



Stantec

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August 9, 2013
File: 121511151

Clayton Developments Limited
255 Lacewood Drive, Suite 100C
Halifax, NS B3M 4G2

Attention: **Mike Hanusiak, Sr. Vice President, General Manager**

Dear Mr. Hanusiak:

Reference: **Water Quality Monitoring Results for Russell Lake – June 2013 Sampling Event**

To monitor the effects of development, water quality monitoring has been undertaken on a seasonal basis since April 2005 at four stations in Russell Lake (Figure 1 in Attachment). Monitoring is conducted four times each year on a seasonal basis, with sampling events carried out once during the spring, twice during the summer, and once during the fall. Water samples are not collected during the winter. Sampling results have been provided in previous letter reports to you, with a summary of the sampling up to April 3, 2013 presented in the report dated May 27, 2013. The present report builds on the results to date while focusing on the most current (June 26, 2013) early summer sampling event, with special attention provided to previous summer sampling events.

The weather during the sampling period on June 26, 2013 was cloudy with light rain and an air temperature of 16 - 17°C. Only a trace amount of rain was recorded for the six days preceding the sampling day, but a significant amount of rain occurred prior to the sampling event in the month of June, with 139.1 mm of rain measured at the Halifax International Airport. Hourly mean wind speeds were up to 44 km/h and blew primarily from the southwest for 48 hours leading up to the date of sample collection. The mean hourly wind speeds were between 12 and 21 km/h on the sampling date, slightly higher than the previous 48 hours. This sampling date was selected in discussion with Clayton Developments to assess a potential worst-case scenario of elevated storm-water discharge and influence on Russell Lake during the summer period.

Sampling was conducted between 11:30 and 14:00 on June 26, 2013. The following conditions were observed at the four Russell Lake monitoring stations (i.e., In-Lake, Outlet, South Inlet, and North Inlet sampling stations):

- Within Russell Lake, at the In-Lake station, the water appeared clear to slightly brownish green and the overall lake level appeared to be lower than previous June sampling events. Three ducks were observed in the vicinity of the boat slipway.
- At the Outlet station of Russell Lake, the water appeared clear. The water level at the Outlet station appeared higher than during other June events. Algae were observed in the low-flow areas and in-stream vegetation was present along the banks.
- Water flowing in the South Inlet station appeared clear to slightly tea stained. Fine silt and organics were observed on the substrate. No in-stream vegetation was observed. The South Inlet station contained a higher flow than previous June sampling events.
- The water at the North Inlet station was not clear and bottom of the water/benthos could not be seen at the time of sample collection. The grating within the culvert at this station contained garbage. Vegetation was present in the water at this site.

August 9, 2013

Mike Hanusiak, Sr. Vice President, General Manager

Page 2 of 6

Reference: Water Quality Monitoring Results for Russell Lake – June 2013 Sampling Event

Tables 1 to 6 below present statistical summaries of analytical results from April 2005 to June 2013 for key water quality parameters (total suspended solids (TSS), turbidity, pH, conductivity, sodium and chloride, total phosphorus (TP), Chlorophyll a (Chl a), and fecal coliforms) at each of the monitoring stations. The seasonal trends for some of the key water quality parameters are presented graphically in Figures 2 to 8 below. Where applicable, the water quality data were compared to the Canadian Council for the Ministers of the Environment Guidelines for the Protection of Freshwater Aquatic Life (CCME FAL).

Water Clarity

TSS concentrations (Figure 2 in Attachment and Table 1 below) were low and consistent with the median values for the In-Lake, Outlet and the North Inlet stations. The TSS concentration measured at the North Inlet station was 20 mg/L and was the highest value obtained from the four stations during the June 2013 sampling event, and the most ever measured for a June sampling event. This result was anticipated based on the intense rainfall (139.1 mm) in the month of June 2013 (prior to sampling on June 26) that led to elevated surface runoff and increased storm water discharge to Russell Lake. However, higher TSS was not observed for the other stations, suggesting that surface runoff from increased precipitation is less likely to contain higher TSS concentrations at these stations.

Table 1 Russell Lake - TSS Statistics

Station	June 26, 2013 Results (mg/L)	Early Summer Min (mg/L)	Early Summer Max (mg/L)	Early Summer Median (mg/L)	Early Summer Mean (mg/L)
In-Lake	1	ND*	3	1	2
Outlet	2	ND	2	1	1
South Inlet	1	ND	17	2	4
North Inlet	20	ND	7	2	3

Turbidity levels at all stations for June 26, 2013 were within the range of historical measurements. The North Inlet had a turbidity concentration of 3.7 NTU, which was still within the historical range but elevated above the median value for early summer results (1.5 NTU) as presented below in Table 2. This could be expected given the high rainfall amounts that occurred in June 2013, even though no rain fell for the six days prior to the sampling event.

Table 2 Russell Lake - Turbidity Statistics

Station	June 26, 2013 Results (NTU)	Early Summer Min (NTU)	Early Summer Max (NTU)	Early Summer Median (NTU)	Early Summer Mean (NTU)
In-Lake	0.5	ND	1.1	1.0	0.9
Outlet	0.9	0.6	2.4	0.8	1.0
South Inlet	1.4	ND	39.0	0.8	5.6
North Inlet	3.7	0.80	5.1	1.5	1.9

pH

Measurements of pH collected since April 2005 (Figure 3 in Attachment and Table 3 below) indicate that the water of Russell Lake in early summer is historically slightly basic with a median value of 7.4. The pH readings in June 2013 ranged from slightly acidic, with a pH of 6.5 at the South Inlet station, to slightly basic,

August 9, 2013

Mike Hanusiak, Sr. Vice President, General Manager

Page 3 of 6

Reference: Water Quality Monitoring Results for Russell Lake – June 2013 Sampling Event

with a pH of 7.2 for the North Inlet station. These pH results are consistent with results from previous early summer sampling events and are within the CCME FAL guideline for pH of 6.5 to 9.0.

Table 3 Russell Lake - pH Statistics

Station	June 26, 2013 Results (Units)	Early Summer Min (Units)	Early Summer Max (Units)	Early Summer Median (Units)	Early Summer Mean (Units)
In-Lake	6.6	6.7	8.0	7.4	7.4
Outlet	6.6	6.8	7.9	7.2	7.3
South Inlet	6.5	6.1	7.8	7.1	7.1
North Inlet	7.2	7.5	8.0	7.7	7.7

Salt Concentrations

As is typical of urban lakes in watersheds subject to development, Russell Lake has relatively higher salt concentrations than would be expected for a similar lake in a less developed watershed. Conductivity increases with salt concentrations and elevated levels are typically exhibited during spring melt conditions which become lower during the summer monitoring periods. Concentrations tend to be higher at the North Inlet station, where the road network and associated drainage is concentrated and lower at the South Inlet station, which is less developed.

As shown in Table 4 (below) and on Figure 4 (Attachment), the June 2013 conductivity measurements at the In-Lake, Outlet and North Inlet stations were within the range observed since March 2005 and similar to the measurements taken in the early summer of 2011 and 2012. However, the June 2013 South Inlet station had a conductivity value of 280 µS/cm, which was higher than the historical maximum and median values (240 µS/cm and 175 µS/cm, respectively) for early summer sampling events.

Table 4 Russell Lake - Conductivity Statistics

Station	June 26, 2013 Results (µS/cm)	Early Summer Min (µS/cm)	Early Summer Max (µS/cm)	Early Summer Median (µS/cm)	Early Summer Mean (µS/cm)
In-Lake	710	360	960	670	659
Outlet	730	360	970	670	661
South Inlet	280	89	240	175	175
North Inlet	1100	580	1400	1000	1069

Sodium and chloride are indicators of road salt concentrations in urban lakes and are discussed in that context below. Given that CCME FAL recommends a chloride concentration of less than 120 mg/L for the long-term health of aquatic organisms (guideline of 640 mg/L for short-term exposure), the discussion of salt concentrations below will revolve predominantly around chloride with a brief description of sodium concentrations within Russell Lake.

Sodium (Na) concentrations in June 2013 at the In-Lake and Outlet sampling stations (108 mg/L and 109 mg/L, respectively) were within their respective ranges observed over the duration of monitoring. The sodium concentration at the South Inlet (27 mg/L) and North Inlet (21 mg/L) stations were both within the range of sodium concentrations previously measured during the early summer sampling events.

August 9, 2013

Mike Hanusiak, Sr. Vice President, General Manager

Page 4 of 6

Reference: Water Quality Monitoring Results for Russell Lake – June 2013 Sampling Event

Chloride ions at the In-Lake, Outlet, South Inlet, and North Inlet stations (190 mg/L, 190 mg/L, 43 mg/L and 240 mg/L, respectively), similarly were within the range observed over the duration of monitoring (refer to Table 5 below and Figure 5 in Attachment). However, concentrations of chloride at the In-Lake, Outlet and North Inlet stations exceeded the CCME FAL long-term guideline value of 120 mg/L, but not the short-term guideline value of 640 mg/L. The In-Lake, Outlet and North Inlet stations on the long term have generally exceeded the CCME long-term guideline concentration for chloride, with the North Inlet exceeding the most with a mean chloride concentration of 257 mg/L for all early summer sampling events (see Table 5).

Table 5 Russell Lake - Chloride Statistics

Station	June 26, 2013 Results (mg/L)	Early Summer Min (mg/L)	Early Summer Max (mg/L)	Early Summer Median (mg/L)	Early Summer Mean (mg/L)
In-Lake	190	87	250	155	162
Outlet	190	88	260	175	172
South Inlet	43	13	49	29	31
North Inlet	240	130	350	290	257

The early summer values for the In-Lake sampling station from 2005 to 2013 ranged from 360 to 960 µS/cm for conductivity, and from 87 to 250 mg/L for chloride. In June 2013, the values at this station were similar to spring concentrations in 2010, 2011 and 2012, and lower than early summer concentrations in 2008 and 2009 (refer to Figure 4 and Figure 5 in Attachment, respectively).

Similar values are typically observed between the Outlet station and the In-Lake station, as supported by the range of early summer values at the Outlet station for conductivity (360 to 970 µS/cm) and chloride (88 to 260 mg/L) for the early summer 2005-2012 sampling events. In June 2013 at the Outlet station, the values were similar to early summer concentrations in 2010, 2011 and 2012, and lower than early summer concentrations in 2008 and 2009 (Figure 4 and Figure 5, respectively).

The early summer 2005-2013 values for the South Inlet station ranged from 89 to 240 µS/cm for conductivity, and chloride ranged from 13 to 49 mg/L. The June 2013 values at this station were within the historic range for conductivity and chloride. Conductivity and chloride results were similar to those from 2009, 2010, 2011 and 2012 (refer to Figure 4 and Figure 5 in Attachment, respectively).

The early summer 2005-2013 values for the North Inlet station ranged from 580 to 1,400 µS/cm for conductivity and from 130 to 350 mg/L for chloride. In June 2013, the concentrations measured at the North Inlet station for conductivity and chloride were 1,100 µS/cm and 240 mg/L, respectively. These June 2013 results are slightly higher than the June 2012 concentrations, but lower than the concentrations reported from 2008-2011.

Nutrient Enrichment

The Chlorophyll a (Chl a) concentration of 3.48 µg/L (based on the acidification technique) at the In-Lake site for June 2013 (Table 6 below) was slightly higher than the previous maximum of 3.04 µg/L reported during the monitoring program (Figure 6 in Attachment). The early summer results for the previous sampling years ranged from 0.96 µg/L in 2010 to 3.04 µg/L in 2011 (Figure 6 in Attachment).

Total phosphorus (TP) concentrations at the In-Lake station have fluctuated over the early summer sampling periods, ranging from a low of 7 µg/L in 2005 to a high of 21 µg/L in 2011 (Figure 7 in Attachment). The total phosphorus concentration in June 2013 was 1 µg/L (Table 7 below), which is lower than the range of previous

August 9, 2013

Mike Hanusiak, Sr. Vice President, General Manager

Page 5 of 6

Reference: Water Quality Monitoring Results for Russell Lake – June 2013 Sampling Event

values and well below the HRM threshold value of 15 µg/L for Russell Lake. It is noted that the threshold value is intended for comparison to sample results at the In-Lake station only.

Table 6 Russell Lake - Chl a Statistics

Station	June 26, 2013 Results (µg/L)	Early Summer Min (µg/L)	Early Summer Max (µg/L)	Early Summer Median (µg/L)	Early Summer Mean (µg/L)
In-Lake	3.48	0.96	3.04	1.45	1.65
Outlet	1.58	0.95	2.19	1.20	1.42
South Inlet	1.81	0.22	5.05	1.23	2.02
North Inlet	1.43	0.51	1.35	0.75	0.84

The Chl a concentration of 1.58 µg/L at the Outlet station in June 2013 (Table 6 above) measured lower than at the In-Lake station, but which was slightly above the early summer mean and median at the Outlet station for the years 2007-2013. Between those years, the values ranged from 0.95 (in 2010) to 2.19 (in 2006) µg/L. The early summer 2013 TP concentration at the Outlet station measured 16 µg/L, which was within the historical range and generally consistent with the historical median and mean (refer to Table 7 below and Figure 7 in Attachment).

The Chl a concentration for the June 2013 sampling event at the South Inlet station was 1.81 µg/L (Table 6 above). This result is within the range of previous early summer values, which were between 0.22 µg/L (in 2007) and 5.05 µg/L (in 2010). The TP concentration at the South Inlet station in June 2013 measured 27 µg/L (Table 7 below). Prior TP concentrations ranged from 10 µg/L in 2007 to 110 µg/L in 2009.

The Chl a concentration for the June 2013 sampling event at the North Inlet station was 1.43 µg/L (Table 6 above). This result is higher than the range of all previous early summer values, which were between 0.51 µg/L (in 2007) and 1.35 µg/L (in 2006). As indicated in Table 7 (below), the TP concentration at the North Inlet station in June 2013 measured 37 µg/L and is within the range of previous early summer values for TP concentrations (8 µg/L to 56 µg/L), but higher than the historical median and mean values (15 µg/L and 20 µg/L, respectively).

Table 7 Russell Lake - TP Statistics

Station	June 26, 2013 Results (µg/L)	Early Summer Min (µg/L)	Early Summer Max (µg/L)	Early Summer Median (µg/L)	Early Summer Mean (µg/L)
In-Lake	1	7	21	9	11
Outlet	16	4	73	13	19
South Inlet	27	10	110	50	58
North Inlet	37	8	56	15	20

Bacterial Contamination

Bacterial contamination in Russell Lake is measured by sampling and testing for the presence of fecal coliforms in the water. In addition to fecal coliform analysis conducted by the lab, analysis of *Escherichia coli* (*E. coli*) has also been carried out for sampling events beginning in 2010. *E. coli* are a type of fecal coliform that may be considered a more specific indicator of bacteria found in the intestines of warm-blooded animals and humans and are a strong indicator of recent sewage or animal waste contamination, whereas some fecal bacteria may originate from non-fecal sources. *E. coli* counts were <1 CFU/100 mL for the In-Lake station and

August 9, 2013

Mike Hanusiak, Sr. Vice President, General Manager

Page 6 of 6

Reference: Water Quality Monitoring Results for Russell Lake – June 2013 Sampling Event

200 CFU/100ml at the Outlet, 100 CFU/100ml at the South Inlet and 300 CFU/100ml at the North Inlet stations. The concentration of fecal coliforms measured at the In-Lake station was <1 CFU/100 mL and 100 CFU/100ml at the Outlet, <1 CFU/100ml at the South Inlet and 400 CFU/100ml at the North Inlet stations. These values are elevated at the Outlet and North Inlet when compared to station-specific results from past years (refer to Figure 8 in Attachment) and is likely in part due to 139.1 mm of rain that fell in the area prior to sampling in the month of June 2013.

Conclusion

The results of the June 2013 sampling event indicate that total phosphorus (TP) level at the In-Lake station was 1 µg /L, well below the HRM threshold value of 15 µg/L. The early summer TP result at the other three stations was higher than the concentrations at the In-Lake station but within the historical ranges. The In-Lake and North Inlet Chl a concentrations were slightly higher than the maximum concentrations to date, for their respective stations, observed during the early summer season (refer to Tables 8 and 9 in Attachment).

As compared to early summer sampling events from 2006 – 2013, TSS, pH, and fecal coliform results were within the historical ranges for previous early summer sampling events. Chl a and TP were within the historical ranges but elevated above the historical median at the South Inlet station (refer to Table 10 in Attachment). During the June 2013 sampling event at the time of the sample collection, the water levels in the stream were elevated as a result of the >100 mm of rain that fell in the area in the month of June 2013.

At the North Inlet station, concentrations of TSS and Chl a were elevated compared to previous early summer sampling events (refer to Table 11 in Attachment). Turbidity was within the historical range but elevated above the median historical value. Fecal coliform concentrations were also elevated as compared to previous early summer sampling events. Total phosphorus was also elevated (37 µg/L) compared to other stations, which is likely attributed to the higher TSS (20 mg/L) and associated particulate matter since the dissolved phosphorus concentration at this station was relatively low (4 µg/L). For the South Inlet station, the TP concentration was 27 µg/L, but the TSS concentration was significantly lower at 1.8 mg/L and the dissolved phosphorus was higher at 11 µg/L, suggesting that the source of phosphorus for this sampling event at this station is attributed to a greater dissolved fraction compared to a particulate form and unlike that for the North Inlet station.

The June 2013 conductivity, sodium (Na) and chloride (Cl) concentrations were within the range of results from previous sampling events for all stations, though they were slightly above their respective median values of early summer samples collected from 2006 – 2013.

Sincerely,

STANTEC CONSULTING LTD.

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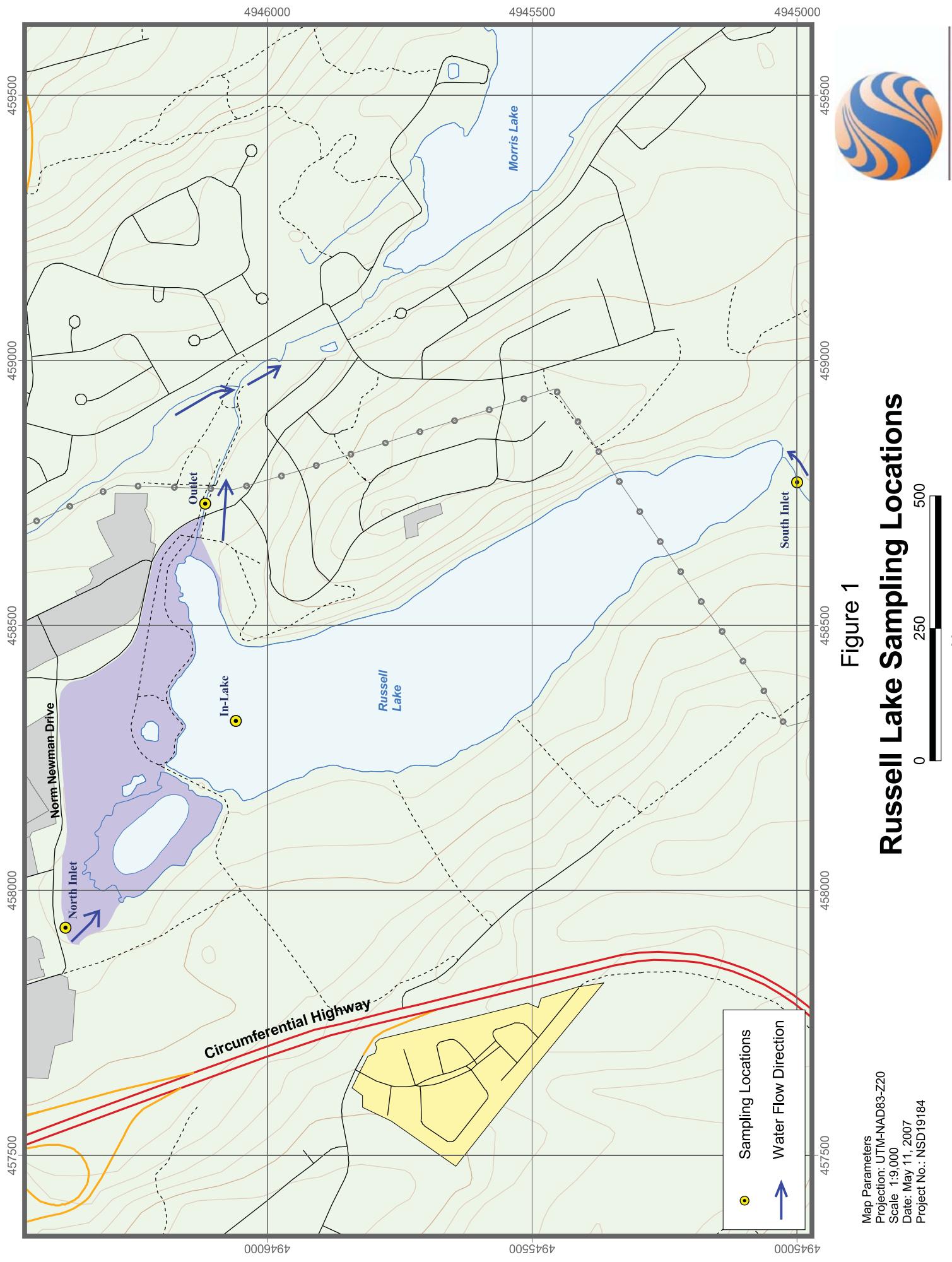
cc: Cameron Deacoff, Halifax Regional Municipality

Attachments: Figures 1-8, Tables 8-11, and Maxxam Certificate of Analysis



Figure 1

Russell Lake Sampling Locations



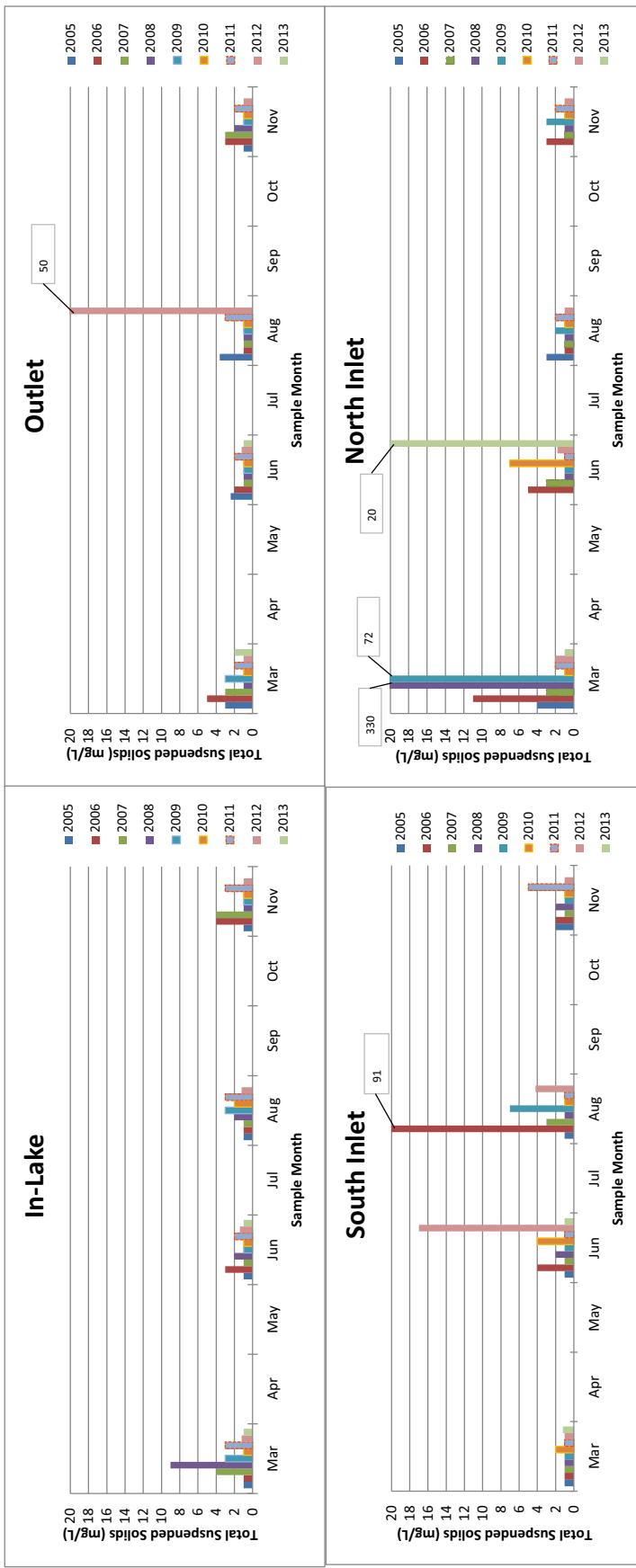


Figure 2. Total Suspended Solids at four sites in Russell Lake from April 2005 to June 2013

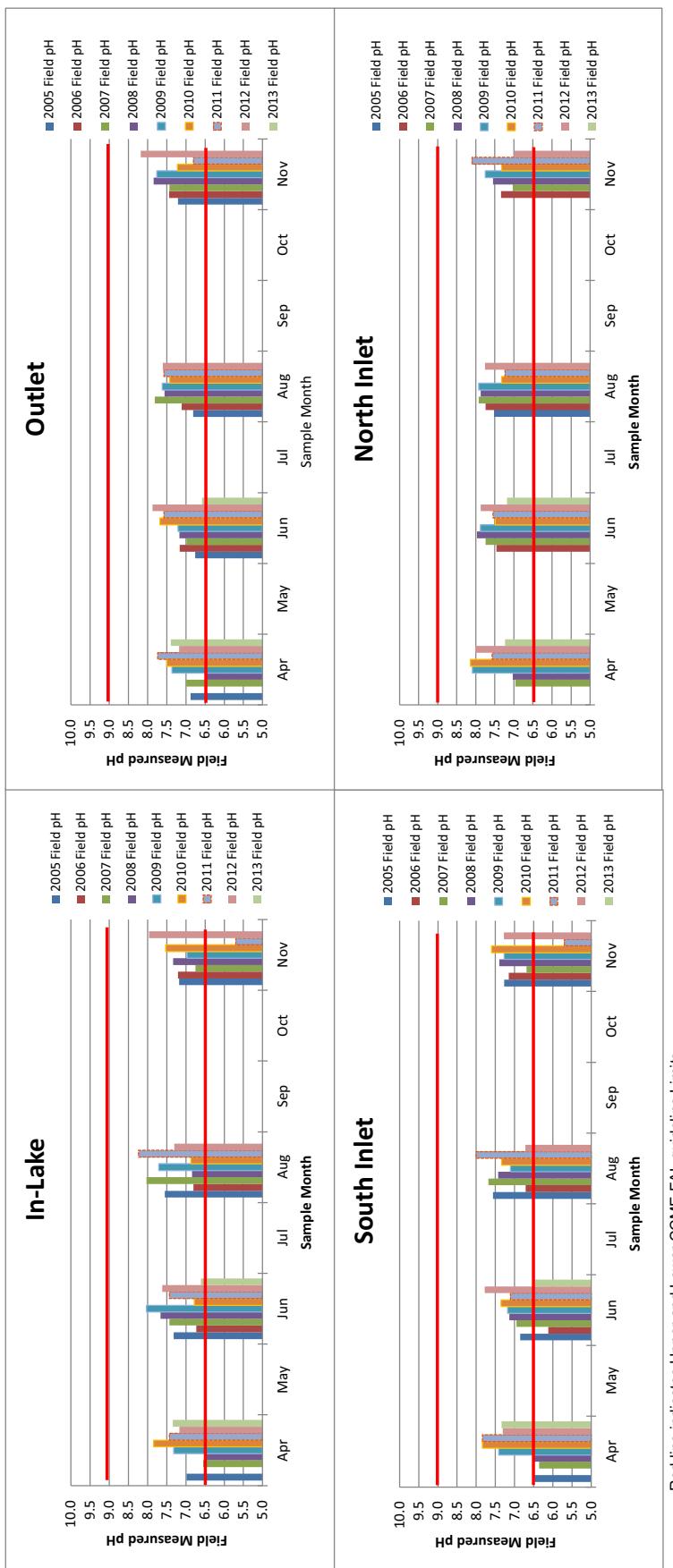


Figure 3. pH at four sites in Russell Lake from April 2005 to June 2013

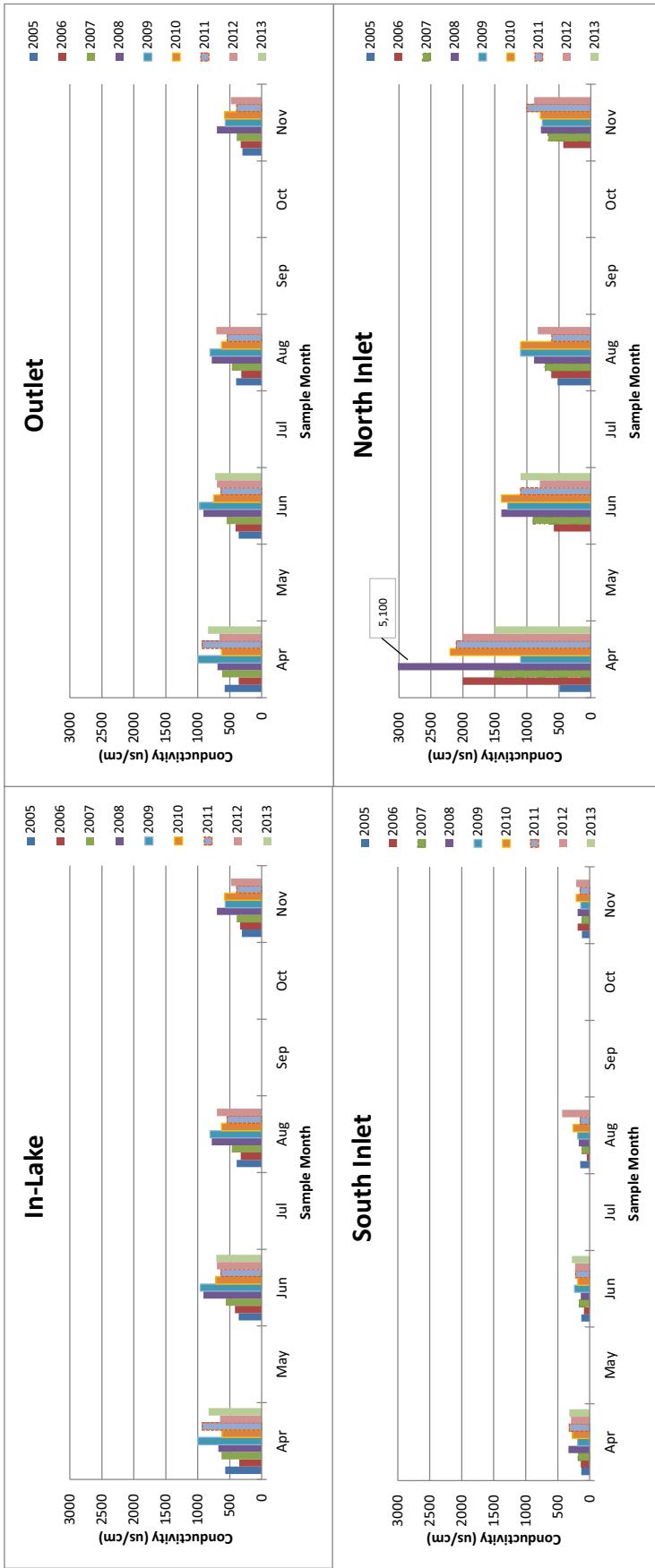


Figure 4. Conductivity at four sites in Russell Lake from April 2005 to June 2013

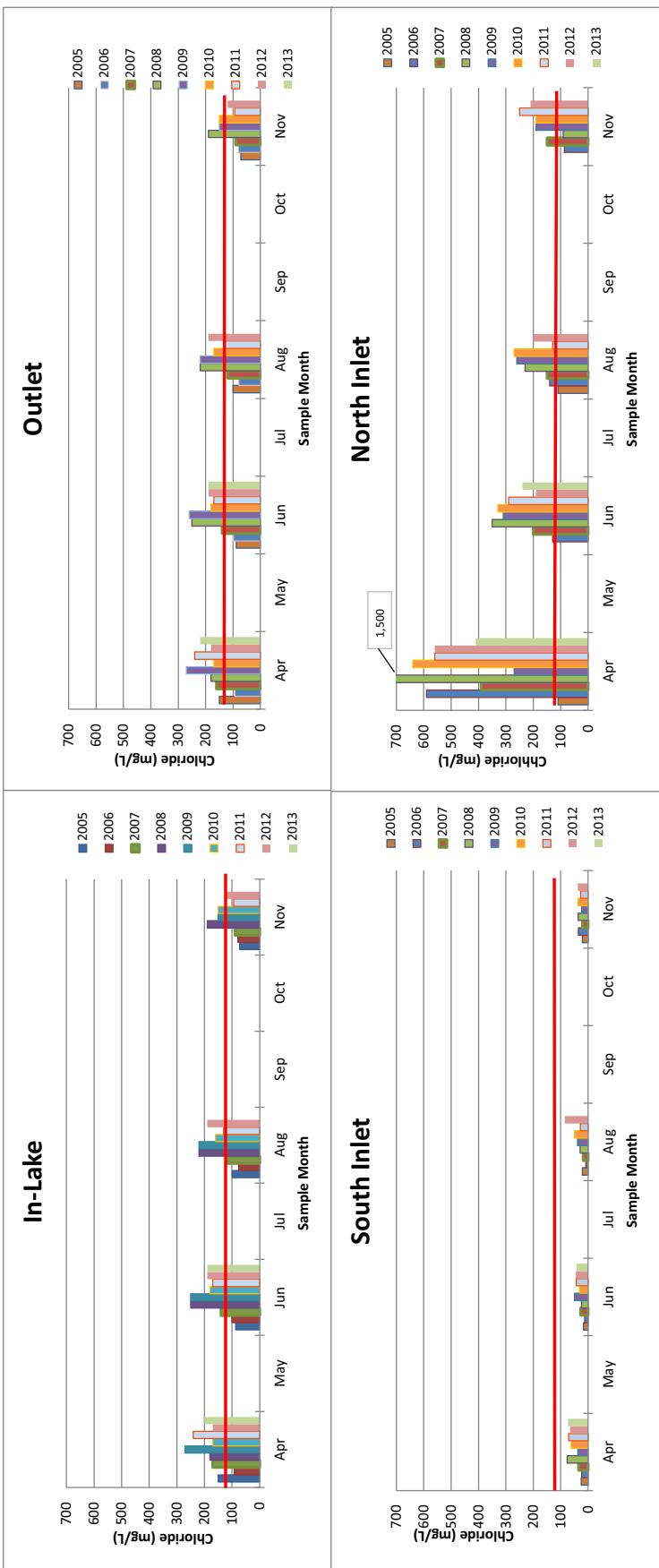


Figure 5. Chloride concentrations at four sites in Russell Lake from April 2005 to June 2013

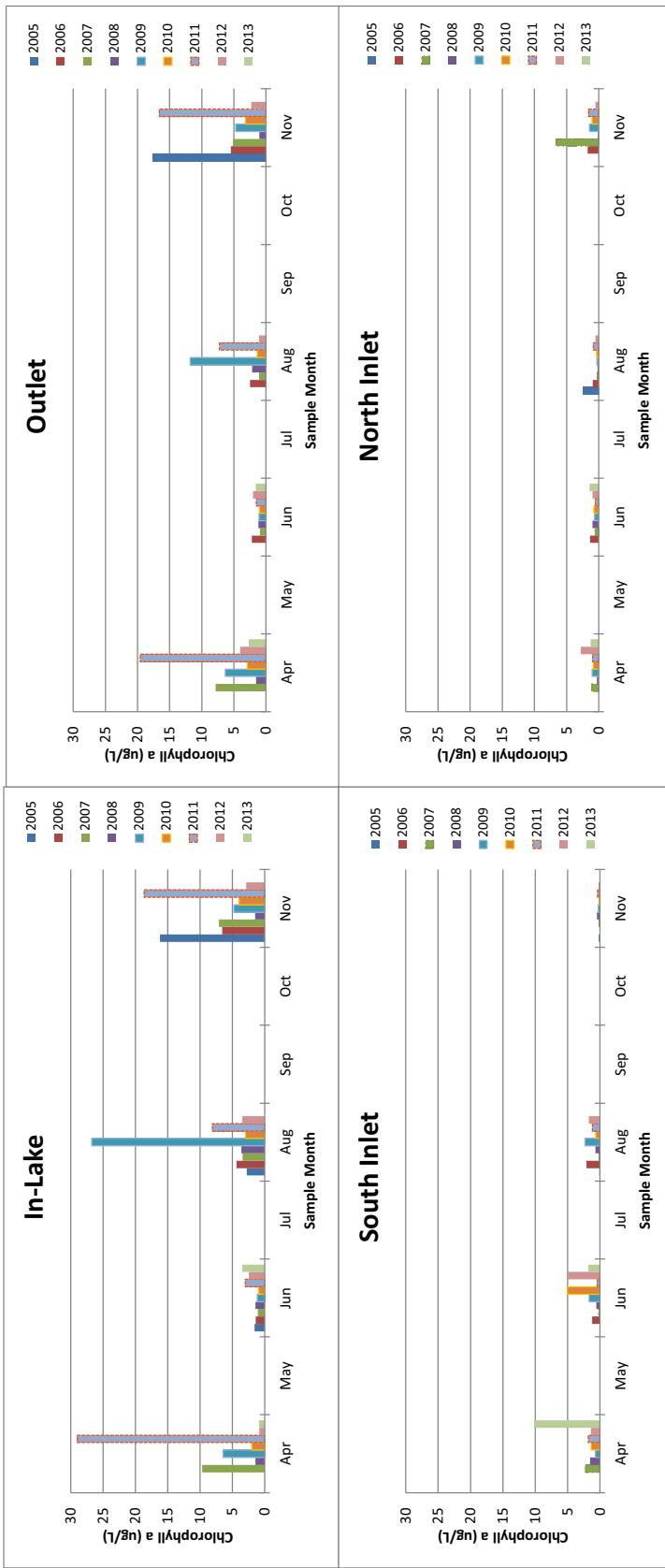


Figure 6. Chlorophyll a concentrations at four sites in Russell Lake from April 2005 to June 2013

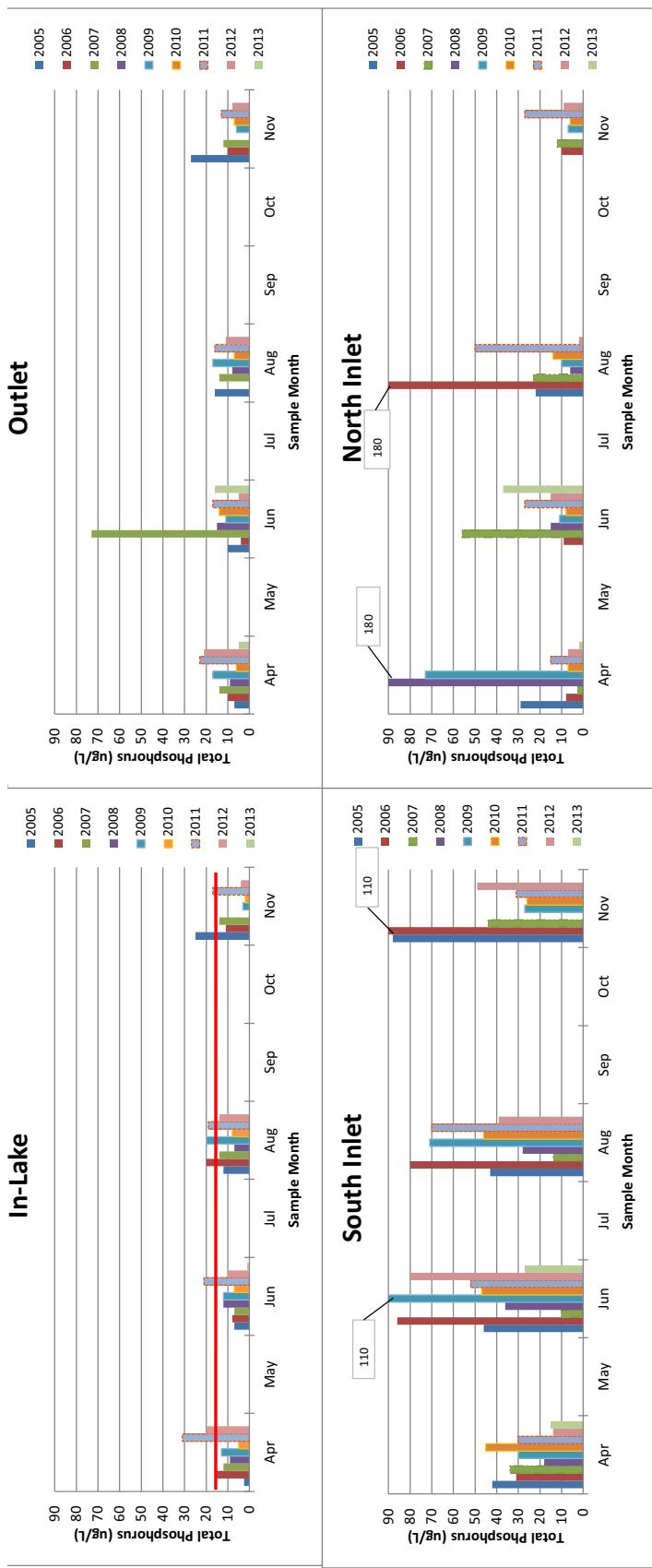


Figure 7. Total Phosphorus concentrations at four sites in Russell Lake from April 2005 to June 2013

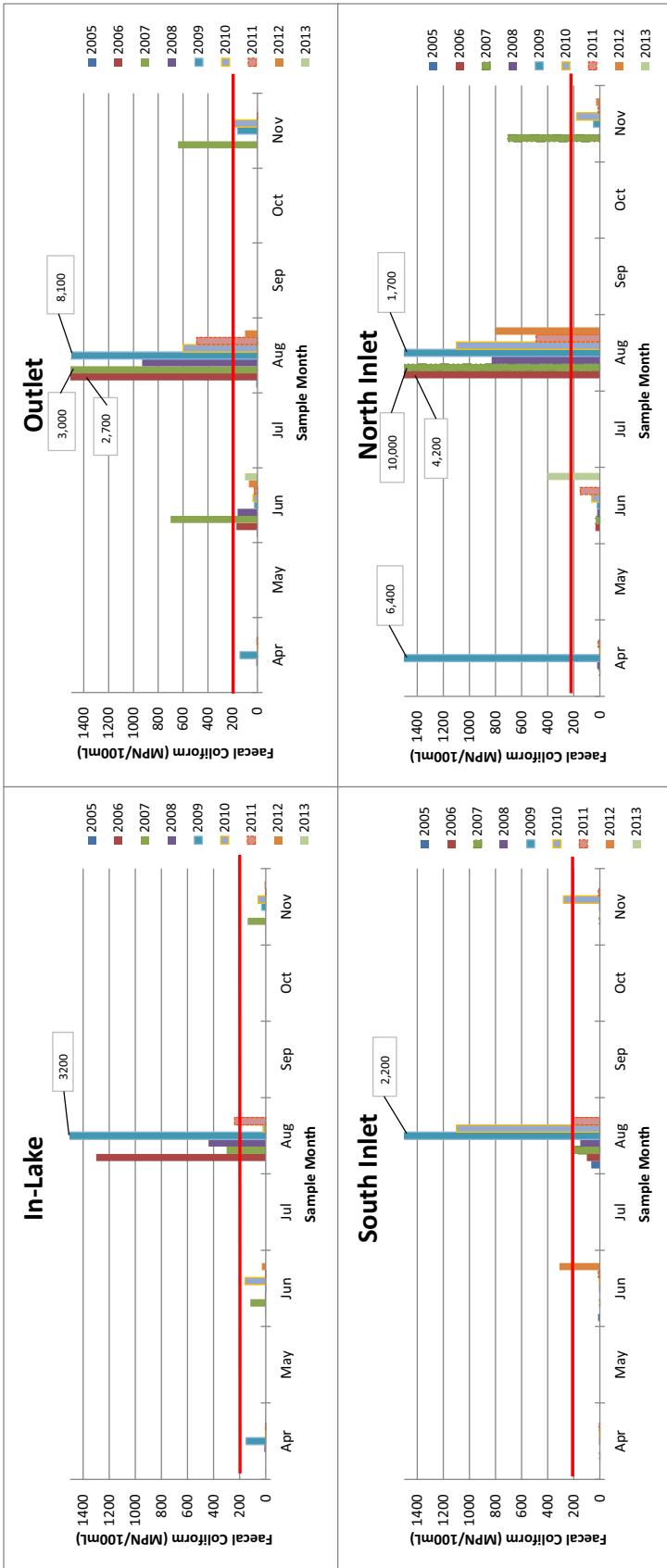


Figure 8. Fecal Coliform at four sites in Russell Lake from April 2005 to June 2013

TABLE 9 Surface Water Quality Data for Russell Lake, Outlet (2005-2013)

$P_{\text{d}} = 1 - \text{ERF}(\frac{M}{\sqrt{2}}) \approx 0.999$ at $M = 12$

TABLE 10 Surface Water Quality Data for Russell Lake, South Inlet (2005-2013)

TABLE 11 Surface Water Quality Data for Russell Lake, North Inlet (2005-2013)

Results below detection limits (DL) shown as 1/2 DL

Your P.O. #: 16400NR
 Your Project #: 121511151
 Your C.O.C. #: 416878-01-01

Attention: Sean Wilson

Stantec Consulting Ltd
 40 Highfield Park Drive
 Suite 102
 Dartmouth, NS
 B3A 0A3

Report Date: 2013/07/09

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B3A1992
Received: 2013/06/26, 16:08

Sample Matrix: Water
 # Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Carbonate, Bicarbonate and Hydroxide	5	N/A	2013/07/05	CAM SOP-00102	APHA 4500-CO2 D
Alkalinity	5	N/A	2013/07/08	ATL SOP 00013	Based on EPA310.2
Chloride	5	N/A	2013/07/09	ATL SOP 00014	Based on SM4500-Cl
Total coliform (CFU/mL) in water	5	N/A	2013/06/28	ATL SOP 00097	MOEE 3371/APHA 9222B
E.coli in water (CFU/mL)	5	N/A	2013/06/28	ATL SOP 00097	MOEE 3371/APHA 9222B
Colour	5	N/A	2013/07/08	ATL SOP 00020	Based on SM2120C
Conductance - water	5	N/A	2013/07/04	ATL SOP-00004	Based on SM2510B
Fecal coliform in water (CFU/100 mL)	5	N/A	2013/06/27	ATL SOP-00071	Based SM9222D
Hardness (calculated as CaCO ₃)	5	N/A	2013/07/05	ATL SOP 00048	Based on SM2340B
Metals Water Total MS	5	2013/07/04	2013/07/04	ATL SOP 00059	Based on EPA6020A
Ion Balance (% Difference)	5	N/A	2013/07/09		
Anion and Cation Sum	5	N/A	2013/07/08		
Nitrogen Ammonia - water	5	N/A	2013/07/05	ATL SOP 00015	Based on USEPA 350.1
Nitrogen - Nitrate + Nitrite	5	N/A	2013/07/08	ATL SOP 00016	Based on USGS - Enz.
pH	5	N/A	2013/07/04	ATL SOP 00003	Based on SM4500H+B
Phosphorus - ortho	5	N/A	2013/07/08	ATL SOP 00021	Based on USEPA 365.2
Sat. pH and Langelier Index (@ 20C)	5	N/A	2013/07/09	ATL SOP-00049	.
Sat. pH and Langelier Index (@ 4C)	5	N/A	2013/07/09	ATL SOP-00049	.
Reactive Silica	5	N/A	2013/07/08	ATL SOP 00022	Based on EPA 366.0
Sulphate	5	N/A	2013/07/08	ATL SOP 00023	Based on EPA 375.4
Chlorophyll A (Sub from Bedford) (1)	5	2013/06/28	2013/07/02		
Total Dissolved Solids (TDS calc)	5	N/A	2013/07/09		
Organic carbon - Total (TOC)	5	N/A	2013/07/09	ATL SOP 00037	Based on SM5310C
Dissolved Phosphorus (2)	5	2013/07/02	2013/07/03	CAM SOP-00407	APHA 4500 P,B,F
Total Phosphorus (Colourimetric) (2)	5	2013/07/04	2013/07/05	CAM SOP-00407	APHA 4500 P,B,F
Total Suspended Solids	5	N/A	2013/06/28	ATL SOP 00007	based on EPA 160.2
Turbidity	5	N/A	2013/07/03	ATL SOP 00011	based on EPA 180.1

Remarks:

Reporting results to two significant figures at the RDL is to permit statistical evaluation and is not intended to be an indication of analytical precision.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

* Results relate only to the items tested.

- (1) This test was performed by Dalhousie Department of Oceanography
 (2) This test was performed by Maxxam Analytics Mississauga

Maxxam Job #: B3A1992
Report Date: 2013/07/09

Stantec Consulting Ltd
Client Project #: 121511151
Your P.O. #: 16400NR
Sampler Initials: SW

-2-

Encryption Key Original Signed *Marie McNair Muise*

Jul 2013 15:51:41 -03:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Marie (McNair) Muise, Project Manager
Email: MMuisse@maxxam.ca
Phone# (902) 420-0203 Ext:253

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

Page 2 of 11

RESULTS OF ANALYSES OF WATER

			SB0768 2013/06/26 13:52		SB0769 2013/06/26 13:28	SB0769 2013/06/26 13:28	
		Units	NORTH INLET	RDL	OUTLET	OUTLET Lab-Dup	RDL
Calculated Parameters							
Anion Sum	me/L	8.57	N/A	6.52			N/A
Bicarb. Alkalinity (calc. as CaCO ₃)	mg/L	70	1.0	38			1.0
Calculated TDS	mg/L	478	1.0	370			1.0
Carb. Alkalinity (calc. as CaCO ₃)	mg/L	ND	1.0	ND			1.0
Cation Sum	me/L	7.74	N/A	6.12			N/A
Hardness (CaCO ₃)	mg/L	110	1.0	65			1.0
Ion Balance (% Difference)	%	5.09	N/A	3.16			N/A
Langelier Index (@ 20C)	N/A	-0.629		-1.22			
Langelier Index (@ 4C)	N/A	-0.877		-1.46			
Saturation pH (@ 20C)	N/A	8.04		8.52			
Saturation pH (@ 4C)	N/A	8.29		8.76			
Inorganics							
Total Alkalinity (Total as CaCO ₃)	mg/L	71	5.0	38			5.0
Dissolved Chloride (Cl)	mg/L	240	5.0	190			1.0
Colour	TCU	46	5.0	18			5.0
Nitrate + Nitrite	mg/L	0.48	0.050	0.054			0.050
Nitrogen (Ammonia Nitrogen)	mg/L	0.51	0.050	0.11			0.050
Total Organic Carbon (C)	mg/L	13(1)	1.0	3.9	3.5		0.50
Orthophosphate (P)	mg/L	ND	0.010	ND			0.010
pH	pH	7.41	N/A	7.30			N/A
Dissolved Phosphorus	mg/L	0.004	0.002	ND			0.002
Total Phosphorus	mg/L	0.037	0.002	0.016			0.002
Reactive Silica (SiO ₂)	mg/L	3.2	0.50	1.3			0.50
Total Suspended Solids	mg/L	20	2.0	ND			1.0
Dissolved Sulphate (SO ₄)	mg/L	21	2.0	17			2.0
Turbidity	NTU	3.7	0.10	0.88			0.10
Conductivity	µS/cm	1100	1.0	730			1.0
Subcontracted Analysis							
Subcontract Parameter	N/A	ATTACHED	N/A	ATTACHED			N/A
							3263829

N/A = Not Applicable

ND = Not detected

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

(1) - Elevated reporting limit due to sample matrix.



Maxxam Job #: B3A1992
Report Date: 2013/07/09

Success Through Science®

Stantec Consulting Ltd
Client Project #: 121511151

Your P.O. #: 16400NR
Sampler Initials: SW

RESULTS OF ANALYSES OF WATER

Maxxam ID		Sampling Date		SB0770 2013/06/26 12:08			SB0771 2013/06/26 11:37		SB0772 2013/06/26 13:57	
	Units	IN-LAKE STATION		RDL	QC Batch	SOUTH INLET	RDL	DUP	RDL	QC Batch
Calculated Parameters										
Anion Sum	me/L	6.43	N/A	3261406	2.66	N/A	8.16		N/A	3261406
Bicarb. Alkalinity (calc. as CaCO ₃)	mg/L	34	1.0	3261402	60	1.0	62		1.0	3261402
Calculated TDS	mg/L	363	1.0	3261411	154	1.0	487		1.0	3261411
Carb. Alkalinity (calc. as CaCO ₃)	mg/L	ND	1.0	3261402	ND	1.0	ND		1.0	3261402
Cation Sum	me/L	5.99	N/A	3261406	2.67	N/A	8.79		N/A	3261406
Hardness (CaCO ₃)	mg/L	63	1.0	3261404	71	1.0	120		1.0	3261404
Ion Balance (% Difference)	%	3.54	N/A	3261405	0.190	N/A	3.72		N/A	3261405
Langelier Index (@ 20C)	N/A	-1.02		3261409	-0.882		-0.772			3261409
Langelier Index (@ 4C)	N/A	-1.27		3261410	-1.13		-1.02			3261410
Saturation pH (@ 20C)	N/A	8.58		3261409	8.25		8.05			3261409
Saturation pH (@ 4C)	N/A	8.83		3261410	8.50		8.30			3261410
Inorganics										
Total Alkalinity (Total as CaCO ₃)	mg/L	34	5.0	3270046	60	5.0	62		5.0	3270046
Dissolved Chloride (Cl)	mg/L	190	1.0	3270048	43	1.0	230		5.0	3270048
Colour	TCU	14	5.0	3270051	62	25	45		10	3270051
Nitrate + Nitrite	mg/L	ND	0.050	3270053	0.13	0.050	0.51		0.050	3270053
Nitrogen (Ammonia Nitrogen)	mg/L	0.054	0.050	3269223	0.24	0.050	0.53		0.050	3269223
Total Organic Carbon (C)	mg/L	3.1	0.50	3272722	9.4	0.50	15(1)		1.0	3272722
Orthophosphate (P)	mg/L	ND	0.010	3270052	0.015	0.010	0.012		0.010	3270052
pH		7.56	N/A	3268629	7.37	N/A	7.28		N/A	3268635
Dissolved Phosphorus	mg/L	ND	0.002	3266216	0.011	0.002	0.010		0.002	3266216
Total Phosphorus	mg/L	ND	0.002	3268462	0.027	0.002	0.046		0.002	3268462
Reactive Silica (SiO ₂)	mg/L	1.1	0.50	3270050	5.7	0.50	2.9		0.50	3270050
Total Suspended Solids	mg/L	1.0	1.0	3262980	1.8	1.0	27		2.0	3262980
Dissolved Sulphate (SO ₄)	mg/L	17	2.0	3270049	12	2.0	21		2.0	3270049
Turbidity	NTU	0.48	0.10	3267261	1.4	0.10	4.6		0.10	3267261
Conductivity	uS/cm	710	1.0	3268634	280	1.0	1000		1.0	3268640
Subcontracted Analysis										
Subcontract Parameter	N/A	ATTACHED	N/A	3263829	ATTACHED	N/A	ATTACHED	N/A	3263829	

N/A = Not Applicable

ND = Not detected

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

(1) - Elevated reporting limit due to sample matrix.

ELEMENTS BY ICP/MS (WATER)

Maxxam ID		SB0768	SB0769	SB0770	SB0771	SB0772	
Sampling Date		2013/06/26 13:52	2013/06/26 13:28	2013/06/26 12:08	2013/06/26 11:37	2013/06/26 13:57	
	Units	NORTH INLET	OUTLET	IN-LAKE STATION	SOUTH INLET	DUP	RDL
Metals							
Total Calcium (Ca)	ug/L	37800	22000	21300	21800	41600	100
Total Copper (Cu)	ug/L	31.4	ND	3.4	ND	25.0	2.0
Total Iron (Fe)	ug/L	3170	268	ND	579	1010	50
Total Magnesium (Mg)	ug/L	4600	2300	2270	4060	4910	100
Total Manganese (Mn)	ug/L	2670	927	110	1560	1910	2.0
Total Potassium (K)	ug/L	2840	2110	2150	2080	3130	100
Total Sodium (Na)	ug/L	121000	109000	108000	26500	142000	100
Total Zinc (Zn)	ug/L	158	5.2	7.7	ND	99.7	5.0

MICROBIOLOGY (WATER)

Maxxam ID		SB0768	SB0769	SB0770	SB0771	SB0772	
Sampling Date		2013/06/26 13:52	2013/06/26 13:28	2013/06/26 12:08	2013/06/26 11:37	2013/06/26 13:57	
	Units	NORTH INLET	OUTLET	IN-LAKE STATION	SOUTH INLET	DUP	RDL
Microbiological							
Escherichia coli	CFU/mL	3.0	2.0	ND	1.0	3.0	1.0
Fecal coliform	CFU/100mL	400	100	ND	ND	400	100
Total Coliforms	CFU/mL	99	80	140	9.0	87	1.0

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Maxxam Job #: B3A1992
Report Date: 2013/07/09

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Package 1	6.7°C
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Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

Sample SB0768-01: Poor RCAP Ion Balance due to sample matrix. Cation sum does not include contribution from Mn and Al.



Maxxam Job #: B3A1992
Report Date: 2013/07/09

QUALITY ASSURANCE REPORT

QC Batch	Parameter	Date	Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
3261686	Fecal coliform	2013/06/27					ND, RDL=1.0	CFU/100mL				
3261758	Total Coliforms	2013/06/27					ND, RDL=1.0	CFU/mL				
3261759	Escherichia coli	2013/06/27					ND, RDL=1.0	CFU/mL				
3262980	Total Suspended Solids	2013/06/28					ND, RDL=1.0	mg/L	2.1	25	100	80 - 120
3266216	Dissolved Phosphorus	2013/07/03	105	80 - 120	95	85 - 115	0.002, RDL=0.002	mg/L	8.5	20	106	85 - 115
3267261	Turbidity	2013/07/03					ND, RDL=0.10	NTU	0.2	25	100	80 - 120
3268341	Total Calcium (Ca)	2013/07/04	NC	80 - 120	99	80 - 120	ND, RDL=100	ug/L	1.0	20		
3268341	Total Copper (Cu)	2013/07/04	92	80 - 120	92	80 - 120	ND, RDL=2.0	ug/L	NC	20		
3268341	Total Iron (Fe)	2013/07/04	98	80 - 120	98	80 - 120	ND, RDL=50	ug/L	NC	20		
3268341	Total Magnesium (Mg)	2013/07/04	101	80 - 120	101	80 - 120	ND, RDL=100	ug/L	2.9	20		
3268341	Total Manganese (Mn)	2013/07/04	97	80 - 120	96	80 - 120	ND, RDL=2.0	ug/L	NC	20		
3268341	Total Potassium (K)	2013/07/04	105	80 - 120	106	80 - 120	ND, RDL=100	ug/L	1.1	20		
3268341	Total Sodium (Na)	2013/07/04	NC	80 - 120	102	80 - 120	ND, RDL=100	ug/L	1.7	20		
3268341	Total Zinc (Zn)	2013/07/04	96	80 - 120	95	80 - 120	ND, RDL=5.0	ug/L	NC	20		
3268462	Total Phosphorus	2013/07/05	NC	80 - 120	106	85 - 115	ND, RDL=0.002	mg/L	3.7	20	109	85 - 115
3268629	pH	2013/07/04							0.3	25	99	80 - 120
3268634	Conductivity	2013/07/04			99	80 - 120	ND, RDL=1.0	uS/cm	0.6	25		
3268635	pH	2013/07/04							2.0	25	100	80 - 120
3268640	Conductivity	2013/07/04			100	80 - 120	ND, RDL=1.0	uS/cm	0.2	25		
3269223	Nitrogen (Ammonia Nitrogen)	2013/07/06	NC	80 - 120	102	80 - 120	ND, RDL=0.050	mg/L	0.9	25		
3270046	Total Alkalinity (Total as CaCO3)	2013/07/08	NC	80 - 120	99	80 - 120	ND, RDL=5.0	mg/L	NC	25		
3270048	Dissolved Chloride (Cl)	2013/07/09	103	80 - 120	101	80 - 120	ND, RDL=1.0	mg/L	NC	25	102	80 - 120
3270049	Dissolved Sulphate (SO4)	2013/07/08	106	80 - 120	101	80 - 120	ND, RDL=2.0	mg/L	NC	25		
3270050	Reactive Silica (SiO2)	2013/07/08	99	80 - 120	101	80 - 120	ND, RDL=0.50	mg/L	0.5	25		
3270051	Colour	2013/07/08					ND, RDL=5.0	TCU	0.4	25	105	80 - 120
3270052	Orthophosphate (P)	2013/07/08	NC	80 - 120	96	80 - 120	ND, RDL=0.010	mg/L	6.4	25		
3270053	Nitrate + Nitrite	2013/07/08	100	80 - 120	99	80 - 120	ND, RDL=0.050	mg/L	NC	25		
3272722	Total Organic Carbon (C)	2013/07/09	86	80 - 120	88	80 - 120	ND, RDL=0.50	mg/L	11.2	25		

N/A = Not Applicable

RDL = Reportable Detection Limit

RPD = Relative Percent Difference

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant



Maxxam Job #: B3A1992
Report Date: 2013/07/09

to permit a reliable recovery calculation.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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Client Project #: 121511151

Your P.O. #: 16400NR
Sampler Initials: SV

Validation Signature Page**Maxxam Job #: B3A1992**

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

original signed

Andrew VanWychen, Bedford Micro

original signed

Colleen Acker, Supervisor, General Chemistry

original signed

Cristina Carriere, Scientific Services

original signed

Erik Beaman, Scientific Specialist

Validation Signature Page

Maxxam Job #: B3A1992

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

original signed


Mike MacGillivray, Scientific Specialist (Inorganics)

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Page 1 of 1

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