phosphorus levels. - Blue green algal blooms present human and pet health concerns as some species produce toxins. - Blue green algal blooms are unsightly and produce unpleasant odours when they decompose. - Decomposing blue green algal blooms reduce dissolved oxygen levels in lakes resulting in the loss of species sensitive to low oxygen levels.

Table 1. continued …

Community	Photos	Comments
Green algal mats	 	- Some green algal mats originate on the lake sediments and float to the water surface under certain environmental conditions such as warm weather. Other types of green algal mats are composed of free-floating species that occur at or just below the water surface. - Green algal mats do not produce toxins. - In lakes with elevated nutrient levels green algal mats can be prolific and are often considered to be a nuisance as they are unsightly and produce an odour upon decay. - Green algal communities develop in waterbodies when no other mechanisms for nutrient uptake exist (e.g., uptake via emergent wetland vegetation).

Table 1. continued…

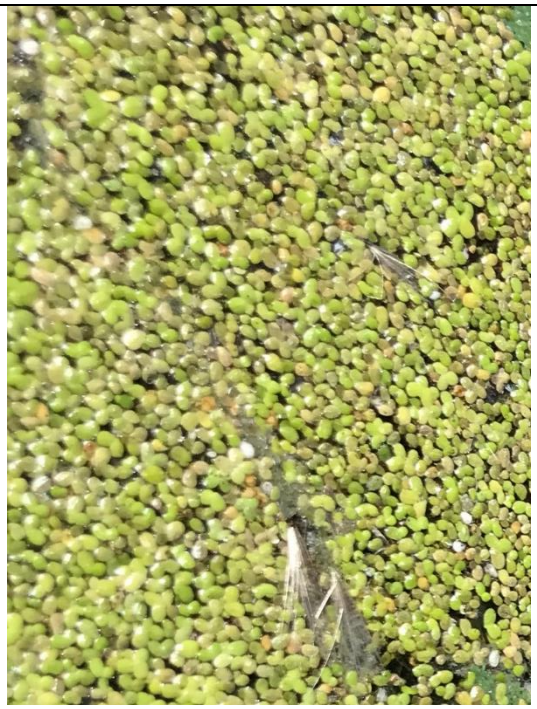
Community	Photos	Comments
Duckweed (*Lemna spp.*)	 	- Duckweed occurs floating on the surface of water bodies. - High nutrient concentrations and calm water can result in excessive duckweed cover. - Wind and water action can cause the accumulation of dense layers of duckweed along the shoreline. - Dense layers of duckweed shade lake sediments and can limit the growth of submergent and emergent vegetation.

Table 1. continued …

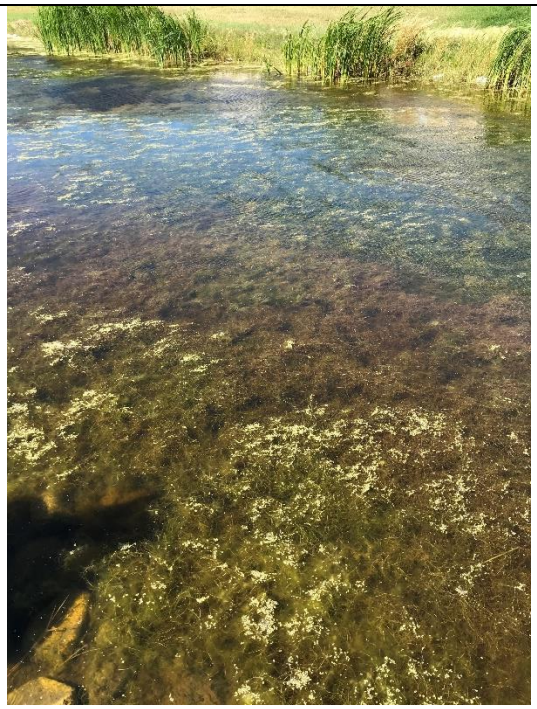
Community	Photos	Comments
Submergent vegetation (pond weed)	 	- Submergent vegetation grows from the sediment of aquatic environments up through the water column to the water surface. - Optimum depth range for submergent vegetation is between 50 and 200 cm. - Submergent vegetation provides habitat for a wide variety of aquatic invertebrates.

Table 1. continued…

Community	Photos	Comments
Emergent vegetation (cattail and bulrush)	 	- Emergent vegetation grows from the sediment of aquatic environments through the water column and extends above the water surface. - Optimum depth for emergent vegetation is 30 to 50 cm. - Emergent vegetation can remove nutrients from the water and store the nutrients within both above and below ground compartments.

Water quality assessment

On August 21 composite water quality samples were collected from each of the lakes (Figure 2). Lakes 1 and 2 were sampled at 4 locations and Lake 3, due to its larger size was sampled at 8 locations. At each location water samples were collected from shore using an extendable water sampling pole (Figure 3). One composite sample from each lake was then submitted to the ALS Environmental laboratory in Winnipeg for analysis of the parameters listed in Table 2. The water quality results along with a commentary on the health of the lakes are presented in the Table 3. See Appendix A for the full laboratory report from ALS.

Figure 2. Water quality sampling locations.

Figure 3. Water sampling from shore with extendable pole.

Table 2. Parameters included in the water quality assessment of the Fifth Avenue Estate lakes.

Parameter	Rationale
Total phosphorous	Plant nutrient
Dissolved ortho phosphate	Form of phosphorus most readily available for algal growth
Total nitrogen	Plant nutrient
Ammonia	Plant nutrient
Total suspended solids	Indicator of sediment flow into lakes
Chlorophyll *a*	Indicator of suspended algal levels in the water column
Blue green algae – cell count	Counts in the lakes can be compared to the Canadian guideline for recreational water quality
Fecal coliform	Counts in the lakes can be compared to the Provincial guideline for recreational water quality
Conductivity	Environmental variable that influences plant growth
pH	Environmental variable that influences plant growth

Table 3. August 21, 2020 water quality results for Fifth Avenue Estate lakes.

Parameter	Lake	Value	Guideline	Comment
Total phosphorous (mg/L)	1	0.370	0.1[A]	Lakes are in the hypereutrophic range (TP > 0.1 mg/L).
	2	0.638		
	3	1.070		
Dissolved ortho phosphate (mg/L)	1	0.072	NA	A high percentage (20 to 70%) of the total phosphorus in the lakes is dissolved ortho phosphate which is the form that is most readily available for plant growth.
	2	0.371		
	3	0.749		
Total nitrogen (mg/L)	1	2.66	2 to 6[B]	Lakes had TN concentrations typical of aquatic environments in agricultural watersheds.
	2	2.41		
	3	2.34		
Ammonia (mg/L)	1	0.072	0.55[C]	Lakes had ammonia concentrations below the Provincial guideline for the protection of aquatic life.
	2	0.432		
	3	0.161		
Total suspended solids (mg/L)	1	15.8	25[C]	Lakes had TSS concentrations below the Provincial guideline for the protection of aquatic life.
	2	10.6		
	3	14.8		
Chlorophyll *a* (µg/L)	1	41.4	30[D]	Lakes had chlorophyll *a* concentrations typical of hypereutrophic systems experiencing blue-green algae blooms
	2	44.4		
	3	51.1		
Blue green algae (cells/mL)	1	306,000	100,000[E]	Lakes exceeded the Federal guideline for blue-green algae cell counts for recreational water use.
	2	234,000		
	3	541,000		
Fecal coliform (MPN/100 mL)	1	17	200[C]	Lakes had fecal coliform concentrations below the Provincial guideline for recreational water use.
	2	10		
	3	16		
pH (pH units)	1	8.86	NA	Slightly alkaline pH in the lakes may be due in part to the effects of algal blooms as photosynthesis removes the slightly acidic carbon dioxide from the water column.
	2	8.91		
	3	8.74		
Conductivity (µmhos/cm)	1	2,720	NA	Lakes are within the oligosaline range (800-8000 µmhos/cm)
	2	1,600		
	3	1,390		

[A]Canadian Council of Ministers of the Environment 2004. Phosphorus: Canadian Guidance Framework for the Management of Freshwater Systems.

[B]United States Environmental Protection Agency 2011. Nitrogen and phosphorus in agricultural streams. Report on the Environment.

[C]Manitoba Water Stewardship 2011. Manitoba Water Quality Standards, Objectives and Guidelines.

[D]Kansas Department of Health and Environment 2015. Blue Green Algae.

[E]Government of Canada 2012. Guidelines for Canadian Recreational Water Quality. Third Edition.

Summary of the water quality assessment

The Fifth Avenue Estate lakes have phosphorus levels that are in the hypereutrophic range for lakes (> 0.1 mg/L). Much of the phosphorus (20 to 70%) that occurs in the lakes exists as dissolved orthophosphate which is the form of phosphorus most available for plant growth. The lakes have limited aquatic emergent vegetation, such as cattail and bulrush, to take up the phosphorus. As such the nutrient is readily available to the other vegetation communities.

Blue green algae take advantage of elevated phosphorus levels given their rapid cell doubling time compared to other vegetation communities. This has resulted in blue green algae levels in the lakes that exceed the federal guideline for recreational waters. Blue green algae levels above the federal guidelines present human and pet health risks.

Recommendations

Given the associated health risks of blue green algae and their aesthetically unpleasing nature the Town of Niverville should consider strategies to address the high blue green algal levels within the Fifth Avenue Estate lakes.

The Town should consider a bi-weekly water quality monitoring program that measures blue green algae cell counts. When federal blue green algae guidelines are exceeded the Town should initiate a public advisory on their website as well as post signs at the lakes to warn visitors of the risks of exposure to the lake water (Figure 4).

Figure 4. An example of information that could be included in a public advisory.

If no action is taken to limit nutrient availability in the lakes, they will continue to regularly experience blue green algae blooms during the summer months. It is possible that this condition will worsen in future years. One strategy to limit nutrient availability is to reduce nutrients entering the lakes via surface runoff. During our visual assessment we noted that many properties upslope of the lakes have manicured lawns which most likely receive fertilizer inputs (Figure 5). Following rain events nutrients from fertilizers applied to lawns can be carried away in surface runoff and enter the lakes. One way to address this issue is to have a public education campaign calling for a reduction in lawn fertilizer use.

Another approach to addressing nutrient runoff is to install native grasses in the uplands surrounding the lakes (Figure 6). The dense thatch and deep root structures of native upland grasses would provide water quality improvement before surface runoff water enters the lakes, and in most cases they would support improved water infiltration before overland runoff ever reaches the lakes.

Figure 5. Manicured lawns (right side of photo) upslope of Fifth Avenue Estate lakes.

Figure 6. Native grasses upslope of a naturalized stormwater pond in Winnipeg.

The Fifth Avenue Estate lakes currently have minimal emergent vegetation (Figure 7). This is due to the lakes contours that do not provide the required depths for emergent vegetation growth. Emergent vegetation can reduce nutrient loads in water through nutrient uptake and storage in above and below ground compartments. The Fifth Avenue Estate lakes could be retrofitted with re-contoured basins that provide benches with optimum depths to support emergent vegetation (Figures 8 and 9).

Once established, naturalized stormwater ponds require minimum maintenance and provide water quality benefits for many years. For example, a recent study demonstrated that a naturalized stormwater pond in Winnipeg continues to have healthier algal communities and better water quality than a conventional pond more than 15 years post construction (Figures 10 and 11).

Figure 7. Fifth Avenue Estate lake with minimal emergent vegetation along the shoreline.

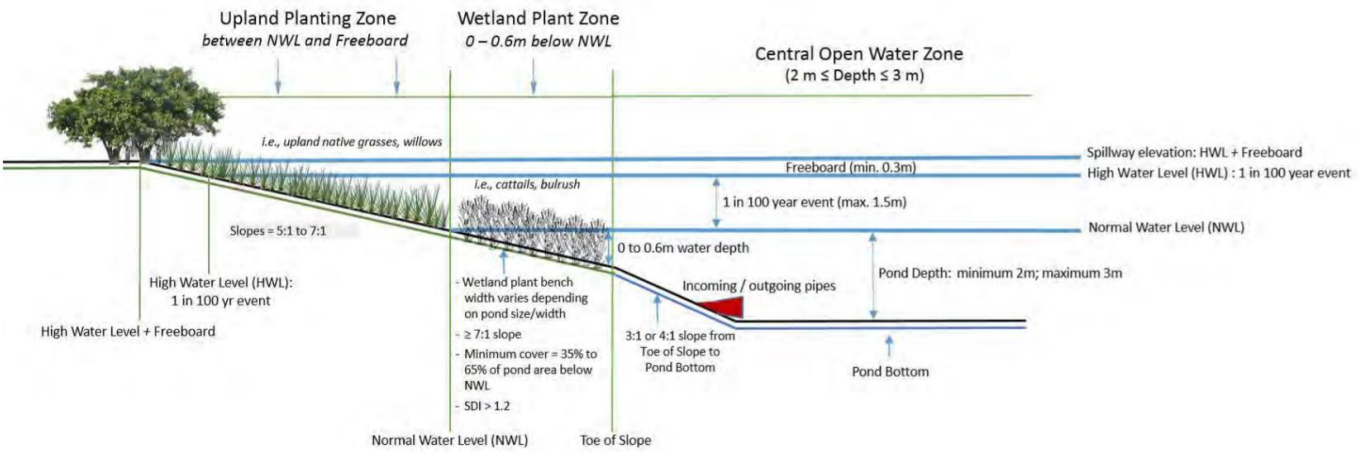


Figure 8. Profile of a naturalized stormwater pond.

Figure 9. Emergent vegetation in a naturalized retrofit of a conventional stormwater pond in Winnipeg during the first year of vegetation establishment.

Figure 10. Algal biomass retained on crucible filters for a conventional stormwater pond (top) and a naturalized stormwater pond (bottom) 17 years post-construction[1].

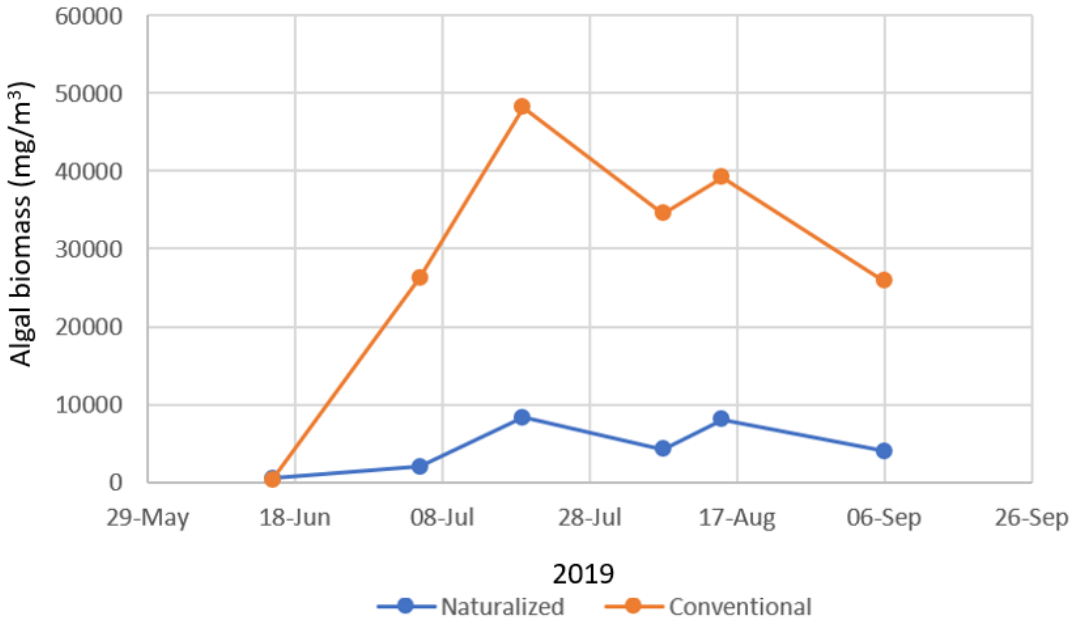


Figure 11. Algal biomass in a conventional stormwater pond and a naturalized stormwater pond[1].

[1]Singh, VJ. 2020. Evaluation of the efficiency of a naturalized stormwater retention basin. Master of Engineering Report, Civil Engineering, University of Manitoba.

Closing

Naturalization of the Fifth Avenue Estate lakes will provide a long-term solution to the lakes' water quality issues. NPS has expertise and experience in naturalized retrofits of conventional stormwater lakes. If the Town wishes to pursue naturalized retrofits of its Fifth Avenue Estate lakes, NPS would be happy to discuss next steps for moving forward.

Should you have questions regarding this letter report or require further information regarding its content please feel free to give me a call to discuss.

Sincerely,

Bruce Friesen-Pankratz
Wetland Specialist
Native Plant Solutions
Phone: 204-304-0242 / Email: b_friesen-pankratz@ducks.ca

Appendix A. Water quality report from ALS.

Native Plant Solutions
ATTN: NICHOLSON JEKE
Unit A - 1238 Chevrier Blvd
Winnipeg MB R3T 1Y3

Date Received: 21-AUG-20
Report Date: 31-AUG-20 14:49 (MT)
Version: FINAL

Client Phone: 204-953-8214

Certificate of Analysis

Lab Work Order #: L2492507
Project P.O. #: NOT SUBMITTED
Job Reference: TOWN OF NIVERVILLE
C of C Numbers:
Legal Site Desc:

Hua Wo
Chemistry Laboratory Manager

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2492507-1 LAKE 1							
Sampled By: CLIENT on 21-AUG-20 @ 10:30							
Matrix: WATER							
Chlorophyll a							
Chlorophyll a by fluorometry							
Chlorophyll a	41.4		0.10	ug/L	24-AUG-20	24-AUG-20	R5203472
Fecal Coliforms and E Coli by QT97							
E. coli by QT97							
Escherichia Coli	4		1	MPN/100mL		21-AUG-20	R5197067
Fecal Coliform by MPN QT97							
Fecal Coliforms	17		1	MPN/100mL		21-AUG-20	R5197068
Miscellaneous Parameters							
Ammonia, Total (as N)	0.072		0.010	mg/L		27-AUG-20	R5203689
Conductivity	2720		1.0	umhos/cm		26-AUG-20	R5202496
Orthophosphate-Dissolved (as P)	0.0722	OPF	0.0030	mg/L		25-AUG-20	R5201088
Phosphorus (P)-Total	0.370		0.0030	mg/L		26-AUG-20	R5201116
Total Suspended Solids	15.8		3.0	mg/L		26-AUG-20	R5204525
pH	8.86		0.10	pH units		26-AUG-20	R5202496
Enumeration of blue green algae cells							
Total cyanobacterial cell count	306000		1	cells/mL		25-AUG-20	R5200457
Anabaena (Cyanophyceae)	2480		1	cells/mL		25-AUG-20	R5200457
Aphanothece (Cyanophyceae)	69300		1	cells/mL		25-AUG-20	R5200457
Microcystis (Cyanophyceae)	89100		1	cells/mL		25-AUG-20	R5200457
Planktothrix (Cyanophyceae)	143000		1	cells/mL		25-AUG-20	R5200457
Pseudanabaena (Cyanophyceae)	2230		1	cells/mL		25-AUG-20	R5200457
Nitrogen Total							
Nitrate in Water by IC							
Nitrate (as N)	<0.40	DLM	0.40	mg/L		21-AUG-20	R5199622
Nitrate+Nitrite							
Nitrate and Nitrite as N	<0.45		0.45	mg/L		25-AUG-20	
Nitrite in Water by IC							
Nitrite (as N)	<0.20	DLM	0.20	mg/L		21-AUG-20	R5199622
Total Kjeldahl Nitrogen							
Total Kjeldahl Nitrogen	2.66		0.20	mg/L	25-AUG-20	26-AUG-20	R5201197
Total Nitrogen Calculated							
Total Nitrogen	2.66		0.45	mg/L		26-AUG-20	
L2492507-2 LAKE 2							
Sampled By: CLIENT on 21-AUG-20 @ 11:30							
Matrix: WATER							
Chlorophyll a							
Chlorophyll a by fluorometry							
Chlorophyll a	44.4		0.10	ug/L	24-AUG-20	24-AUG-20	R5203472
Fecal Coliforms and E Coli by QT97							
E. coli by QT97							
Escherichia Coli	8		1	MPN/100mL		21-AUG-20	R5197067
Fecal Coliform by MPN QT97							
Fecal Coliforms	10		1	MPN/100mL		21-AUG-20	R5197068
Miscellaneous Parameters							
Ammonia, Total (as N)	0.432		0.010	mg/L		27-AUG-20	R5203689
Conductivity	1600		1.0	umhos/cm		26-AUG-20	R5202496
Orthophosphate-Dissolved (as P)	0.371	OPF	0.0030	mg/L		25-AUG-20	R5201088
Phosphorus (P)-Total	0.635		0.0030	mg/L		26-AUG-20	R5201116
Total Suspended Solids	10.6		3.0	mg/L		26-AUG-20	R5204525
pH	8.91		0.10	pH units		26-AUG-20	R5202496
Enumeration of blue green algae cells							

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2492507-2 LAKE 2							
Sampled By: CLIENT on 21-AUG-20 @ 11:30							
Matrix: WATER							
Enumeration of blue green algae cells							
Total cyanobacterial cell count	234000		1	cells/mL		25-AUG-20	R5200457
Anabaena (Cyanophyceae)	1740		1	cells/mL		25-AUG-20	R5200457
Aphanothece (Cyanophyceae)	129000		1	cells/mL		25-AUG-20	R5200457
Microcystis (Cyanophyceae)	59400		1	cells/mL		25-AUG-20	R5200457
Planktothrix (Cyanophyceae)	31700		1	cells/mL		25-AUG-20	R5200457
Pseudanabaena (Cyanophyceae)	11900		1	cells/mL		25-AUG-20	R5200457
Nitrogen Total							
Nitrate in Water by IC							
Nitrate (as N)	<0.10	DLM	0.10	mg/L		21-AUG-20	R5199622
Nitrate+Nitrite							
Nitrate and Nitrite as N	<0.11		0.11	mg/L		25-AUG-20	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLM	0.050	mg/L		21-AUG-20	R5199622
Total Kjeldahl Nitrogen							
Total Kjeldahl Nitrogen	2.41		0.20	mg/L	25-AUG-20	26-AUG-20	R5201197
Total Nitrogen Calculated							
Total Nitrogen	2.41		0.20	mg/L		26-AUG-20	
L2492507-3 LAKE 3							
Sampled By: CLIENT on 21-AUG-20 @ 12:00							
Matrix: WATER							
Chlorophyll a							
Chlorophyll a by fluorometry							
Chlorophyll a	51.1		0.10	ug/L	24-AUG-20	24-AUG-20	R5203472
Fecal Coliforms and E Coli by QT97							
E. coli by QT97							
Escherichia Coli	15		1	MPN/100mL		21-AUG-20	R5197067
Fecal Coliform by MPN QT97							
Fecal Coliforms	16		1	MPN/100mL		21-AUG-20	R5197068
Miscellaneous Parameters							
Ammonia, Total (as N)	0.161		0.010	mg/L		27-AUG-20	R5203689
Conductivity	1390		1.0	umhos/cm		26-AUG-20	R5202496
Orthophosphate-Dissolved (as P)	0.749	OPF	0.0030	mg/L		25-AUG-20	R5201088
Phosphorus (P)-Total	1.07		0.0060	mg/L		26-AUG-20	R5201116
Total Suspended Solids	14.8		3.0	mg/L		26-AUG-20	R5204525
pH	8.74		0.10	pH units		26-AUG-20	R5202496
Enumeration of blue green algae cells							
Total cyanobacterial cell count	541000		1	cells/mL		25-AUG-20	R5200457
Anabaena (Cyanophyceae)	186		1	cells/mL		25-AUG-20	R5200457
Aphanothece (Cyanophyceae)	455000		1	cells/mL		25-AUG-20	R5200457
Merismopedia (Cyanophyceae)	7920		1	cells/mL		25-AUG-20	R5200457
Microcystis (Cyanophyceae)	69300		1	cells/mL		25-AUG-20	R5200457
Planktothrix (Cyanophyceae)	6200		1	cells/mL		25-AUG-20	R5200457
Pseudanabaena (Cyanophyceae)	1980		1	cells/mL		25-AUG-20	R5200457
Nitrogen Total							
Nitrate in Water by IC							
Nitrate (as N)	<0.10	DLM	0.10	mg/L		21-AUG-20	R5199622
Nitrate+Nitrite							
Nitrate and Nitrite as N	<0.11		0.11	mg/L		25-AUG-20	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLM	0.050	mg/L		21-AUG-20	R5199622
Total Kjeldahl Nitrogen							

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

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2492507-3 LAKE 3							
Sampled By: CLIENT on 21-AUG-20 @ 12:00							
Matrix: WATER							
Total Kjeldahl Nitrogen							
Total Kjeldahl Nitrogen	2.34		0.20	mg/L	25-AUG-20	26-AUG-20	R5201197
Total Nitrogen Calculated							
Total Nitrogen	2.34		0.20	mg/L		26-AUG-20	

Reference Information

Version: FINAL

Sample Parameter Qualifier Key:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
OPF	Orthophosphate test was conducted on frozen (preserved) sample. CCME hold time (72 hrs) was exceeded, but freezing can extend hold time to 30 days according to ISO 5667-3 (2012).

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALGAE-CYANO-BACT-WP	Water	Enumeration of blue green algae cells	APHA 10200 C & F
Samples are prepared by sedimentation/settling and examined using a compound phase contrast inverted microscope. Cyanobacteria (also known as blue-green algae) are identified to genus and the cells are enumerated. The total cyanobacteria count is also reported.			
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-SCREEN-WP	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other test eg. IC, TDS, TSS, etc			
EC-WP	Water	Conductivity	APHA 2510B
Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.			
ECOLI-QT97-WP	Water	E. coli by QT97	APHA 9223B QT97
This analysis is carried out using procedures adapted from APHA 9223 "Enzyme Substrate Coliform Test". Escherichia coli bacteria are determined by mixing sample with a product containing hydrolyzable substrates and sealing in a 97-well packet. The packet is incubated at 35.0 +/- 0.5 degrees C for 18 or 24 hours and then the number of wells exhibiting positive responses are counted. The final results are obtained by comparing the number of positive responses to a probability table.			
ETL-N-TOT-ANY-WP	Water	Total Nitrogen Calculated	Calculated
FC-QT97-WP	Water	Fecal Coliform by MPN QT97	APHA 9223B QT97
This analysis is carried out using procedures adapted from APHA Method 9223B "Enzyme Substrate Coliform Test". The sample is mixed with a mixture of hydrolyzable substrates and then sealed in a 97-well packet. The packet is incubated at 44.5 +/- 0.2 degrees C for 18 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the number of positive responses to a probability table.			
N-TOTKJ-WP	Water	Total Kjeldahl Nitrogen	APHA 4500 NorgD (modified)
Aqueous samples are digested in a block digester with sulfuric acid and copper sulfate as a catalyst. Total Kjeldahl Nitrogen is then analyzed using a discrete analyzer with colorimetric detection.			
NH3-COL-WP	Water	Ammonia by colour	APHA 4500 NH3 F
Ammonia in water samples forms indophenol when reacted with hypochlorite and phenol. The intensity is amplified by the addition of sodium nitroprusside and measured colourmetrically.			
NO2+NO3-CALC-WP	Water	Nitrate+Nitrite	CALCULATION
NO2-IC-N-WP	Water	Nitrite in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-IC-N-WP	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-WP	Water	Phosphorus, Total	APHA 4500 P PHOSPHORUS-L
This analysis is carried out using procedures adapted from APHA METHOD 4500-P "Phosphorus". Total Phosphorus is determined colourmetrically after persulphate digestion of the sample.			

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
colourmetricaly on a sample that has been lab or field filtered through a 0.45 micron filter.			
SOLIDS-TOTSUS-WP	Water	Total Suspended Solids	APHA 2540 D (modified)
Total suspended solids in aquesous matrices is determined gravimetrically after drying the residue at 103 □ 105□C.			

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

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