



Lake Manitoba & Lake St. Martin Outlet Channels Project

Aquatic Environment Monitoring, Fall 2020 - Water Quality

REPORT

Prepared for Manitoba Transportation and Infrastructure
By North/South Consultants Inc. · 83 Scurfield Blvd. · Winnipeg, MB · R3Y 1G4

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A Data Report Prepared for
Manitoba Transportation and Infrastructure

By:

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May 2021



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EXECUTIVE SUMMARY

North/South Consultants Inc. (NSC) was retained by Manitoba Transportation and Infrastructure (MTI) to collect supplemental data with respect to the aquatic environment in support of the Lake Manitoba and Lake St. Martin Outlet Channel Project (the Project). An Aquatic Effects Monitoring Program (AEMP) was developed in 2020 to provide a plan for monitoring the effects of the Project on the aquatic environment, focusing on key issues identified in the Environmental Impact Statement (EIS). The AEMP identified the need for the collection of data to supplement existing information that had been presented in the EIS.

This report presents the results of water quality sampling that was conducted in early September and mid-October 2020 to provide additional pre-construction data for the surface water quality study described in the AEMP. The surface water quality monitoring study was designed to determine whether water quality conditions change due to channel operations, specifically whether the change in flow patterns affects water quality. As such, the AEMP includes sampling locations throughout the study area. In addition to the locations identified in the AEMP, sampling described in this report was conducted at supplemental locations where historical sampling has occurred or to characterize tributaries in the study area.

In situ water quality measurements and water samples were collected at 20 core sampling sites in the study area from Lake Manitoba to Lake Winnipeg from September 1-10 and October 13-14, 2020; not all sites were sampled in October due to weather conditions. In addition, 10 sites along the alignments of the proposed Lake Manitoba Outlet Channel (LMOC) and Lake St. Martin Outlet Channel (LSMOC) were surveyed for the presence of water and *in situ* water quality in September.

Quality assurance/quality control (QA/QC) measures were incorporated into the monitoring program including standard sampling methods and QA/QC samples. All results were compared to the Manitoba Water Quality Standards, Objectives and Guidelines (MWQSOG) for the protection of aquatic life (PAL) as well as the Canadian Council of Ministers of the Environment (CCME) guidelines for the protection of freshwater aquatic life.

Based on the results collected, the water quality of the study area can be described as moderately nutrient-rich to nutrient-rich, low to moderately turbid, slightly alkaline, hard to very hard, and well-oxygenated. In general, water quality was similar at sites sampled along the main flow path from Lake Manitoba through the Fairford River to Lake St. Martin and into the Dauphin River; however, differences in water quality were observed between the sites sampled along the main flow path and Birch Creek, Big Buffalo Lake, Buffalo Creek, and Sturgeon Bay, including:

- Birch Creek had higher alkalinity, hardness, carbon, colour and magnesium, and lower conductivity, total dissolved solids (TDS), chloride, molybdenum, sodium and vanadium;
- Big Buffalo Lake had higher total phosphorus (TP), carbon, chlorophyll *a* and silicon, and lower conductivity, TDS, potassium, lithium, molybdenum, rubidium, sodium, sulphur and uranium;

- Buffalo Creek had higher carbon and silicon, and lower conductivity, TDS, potassium, lithium, molybdenum, rubidium, sodium, strontium, sulphur and uranium; and
- Sturgeon Bay had lower alkalinity, hardness, total nitrogen, carbon, antimony, boron, chloride, lithium, magnesium, molybdenum, potassium, sodium, strontium, sulphate and uranium, and higher TP, chlorophyll *a*, aluminum, cesium, chromium, copper, iron, nickel and titanium compared with sites along the main flow path.

Sampling for additional parameters was conducted at sites in the Fairford and Dauphin rivers, and Birch Creek in September which showed that *E. coli* concentrations were higher in the Fairford River than in Birch Creek or the Dauphin River; and that blue-green algae (i.e., cyanobacteria) were most abundant in the Dauphin River and least abundant in Birch Creek. Sampling was also conducted at these locations for microcystin, hydrocarbons, and pesticides; all results were below analytical detection limits.

TP exceeded the MWQSOG narrative guideline for phosphorus for lakes and river mouths (0.025 mg/L) at several locations, including: Watchorn Bay; Mercer Creek at Watchorn Bay; Fairford River at Lake St. Martin; Birch Creek at Lake St. Martin; Lake St. Martin; Big Buffalo Lake; the Dauphin River at Sturgeon Bay; and in Sturgeon Bay. TP was below the MWQSOG narrative guideline for rivers and streams (0.05 mg/L) in the Fairford and Dauphin rivers and in Birch and Buffalo creeks.

Aluminum exceeded the MWQSOG and CCME guideline for PAL (0.1 mg/L) in approximately half of the samples collected, including samples from Watchorn and Sturgeon bays, Watchorn, Birch and Buffalo creeks, the Fairford and Dauphin rivers, and Lake St. Martin. Iron exceeded the MWQSOG and CCME guideline for PAL (0.3 mg/L) in Buffalo Creek and Sturgeon Bay. Additionally, chloride exceeded the CCME long-term guideline (120 mg/L) in all samples collected from along the main flow path from Lake Manitoba through the Fairford River to Lake St. Martin and into the Dauphin River. Exceedances of these parameters are common in the region.

All other water quality variables measured for which there are MWQSOG and CCME PAL objectives or guidelines were within PAL objectives and guidelines at all core sampling sites.

Of the ten locations in natural waterbodies surveyed along the alignments of the proposed LMOC and LSMOC, three were dry and elsewhere total water depths were less than half a metre. Sites sampled along the alignment of the proposed LMOC were well oxygenated, alkaline, and had moderately high specific conductance; whereas, sites along the alignment of the proposed LSMOC were low to moderately oxygenated, circum-neutral, and had lower specific conductance. Turbidity was low at all sites sampled. At the time of the survey, dissolved oxygen (DO) was below the MWQSOG 7-day objective for cold-water aquatic life (5.0 mg/L), the MWQSOG instantaneous objective for cool-water aquatic life (5.0 mg/L), and the CCME guidelines for warm water biota (6.0 mg/L and 5.5 mg/L, for early life and all other stages, respectively) at a site located on a small creek (Creek C) upstream of the alignment of the proposed LSMOC. Additionally, pH exceeded the MWQSOG/CCME upper limit for PAL (9.0 pH units) at a small waterbody (Water Lake) along the alignment of the proposed LMOC. DO and pH were within applicable MWQSOG/CCME PAL objectives/guidelines at all other sites sampled. There are no MWQSOG/CCME PAL guidelines for the other *in situ* parameters measured.

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ACRONYMS

AEMP	Aquatic Effects Monitoring Program
BCMELP	British Columbia Ministry of Environment, Lands, and Parks
BOD	Biological Oxygen Demand
CCME	Canadian Council of Ministers of the Environment
DIN	Dissolved Inorganic Nitrogen
DL	Analytical Detection Limit
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
EIS	Environmental Impact Statement
FRWCS	Fairford Water Control Structure
LMOC	Lake Manitoba Outlet Channel
LSMOC	Lake St. Martin Outlet Channel
MTI	Manitoba Transportation and Infrastructure
MWQSOG	Manitoba Water Quality Standards, Objectives, and Guidelines
MWS	Manitoba Water Stewardship
NSC	North/South Consultants Inc.
PAL	Protection of Freshwater Aquatic Life
PRSD	Percent Standard Relative Deviation
QA/QC	Quality Assurance/Quality Control
SD	Standard Deviation
TDS	Total Dissolved Solids
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids

1.0

INTRODUCTION

North/South Consultants Inc. (NSC) was retained by Manitoba Transportation and Infrastructure (MTI) to collect supplemental data with respect to the aquatic environment in support of the Lake Manitoba and Lake St. Martin Outlet Channel Project (the Project). The proposed Project is designed to manage flood waters on Lake Manitoba and Lake St. Martin by providing a channel by which flood waters can be conveyed, in addition to the natural outflow via the Fairford and Dauphin rivers (Figure 1). The Project consists of two outlet channels that are intended to work together:

- The 24 km Lake Manitoba Outlet Channel (LMOC) will work in tandem with the existing water control structure on the Fairford River (the Fairford Water Control Structure or FRWCS) to help regulate water levels and mitigate flooding on Lake Manitoba; and
- The 24 km Lake St. Martin Outlet Channel (LSMOC) will restore a more natural water regime to Lake St. Martin and will also provide flood protection by mitigating increased inflows from operation of the FRWCS, as well as additional inflows from the planned outlet from Lake Manitoba.

An Aquatic Effects Monitoring Program (AEMP) was developed in 2020 to provide a plan for monitoring the effects of the Project on the aquatic environment, focusing on key issues identified in the Environmental Impact Statement (EIS). The specific objectives of the AEMP were to:

- Verify the predicted effects presented in the surface water quality and fish and fish habitat sections of the EIS;
- Determine the effectiveness of mitigation measures;
- Assess the need for additional mitigation measures if initial measures are not adequate;
- Determine the effectiveness of any additional/adapted measure(s); and
- Confirm compliance with regulatory requirements relevant to surface water quality and fish and fish habitat set out in the Project approvals (e.g., Manitoba Environment Act License; Fisheries Act Authorization).

The AEMP identified the need for the collection of data to supplement existing information that had been presented in the EIS.

This report presents the results of water quality sampling that was conducted in early September and mid-October 2020 to provide additional pre-construction data for the surface water quality study described in the AEMP. The surface water quality monitoring study was designed to determine whether water quality conditions change due to channel operations, specifically whether the change in flow patterns affects water quality. As such, the AEMP included sampling locations throughout the study area. In addition to the locations identified in the AEMP, sampling described in this report was conducted at supplemental locations where historical sampling has occurred or to characterize tributaries in the study area (Table 1).

2.0

METHODS

2.1 SAMPLING PERIODS

Water quality sampling was conducted twice during the open-water season of 2020. Sampling periods were as follows:

- September 1-10; and
- October 13 and 14.

Sampling under ice-cover is planned for March 2021.

2.2 SAMPLING SITES

The study area for the monitoring program is comprised of Lake Manitoba, the Fairford and Dauphin rivers, Lake St. Martin, creeks and drains along the proposed LMOC alignment, the Buffalo Creek watershed, and Sturgeon Bay in Lake Winnipeg. In 2020, water quality sampling was conducted at 20 core sampling sites in the study area. Information on sampling locations is listed in Table 1 and illustrated in Figure 1 . Sampling sites were as follows:

- Two sites in Lake Manitoba in Watchorn Bay,
 - offshore of the proposed LMOC (WHB1), and
 - nearshore at the proposed LMOC (WHB2);
- One site in Watchorn Creek at Watchorn Bay (WHC-WB);
- One site in Mercer Creek at Watchorn Bay (MC-WB);
- Two sites in Birch Creek,
 - at PR 239 (BCD-2018-9), and
 - the outlet at Lake St. Martin (BC-LSM);
- Two sites in the Fairford River,
 - at highway 6 (FR1), and
 - near the outlet at Lake St. Martin (FR2);
- Five sites in Lake St. Martin,
 - Birch Bay (BB-LSM),
 - middle of the south basin (LSM5),
 - at the narrows (LSM4),
 - middle of the north basin (LSM1), and
 - the eastern bay near the proposed LSMOC (LSM3);
- Three sites in the Dauphin River,
 - at Lake St. Martin (DR-A),
 - near the provincial monitoring station at the “Big Bend” (DR-B), and
 - at Sturgeon Bay (DR-E);
- One site in Big Buffalo Lake (BBL);

- One site in Buffalo Creek at the Dauphin River (BC3); and
- Two sites in Lake Winnipeg in Sturgeon Bay,
 - nearshore at the proposed LSMOC (SB1), and
 - offshore of the proposed LSMOC (SB2).

Water quality sampling sites in Watchorn Bay (WHB1 and WHB2) and its associated creeks (WHC-WB and MC-WB), the south bay of Lake St. Martin (LSM5), two sites on the Dauphin River (DR-B and DR-E), and the sites in Sturgeon Bay (SB-1 and SB-2) were not sampled in October due to poor weather conditions, including strong winds and the early and rapid formation of ice, which made accessing the sites unsafe.

In addition to the core sampling sites described above, ten other locations along the alignments of the proposed LMOC and LSMOC were surveyed by helicopter on September 1, 2020 to ascertain the presence of water. If possible, *in situ* water quality parameters were measured. Location information for these sites is presented in Table 2 and Figure 1.

2.3 WATER QUALITY PARAMETERS

In situ measurements of physical and chemical parameters were collected at each sampling site, including: total depth; dissolved oxygen (DO); water temperature; specific conductance; pH; and turbidity. Secchi depth was also measured at sites with low water velocity.

At core sampling sites, water samples were collected for laboratory analysis of routine parameters (e.g., pH, conductivity), nutrients (e.g., nitrogen, phosphorus), chlorophyll *a*, water clarity (e.g., total suspended solids, turbidity), and metals and major ions (e.g., aluminum, iron, calcium). A detailed list of parameters analysed at core sampling sites is provided in Table 3.

During the September sampling period, selected sites were also sampled for additional parameters including: *Escherichia coli*; blue-green algae (i.e., cyanobacteria); microcystin; hydrocarbons; and pesticides. These additional parameters were analysed from samples collected at BC-LSM, FR1 and DR-A. Detailed lists of hydrocarbons and pesticides measured by the laboratory are presented in Tables 4 and 5, respectively.

In addition, samples for the laboratory analysis of biological oxygen demand (BOD) were collected from six sites during the September sampling period, including: WHC-WB; MC-WB; BCD-2018-9; BC-LSM; BBL; and BC3.

2.4 FIELD METHODS

Sampling sites were accessed by truck, boat, or helicopter depending on site accessibility. Sampling date and time were noted for each site. Sample locations were recorded using a handheld Garmin GPS receiver. Total water depth was recorded using a hand-held depth sounder at sites accessed by boat; at other sites, total water depth was estimated.

In situ measurements of water quality parameters including pH, specific conductance, DO, turbidity, and water temperature were collected using a YSI EXO™2 sonde. At river sites and those accessed from shore, *in situ* parameters were measured at approximately 0.3 m below the water's surface. At lake sites, *in situ* profiles were taken such that measurements were recorded near the surface (i.e., at 0.3 m) and at increments of either 0.5 m (if total water depth was less than 5 m) or 1.0 m. Secchi depth was measured at low velocity sites and was defined as the average of two depth readings: (1) the depth at which a circular black and white disk can no longer be seen when lowered into the water column; and (2) the depth at which the disk becomes visible again, when raised. Weather conditions (i.e., wind and waves) prohibited the collection of profiles and Secchi depths at some lake sites in September.

Grab samples were collected from approximately 0.3 m below the water's surface into clean sample bottles supplied by ALS Laboratories. Where necessary, samples were preserved according to instructions provided by the analytical laboratory. After collection, samples were placed in a cooler and kept cool using ice packs until submission (within 48 hours) to ALS Laboratories in Winnipeg, MB (a Canadian Association for Laboratory Accreditations, Inc. accredited laboratory) for analysis.

2.5 QUALITY ASSURANCE AND QUALITY CONTROL

Quality Assurance/Quality Control (QA/QC) measures were incorporated over the course of the monitoring program. Standard QA/QC measures were followed during sample collection (e.g., use of latex gloves, standard labelling practices, meter calibration, etc.). Additionally, QA/QC samples were collected for the list of parameters in Table 3 including field blanks, trip blanks, and replicate samples. For the September sampling period, two field blanks, two trip blanks and two sets of triplicate samples were submitted to the analytical laboratory. Due to the shortened sampling period in October, only one set of QA/QC samples (blanks and triplicates) was submitted.

2.5.1 Field Blanks

Field blanks are intended to provide information on sample contamination from atmospheric exposure and sample handling techniques, as well as potential laboratory contamination and/or error (British Columbia Ministry of Environment, Lands, and Parks [BCMELP] 1998). Field blanks were prepared by filling sample bottles with deionized water (both provided by the analytical laboratory) in the field and submitting the blanks along with the environmental samples.

2.5.2 Trip Blanks

Trip blanks are used for evaluating the potential for sample contamination that may occur from the container or preservatives through transport and storage of the sample, as well as laboratory precision (BCMELP 1998). Trip blanks were prepared in the laboratory by filling sample bottles with deionized water. Trip blanks were transported to the field sampling sites, but remained sealed, and were then submitted to the analytical laboratory in conjunction with environmental samples for analysis.

2.5.3 Replicate Samples

Triplicate samples were collected at two sites during the September sampling period, and one site during the October sampling period. Replicate samples provide a measure of variability of environmental conditions and the overall precision associated with field methods and laboratory analyses.

2.6 QA/QC ASSESSMENT

All water quality data were examined qualitatively for potential outliers and/or transcription or analytical errors. Where one replicate sample differed notably from the others, the measurement was flagged as “suspect” and the laboratory was asked to verify the result.

QA/QC samples were assessed according to standard criteria to evaluate precision and identify potential sample contamination issues (BCMELP 1998). Percent relative standard deviation (PRSD) was calculated for triplicate samples as follows:

$PRSD (\%) = \text{standard deviation (SD) of the triplicate values} / \text{mean of the triplicate values} \times 100$

Precision of replicate samples was evaluated using the “rule of thumb” criteria for precision of 18% for triplicate samples (BCMELP 1998). Where one or more of the replicate values were less than five times the analytical detection limit (DL), an analysis of precision was not undertaken, in accordance with guidance provided in BCMELP (1998).

Field and trip blank results were also evaluated for evidence of sample contamination. Values for any parameter that exceeded five times the DL were considered to be indicative of sample contamination and/or laboratory error.

2.7 DATA ANALYSIS

All data analyses treated censored values (i.e., values reported as below the DL) as equal to one half the DL. In cases where triplicate samples were collected, sample means are presented. Dissolved inorganic nitrogen (DIN) was calculated as the sum of ammonia-N and nitrate/nitrite-N. Nitrogen to phosphorus molar ratios were also calculated.

2.8 COMPARISON TO WATER QUALITY OBJECTIVES AND GUIDELINES

Results were compared to the Manitoba Water Quality Standards, Objectives and Guidelines (MWQSOG; MWS 2011) for the protection of aquatic life (PAL) as well as the Canadian Council of Ministers of the Environment (CCME) guidelines for the protection of freshwater aquatic life (CCME 1999; updated to 2020). In general, the MWQSOG for PAL are similar to the CCME guidelines for PAL for parameters measured; however, there are CCME guidelines for some parameters which lack a provincial guideline/objective and others for which the CCME and provincial guidelines are different. Typically, the

CCME guideline is more stringent than the provincial guideline. A summary of relevant water quality objectives and guidelines is presented in Appendix 1.

3.0

RESULTS

3.1 QA/QC RESULTS

QA/QC results are presented in Appendix 2.

3.1.1 Field and Trip Blanks

Field and trip blank results generally indicated high precision and no sample contamination. Although some parameters were occasionally detected in blank samples, all parameters were below the threshold of five times the DL.

3.1.2 Replicate Samples

PRSD values were not derived for several parameters due to low concentrations (i.e., concentrations less than five times the DL). In general, the results indicate good agreement between samples and acceptable levels of precision. The PRSD exceeded threshold values (18%) for four parameters, including: carbonate alkalinity; total and dissolved aluminum; and total titanium.

3.2 ROUTINE VARIABLES AND LIMNOLOGY

This section discusses the results for routine and *in situ* water quality parameters measured at the core water quality sampling sites; results of the *in situ* survey conducted on September 1, are presented separately (see Section 3.5 *In Situ* Survey Results). Results for *in situ* and routine water quality parameters measured at core sampling sites are presented in Tables 6 and 7, respectively; the following is a summary of these results.

Based on the results of the sampling that was conducted in September and October 2020, water quality of the study area can be generally described as moderately nutrient-rich to nutrient-rich, low to moderately turbid, slightly alkaline, hard to very hard, and well-oxygenated. Additionally, BOD was low at all six sites where samples were collected, including: Watchorn (WHC-WB), Mercer (MC-WB), Birch (BCD-2018-9 and BC-LSM) and Buffalo (BC3) creeks; and Big Buffalo Lake (BBL). *In situ* variables including, temperature, DO, turbidity, pH, and specific conductance were consistent across depth in Lake St. Martin. *In situ* profiles could not be collected at Watchorn and Sturgeon bays due to wavy conditions at the time of sampling.

Total phosphorus (TP) concentrations in the study area were composed of a mix of dissolved and particulate forms; in general phosphorus was predominately in particulate form. Most total nitrogen (TN) was present in organic form at all sites, with ammonia nitrogen generally comprising a greater amount of DIN than nitrate/nitrite nitrogen. Sturgeon Bay was an exception to this trend; there, DIN was dominated by nitrate/nitrite nitrogen. Based on TN:TP molar ratios, all waterbodies sampled were phosphorus limited (i.e., TN:TP ratio > 20; Kalff 2002).

Routine water quality was similar at sites sampled along the main flow path from Lake Manitoba through the Fairford River to Lake St. Martin and into the Dauphin River, including WHB1, WHB2, WHC-WB, MC-WB, FR1, FR2, BB-LSM, LSM5, LSM4, LSM1, LSM3, DR-A, DR-B and DR-E. However, differences in water quality were observed between the sites sampled along the main flow path and Birch Creek, Big Buffalo Lake, Buffalo Creek, and Sturgeon Bay. The following spatial differences in routine water quality were observed:

- Birch Creek (BCD-2018-9 and BC-LSM) had higher alkalinity, hardness, carbon and colour, and lower total dissolved solids (TDS) and conductivity than all other sites sampled;
- Big Buffalo Lake (BBL) had higher carbon and lower conductivity and TDS than sites along the main flow, and higher TP and chlorophyll *a* than all other sites sampled;
- Buffalo Creek (BC3) had higher carbon, and lower conductivity and TDS than the sites sampled along the main flow; and
- Sturgeon Bay (SB1 and SB2) had lower alkalinity, hardness, TN and carbon, and higher TP and chlorophyll *a* than upstream sites along the main flow path.

3.2.1 Comparison to Water Quality Guidelines and Objectives

TP exceeded the MWQSOG narrative guideline for phosphorus for lakes and river mouths (i.e., 0.025 mg/L) in several samples collected, including samples from the following locations:

- Watchorn Bay (WHB1 and WHB2);
- Mercer Creek at Watchorn Bay (MC-WB);
- Fairford River at Lake St. Martin (FR2);
- Birch Creek at Lake St. Martin (BC-LSM);
- Lake St. Martin at the Narrows (LSM4), the north Basin (LSM1) and eastern bay (LSM3);
- Big Buffalo Lake (BBL);
- the Dauphin River at Sturgeon Bay (DR-E); and
- Sturgeon Bay (SB1 and SB2).

TP was below the MWQSOG narrative guideline for rivers and streams (0.05 mg/L) in all samples collected from sites where the guideline applies, including FR1, BCD-2018-9, DR-A, DR-B and BC3.

DO was below the CCME PAL for early life stages of cold-water biota (9.5 mg/L) at several sites sampled in September, and at one site (BCD-2018-9) sampled in October. However, it is unlikely that early life stages of cold-water species were present at the time the measurements were taken (i.e., water temperatures were above 5°C in all instances where DO was less than 9.5 mg/L). DO was within MWQSOG objectives and CCME guidelines for PAL at all other sites and times sampled in 2020.

All other routine water quality parameters for which there are MWQSOG and CCME PAL objectives/guidelines, including, pH (6.5-9.0 pH units), ammonia (sample specific based on pH and temperature), nitrate (2.93 mg N/L and 3.0 mg/L for MWQSOG and CCME, respectively), and nitrite (0.60 mg N/L) were within PAL objectives and guidelines.

3.3 METALS AND MAJOR IONS

Metal and major ion concentrations measured in the study area are presented in Table 8.

Beryllium, bismuth, silver, tellurium, and tungsten were not detected at any site. Additionally, some metals were not detected in dissolved form at any site, including: cesium; lead; thallium; thorium; and tin. Total aluminum, arsenic, barium, boron, calcium, dissolved chloride, total iron, lithium, magnesium, total manganese, molybdenum, potassium, rubidium, dissolved selenium, silicon, sodium, strontium, dissolved sulphate, sulphur, total titanium, uranium, and total vanadium were consistently detected. The remaining metals and major ions were detected in some samples.

Like routine parameters, metals and major ions were similar at sites sampled along the main flow path from Lake Manitoba through the Fairford River to Lake St. Martin and into the Dauphin River (WHB1, WHB2, WHC WB, MC-WB, FR1, FR2, BB-LSM, LSM5, LSM4, LSM1, LSM3, DR-A, DR-B and DR-E); however, differences were observed between the sites sampled along the main flow path and Birch Creek, Big Buffalo Lake, Buffalo Creek, and in particular Sturgeon Bay. The following spatial differences in metals and major ions were observed:

- Birch Creek (BCD-2018-9 and BC-LSM) had lower chloride, molybdenum, sodium and vanadium, and higher magnesium;
- Big Buffalo Lake (BBL) had lower potassium, lithium, molybdenum, rubidium, sodium, sulphur and uranium, and higher silicon;
- Buffalo Creek (BC3) had lower potassium, lithium, molybdenum, rubidium, sodium, strontium, sulphur and uranium, and higher silicon; and
- Sturgeon Bay (SB1 and SB2) had lower antimony, boron, chloride, lithium, magnesium, molybdenum, potassium, sodium, strontium, sulphate, and uranium, and higher aluminum, cesium, chromium, copper, iron, nickel and titanium than sites sampled along the flow path from Lake Manitoba through the Dauphin River.

3.3.1 Comparison to Water Quality Guidelines and Objectives

Metals and major ions for which there are MWQSOG or CCME guidelines for PAL were, with few exceptions, within objectives and guidelines at sites sampled in 2020; PAL exceedances occurred for aluminum, chloride and iron as described below. Exceedance of PAL guidelines for aluminum and iron are common in waterbodies throughout Manitoba (CAMP 2017) and exceedance of the CCME PAL for chloride was regularly observed in the study area during the monitoring studies conducted for the Lake St. Martin Emergency Outlet Channel project (NSC and KGS Group 2016).

Aluminum exceeded the MWQSOG and CCME guideline for PAL (0.1 mg/L) in 15 of 29 samples collected, including samples from the following locations:

- Watchorn Bay (WHB1 and WHB2);
- Watchorn Creek (WHC-WB);
- Birch Creek at PR239 (BCD-2018-9);

- Fairford River (FR1 and FR2);
- Lake St. Martin (BB-LSM, LSM1 and LSM3);
- Buffalo Creek (BC3);
- Dauphin River (DR-E); and
- Sturgeon Bay (SB1 and SB2).

Iron exceeded the MWQSOG and CCME guideline for PAL (0.3 mg/L) in the samples collected from Buffalo Creek (BC3) and Sturgeon Bay (SB1 and SB2) in September; these sites were not sampled in October. Iron was below PAL guidelines at all other sites sampled.

Chloride exceeded the CCME long-term guideline (120 mg/L) in all samples collected from Watchorn Bay (WHB1 and WHB2), Watchorn and Mercer creeks (WHC-WB and MC-WB), Lake St. Martin (LSM5, LSM4, LSM1 and LSM3), and the Fairford (FR1 and FR2) and Dauphin (DR-A, DR-B and DR-E) rivers; all concentrations were below the CCME short-term guideline (640 mg/L). Chloride was below CCME PAL guidelines in all other sites sampled. There are no MWOSOG for PAL for chloride.

3.4 ADDITIONAL PARAMETERS

This section presents the results for the additional parameters that were analyzed in samples collected from Birch Creek at Lake St. Martin (BC-LSM), the Fairford River at PTH 6 (FR1), and the Dauphin River at Lake St. Martin (DR-A) in September 2020, including: *E. coli*; blue-green algae; microcystin; hydrocarbons; and pesticides. Detailed results are available in Appendix 3, the following is a summary of these results:

- *E. coli* was detected at all three sites sampled and concentrations were higher in the Fairford River (308 MPN/100 mL) than in Birch Creek (9 MPN/100 mL) and the Dauphin River (2 MPN/100 mL);
- blue-green algae were most abundant in the Dauphin River and least abundant in Birch Creek (Figure 2);
- microcystin was not detected (DL = 0.20 µg/L) at any of the three sites;
- hydrocarbons and were not detected at any of the three sites; and
- pesticides were not detected at any of the three sites.

For a list of hydrocarbons and pesticides measured including DLs, see Tables 4 and 5, respectively.

3.4.1 Comparison to Water Quality Guidelines and Objectives

As all results for hydrocarbons and pesticides were below detection and the DLs were lower than MWQSOG and CCME PAL guidelines, all measurements were also within the PAL guidelines.

There are no MWQSOG or CCME guidelines for PAL for *E. coli*, blue-green algae, or microcystin.

3.5 *IN SITU* SURVEY RESULTS

This section presents the results of the *in situ* survey that was conducted at ten locations in the study area on September 1, 2020. Results from this survey are presented in Table 9.

Of the ten locations surveyed, three sites along the alignment of the proposed LMOC were dry, including: Goodison Lake, Clarks Drain; and Woodale Drain. Water was present at the outlet of the drain at Goodison Lake; however, *in situ* parameters were not measured. All other sites surveyed were quite shallow with total water depths less than 0.5 m.

Sites along the alignment of the proposed LMOC where water was found (i.e., Reed, Clear and Water lakes) were well oxygenated, alkaline, and had low turbidity. Specific conductance was moderately high and ranged from 470-802 $\mu\text{S}/\text{cm}$.

Sites sampled along the alignment of the proposed LSMOC were low to moderately oxygenated, circum-neutral, and had low turbidity. Specific conductance at these sites was lower (8-367 $\mu\text{S}/\text{cm}$) than at the sites sampled along the alignment of the proposed LMOC.

3.5.1 Comparison to Water Quality Guidelines and Objectives

DO was below the MWQSOG 7-day objective for cold-water aquatic life (5.0 mg/L), the MWQSOG instantaneous objective for cool-water aquatic life (5.0 mg/L), and the CCME guidelines for warm water biota (6.0 mg/L and 5.5 mg/L for early life and all other stages, respectively) at the site located on Creek C upstream of the alignment of the proposed LSMOC (4.15 mg/L). Additionally, DO was below the CCME PAL for early life stages of cold-water biota (9.5 mg/L) at all sites sampled along the alignment of the proposed LSMOC; however, it is unlikely that early life stages of cold-water species were present at the time the measurements were taken (i.e., water temperatures were above 5°C in all instances where DO was less than 9.5 mg/L). DO was within MWQSOG objectives and CCME guidelines for PAL at all sites sampled along the alignment of the proposed LMOC.

In situ pH exceeded the MWQSOG/CCME upper limit for PAL (9.0 pH units) at Water Lake (9.68 pH units); pH was within MWQSOG/CCME PAL guidelines (6.5-9.0 pH units) at all other sites sampled.

There are no MWQSOG/CCME PAL guidelines for the other *in situ* parameters measured.

4.0

SUMMARY

Based on the results of the monitoring that was conducted in September and October 2020, the water quality of the study area can be described as moderately nutrient-rich to nutrient-rich, low to moderately turbid, slightly alkaline, hard to very hard, and well-oxygenated. In general, water quality was similar at sites sampled along the main flow path from Lake Manitoba through the Fairford River to Lake St. Martin and into the Dauphin River; however, differences in water quality were observed between the sites sampled along the main flow path and Birch Creek, Big Buffalo Lake, Buffalo Creek, and Sturgeon Bay, including:

- Birch Creek had higher alkalinity, hardness, carbon, colour and magnesium, and lower conductivity, TDS, chloride, molybdenum, sodium and vanadium;
- Big Buffalo Lake had higher TP, carbon, chlorophyll *a* and silicon, and lower conductivity, TDS, potassium, lithium, molybdenum, rubidium, sodium, sulphur and uranium;
- Buffalo Creek had higher carbon and silicon, and lower conductivity, TDS, potassium, lithium, molybdenum, rubidium, sodium, strontium, sulphur and uranium; and
- Sturgeon Bay had lower alkalinity, hardness, TN, carbon, antimony, boron, chloride, lithium, magnesium, molybdenum, potassium, sodium, strontium, sulphate and uranium, and higher TP, chlorophyll *a*, aluminum, cesium, chromium, copper, iron, nickel and titanium compared with sites along the main flow path.

The results of the additional sampling that was conducted in the Fairford and Dauphin rivers, and Birch Creek in September showed that *E. coli* concentrations were higher in the Fairford River than in Birch Creek or the Dauphin River; and that blue-green algae were most abundant in the Dauphin River and least abundant in Birch Creek. Microcystin, hydrocarbons, and pesticides were not detected.

TP exceeded the MWQSOG narrative guideline for phosphorus for lakes and river mouths at several locations, including: Watchorn Bay; Mercer Creek at Watchorn Bay; Fairford River at Lake St. Martin; Birch Creek at Lake St. Martin; Lake St. Martin; Big Buffalo Lake; the Dauphin River at Sturgeon Bay; and in Sturgeon Bay. TP was below the MWQSOG narrative guideline for rivers and streams in the Fairford and Dauphin rivers and in Birch and Buffalo creeks.

Aluminum exceeded the MWQSOG and CCME guideline for PAL in approximately half of the samples collected, including samples from Watchorn and Sturgeon bays, Watchorn, Birch and Buffalo creeks, the Fairford and Dauphin rivers, and Lake St. Martin. Iron exceeded the MWQSOG and CCME guideline for PAL Buffalo Creek and Sturgeon Bay. Additionally, chloride exceeded the CCME long-term guideline in all samples collected from along the main flow path from Lake Manitoba through the Fairford River to Lake St. Martin and into the Dauphin River. Exceedances of these parameters are common in the region.

All other water quality variables measured for which there are MWQSOG and CCME PAL objectives or guidelines were within PAL objectives and guidelines at all core sampling sites.

The *in situ* survey that was conducted on September 1, 2020 found that, of the ten locations surveyed, three were dry (Goodison Lake, and Clarks and Woodale drains) and elsewhere total water depths were

less than half a metre. Sites along the alignment of the proposed LMOC (where water was found) were well oxygenated, alkaline, and had moderately high specific conductance; whereas, sites along the alignment of the proposed LSMOC were low to moderately oxygenated, circum-neutral, and had lower specific conductance. Turbidity was low at all sites sampled. At the time of the survey, DO was below the MWQSOG 7-day objective for cold-water aquatic life, the MWQSOG instantaneous objective for cool-water aquatic life, and the CCME guidelines for warm water biota at the site located on Creek C upstream of the alignment of the proposed LSMOC. Additionally, pH exceeded the MWQSOG/CCME upper limit for PAL at Water Lake. DO and pH were within applicable MWQSOG/CCME PAL objectives/guidelines at all other sites sampled. There are no MWQSOG/CCME PAL guidelines for the other *in situ* parameters measured.

5.0**REFERENCES**

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Table 1. Core water quality sampling sites, 2020.

Waterbody	Location Description	Site ID	Sampling Date	Sampling Time	UTM Coordinates			AEMP Site ¹
					Zone	Easting	Northing	
Lake Manitoba	offshore at proposed LMOC	WHB1	1-Sep-20	13:15	14U	529544	5681689	-
	nearshore at proposed LMOC	WHB2	1-Sep-20	15:23	14U	529859	5681409	Yes
Watchorn Creek	at Watchorn Bay	WHC-WB	1-Sep-20	16:26	14U	530536	5681120	-
Mercer Creek	at Watchorn Bay	MC-WB	1-Sep-20	14:19	14U	528731	5682150	-
Birch Creek	at PR 239	BCD-2018-9	9-Sep-20	19:05	14U	531737	5697480	-
	at Lake St. Martin	BC-LSM	1-Sep-20	18:13	14U	533227	5702296	Yes
Fairford River	at highway 6	FR1	1-Sep-20	19:20	14U	518844	5715212	Yes
	at Lake St. Martin	FR2	10-Sep-20	9:45	14U	527235	5717448	-
Lake St. Martin	Birch Bay	BB-LSM	10-Sep-20	11:45	14U	534236	5704268	Yes
	middle of south basin	LSM5	2-Sep-20	17:13	14U	536274	5724382	Yes
	at the narrows	LSM4	2-Sep-20	15:10	14U	541937	5733207	Yes
	middle of north basin	LSM1	2-Sep-20	13:03	14U	549677	5736337	-
Dauphin River	eastern bay near proposed LSMOC	LSM3	2-Sep-20	12:10	14U	555893	5737189	Yes
	at Lake St. Martin	DR-A	2-Sep-20	9:00	14U	547145	5742411	Yes
	at Big Bend	DR-B	3-Sep-20	11:44	14U	545990	5757471	-
	at Sturgeon Bay	DR-E	3-Sep-20	10:09	14U	564901	5757120	Yes
Big Buffalo Lake	Big Buffalo Lake	BBL	1-Sep-20	11:27	14U	557985	5745469	-
Buffalo Creek	at the Dauphin River	BC3	1-Sep-20	12:16	14U	562248	5754739	-
Lake Winnipeg	nearshore at LSMOC	SB1	3-Sep-20	9:09	14U	574355	5751490	Yes
	offshore at LSMOC	SB2	3-Sep-20	8:39	14U	576810	5753556	Yes
Birch Creek	at PR 239	BCD-2018-9	13-Oct-20	10:30	14U	531731	5697492	-
	at Lake St. Martin	BC-LSM	13-Oct-20	11:00	14U	533229	5702304	-
Fairford River	at Highway 6 bridge	FR1	13-Oct-20	14:00	14U	518732	5715287	Yes
	at Lake St. Martin	FR2	13-Oct-20	15:25	14U	527262	5717433	-
Lake St. Martin	Birch Bay on LSM	BB-LSM	13-Oct-20	12:20	14U	534252	5704286	Yes
	at the narrows	LSM4	14-Oct-20	9:50	14U	541802	5733290	Yes
	middle of north basin	LSM1	14-Oct-20	8:40	14U	549827	5736359	-
	eastern bay near proposed LSMOC	LSM3	14-Oct-20	11:25	14U	555975	5737080	Yes
Dauphin River	at Lake St. Martin	DR-A	14-Oct-20	12:00	14U	547384	5741997	Yes

1 - Sampling sites that were identified for surface water quality monitoring in the AEMP.

Table 2. Locations surveyed for the presence of water and *in situ* parameters.

Waterbody	Sampling Date	Sampling Time	UTM coordinates		
			Zone	Easting	Northing
Reed Lake	1-Sep-20	13:36	14U	532101	5688016
Clear Lake	1-Sep-20	10:10	14U	531143	5690661
Water Lake	1-Sep-20	10:13	14U	531272	5692230
Goodison Lake	1-Sep-20	10:18	14U	531826	5695562
Clarks Drain	1-Sep-20	10:21	14U	532986	5699419
Woodale Drain	1-Sep-20	10:22	14U	532791	5699899
Creek C at LSMOC alignment	1-Sep-20	12:58	14U	566275	5749279
Creek C upstream of LSMOC alignment	1-Sep-20	12:59	14U	566666	5748941
Unnamed Creek at Buffalo Creek	1-Sep-20	13:09	14U	559977	5745858
Unnamed Creek at LSMOC alignment	1-Sep-20	13:11	14U	561564	5743054

Table 3. Laboratory parameters measured at core water quality sampling sites.

Routine Parameters	Metals (total and dissolved) and Major Ions	
<u>Routine Chemistry</u>	Aluminum	Nickel
Total alkalinity, as CaCO ₃	Antimony	Phosphorus
Bicarbonate alkalinity as HCO ₃	Arsenic	Potassium
Carbonate alkalinity, as CO ₃	Barium	Rubidium
Hydroxide alkalinity, as OH	Beryllium	Selenium
pH	Bismuth	Silicon
Conductivity	Boron	Silver
Total Dissolved Solids	Cadmium	Sodium
Hardness, as CaCO ₃	Calcium	Strontium
<u>Nutrients</u>	Cesium	Sulfate, dissolved
Total Ammonia (as N)	Chloride, dissolved	Sulfur
Nitrate (as N)	Chromium	Tellurium
Nitrite (as N)	Cobalt	Thallium
Nitrate and Nitrite (as N)	Copper	Thorium
Total Kjeldahl Nitrogen	Iron	Tin
Total Nitrogen	Lead	Titanium
Dissolved Phosphorus	Lithium	Tungsten
Total Particulate Phosphorus	Magnesium	Uranium
Total Phosphorus	Manganese	Vanadium
Total Inorganic Carbon	Mercury	Zinc
Total Organic Carbon	Molybdenum	Zirconium
Dissolved Organic Carbon		
Total Carbon		
<u>Water Clarity</u>		
Total Suspended Solids		
Turbidity		
True Colour		
<u>Algal Pigments</u>		
Chlorophyll <i>a</i>		
Phaeophytin <i>a</i>		

Table 4. Hydrocarbon parameters measured at selected water quality sampling sites in September 2020.

Parameter	Unit	DL
Benzene	mg/L	0.00050
Ethyl benzene	mg/L	0.00050
Toluene	mg/L	0.0010
o-Xylene	mg/L	0.00050
m+p-Xylenes	mg/L	0.00040
Xylenes (Total)	mg/L	0.00064
F1 (C6-C10)	mg/L	0.10
F1-BTEX	mg/L	0.10
F2-Naphth	mg/L	0.10
F2 (C10-C16)	mg/L	0.10
F3-PAH	mg/L	0.25
F3 (C16-C34)	mg/L	0.25
F4 (C34-C50)	mg/L	0.25
Total Hydrocarbons (C6-C50)	mg/L	0.38
Acenaphthene	mg/L	0.000020
Acenaphthylene	mg/L	0.000020
Acridine	mg/L	0.000020
Anthracene	mg/L	0.000010
Benzo(a)anthracene	mg/L	0.000010
Benzo(a)pyrene	mg/L	0.0000050
Benzo(b&j)fluoranthene	mg/L	0.000010
Benzo(g,h,i)perylene	mg/L	0.000020
Benzo(k)fluoranthene	mg/L	0.000010
Chrysene	mg/L	0.000020
Dibenzo(a,h)anthracene	mg/L	0.0000050
Fluoranthene	mg/L	0.000020
Fluorene	mg/L	0.000020
Indeno(1,2,3-cd)pyrene	mg/L	0.000010
1-Methyl Naphthalene	mg/L	0.000020
2-Methyl Naphthalene	mg/L	0.000020
Naphthalene	mg/L	0.000050
Phenanthrene	mg/L	0.000050
Pyrene	mg/L	0.000010
Quinoline	mg/L	0.000020
B(a)P Total Potency Equivalent	mg/L	0.000030

Table 5. Pesticides measured at selected water quality sampling sites in September 2020.

Parameter	Unit	DL	Parameter	Unit	DL
Aldrin	µg/L	0.0080	Bromoxynil	mg/L	0.00010
alpha-BHC	µg/L	0.0080	Clopyralid	mg/L	0.00010
beta-BHC	µg/L	0.0080	2,4-D	mg/L	0.00010
gamma-hexachlorocyclohexane	µg/L	0.0080	Dicamba	mg/L	0.00010
delta-BHC	µg/L	0.0080	2,4-DB	mg/L	0.00010
a-chlordane	µg/L	0.0080	2,4-DP	mg/L	0.00010
g-chlordane	µg/L	0.0080	Dinoseb	mg/L	0.00010
o,p-DDD	µg/L	0.0040	MCPA	mg/L	0.00010
pp-DDD	µg/L	0.0040	MCPB	mg/L	0.00010
o,p-DDE	µg/L	0.0040	Mecoprop	mg/L	0.00010
pp-DDE	µg/L	0.0040	Picloram	mg/L	0.00010
op-DDT	µg/L	0.0040	2,4,5-T	mg/L	0.00010
pp-DDT	µg/L	0.0040	2,4,5-TP	mg/L	0.00010
Dieldrin	µg/L	0.0080	Triclopyr	mg/L	0.00010
Endosulfan I	µg/L	0.0070	Atrazine	µg/L	0.10
Endosulfan II	µg/L	0.0070	Atrazine+N-Dealkylated Metabolites	µg/L	0.20
Endosulfan Sulfate	µg/L	0.0070	Ethalfuralin	mg/L	0.00010
Endrin	µg/L	0.010	Atrazine Desethyl	µg/L	0.10
Endrin Aldehyde	µg/L	0.010	Fluazifop-p-butyl	mg/L	0.00010
Heptachlor	µg/L	0.0080	Glyphosate	µg/L	0.20
Heptachlor Epoxide	µg/L	0.0080	Diclofop-methyl	mg/L	0.00010
Hexachlorobenzene	µg/L	0.0080	Triallate	mg/L	0.00010
Hexachlorobutadiene	µg/L	0.0080	Trifluralin	mg/L	0.00010
Hexachloroethane	µg/L	0.0080			
Methoxychlor	µg/L	0.0080			
Mirex	µg/L	0.0080			
trans-Nonachlor	µg/L	0.010			
Oxychlordane	µg/L	0.0080			
Pentachloronitrobenzene	µg/L	0.010			
AMPA	µg/L	0.50			

Table 6. Results for *in situ* parameters measured at core sampling sites.

Waterbody	Site ID	Sampling Date	Sampling Time	Total Depth (m)	Sample Depth (m)	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Oxygen Saturation (%)	Specific Conductance (µS/cm)	Turbidity (NTU)	Secchi Depth (m)					
Lake Manitoba	WHB1	1-Sep-20	13:15	2.1	0.3	15.31	8.62	9.37	93.8	1086	13.09	0.75					
					0.7	15.26	8.60	9.37	93.8	1086	13.78						
					1.2	153.26	8.59	9.36	93.7	1086	13.64						
	WHB2	1-Sep-20	15:23	1.9	0.5	14.13	8.70	9.91	96.7	1085	16.47	0.55					
					1.0	14.13	8.69	9.90	96.7	1085	16.66						
Watchorn Creek	WHC-WB	1-Sep-20	16:26	1.1	0.5	14.24	8.75	10.84	106.1	1018	7.22	>1.1					
					0.9	14.24	8.73	10.85	106.2	1017	7.44						
Mercer Creek	MC-WB	1-Sep-20	14:19	0.7	0.3	13.79	8.20	8.92	86.5	1102	13.49	-					
Birch Creek	BCD-2018-9	9-Sep-20	19:05	0.4	0.4	11.68	8.08	10.63	100.2	764	21.94	>0.4					
	BC-LSM	1-Sep-20	18:13	0.4	0.2	14.42	8.74	10.76	107.2	680	1.45	>0.4					
Fairford River	FR1	1-Sep-20	19:20	-	0.2	14.57	8.65	11.12	109.6	1079	10.08	-					
					FR2	10-Sep-20	9:45	1.2	0.3	11.40	8.53		10.70	98.2	1089	13.41	0.55
									0.5	11.39	8.54		10.70	98.3	1089	13.40	
Lake St. Martin	BB-LSM	10-Sep-20	11:45	2.6	0.3	11.90	8.52	10.78	100.1	1047	9.43	0.68					
					0.5	11.88	8.52	10.78	100.1	1047	9.48						
					1.0	11.78	8.52	10.78	99.9	1047	9.50						
					1.5	11.78	8.52	10.75	99.2	1047	9.66						
					2.0	11.60	8.52	10.72	98.8	1048	9.84						
	LSM5	2-Sep-20	17:13	3.8	1.0	16.21	8.66	9.46	96.5	1053	5.50	0.62					
					2.0	16.20	8.66	9.45	96.5	1053	5.53						
					3.0	16.20	8.66	9.45	96.5	1053	5.52						
					2.5	11.46	8.52	10.64	97.8	1048	11.72						
LSM4	2-Sep-20	15:10	1.0	0.5	14.44	8.75	10.58	104.0	1052	3.96	>1.0						
LSM1	2-Sep-20	13:03	1.0	0.3	14.26	8.68	10.14	99.3	1058	8.68	0.55						
LSM3	2-Sep-20	12:10	1.5	0.3	13.38	8.73	10.16	97.5	862	9.32	0.45						
				1.0	13.29	8.74	10.28	98.5	863	9.14							

Table 6. continued.

Waterbody	Site ID	Sampling Date	Sampling Time	Total Depth (m)	Sample Depth (m)	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Oxygen Saturation (%)	Specific Conductance (µS/cm)	Turbidity (NTU)	Secchi Depth (m)
Dauphin River	DR-A	2-Sep-20	9:00	1.1	0.3	13.07	8.80	9.99	95.3	1058	6.25	0.68
					0.7	13.08	8.79	10.00	95.4	1058	6.34	
	DR-B	3-Sep-20	11:44	-	0.3	13.86	8.75	10.37	100.7	1055	8.67	-
Dauphin River	DR-E	3-Sep-20	10:09	2.5	1.0	13.75	8.52	9.28	89.9	1044	12.39	0.55
					2.0	13.64	8.58	9.37	90.5	1048	11.38	
	BBL	1-Sep-20	11:27	1.5	0.3	13.98	8.54	9.19	89.3	464	4.13	-
Big Buffalo Lake	BC3	1-Sep-20	12:16	<0.1	0.3	13.95	7.93	9.38	91.1	448	11.04	-
Lake Winnipeg	SB-1	3-Sep-20	9:09	3.8	1.0	15.90	8.33	9.04	91.4	531	22.48	-
					2.0	15.90	8.33	9.04	91.7	522	22.20	
	SB-2	3-Sep-20	8:39	6.5	1.0	15.90	8.31	9.22	93.4	384	17.10	-
Fairford River	FR1	13-Oct-20	14:00	-	0.3	6.51	8.32	11.99	98.0	1114	32.00	-
	FR2	13-Oct-20	15:25	1.4	0.3	6.88	8.1	11.67	96.1	1107	19.76	0.35
Birch Creek	BCD-2018-9	13-Oct-20	10:30	-	0.3	5.90	7.62	7.20	57.9	920	0.38	-
	BC-LSM	13-Oct-20	11:00	<1 m	0.3	5.06	8.18	11.03	86.7	911	1.09	-
Lake St. Martin	BB-LSM	13-Oct-20	12:20	2.6	0.3	7.76	8.38	11.13	93.7	1073	6.58	0.75
					1.0	7.76	8.38	11.12	93.7	1073	6.48	
	LSM4	14-Oct-20	9:50	1.0	0.3	5.41	8.14	11.41	90.7	1089	5.40	-
	LSM1	14-Oct-20	8:40	1.4	0.3	5.05	8.18	11.56	90.9	1092	19.90	0.45
	LSM3	14-Oct-20	11:25	-	0.3	4.73	8.12	11.91	92.9	1137	17.80	-
Dauphin River	DR-A	14-Oct-20	12:00	0.9	0.3	4.84	8.23	12.08	94.5	1091	7.20	0.70

Table 7. Laboratory results for routine parameters measured at core sampling sites.

Waterbody	Site ID	Sampling Date	ALS ID	Alkalinity				Nitrogen			
				Total Alkalinity as CaCO ₃ (mg/L)	Bicarbonate, HCO ₃ (mg/L)	Carbonate, CO ₃ (mg/L)	Hydroxide, OH (mg/L)	Total Ammonia (mg N/L)	Nitrate (mg N/L)	Nitrite (mg N/L)	Nitrate/nitrite (mg N/L)
<i>Analytical DL</i>				1.0	1.2	0.60	0.34	0.010	0.0050 / 0.010	0.0010 / 0.0020	0.0051 / 0.010
Lake Manitoba	WHB1	1-Sep-20	L2497954-1	170	193	7.20	<0.34	<0.010	<0.010	<0.0020	<0.010
	WHB2	1-Sep-20	L2497954-2	169	191	7.08	<0.34	<0.010	<0.010	<0.0020	<0.010
Watchorn Creek	WHC-WB	1-Sep-20	L2497954-3	184	206	9.24	<0.34	<0.010	<0.010	<0.0020	<0.010
Mercer Creek	MC-WB	1-Sep-20	Mean	190	231	<0.60	<0.34	0.031	<0.010	<0.0020	<0.010
Birch Creek drain	BCD-2018-9	9-Sep-20	L2501445-3	379	440	11.00	<0.34	0.010	<0.0050	<0.0010	<0.0051
	BC-LSM	1-Sep-20	L2497954-5	320	347	21.2	<0.34	0.024	0.0059	<0.0010	0.0059
Fairford River	FR1	1-Sep-20	L2497954-6	170	192	7.32	<0.34	<0.010	<0.010	0.0035	<0.010
	FR2	10-Sep-20	L2501445-2	201	232	6.60	<0.34	<0.010	<0.010	<0.0020	<0.010
Lake St. Martin	BB-LSM	10-Sep-20	L2501445-1	216	250	6.84	<0.34	<0.010	<0.010	<0.0020	<0.010
	LSM5	2-Sep-20	L2498786-4	209	237	9.24	<0.34	<0.010	<0.010	<0.0020	<0.010
	LSM4	2-Sep-20	L2498786-3	170	188	9.96	<0.34	<0.010	<0.010	<0.0020	<0.010
	LSM1	2-Sep-20	Mean	188	211	8.80	<0.34	<0.010	<0.010	<0.0020	<0.010
	LSM3	2-Sep-20	L2498786-2	193	213	10.9	<0.34	<0.010	<0.0050	<0.0010	<0.0051
Dauphin River	DR-A	2-Sep-20	L2497954-7	163	181	8.76	<0.34	<0.010	<0.010	<0.0020	<0.010
	DR-B	3-Sep-20	L2498784-1	184	206	8.64	<0.34	<0.010	<0.010	<0.0020	<0.010
	DR-E	3-Sep-20	L2498784-2	194	223	6.96	<0.34	<0.010	<0.010	<0.0020	<0.010
Big Buffalo Lake	BBL	1-Sep-20	L2497371-1	283	311	16.9	<0.34	0.017	<0.0050	<0.0010	<0.0051
Buffalo Creek	BC3	1-Sep-20	L2497371-2	226	270	3.00	<0.34	0.010	<0.0050	<0.0010	<0.0051
Lake Winnipeg	SB1	3-Sep-20	L2498784-3	128	156	<0.60	<0.34	<0.010	0.0206	<0.0010	0.0206
	SB2	3-Sep-20	L2498784-4	113	138	<0.60	<0.34	<0.010	0.0215	<0.0010	0.0215

Table 7. continued.

Waterbody	Site ID	Sampling Date	ALS ID	Alkalinity				Nitrogen			
				Total Alkalinity as CaCO ₃ (mg/L)	Bicarbonate, HCO ₃ (mg/L)	Carbonate, CO ₃ (mg/L)	Hydroxide, OH (mg/L)	Total Ammonia (mg N/L)	Nitrate (mg N/L)	Nitrite (mg N/L)	Nitrate/nitrite (mg N/L)
Birch Creek	BCD-2018-9	13-Oct-20	L2516048-1	381	429	17.4	<0.34	0.026	<0.010	<0.0020	<0.010
	BC-LSM	13-Oct-20	L2516048-2	383	427	19.8	<0.34	0.024	<0.010	<0.0020	<0.010
Fairford River	FR1	13-Oct-20	Mean	183	213	4.60	<0.34	<0.010	<0.010	<0.0020	<0.010
	FR2	13-Oct-20	L2516048-5	181	212	4.32	<0.34	<0.010	<0.010	<0.0020	<0.010
Lake St. Martin	BB-LSM	13-Oct-20	L2516048-3	180	207	5.88	<0.34	<0.010	<0.010	<0.0020	<0.010
	LSM4	14-Oct-20	L2516868-3	179	210	4.20	<0.34	0.013	<0.010	<0.0020	<0.010
	LSM1	14-Oct-20	L2516868-1	181	210	5.28	<0.34	0.011	<0.010	<0.0020	<0.010
	LSM3	14-Oct-20	L2516868-2	207	239	6.48	<0.34	0.029	<0.010	<0.0020	<0.010
Dauphin River	DR-A	14-Oct-20	L2516868-4	181	212	4.32	<0.34	0.025	<0.010	<0.0020	<0.010

Table 7. continued.

Site ID	Sampling Date	Nitrogen			Phosphorus				Molar N:P Ratios		
		Dissolved Inorganic Nitrogen (mg/L) ¹	Total Kjeldahl Nitrogen (mg/L)	Total Nitrogen (mg/L)	Dissolved Phosphorus (mg/L)	Total Particulate Phosphorus (mg/L)	Total Phosphorus (mg/L)	Dissolved Fraction (%)	TN:TP	DIN:DP	DIN:TP
<i>Analytical DL</i>		<i>0.010</i>	<i>0.20</i>	<i>0.20</i>	<i>0.0010/ 0.0030</i>	<i>0.0028/ 0.0042</i>	<i>0.0010/ 0.0030</i>	-	-	-	-
WHB1	1-Sep-20	<0.010	1.23	1.23	0.0058	0.0205	0.0263	22	103	2	0
WHB2	1-Sep-20	<0.010	1.28	1.28	0.0067	0.0223	0.0289	23	98	2	0
WHC-WB	1-Sep-20	<0.010	1.26	1.26	0.0077	0.0213	0.0290	27	96	1	0
MC-WB	1-Sep-20	0.036	1.15	1.15	0.0123	0.0262	0.0386	32	66	6	2
BCD-2018-9	9-Sep-20	0.013	1.82	1.82	0.0122	0.0210	0.0332	37	121	2	1
BC-LSM	1-Sep-20	0.030	2.35	2.36	0.0235	0.0102	0.0337	70	155	3	2
FR1	1-Sep-20	<0.010	1.10	1.10	0.0068	0.0167	0.0235	29	104	2	0
FR2	10-Sep-20	<0.010	1.31	1.31	0.0054	0.0187	0.0241	22	120	2	0
BB-LSM	10-Sep-20	<0.010	1.81	1.81	0.0061	0.0161	0.0222	27	180	2	0
LSM5	2-Sep-20	<0.010	1.45	1.45	0.0081	0.0137	0.0218	37	147	1	1
LSM4	2-Sep-20	<0.010	1.17	1.17	0.0079	0.0186	0.0265	30	98	1	0
LSM1	2-Sep-20	<0.010	1.29	1.29	0.0086	0.0169	0.0254	34	112	1	0
LSM3	2-Sep-20	<0.010	1.46	1.46	0.0096	0.0121	0.0217	44	149	1	1
DR-A	2-Sep-20	<0.010	1.29	1.29	0.0078	0.0175	0.0253	31	113	1	0
DR-B	3-Sep-20	<0.010	1.20	1.20	0.0091	0.0169	0.0260	35	102	1	0
DR-E	3-Sep-20	<0.010	1.33	1.33	0.0088	0.0224	0.0311	28	95	1	0
BBL	1-Sep-20	0.020	1.79	1.79	0.0106	0.0473	0.0579	18	68	4	1
BC3	1-Sep-20	0.013	0.99	0.99	0.0081	0.0127	0.0208	39	105	3	1
SB1	3-Sep-20	0.026	0.64	0.66	0.0208	0.0229	0.0437	48	33	3	1
SB2	3-Sep-20	0.027	0.46	0.48	0.0266	0.0221	0.0487	55	22	2	1

Table 7. continued.

Site ID	Sampling Date	Nitrogen			Phosphorus				Molar N:P Ratios		
		Dissolved Inorganic Nitrogen (mg/L) ¹	Total Kjeldahl Nitrogen (mg/L)	Total Nitrogen (mg/L)	Dissolved Phosphorus (mg/L)	Total Particulate Phosphorus (mg/L)	Total Phosphorus (mg/L)	Dissolved Fraction (%)	TN:TP	DIN:DP	DIN:TP
BCD-2018-9	13-Oct-20	0.031	1.67	1.67	0.0074	<0.0042	0.0106	70	348	9	6
BC-LSM	13-Oct-20	0.029	1.70	1.70	0.0114	0.0091	0.0204	56	184	6	3
FR1	13-Oct-20	<0.010	1.39	1.39	0.0061	0.0291	0.0352	17	87	2	0
FR2	13-Oct-20	<0.010	1.08	1.08	0.0070	0.0257	0.0326	21	73	2	0
BB-LSM	13-Oct-20	<0.010	1.15	1.15	0.0064	0.0164	0.0228	28	112	2	0
LSM4	14-Oct-20	0.018	1.13	1.13	0.0059	0.0158	0.0218	27	115	7	2
LSM1	14-Oct-20	0.016	1.49	1.49	0.0062	0.0267	0.0329	19	100	6	1
LSM3	14-Oct-20	0.034	1.42	1.42	0.0056	0.0235	0.0291	19	108	13	3
DR-A	14-Oct-20	0.030	1.17	1.17	0.0060	0.0166	0.0226	27	114	11	3

Table 7. continued.

Site ID	Sampling Date	Carbon				Routine Chemistry				
		Total Inorganic Carbon (mg/L)	Total Organic Carbon (mg/L)	Dissolved Organic Carbon (mg/L)	Total Carbon (mg/L)	Laboratory pH (pH units)	Laboratory Conductivity (µmhos/cm)	Total Dissolved Solids (mg/L)	Hardness, as CaCO ₃ (mg/L)	Biochemical Oxygen Demand (mg/L) ²
<i>Analytical DL</i>		<i>0.50</i>	<i>0.50</i>	<i>0.50</i>	<i>1.0</i>	<i>0.10</i>	<i>1</i>	<i>4.0/20</i>	<i>0.2</i>	<i>2.0</i>
WHB1	1-Sep-20	30.2	13.0	12.4	43.2	8.56	1050	624	237	-
WHB2	1-Sep-20	37.1	13.0	12.4	50.1	8.57	1060	603	236	-
WHC-WB	1-Sep-20	39.3	14.4	13.9	53.7	8.62	1010	583	248	<2.0
MC-WB	1-Sep-20	41.2	13.6	13.3	54.8	8.05	1090	632	256	<2.0
BCD-2018-9	9-Sep-20	77.0	32.1	31.6	109	8.41	766	503	458	2.2
BC-LSM	1-Sep-20	65.4	35.1	34.6	101	8.72	666	460	383	<2.0
FR1	1-Sep-20	37.5	13.1	12.7	50.6	8.56	1060	615	233	-
FR2	10-Sep-20	36.8	13.0	12.3	49.8	8.43	1090	604	249	-
BB-LSM	10-Sep-20	39.0	13.4	13.1	52.4	8.45	1050	586	238	-
LSM5	2-Sep-20	36.6	13.4	12.9	50.1	8.54	1040	606	241	-
LSM4	2-Sep-20	36.2	13.4	12.9	49.6	8.59	1030	582	249	-
LSM1	2-Sep-20	34.4	13.3	13.1	47.6	8.54	1047	612	237	-
LSM3	2-Sep-20	38.9	18.5	16.8	57.4	8.58	852	534	234	-
DR-A	2-Sep-20	35.1	13.8	13.6	48.8	8.66	1030	590	226	-
DR-B	3-Sep-20	34.0	13.8	13.9	47.8	8.55	1040	612	234	-
DR-E	3-Sep-20	36.5	13.8	13.4	50.3	8.50	1040	578	232	-
BBL	1-Sep-20	58.0	27.5	27.6	85.5	8.63	565	382	279	3.4
BC3	1-Sep-20	49.8	24.4	24.4	74.3	8.31	419	285	229	2.0
SB1	3-Sep-20	25.0	9.14	9.29	34.1	8.29	521	307	167	-
SB2	3-Sep-20	22.9	7.47	7.43	30.4	8.26	384	230	144	-

Table 7. continued.

Site ID	Sampling Date	Carbon				Routine Chemistry				
		Total Inorganic Carbon (mg/L)	Total Organic Carbon (mg/L)	Dissolved Organic Carbon (mg/L)	Total Carbon (mg/L)	Laboratory pH (pH units)	Laboratory Conductivity (µmhos/cm)	Total Dissolved Solids (mg/L)	Hardness, as CaCO ₃ (mg/L)	Biochemical Oxygen Demand (mg/L) ²
BCD-2018-9	13-Oct-20	70.4	30.4	28.6	101	8.49	937	642	519	-
BC-LSM	13-Oct-20	74.4	30.6	31.0	105	8.54	936	618	508	-
FR1	13-Oct-20	34.4	12.4	11.9	46.8	8.33	1147	623	246	-
FR2	13-Oct-20	32.4	13.2	11.8	45.6	8.31	1140	588	240	-
BB-LSM	13-Oct-20	35.4	13.1	12.5	48.5	8.38	1110	593	241	-
LSM4	14-Oct-20	33.5	14.3	13.3	47.8	8.33	1130	633	251	-
LSM1	14-Oct-20	33.8	14.6	13.4	48.3	8.36	1130	637	250	-
LSM3	14-Oct-20	39.4	16.7	16.2	56.1	8.39	1010	580	266	-
DR-A	14-Oct-20	33.0	14.0	13.4	47.0	8.34	1130	632	252	-

Table 7. continued.

Site ID	Sampling Date	Water Clarity			Algal Pigments	
		Total Suspended Solids (mg/L)	Turbidity (NTU)	True Colour (CU)	Chlorophyll <i>a</i> (µg/L)	Phaeophytin <i>a</i> (µg/L)
<i>Analytical DL</i>		<i>1.0</i>	<i>0.1</i>	<i>5.0</i>	<i>0.10</i>	<i>0.10</i>
WHB1	1-Sep-20	22.4	17.8	<5.0	9.39	2.08
WHB2	1-Sep-20	28.1	20.1	<5.0	8.56	1.96
WHC-WB	1-Sep-20	14.0	10.5	14.2	6.55	2.44
MC-WB	1-Sep-20	7.9	5.73	17.5	6.98	4.73
BCD-2018-9	9-Sep-20	12.9	3.13	113	7.95	5.68
BC-LSM	1-Sep-20	3.5	2.17	117	3.30	3.22
FR1	1-Sep-20	18.6	13.8	7.0	7.54	1.95
FR2	10-Sep-20	19.4	15.0	<5.0	6.41	1.43
BB-LSM	10-Sep-20	13.7	7.76	5.7	9.94	1.88
LSM5	2-Sep-20	13.0	6.59	<5.0	7.99	2.04
LSM4	2-Sep-20	9.2	5.00	<5.0	6.91	1.70
LSM1	2-Sep-20	17.3	11.5	5.8	7.79	2.10
LSM3	2-Sep-20	15.3	10.8	16.8	7.49	2.16
DR-A	2-Sep-20	12.3	7.53	9.2	10.5	2.80
DR-B	3-Sep-20	15.4	10.1	7.8	9.17	2.32
DR-E	3-Sep-20	18.7	13.8	14	9.92	3.04
BBL	1-Sep-20	16.1	6.21	61.0	20.7	5.83
BC3	1-Sep-20	3.5	9.94	60.7	1.14	1.33
SB1	3-Sep-20	20.8	22.0	13.2	2.58	2.52
SB2	3-Sep-20	19.6	16.6	13.1	2.63	1.58

Table 7. continued.

Site ID	Sampling Date	Water Clarity			Algal Pigments	
		Total Suspended Solids (mg/L)	Turbidity (NTU)	True Colour (CU)	Chlorophyll <i>a</i> (µg/L)	Phaeophytin <i>a</i> (µg/L)
BCD-2018-9	13-Oct-20	<1.0	0.83	106	3.13	2.32
BC-LSM	13-Oct-20	1.5	1.62	109	3.97	2.36
FR1	13-Oct-20	43.0	32.4	6.6	10.9	2.53
FR2	13-Oct-20	31.9	22.7	7.0	9.68	2.59
BB-LSM	13-Oct-20	12.9	7.82	8.0	9.46	2.22
LSM4	14-Oct-20	11.0	5.49	7.5	7.36	2.40
LSM1	14-Oct-20	30.8	21.3	7.0	7.43	2.51
LSM3	14-Oct-20	25.4	19.3	15.2	8.36	2.78
DR-A	14-Oct-20	11.0	7.24	<5.0	6.29	1.77

1 - Calculated as the sum of ammonia-N and nitrate/nitrite-N.

2 - Samples for BOD were only collected during the September sampling period and only from selected sites.

Table 8. Laboratory results for metals and major ions measured at core sampling sites. All units are mg/L.

Waterbody	Site ID	Sampling Date	ALS ID	Aluminum (Al)		Antimony (Sb)		Arsenic (As)		Barium (Ba)	
				Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>				<i>0.0010</i>	<i>0.0030</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00010</i>
Lake Manitoba	WHB1	1-Sep-20	L2497954-1	0.0027	0.107	0.00017	0.00018	0.00222	0.00236	0.0414	0.0443
	WHB2	1-Sep-20	L2497954-2	0.0041	0.190	0.00016	0.00018	0.00217	0.00230	0.0409	0.0452
Watchorn Creek	WHC-WB	1-Sep-20	L2497954-3	0.0030	0.101	0.00015	0.00017	0.00198	0.00209	0.0387	0.0410
Mercer Creek	MC-WB	1-Sep-20	Mean	0.0040	0.0686	0.00018	0.00017	0.00213	0.00214	0.0452	0.0453
Birch Creek	BCD-2018-9	9-Sep-20	L2501445-3	<0.0010	0.108	<0.00010	<0.00010	0.00152	0.00157	0.0361	0.0402
	BC-LSM	1-Sep-20	L2497954-5	0.0639	0.0912	0.00011	0.00011	0.00271	0.00258	0.0330	0.0337
Fairford River	FR1	1-Sep-20	L2497954-6	0.0046	0.0982	0.00019	0.00019	0.00214	0.00222	0.0386	0.0415
	FR2	10-Sep-20	L2501445-2	0.0033	0.123	0.00017	0.00021	0.00228	0.00219	0.0406	0.0424
Lake St. Martin	BB-LSM	10-Sep-20	L2501445-1	0.0072	0.109	0.00022	0.00022	0.00245	0.00239	0.0413	0.0424
	LSM5	2-Sep-20	L2498786-4	0.0025	0.0358	0.00017	0.00018	0.00224	0.00226	0.0400	0.0407
	LSM4	2-Sep-20	L2498786-3	0.0019	0.0160	0.00016	0.00017	0.00224	0.00221	0.0367	0.0378
	LSM1	2-Sep-20	Mean	0.0041	0.0957	0.00016	0.00020	0.00230	0.00226	0.0379	0.0407
	LSM3	2-Sep-20	L2498786-2	0.0073	0.117	0.00014	0.00015	0.00225	0.00226	0.0328	0.0357
Dauphin River	DR-A	2-Sep-20	L2497954-7	0.0047	0.039	0.00017	0.00022	0.00219	0.00224	0.0338	0.0354
	DR-B	3-Sep-20	L2498784-1	0.0048	0.0757	0.00018	0.0002	0.00229	0.00234	0.0365	0.0384
	DR-E	3-Sep-20	L2498784-2	0.0058	0.215	0.00017	0.00018	0.00231	0.00233	0.0343	0.0394
Big Buffalo Lake	BBL	1-Sep-20	L2497371-1	0.0041	0.0706	0.00011	0.00012	0.00189	0.00179	0.0410	0.0408
Buffalo Creek	BC3	1-Sep-20	L2497371-2	0.0320	0.433	<0.00010	<0.00010	0.00155	0.0015	0.0230	0.0260
Lake Winnipeg	SB1	3-Sep-20	L2498784-3	0.0495	0.825	0.00011	0.00013	0.00205	0.00208	0.0361	0.0422
	SB2	3-Sep-20	L2498784-4	0.0432	0.700	0.0001	0.00012	0.00183	0.00186	0.0335	0.0413

Table 8. continued.

Waterbody	Site ID	Sampling Date	ALS ID	Aluminum (Al)		Antimony (Sb)		Arsenic (As)		Barium (Ba)	
				Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
Birch Creek	BCD-2018-9	13-Oct-20	L2516048-1	0.0028	0.0281	<0.00010	<0.00010	0.00110	0.00101	0.0481	0.0465
	BC-LSM	13-Oct-20	L2516048-2	0.0045	0.0449	<0.00010	<0.00010	0.00126	0.00123	0.0561	0.0517
Fairford River	FR1	13-Oct-20	Mean	0.0128	0.215	0.00019	0.00020	0.00206	0.00217	0.0447	0.0475
	FR2	13-Oct-20	L2516048-5	0.0102	0.163	0.00019	0.00019	0.00210	0.00216	0.0439	0.0448
Lake St. Martin	BB-LSM	13-Oct-20	L2516048-3	0.0082	0.0813	0.00021	0.00023	0.00216	0.00218	0.0439	0.0438
Lake St. Martin	LSM4	14-Oct-20	L2516868-3	0.0024	0.0333	0.00018	0.0002	0.00202	0.00221	0.0380	0.0415
Lake St. Martin	LSM1	14-Oct-20	L2516868-1	0.0030	0.178	0.00018	0.00019	0.00203	0.00220	0.0385	0.0448
Lake St. Martin	LSM3	14-Oct-20	L2516868-2	0.0078	0.224	0.00015	0.00018	0.00183	0.00194	0.0355	0.0418
Dauphin River	DR-A	14-Oct-20	L2516868-4	0.0032	0.046	0.00019	0.00019	0.00195	0.00209	0.0368	0.0404

Table 8. continued.

Site ID	Sampling Date	Beryllium (Be)		Bismuth (Bi)		Boron (B)		Cadmium (Cd)		Calcium (Ca)	
		Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>		<i>0.00010</i>	<i>0.00010</i>	<i>0.000050</i>	<i>0.000050</i>	<i>0.010</i>	<i>0.010</i>	<i>0.0000050</i>	<i>0.0000050</i>	<i>0.05</i>	<i>0.050</i>
WHB1	1-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.096	0.086	<0.0000050	0.0000089	34.2	38.3
WHB2	1-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.096	0.086	<0.0000050	<0.0000050	34.6	38.8
WHC-WB	1-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.093	0.081	<0.0000050	<0.0000050	33.9	35.3
MC-WB	1-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.092	0.083	<0.0000050	<0.0000050	39.0	39.5
BCD-2018-9	9-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.132	0.150	<0.0000050	0.0000073	62.0	63.7
BC-LSM	1-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.146	0.129	<0.0000050	<0.0000050	35.0	35.9
FR1	1-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.095	0.083	<0.0000050	<0.0000050	33.4	35.1
FR2	10-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.109	0.122	<0.0000050	0.0000070	37.4	39.0
BB-LSM	10-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.110	0.118	<0.0000050	<0.0000050	35.2	38.8
LSM5	2-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.098	0.091	<0.0000050	<0.0000050	35.5	35.7
LSM4	2-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.094	0.090	<0.0000050	<0.0000050	34.9	36.1
LSM1	2-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.092	0.088	<0.0000050	<0.0000050	33.8	35.7
LSM3	2-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.072	0.076	<0.0000050	<0.0000050	34.5	37.8
DR-A	2-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.091	0.079	<0.0000050	<0.0000050	32.1	32.1
DR-B	3-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.087	0.090	<0.0000050	<0.0000050	33.1	35.8
DR-E	3-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.092	0.089	<0.0000050	0.0000059	32.0	34.5
BBL	1-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.094	0.098	0.0000105	0.0000205	49.9	51.9
BC3	1-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.043	0.043	<0.0000050	<0.0000050	43.6	45.7
SB1	3-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.048	0.046	<0.0000050	0.0000053	30.3	30.4
SB2	3-Sep-20	<0.00010	<0.00010	<0.000050	<0.000050	0.034	0.034	<0.0000050	0.0000056	27.8	29.2

Table 8. continued.

Site ID	Sampling Date	Beryllium (Be)		Bismuth (Bi)		Boron (B)		Cadmium (Cd)		Calcium (Ca)	
		Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
BCD-2018-9	13-Oct-20	<0.00010	<0.00010	<0.000050	<0.000050	0.090	0.108	<0.0000050	<0.0000050	76.7	71.8
BC-LSM	13-Oct-20	<0.00010	<0.00010	<0.000050	<0.000050	0.112	0.114	<0.0000050	<0.0000050	75.7	72.0
FR1	13-Oct-20	<0.00010	<0.00010	<0.000050	<0.000050	0.112	0.111	<0.0000050	0.00000843	42.7	44.9
FR2	13-Oct-20	<0.00010	<0.00010	<0.000050	<0.000050	0.115	0.108	<0.0000050	0.0000054	41.9	42.3
BB-LSM	13-Oct-20	<0.00010	<0.00010	<0.000050	<0.000050	0.106	0.104	<0.0000050	<0.0000050	41.5	39.0
LSM4	14-Oct-20	<0.00010	<0.00010	<0.000050	<0.000050	0.093	0.104	<0.0000050	<0.0000050	37.2	39.1
LSM1	14-Oct-20	<0.00010	<0.00010	<0.000050	<0.000050	0.090	0.101	<0.0000050	0.0000057	37.7	42.5
LSM3	14-Oct-20	<0.00010	<0.00010	<0.000050	<0.000050	0.076	0.085	<0.0000050	0.0000073	41.9	45.7
DR-A	14-Oct-20	<0.00010	<0.00010	<0.000050	<0.000050	0.089	0.102	<0.0000050	<0.0000050	37.6	39.8

Table 8. continued.

Site ID	Sampling Date	Cesium (Cs)		Chloride (Cl)	Chromium (Cr)		Cobalt (Co)		Copper (Cu)	
		Dissolved	Total	Dissolved	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>		<i>0.000010</i>	<i>0.000010</i>	<i>0.10/0.20</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00020</i>	<i>0.00050</i>
WHB1	1-Sep-20	<0.000010	0.000014	206	<0.00010	0.00026	<0.00010	0.00011	0.00024	0.00050
WHB2	1-Sep-20	<0.000010	0.000033	203	<0.00010	0.00041	<0.00010	0.00015	0.00024	0.00055
WHC-WB	1-Sep-20	<0.000010	0.000014	185	<0.00010	0.00022	<0.00010	0.00011	0.00026	<0.00050
MC-WB	1-Sep-20	<0.000010	<0.000010	200	<0.00010	0.00018	<0.00010	<0.00010	<0.00020	<0.00050
BCD-2018-9	9-Sep-20	<0.000010	0.000014	11.8	<0.00010	0.00058	<0.00010	0.00017	0.00023	0.00055
BC-LSM	1-Sep-20	<0.000010	<0.000010	15.4	0.00017	0.00025	0.00023	0.00025	0.00039	0.00054
FR1	1-Sep-20	<0.000010	<0.000010	200	<0.00010	0.00022	<0.00010	0.00010	0.00028	<0.00050
FR2	10-Sep-20	<0.000010	0.000035	205	<0.00010	0.00030	<0.00010	0.00014	0.00030	0.00054
BB-LSM	10-Sep-20	<0.000010	0.000017	198	<0.00010	0.00024	<0.00010	0.00014	0.00030	0.00053
LSM5	2-Sep-20	<0.000010	<0.000010	198	<0.00010	0.00014	<0.00010	<0.00010	0.00024	<0.00050
LSM4	2-Sep-20	<0.000010	<0.000010	198	<0.00010	<0.00010	<0.00010	<0.00010	0.00023	<0.00050
LSM1	2-Sep-20	<0.000010	0.000017	199	<0.00010	0.00023	<0.00010	0.00011	0.00026	<0.00050
LSM3	2-Sep-20	<0.000010	0.000011	140	<0.00010	0.00018	<0.00010	0.00013	0.00033	0.00064
DR-A	2-Sep-20	<0.000010	<0.000010	203	<0.00010	0.00010	<0.00010	<0.00010	0.00023	<0.00050
DR-B	3-Sep-20	<0.000010	0.000013	198	<0.00010	0.00020	<0.00010	0.00012	0.00028	0.00137
DR-E	3-Sep-20	<0.000010	0.000036	197	<0.00010	0.00039	<0.00010	0.00017	0.00027	0.00052
BBL	1-Sep-20	<0.000010	<0.000010	20.4	<0.00010	0.00013	<0.00010	0.00010	0.00034	<0.00050
BC3	1-Sep-20	<0.000010	0.000040	4.9	<0.00010	0.00175	<0.00010	0.00022	0.00064	0.00090
SB1	3-Sep-20	<0.000010	0.00009	66.2	<0.00010	0.00132	<0.00010	0.00038	0.00105	0.00209
SB2	3-Sep-20	<0.000010	0.000081	31.6	<0.00010	0.00117	<0.00010	0.00035	0.00117	0.00185

Table 8. continued.

Site ID	Sampling Date	Cesium (Cs)		Chloride (Cl)	Chromium (Cr)		Cobalt (Co)		Copper (Cu)	
		Dissolved	Total	Dissolved	Dissolved	Total	Dissolved	Total	Dissolved	Total
BCD-2018-9	13-Oct-20	<0.000010	<0.000010	20.5	<0.00010	0.00012	<0.00010	<0.00010	<0.00020	<0.00050
BC-LSM	13-Oct-20	<0.000010	<0.000010	23.4	<0.00010	0.00014	<0.00010	<0.00010	0.00065	0.00077
FR1	13-Oct-20	<0.000010	0.000031	206	<0.00010	0.00049	<0.00010	0.00018	0.00032	0.00069
FR2	13-Oct-20	<0.000010	0.000023	206	<0.00010	0.00036	<0.00010	0.00015	0.00027	0.00059
BB-LSM	13-Oct-20	<0.000010	0.000012	199	<0.00010	0.00020	<0.00010	0.00011	0.00031	<0.00050
LSM4	14-Oct-20	<0.000010	<0.000010	202	<0.00010	<0.00010	<0.00010	<0.00010	0.00026	<0.00050
LSM1	14-Oct-20	<0.000010	0.000031	204	<0.00010	0.00046	<0.00010	0.00017	0.00032	0.00066
LSM3	14-Oct-20	<0.000010	0.000034	163	<0.00010	0.00047	<0.00010	0.00018	0.00044	0.00072
DR-A	14-Oct-20	<0.000010	<0.000010	202	<0.00010	0.00014	<0.00010	<0.00010	0.00029	<0.00050

Table 8. continued.

Site ID	Sampling Date	Iron (Fe)		Lead (Pb)		Lithium (Li)		Magnesium (Mg)		Manganese (Mn)	
		Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>		<i>0.010</i>	<i>0.010</i>	<i>0.000050</i>	<i>0.000050</i>	<i>0.0010</i>	<i>0.0010</i>	<i>0.0050</i>	<i>0.0050</i>	<i>0.00010</i>	<i>0.00010</i>
WHB1	1-Sep-20	<0.010	0.104	<0.000050	0.000205	0.0337	0.0310	36.7	36.9	<0.00010	0.00839
WHB2	1-Sep-20	<0.010	0.176	<0.000050	0.000262	0.0345	0.0315	36.3	38.0	<0.00010	0.00947
WHC-WB	1-Sep-20	<0.010	0.090	<0.000050	0.000196	0.0348	0.0307	39.6	38.8	0.00017	0.00707
MC-WB	1-Sep-20	<0.010	0.062	<0.000050	0.000093	0.0333	0.0310	38.5	38.9	0.00016	0.00751
BCD-2018-9	9-Sep-20	0.021	0.249	<0.000050	0.000152	0.0241	0.0266	73.7	76.6	0.00046	0.264
BC-LSM	1-Sep-20	0.028	0.055	<0.000050	<0.000050	0.0222	0.0194	71.8	70.5	0.00450	0.0262
FR1	1-Sep-20	<0.010	0.072	<0.000050	0.000175	0.0334	0.0308	36.3	36.1	<0.00010	0.00735
FR2	10-Sep-20	<0.010	0.134	<0.000050	0.000268	0.0372	0.0399	37.8	39.2	<0.00010	0.0102
BB-LSM	10-Sep-20	<0.010	0.106	<0.000050	0.000341	0.0320	0.0362	36.4	36.7	<0.00010	0.0106
LSM5	2-Sep-20	<0.010	0.031	<0.000050	0.000143	0.0348	0.0317	37.1	35.5	<0.00010	0.00614
LSM4	2-Sep-20	<0.010	0.016	<0.000050	0.000107	0.0316	0.0319	39.2	35.0	<0.00010	0.00526
LSM1	2-Sep-20	<0.010	0.082	<0.000050	0.000207	0.0336	0.0322	37.1	35.8	<0.00010	0.00913
LSM3	2-Sep-20	<0.010	0.083	<0.000050	0.000239	0.0243	0.0247	35.9	36.4	0.00013	0.0115
DR-A	2-Sep-20	<0.010	0.033	<0.000050	0.000154	0.0314	0.0284	35.5	34.1	<0.00010	0.00797
DR-B	3-Sep-20	<0.010	0.079	<0.000050	0.000202	0.0310	0.0329	36.7	34.3	<0.00010	0.00939
DR-E	3-Sep-20	<0.010	0.187	<0.000050	0.000306	0.0316	0.0319	37.0	36.0	<0.00010	0.0133
BBL	1-Sep-20	<0.010	0.066	<0.000050	0.000093	0.0148	0.0159	37.4	38.5	0.00032	0.0154
BC3	1-Sep-20	0.033	0.384	<0.000050	0.000175	0.0088	0.0097	29.0	28.9	0.00162	0.0231
SB1	3-Sep-20	<0.010	0.747	<0.000050	0.000450	0.0177	0.0171	22.2	21.2	0.00015	0.0191
SB2	3-Sep-20	<0.010	0.678	<0.000050	0.000346	0.0135	0.0138	18.1	17.4	<0.00010	0.0153

Table 8. continued.

Site ID	Sampling Date	Iron (Fe)		Lead (Pb)		Lithium (Li)		Magnesium (Mg)		Manganese (Mn)	
		Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>		<i>0.010</i>	<i>0.010</i>	<i>0.000050</i>	<i>0.000050</i>	<i>0.0010</i>	<i>0.0010</i>	<i>0.0050</i>	<i>0.0050</i>	<i>0.00010</i>	<i>0.00010</i>
BCD-2018-9	13-Oct-20	0.024	0.041	<0.000050	0.000076	0.0287	0.0304	79.5	87.5	0.00449	0.00943
BC-LSM	13-Oct-20	0.026	0.048	<0.000050	<0.000050	0.0320	0.0298	77.6	88.1	0.00198	0.0054
FR1	13-Oct-20	<0.010	0.238	<0.000050	0.000356	0.0387	0.0370	33.8	40.1	<0.00010	0.01593
FR2	13-Oct-20	<0.010	0.182	<0.000050	0.000289	0.0391	0.0363	32.8	39.1	0.00014	0.0121
BB-LSM	13-Oct-20	<0.010	0.069	<0.000050	0.000256	0.0355	0.0330	33.4	37.2	0.00016	0.00765
LSM4	14-Oct-20	<0.010	0.032	<0.000050	0.000149	0.0309	0.0323	38.3	38.5	<0.00010	0.00493
LSM1	14-Oct-20	<0.010	0.206	<0.000050	0.000297	0.0316	0.0321	37.8	38.9	<0.00010	0.0114
LSM3	14-Oct-20	<0.010	0.236	<0.000050	0.000338	0.0270	0.0278	39.2	39.5	0.00010	0.0140
DR-A	14-Oct-20	<0.010	0.043	<0.000050	0.000145	0.0309	0.0326	38.4	38.8	<0.00010	0.00513

Table 8. continued.

Site ID	Sampling Date	Mercury (Hg)		Molybdenum (Mo)		Nickel (Ni)		Phosphorus (P)		Potassium (K)	
		Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>		<i>0.0000050/ 0.00000050</i>	<i>0.0000050/ 0.00000050</i>	<i>0.000050</i>	<i>0.000050</i>	<i>0.00050</i>	<i>0.00050</i>	<i>0.030</i>	<i>0.030</i>	<i>0.050</i>	<i>0.050</i>
WHB1	1-Sep-20	<0.00000050	0.00000072	0.00212	0.00221	<0.00050	0.00075	<0.030	<0.030	9.81	9.95
WHB2	1-Sep-20	<0.00000050	0.00000074	0.00221	0.00227	<0.00050	0.00084	<0.030	0.034	9.91	10.1
WHC-WB	1-Sep-20	<0.00000050	0.00000061	0.00193	0.00199	<0.00050	0.00069	<0.030	0.037	9.41	9.51
MC-WB	1-Sep-20	<0.00000050	0.00000060	0.00217	0.00219	<0.00050	0.00065	<0.030	0.041	9.98	10.0
BCD-2018-9	9-Sep-20	0.00000097	0.00000166	0.000291	0.000383	<0.00050	0.00078	<0.030	0.054	7.04	6.84
BC-LSM	1-Sep-20	<0.00000050	0.00000079	0.000530	0.00056	0.00101	0.00107	<0.030	0.038	10.8	10.6
FR1	1-Sep-20	<0.00000050	0.00000123	0.00204	0.00204	<0.00050	0.00068	<0.030	<0.030	9.83	9.51
FR2	10-Sep-20	<0.00000050	0.00000084	0.00225	0.00229	<0.00050	0.00078	<0.030	<0.030	10.5	9.86
BB-LSM	10-Sep-20	<0.00000050	0.00000077	0.00245	0.00239	0.00050	0.00077	<0.030	<0.030	9.06	9.02
LSM5	2-Sep-20	<0.00000050	0.00000066	0.00226	0.00228	<0.00050	0.00063	<0.030	<0.030	9.96	9.35
LSM4	2-Sep-20	<0.00000050	0.00000057	0.00212	0.00221	<0.00050	0.00053	<0.030	<0.030	10.8	9.35
LSM1	2-Sep-20	<0.00000050	0.00000080	0.00232	0.00232	<0.00050	0.00069	<0.030	<0.030	9.77	9.6
LSM3	2-Sep-20	<0.00000050	0.00000112	0.00184	0.00188	0.00050	0.00068	<0.030	<0.030	7.01	6.90
DR-A	2-Sep-20	<0.00000050	0.00000056	0.00212	0.00228	<0.00050	0.00066	<0.030	<0.030	9.26	9.28
DR-B	3-Sep-20	<0.00000050	0.00000087	0.00228	0.00232	<0.00050	0.00072	<0.030	0.034	9.84	9.37
DR-E	3-Sep-20	<0.00000050	0.00000095	0.00219	0.00230	<0.00050	0.00081	<0.030	0.035	9.86	9.52
BBL	1-Sep-20	<0.00000050 ¹	<0.00000050 ¹	0.000491	0.000512	<0.00050	<0.00050	<0.030	0.032	3.10	3.16
BC3	1-Sep-20	<0.00000050 ¹	<0.00000050 ¹	0.000305	0.000308	0.00060	0.00109	<0.030	<0.030	1.40	1.52
SB1	3-Sep-20	<0.00000050	0.00000105	0.00114	0.00115	0.00070	0.00182	<0.030	0.052	4.84	4.91
SB2	3-Sep-20	<0.00000050	0.00000102	0.000881	0.000857	0.00078	0.00177	0.042	0.050	3.95	3.86

Table 8. continued.

Site ID	Sampling Date	Mercury (Hg)		Molybdenum (Mo)		Nickel (Ni)		Phosphorus (P)		Potassium (K)	
		Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
BCD-2018-9	13-Oct-20	0.00000051	0.00000073	0.000501	0.000565	<0.00050	0.00078	<0.030	<0.030	13.7	14.6
BC-LSM	13-Oct-20	0.00000084	0.00000067	0.000671	0.000656	<0.00050	0.00052	<0.030	<0.030	14.9	14.8
FR1	13-Oct-20	<0.00000050	0.00000112	0.00224	0.00238	<0.00050	0.00106	<0.030	0.035	10.1	10.4
FR2	13-Oct-20	<0.00000050	0.00000111	0.00228	0.00232	<0.00050	0.00090	<0.030	0.038	9.70	10.2
BB-LSM	13-Oct-20	<0.00000050	0.00000061	0.00251	0.00252	0.00054	0.00074	<0.030	<0.030	9.39	9.59
LSM4	14-Oct-20	<0.00000050	<0.00000050	0.00219	0.00226	<0.00050	0.00059	<0.030	<0.030	10.3	10.1
LSM1	14-Oct-20	<0.00000050	0.00000118	0.00227	0.00225	0.00051	0.00094	<0.030	0.034	10.1	10.1
LSM3	14-Oct-20	<0.00000050	0.00000110	0.00211	0.00224	0.00051	0.00097	<0.030	<0.030	8.29	8.24
DR-A	14-Oct-20	<0.00000050	0.00000055	0.00222	0.00233	<0.00050	0.00063	<0.030	<0.030	10.0	10.2

Table 8. continued.

Site ID	Sampling Date	Rubidium (Rb)		Selenium (Se)		Silicon (Si)		Silver (Ag)		Sodium (Na)	
		Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>		0.00020	0.00020	0.000050	0.000050	0.050	0.10	0.000010	0.000010	0.050	0.050
WHB1	1-Sep-20	0.00391	0.00429	0.000094	<0.000050	4.24	4.74	<0.000010	<0.000010	130	133
WHB2	1-Sep-20	0.00404	0.00452	0.000059	<0.000050	4.20	5.07	<0.000010	<0.000010	136	130
WHC-WB	1-Sep-20	0.00381	0.00414	0.000094	0.000058	3.29	3.68	<0.000010	<0.000010	121	121
MC-WB	1-Sep-20	0.00406	0.00402	0.000084	<0.000050	3.79	3.95	<0.000010	<0.000010	128	126
BCD-2018-9	9-Sep-20	0.00356	0.00360	0.000220	0.000177	10.3	11.1	<0.000010	<0.000010	13.7	14.4
BC-LSM	1-Sep-20	0.00471	0.00480	0.000207	0.000109	1.34	1.42	<0.000010	<0.000010	15.2	15.0
FR1	1-Sep-20	0.00389	0.00390	0.000085	<0.000050	4.19	4.49	<0.000010	<0.000010	129	128
FR2	10-Sep-20	0.00407	0.00412	0.000093	0.000085	4.15	4.83	<0.000010	<0.000010	136	144
BB-LSM	10-Sep-20	0.00405	0.00394	0.000074	0.000108	4.32	4.75	<0.000010	<0.000010	127	134
LSM5	2-Sep-20	0.00428	0.00412	0.000070	0.000054	4.15	4.23	<0.000010	<0.000010	134	125
LSM4	2-Sep-20	0.00415	0.00401	0.000055	0.000095	3.87	4.06	<0.000010	<0.000010	145	127
LSM1	2-Sep-20	0.00420	0.00435	0.000076	0.000086	4.19	4.47	<0.000010	<0.000010	131	126
LSM3	2-Sep-20	0.00392	0.00414	0.000111	0.000097	6.21	6.55	<0.000010	<0.000010	89.3	90.2
DR-A	2-Sep-20	0.00393	0.00393	0.000064	<0.000050	3.92	4.10	<0.000010	<0.000010	130	130
DR-B	3-Sep-20	0.00441	0.00432	0.000089	0.000075	4.29	4.78	<0.000010	<0.000010	130	124
DR-E	3-Sep-20	0.00422	0.00444	0.000069	0.000071	4.38	5.50	<0.000010	<0.000010	132	126
BBL	1-Sep-20	0.00246	0.00260	0.000120	0.000129	12.1	14.8	<0.000010	<0.000010	27.4	27.7
BC3	1-Sep-20	0.00170	0.00246	0.000091	0.000110	9.39	10.6	<0.000010	<0.000010	10.1	10.2
SB1	3-Sep-20	0.00220	0.00369	0.000126	0.000111	3.40	4.95	<0.000010	<0.000010	44.5	44.3
SB2	3-Sep-20	0.00157	0.00297	0.000131	0.000121	2.78	4.29	<0.000010	<0.000010	28.5	26.6

Table 8. continued.

Site ID	Sampling Date	Rubidium (Rb)		Selenium (Se)		Silicon (Si)		Silver (Ag)		Sodium (Na)	
		Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
BCD-2018-9	13-Oct-20	0.00396	0.00422	0.000136	0.000128	11.0	11.8	<0.000010	<0.000010	17.1	18.4
BC-LSM	13-Oct-20	0.00416	0.00434	0.000155	0.000089	11.4	9.98	<0.000010	<0.000010	17.2	18.8
FR1	13-Oct-20	0.00406	0.00449	0.000069	0.000099	4.53	4.93	<0.000010	<0.000010	130	146
FR2	13-Oct-20	0.00428	0.00440	0.000085	0.000089	4.38	4.70	<0.000010	<0.000010	128	142
BB-LSM	13-Oct-20	0.00413	0.00413	0.000072	0.000084	4.48	4.35	<0.000010	<0.000010	129	139
LSM4	14-Oct-20	0.00416	0.00412	0.000109	0.000081	3.83	4.08	<0.000010	<0.000010	143	144
LSM1	14-Oct-20	0.00399	0.00450	0.000100	0.000100	3.79	4.34	<0.000010	<0.000010	141	144
LSM3	14-Oct-20	0.00378	0.00435	0.000093	0.000102	4.61	5.23	<0.000010	<0.000010	117	117
DR-A	14-Oct-20	0.00412	0.00418	0.000103	0.000123	3.70	4.01	<0.000010	<0.000010	142	142

Table 8. continued.

Site ID	Sampling Date	Strontium (Sr)		Sulphate (SO4)	Sulphur (S)		Tellurium (Te)		Thallium (Tl)	
		Dissolved	Total	Dissolved	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>		<i>0.00010</i>	<i>0.00020</i>	<i>0.30/0.60</i>	<i>0.50</i>	<i>0.50</i>	<i>0.00020</i>	<i>0.00020</i>	<i>0.000010</i>	<i>0.000010</i>
WHB1	1-Sep-20	0.259	0.276	97.6	30.9	32.2	<0.00020	<0.00020	<0.000010	<0.000010
WHB2	1-Sep-20	0.266	0.266	97.9	32.1	31.6	<0.00020	<0.00020	<0.000010	<0.000010
WHC-WB	1-Sep-20	0.253	0.245	90.7	29.1	30.8	<0.00020	<0.00020	<0.000010	<0.000010
MC-WB	1-Sep-20	0.262	0.261	97.9	30.6	31.6	<0.00020	<0.00020	<0.000010	<0.000010
BCD-2018-9	9-Sep-20	0.205	0.205	85.6	28.6	30.0	<0.00020	<0.00020	<0.000010	<0.000010
BC-LSM	1-Sep-20	0.151	0.153	65.5	22.4	22.5	<0.00020	<0.00020	<0.000010	<0.000010
FR1	1-Sep-20	0.257	0.266	92.6	29.7	30.4	<0.00020	<0.00020	<0.000010	<0.000010
FR2	10-Sep-20	0.275	0.273	93.5	29.9	32.5	<0.00020	<0.00020	<0.000010	<0.000010
BB-LSM	10-Sep-20	0.253	0.249	82.4	28.5	29.1	<0.00020	<0.00020	<0.000010	<0.000010
LSM5	2-Sep-20	0.267	0.257	81.7	27.2	29.6	<0.00020	<0.00020	<0.000010	<0.000010
LSM4	2-Sep-20	0.254	0.254	82.8	27.4	29.9	<0.00020	<0.00020	<0.000010	<0.000010
LSM1	2-Sep-20	0.255	0.254	83.3	28.1	30.3	<0.00020	<0.00020	<0.000010	<0.000010
LSM3	2-Sep-20	0.196	0.203	56.7	19.2	20.6	<0.00020	<0.00020	<0.000010	<0.000010
DR-A	2-Sep-20	0.235	0.242	85.9	27.4	27.5	<0.00020	<0.00020	<0.000010	<0.000010
DR-B	3-Sep-20	0.249	0.244	82.8	27.3	28.9	<0.00020	<0.00020	<0.000010	<0.000010
DR-E	3-Sep-20	0.235	0.242	82.5	28.8	29.7	<0.00020	<0.00020	<0.000010	<0.000010
BBL	1-Sep-20	0.209	0.204	24.6	8.82	9.33	<0.00020	<0.00020	<0.000010	<0.000010
BC3	1-Sep-20	0.114	0.108	12.8	4.75	5.01	<0.00020	<0.00020	<0.000010	<0.000010
SB1	3-Sep-20	0.155	0.156	50.3	16.2	17.3	<0.00020	<0.00020	<0.000010	0.000013
SB2	3-Sep-20	0.135	0.134	44.8	14.9	15.5	<0.00020	<0.00020	<0.000010	0.000010

Table 8. continued.

Site ID	Sampling Date	Strontium (Sr)		Sulphate (SO4)	Sulphur (S)		Tellurium (Te)		Thallium (Tl)	
		Dissolved	Total	Dissolved	Dissolved	Total	Dissolved	Total	Dissolved	Total
BCD-2018-9	13-Oct-20	0.207	0.233	149	47.4	54.6	<0.00020	<0.00020	<0.000010	<0.000010
BC-LSM	13-Oct-20	0.221	0.234	136	52.9	45.9	<0.00020	<0.00020	<0.000010	<0.000010
FR1	13-Oct-20	0.259	0.293	92.4	33.6	34.0	<0.00020	<0.00020	<0.000010	<0.000010
FR2	13-Oct-20	0.259	0.282	92.1	32.5	33.5	<0.00020	<0.00020	<0.000010	<0.000010
BB-LSM	13-Oct-20	0.248	0.254	84.9	31.3	28.9	<0.00020	<0.00020	<0.000010	<0.000010
LSM4	14-Oct-20	0.263	0.254	87.2	29.1	32.1	<0.00020	<0.00020	<0.000010	<0.000010
LSM1	14-Oct-20	0.264	0.262	88.0	29.1	31.7	<0.00020	<0.00020	<0.000010	<0.000010
LSM3	14-Oct-20	0.227	0.229	71.0	23.5	25.6	<0.00020	<0.00020	<0.000010	<0.000010
DR-A	14-Oct-20	0.262	0.260	86.4	28.7	32.1	<0.00020	<0.00020	<0.000010	<0.000010

Table 8. continued.

Site ID	Sampling Date	Thorium (Th)		Tin (Sn)		Titanium (Ti)		Tungsten (W)	
		Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>		<i>0.00010</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00030</i>	<i>0.00030</i>	<i>0.00010</i>	<i>0.00010</i>
WHB1	1-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00455	<0.00010	<0.00010
WHB2	1-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00835	<0.00010	<0.00010
WHC-WB	1-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00444	<0.00010	<0.00010
MC-WB	1-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00291	<0.00010	<0.00010
BCD-2018-9	9-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00542	<0.00010	<0.00010
BC-LSM	1-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	0.00039	0.00154	<0.00010	<0.00010
FR1	1-Sep-20	<0.00010	<0.00010	<0.00010	0.00012	<0.00030	0.00357	<0.00010	<0.00010
FR2	10-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00530	<0.00010	<0.00010
BB-LSM	10-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00463	<0.00010	<0.00010
LSM5	2-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00137	<0.00010	<0.00010
LSM4	2-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00048	<0.00010	<0.00010
LSM1	2-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00399	<0.00010	<0.00010
LSM3	2-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00393	<0.00010	<0.00010
DR-A	2-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00168	<0.00010	<0.00010
DR-B	3-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00398	<0.00010	<0.00010
DR-E	3-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00939	<0.00010	<0.00010
BBL	1-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00252	<0.00010	<0.00010
BC3	1-Sep-20	<0.00010	<0.00010	<0.00010	<0.00010	0.00172	0.0163	<0.00010	<0.00010
SB1	3-Sep-20	<0.00010	0.00013	<0.00010	<0.00010	0.00087	0.0330	<0.00010	<0.00010
SB2	3-Sep-20	<0.00010	0.00011	<0.00010	<0.00010	0.00072	0.0288	<0.00010	<0.00010

Table 8. continued.

Site ID	Sampling Date	Thorium (Th)		Tin (Sn)		Titanium (Ti)		Tungsten (W)	
		Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
BCD-2018-9	13-Oct-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00065	<0.00010	<0.00010
BC-LSM	13-Oct-20	<0.00010	<0.00010	<0.00010	<0.00010	0.00031	0.00166	<0.00010	<0.00010
FR1	13-Oct-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00955	<0.00010	<0.00010
FR2	13-Oct-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00730	<0.00010	<0.00010
BB-LSM	13-Oct-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00321	<0.00010	<0.00010
LSM4	14-Oct-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00133	<0.00010	<0.00010
LSM1	14-Oct-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00818	<0.00010	<0.00010
LSM3	14-Oct-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00919	<0.00010	<0.00010
DR-A	14-Oct-20	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00174	<0.00010	<0.00010

Table 8. continued.

Site ID	Sampling Date	Uranium (U)		Vanadium (V)		Zinc (Zn)		Zirconium (Zr)	
		Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>		0.000010	0.000010	0.00050	0.00050	0.0010	0.0030	0.00020	0.00020
WHB1	1-Sep-20	0.00170	0.00159	0.00142	0.00213	<0.0010	<0.0030	<0.00020	<0.00020
WHB2	1-Sep-20	0.00172	0.00166	0.00148	0.00226	<0.0010	<0.0030	<0.00020	0.00060
WHC-WB	1-Sep-20	0.00160	0.00154	0.00129	0.00194	<0.0010	<0.0030	<0.00020	<0.00020
MC-WB	1-Sep-20	0.00168	0.00161	0.00126	0.00179	<0.0010	<0.0030	<0.00020	<0.00020
BCD-2018-9	9-Sep-20	0.000532	0.00063	<0.00050	0.00076	<0.0010	<0.0030	<0.00020	<0.00020
BC-LSM	1-Sep-20	0.000693	0.000691	0.00060	0.00109	<0.0010	<0.0030	0.00032	0.00028
FR1	1-Sep-20	0.00163	0.00157	0.00136	0.00191	<0.0010	<0.0030	<0.00020	<0.00020
FR2	10-Sep-20	0.00147	0.00170	0.00140	0.00180	<0.0010	<0.0030	<0.00020	0.00053
BB-LSM	10-Sep-20	0.00184	0.00180	0.00173	0.00214	<0.0010	<0.0030	<0.00020	<0.00020
LSM5	2-Sep-20	0.00154	0.00161	0.00153	0.00202	<0.0010	<0.0030	<0.00020	<0.00020
LSM4	2-Sep-20	0.00161	0.00165	0.00160	0.00198	<0.0010	<0.0030	<0.00020	<0.00020
LSM1	2-Sep-20	0.00165	0.00171	0.00160	0.00217	<0.0010	<0.0030	<0.00020	<0.00020
LSM3	2-Sep-20	0.00131	0.00138	0.00173	0.00227	<0.0010	<0.0030	<0.00020	<0.00020
DR-A	2-Sep-20	0.00170	0.00161	0.00158	0.00199	<0.0010	<0.0030	<0.00020	<0.00020
DR-B	3-Sep-20	0.00167	0.00172	0.00156	0.00219	<0.0010	<0.0030	<0.00020	<0.00020
DR-E	3-Sep-20	0.00165	0.00173	0.00167	0.00235	<0.0010	<0.0030	<0.00020	0.00052
BBL	1-Sep-20	0.000671	0.000656	0.00078	0.00126	0.0011	<0.0030	<0.00020	<0.00020
BC3	1-Sep-20	0.000320	0.000317	0.00077	0.00170	<0.0010	<0.0030	0.00022	0.00122
SB1	3-Sep-20	0.000942	0.000988	0.00165	0.00342	<0.0010	0.0030	<0.00020	0.00042
SB2	3-Sep-20	0.000826	0.000893	0.00152	0.00298	<0.0010	<0.0030	<0.00020	0.00040

Table 8. continued.

Site ID	Sampling Date	Uranium (U)		Vanadium (V)		Zinc (Zn)		Zirconium (Zr)	
		Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
BCD-2018-9	13-Oct-20	0.00174	0.00177	<0.00050	0.00072	0.0011	<0.0030	<0.00020	<0.00020
BC-LSM	13-Oct-20	0.00225	0.00211	0.00088	0.00130	<0.0010	<0.0030	<0.00020	<0.00020
FR1	13-Oct-20	0.00186	0.00178	0.00125	0.00220	<0.0010	<0.0030	<0.00020	<0.00020
FR2	13-Oct-20	0.00191	0.00173	0.00129	0.00200	<0.0010	<0.0030	<0.00020	<0.00020
BB-LSM	13-Oct-20	0.00201	0.00190	0.00159	0.00214	<0.0010	<0.0030	<0.00020	<0.00020
LSM4	14-Oct-20	0.00159	0.00178	0.00143	0.00171	<0.0010	<0.0030	<0.00020	<0.00020
LSM1	14-Oct-20	0.00165	0.00180	0.00139	0.00207	<0.0010	<0.0030	<0.00020	<0.00020
LSM3	14-Oct-20	0.00156	0.00170	0.00131	0.00194	<0.0010	<0.0030	<0.00020	<0.00020
DR-A	14-Oct-20	0.00165	0.00181	0.00141	0.00174	<0.0010	<0.0030	<0.00020	<0.00020

1 - Detection limit raised; the mercury sample could not be collected by the “clean-hands-dirty-hands” method therefore analysis for ultra-trace mercury was not appropriate.

Table 9. Results of the *in situ* survey conducted on September 1, 2020.

Location	Sampling Date	Sampling Time	Total Depth (m)	Sample Depth (m)	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Oxygen Saturation (%)	Specific Conductance (µS/cm)	Turbidity (NTU)	Comments
Reed Lake	1-Sep-20	13:36	<0.5	0.3	14.03	8.56	10.10	98.2	641	0.88	heavy vegetation
Clear Lake	1-Sep-20	10:10	<0.5	0.3	13.40	8.88	9.82	94.1	802	1.75	heavy vegetation
Water Lake	1-Sep-20	10:13	<0.5	0.3	14.01	9.68	10.40	101.4	470	1.74	heavy vegetation
Goodison Lake	1-Sep-20	10:18	-	-	-	-	-	-	-	-	No water
Clarks Drain	1-Sep-20	10:21	-	-	-	-	-	-	-	-	No water
Woodale Drain	1-Sep-20	10:22	-	-	-	-	-	-	-	-	No water
Creek C											
at LSMOC alignment	1-Sep-20	12:58	<0.1	0.3	13.06	7.33	6.96	66.2	319	1.19	-
upstream of LSMOC alignment	1-Sep-20	12:59	<0.1	0.3	13.17	7.04	4.15	39.5	281	1.52	-
Unnamed Creek											
at Buffalo Creek	1-Sep-20	13:09	<0.1	0.3	13.49	7.24	7.47	71.7	8.2 ¹	2.96	-
at LSMOC alignment	1-Sep-20	13:11	<0.1	0.3	13.36	7.19	6.88	65.8	367	0.15	-

1 - Result suspect.

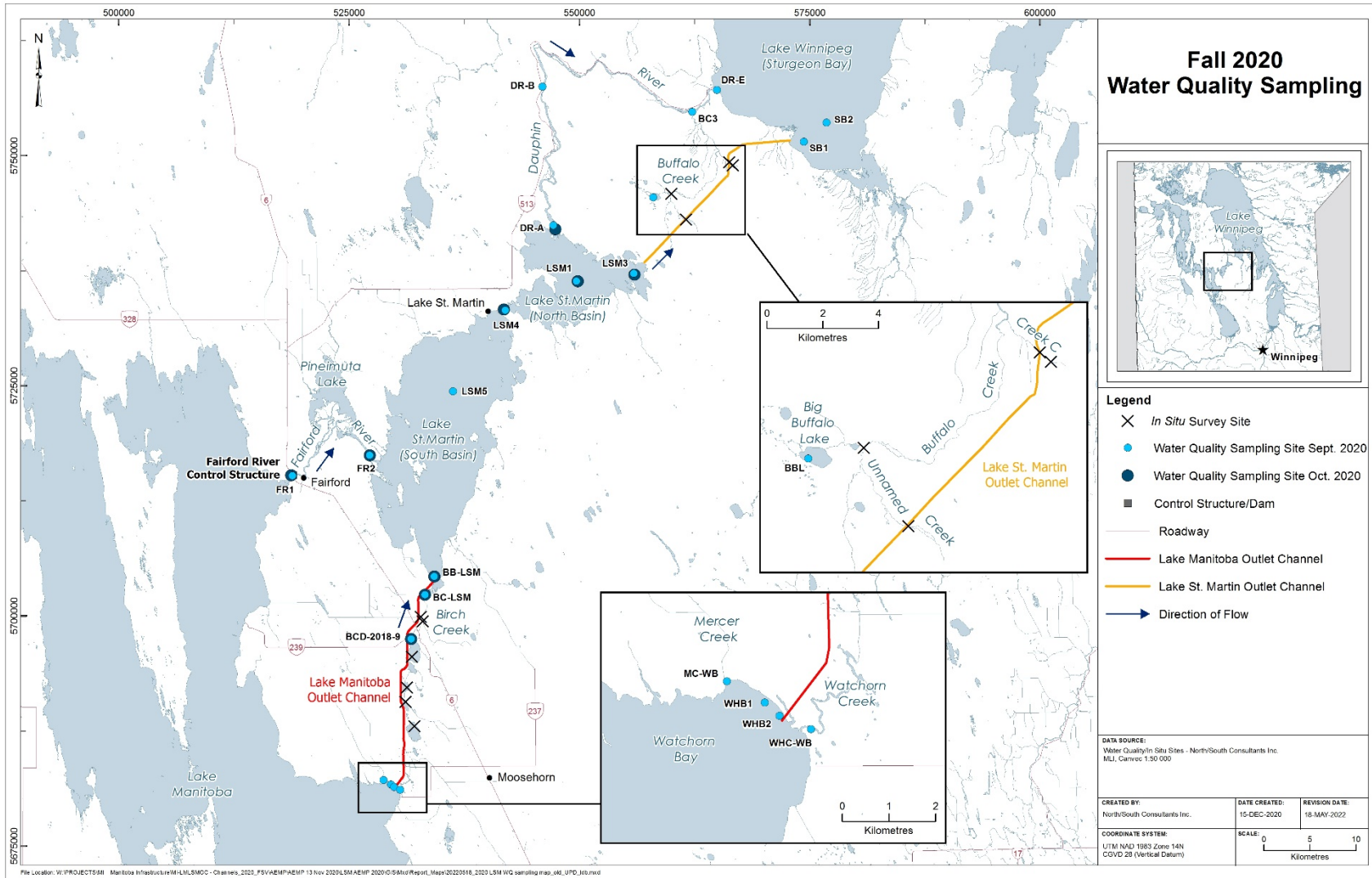


Figure 1. Water quality sampling locations, fall 2020.

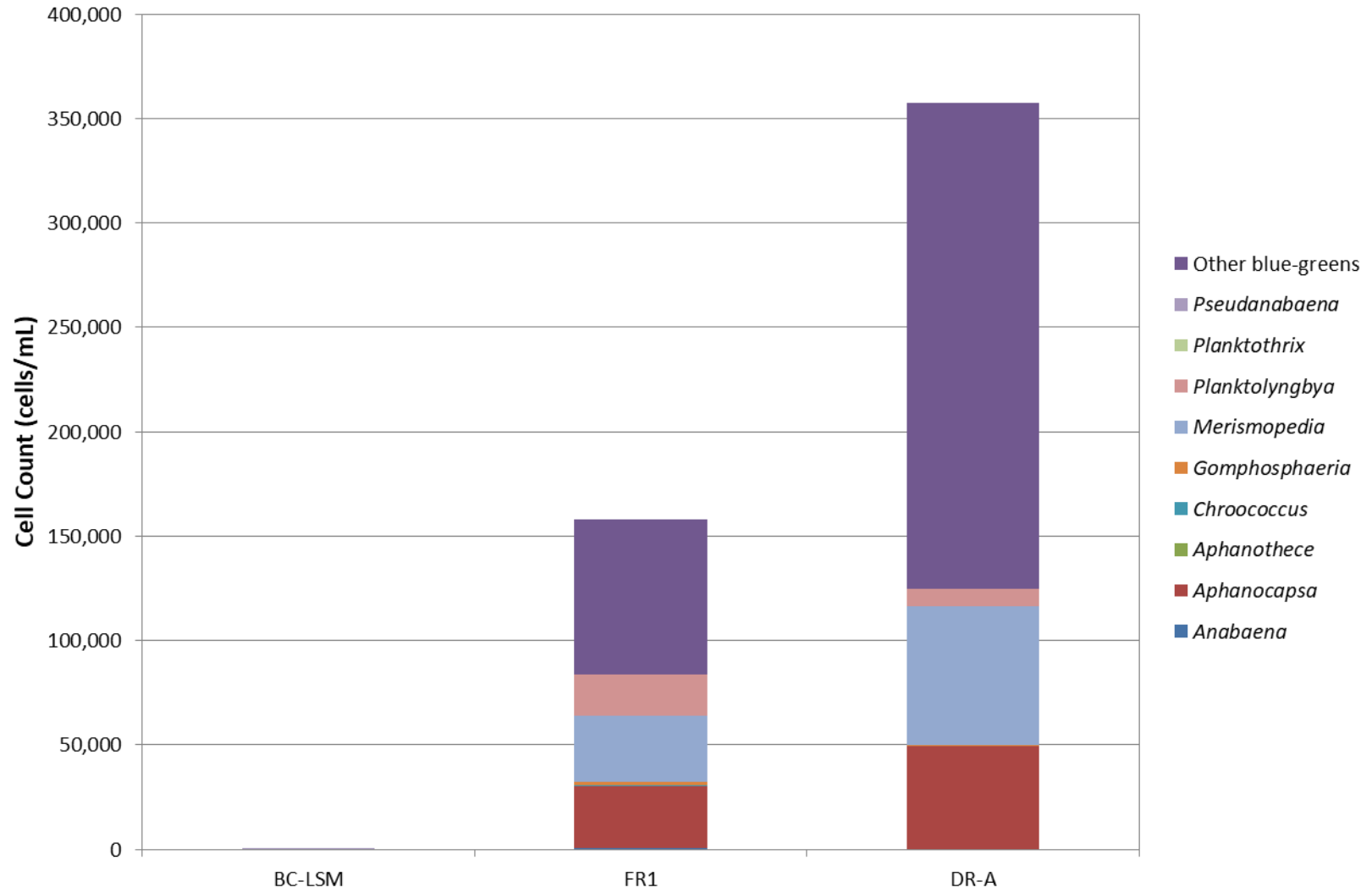


Figure 2. Abundance of blue-green algae at selected sampling sites in September 2020.

APPENDIX 1. WATER QUALITY OBJECTIVES AND GUIDELINES

WATER QUALITY OBJECTIVES AND GUIDELINES

The following is a summary of applicable water quality objectives and guidelines for evaluation of water chemistry data collected in the study area, including: the Manitoba Water Quality Standards, Objectives, and Guidelines (MWQSOG) for the protection of aquatic life (PAL; MWS 2011); and the Canadian Council of Ministers for the Environment (CCME) guidelines for the protection of freshwater aquatic life (CCME 1999, updated to 2020).

AMMONIA

Both MWQ objectives and CCME guidelines for PAL exist for ammonia; these criteria are dependent upon water temperature and pH. A representative range of Manitoba water quality objectives and CCME guidelines for ammonia appropriate for the range of pH and temperature measured in the study area (i.e., site-specific objectives) in 2020 are presented in Tables A1-1 and A1-2, respectively.

Table A1-1. Range of applicable Manitoba Water Quality Objectives for ammonia, for the protection of cool-water and cold-water aquatic life and wildlife.

Water Use	pH	Temperature (°C)	Manitoba Water Quality Objective (mg N/L) ¹		
			30-day	4-day	1-hour
<u>Cool water aquatic life, early life stages present</u>					
	7.62	4.73	3.90	9.74	16.5
		16.2	3.49	8.74	16.5
	8.42	4.73	1.25	3.12	3.74
		16.2	1.12	2.80	3.74
<u>Cool water aquatic life, early life stages absent</u>					
	7.62	4.73	6.33	15.8	16.5
		16.2	3.49	8.74	16.5
	8.42	4.73	2.02	3.74	3.74
		16.2	1.12	3.74	3.74
<u>Cold water aquatic life, early life stages present</u>					
	7.62	4.73	3.90	9.74	11.0
		16.2	3.49	8.74	11.0
	8.42	4.73	1.25	2.49	2.49
		16.2	1.12	2.49	2.49
<u>Cold water aquatic life, early life stages absent</u>					
	7.62	4.73	6.33	11.0	11.0
		16.2	3.49	8.74	11.0
	8.42	4.73	2.02	2.49	2.49
		16.2	1.12	2.49	2.49

1 - Values calculated from algorithms provided in MWS (2011) and the range of pH and water temperature measured in the study area in 2020. The most stringent objective is indicated in red.

Table A1-2. CCME water quality guidelines for total ammonia for the protection of freshwater aquatic life.

Temperature (°C)	CCME water quality guideline (mg N/L) ¹				
	pH				
	7.0	7.5	8.0	8.5	9.0
0	19.0	6.02	1.92	0.616	0.206
5	12.6	3.98	1.27	0.413	0.141
10	8.47	2.68	0.855	0.282	0.100
15	5.74	1.83	0.588	0.197	0.073
20	3.96	1.27	0.410	0.141	0.055

1. - Guidelines presented are for the range of pH and water temperature measured in the study area in 2020. The most stringent guideline is indicated in red.

DISSOLVED OXYGEN

Manitoba objectives for dissolved oxygen (DO) are dependent upon water temperature, the presence of early life stages, and the presence of sensitive fish species (e.g., cool-water fish such as Northern Pike and Walleye or cold-water fish species such as Lake Whitefish, MWS 2011). Objectives, which are specific for early life stages and mature life stages and vary according to the averaging duration, are presented in Table A1-3. Similarly, the CCME lowest acceptable level of DO varies by warm/cold water biota and life stage, as shown in Table A1-4.

Table A1-3. Manitoba Water Quality Objectives for dissolved oxygen.

Applicable Conditions	Dissolved Oxygen Objective (mg/L)			
	Averaging Duration			
	Instantaneous Minimum	7 Day Minimum	7 Days	30 Days
<u>Cold-Water Aquatic Life and Wildlife</u>				
Water Temperature ≤ 5°C and Early Life Stages Present	8.0	-	9.5	-
Water Temperature > 5°C and Mature Life Stages Present	4.0	5.0	-	6.5
<u>Cool-Water Aquatic Life and Wildlife</u>				
Water Temperature ≤ 5°C and Mature Life Stages Present	3.0	4.0	-	5.5
Water Temperature > 5°C and Early Life Stages Present	5.0	-	6.0	-

Table A1-4. CCME lowest acceptable concentration of dissolved oxygen for the protection of freshwater aquatic life.

	Dissolved Oxygen Value (mg/L)	
	Early life stages	Other life stages
Warm water biota	6.0	5.5
Cold water biota	9.5	6.5

TOTAL SUSPENDED SOLIDS AND TURBIDITY

MWQSOG and CCME guidelines for PAL for total suspended solids (TSS) are similar and allow the following: a maximum increase of 25 mg/L from background for short term exposure (up to 24 hrs.); an average increase of 5 mg/L from background for long term exposure (i.e., 1 to 30 days); a maximum increase of 25 mg/L from background when background TSS is between 25 mg/L and 250 mg/L; and a maximum change of 10% from background when TSS greater than 250 mg/L.

There are different criteria for turbidity for the MWQSOG and CCME guidelines for PAL. The Manitoba objective for turbidity for PAL is for “equivalent induced levels of change as calculated from site-specific or regional-specific correlation between total suspended solids and turbidity” (MWS 2011). The CCME guideline is more definitive and allows for the following (CCME 1999, updated to 2020) a maximum increase of 8 NTU from background for short term exposure (up to 24 hrs.); an average increase of 2 NTU from background for long term exposure (i.e., 1 to 30 days); a maximum increase of 8 NTU from background when background TSS is between 8 NTU and 80 NTU; and a maximum change of 10% from background when background is greater than 80 NTU.

There is also a MWQSOG maximum acceptable concentration of 1.0 NTU for drinking water. However, this guideline, as with all drinking water guidelines/objectives, is to be applied to finished drinking water; and, since the majority of natural surface waters will exceed this guideline it has not been included in this assessment.

PHOSPHORUS

MWQSOG include narrative guidelines for total phosphorus (TP) which state: “[TP] should not exceed 0.025 mg/L in any reservoir, lake, or pond, or in a tributary at the point where it enters such bodies of water. In other streams, [TP] should not exceed 0.05 mg/L” (MWS 2011).

CCME guidelines for the protection of freshwater aquatic life provide a guidance framework for the development of site-specific guidelines; this is a detailed process that requires sufficient baseline data for guideline development and is beyond the scope of this report.

OTHER ROUTINE PARAMETERS

Table A1-5 presents water quality criteria for other routine parameters not discussed above.

METALS AND MAJOR IONS

Table A1-6 presents water quality criteria for select metals and major ions.

HYDROCARBONS

Table A1-7 presents water quality criteria for select hydrocarbons.

PESTICIDES

Table A1-8 presents water quality criteria for select pesticides.

Table A1-5. Manitoba and CCME guidelines for the protection of aquatic life for other routine parameters measured.

Parameter	Guidelines/Objectives for PAL		
	MWQSOG ¹	CCME ²	
		Short Term	Long Term
Nitrate	2.93 mg N/L ³	124 mg N/L	3.0 mg N/L
Nitrite	0.060 mg N/L	-	0.060 mg N/L
pH	6.5 to 9.0	-	6.5 to 9.0

1 - Manitoba Water Quality Standards, Objectives, and Guidelines (MWS 2011).

2 - CCME guidelines for the protection of freshwater aquatic life (CCME 1999, updated to 2020).

3 - The Manitoba PAL guideline for nitrate indicated in MWS (2011) was incorrectly identified as 13 mg N/L. The PAL guideline should read 2.93 mg N/L (N. Armstrong, Pers. Comm.).

Table A1-6. Manitoba and CCME guidelines for the protection of aquatic life for metals and major ions.

Parameter	Manitoba Objectives and Guidelines (mg/L)					CCME Guidelines (mg/L)		
	Tier II Objectives		Tier III Guidelines			CWQG	Short-term	Long-term
	Acute ¹	Chronic ²	MWQG	Short-term	Long-term			
Aluminum	-	-	0.1 ³	-	-	0.1 ³	-	-
Arsenic, dissolved	0.34	0.15	-	-	-	-	-	-
Arsenic, total	-	-	-	-	-	0.005	-	-
Boron	-	-	-	29	1.5	-	29	1.5
Cadmium, dissolved	0.00287 to 0.00996 ⁴	0.000317 to 0.000770 ⁴	-	-	-	-	0.00304 to 0.0112 ⁴	0.000215 to 0.000622 ⁴
Chloride	-	-	-	-	-	-	640	120
Chromium (III), dissolved	0.768 to 2.19 ⁴	0.0999 to 0.286 ⁴	-	-	-	0.0089 ⁵	-	-
Copper, dissolved	0.0189 to 0.0634 ⁴	0.0122 to 0.0366 ⁴	-	-	-	0.00323 to 0.004 ⁴	-	-
Iron	-	-	≤0.3	-	-	0.3	-	-
Lead, dissolved	0.0958 to 0.366 ⁴	0.00373 to 0.0143 ⁴	-	-	-	0.00506 to 0.007 ⁴	-	-
Manganese, dissolved	-	-	-	-	-	-	9.2 to 15.0 ⁶	0.260 to 0.650 ⁶
Mercury	-	-	0.000026	-	-	0.000026 ⁵	-	-
Molybdenum	-	-	0.073	-	-	0.73 ⁵	-	-
Nickel, dissolved	0.637 to 1.89 ⁴	0.0708 to 0.209 ⁴	-	-	-	0.126 to 0.150 ⁴	-	-
Selenium, total	-	-	0.001	-	-	0.001	-	-
Silver, total	-	-	0.0001	-	-	-	-	0.00025
Thallium	-	-	0.0008	-	-	0.0008	-	-
Uranium	-	-	-	0.033	0.015	-	0.033	0.015
Zinc, dissolved	0.160 to 0.473 ⁴	0.161 to 0.480 ⁴	-	-	-	-	0.172 to 0.334 ⁷	0.0193 to 0.207 ⁸

- 1 - 1-hour averaging objective.
- 2 - 4-day averaging objective.
- 3 - Value represents the guideline where pH > 6.5.
- 4 - Calculated based on the range of hardness (144-519 mg/L) observed in all samples collected.
- 5 - Interim guideline
- 6 - Calculated based on the range of hardness (144-519 mg/L) and pH (7.62-8.80) observed in all samples collected.
- 7 - Calculated based on the range of hardness (144-519 mg/L) and dissolved organic carbon (DOC; 7.43-34.6 mg/L) observed in all samples collected.
- 8 - Calculated based on the range of hardness (144-519 mg/L), DOC (7.43-34.6 mg/L) and pH (7.62-8.80) observed in all samples collected.

Table A1-7. Manitoba and CCME guidelines for the protection of aquatic life for hydrocarbons.

Parameter	Units	PAL Guideline ¹
Benzene	mg/L	0.370
Ethyl benzene	mg/L	0.090
Toluene	mg/L	0.002
Acenaphthene	mg/L	0.0058
Acridine	mg/L	0.0044
Anthracene	mg/L	0.000012
Benzo(a)anthracene	mg/L	0.000018
Benzo(a)pyrene	mg/L	0.000015
Fluoranthene	mg/L	0.00004
Fluorene	mg/L	0.003
Naphthalene	mg/L	0.0011
Phenanthrene	mg/L	0.0004
Pyrene	mg/L	0.000025
Quinoline	mg/L	0.0034

1 - MWQSOG and CCME guidelines are the same for these parameters.

Table A1-8. Manitoba and CCME guidelines for the protection of aquatic life for pesticides.

Parameter	Unit	MWQSOG			CCME Guidelines		
		MWQG	Short-term	Long-term	CWQG	Short-term	Long-term
Aldrin	µg/L	-	-	-	-	-	0.004
alpha-BHC	µg/L	0.01 ¹	-	-	-	-	0.01 ¹
beta-BHC	µg/L	0.01 ¹	-	-	-	-	0.01 ¹
gamma-hexachlorocyclohexane	µg/L	0.01 ¹	-	-	-	-	0.01 ¹
delta-BHC	µg/L	0.01 ¹	-	-	-	-	0.01 ¹
a-chlordane	µg/L	-	-	-	-	-	0.006 ²
g-chlordane	µg/L	-	-	-	-	-	0.006 ²
Endosulfan	µg/L	-	0.06	0.003	-	0.06	0.003
Hexachlorobutadiene	µg/L	1.3	-	-	1.3	-	-
Bromoxynil	mg/L	0.005	-	-	-	-	0.005
2,4-D	mg/L	-	-	-	-	-	0.004
Dicamba	mg/L	0.01	-	-	-	-	0.01
Dinoseb	mg/L	0.00005	-	-	-	-	0.00005
MCPA	mg/L	0.0026	-	-	-	-	0.0026
Picloram	mg/L	0.029	-	-	-	-	0.029
Atrazine	µg/L	1.8 ³	-	-	-	-	1.8
Atrazine+N-Dealkylated Metabolites	µg/L	1.8 ³	-	-	-	-	-
Glyphosate	µg/L	65	-	-	-	27000	800
Diclofop-methyl	mg/L	0.0061	-	-	-	-	0.0061
Triallate	mg/L	0.00024	-	-	-	-	0.00024
Trifluralin	mg/L	0.00020	-	-	-	-	0.0002

**APPENDIX 2. QUALITY ASSURANCE / QUALITY CONTROL
RESULTS**

Table A2-1. QA/QC results for routine parameters. Percent relative standard deviation (PRSD) values greater than 18 are indicated in red bold. Results for all blanks are less than five times the analytical detection limit.

Waterbody	Sampling Date	Sample ID	ALS ID	Alkalinity				Nitrogen		
				Total Alkalinity as CaCO ₃ (mg/L)	Bicarbonate, HCO ₃ (mg/L)	Carbonate, CO ₃ (mg/L)	Hydroxide, OH (mg/L)	Total Ammonia (mg N/L)	Nitrate (mg N/L)	Nitrite (mg N/L)
<i>Analytical DL</i>				1.0	1.2	0.60	0.34	0.010	0.0050/ 0.010	0.0010/ 0.0020
<u>Replicates</u>										
Mercer Creek	1-Sep-20	MC-WB	L2497954-4	188	230	<0.60	<0.34	0.030	<0.010	<0.0020
		REP-2A	L2497954-8	189	230	<0.60	<0.34	0.031	<0.010	<0.0020
		REP-2B	L2497954-9	192	234	<0.60	<0.34	0.031	<0.010	<0.0020
		Mean		190	231	<0.60	<0.34	0.031	<0.010	<0.0020
		SD		2.1	2.3	-	-	0.0006	-	-
		PRSD		1	1	-	-	2	-	-
Lake St. Martin	2-Sep-20	LSM1	L2498786-1	168	186	9.24	<0.34	<0.010	<0.010	<0.0020
		REP-1A	L2498786-6	205	233	8.40	<0.34	<0.010	<0.010	<0.0020
		REP-1B	L2498786-7	191	215	8.76	<0.34	<0.010	<0.010	<0.0020
		Mean		188	211	8.80	<0.34	<0.010	<0.010	<0.0020
		SD		18.7	23.7	0.421	-	-	-	-
		PRSD		10	11	5	-	-	-	-
Fairford River	13-Oct-20	FR1	L2516048-4	183	216	3.48	<0.34	<0.010	<0.010	<0.0020
		REP-2A	L2516048-6	183	211	5.76	<0.34	<0.010	<0.010	<0.0020
		REP-2B	L2516048-7	182	213	4.56	<0.34	0.010	<0.010	<0.0020
		Mean		183	213	4.60	<0.34	<0.010	<0.010	<0.0020
		SD		0.6	2.5	1.14	-	-	-	-
		PRSD		0	1	25	-	-	-	-
<u>Blanks</u>										
Field Blanks	3-Sep-20	WB-2A	L2498784-6	<1.0	<1.2	<0.60	<0.34	<0.010	<0.0050	<0.0010
	2-Sep-20	WB-1A	L2498786-5	<1.0	<1.2	<0.60	<0.34	<0.010	<0.0050	<0.0010
	13-Oct-20	WB-2A	L2516048-8	1.6	2.0	<0.60	<0.34	<0.010	<0.0050	<0.0010
Trip Blanks	3-Sep-20	WB-2B	L2498784-7	<1.0	<1.2	<0.60	<0.34	<0.010	<0.0050	<0.0010
	2-Sep-20	WB-1B	L2498784-8	<1.0	<1.2	<0.60	<0.34	<0.010	<0.0050	<0.0010
	13-Oct-20	WB-2B	L2516048-9	<1.0	<1.2	<0.60	<0.34	<0.010	<0.0050	<0.0010

Table A2-1. continued.

Waterbody	Sampling Date	Sample ID	Nitrogen			Phosphorus			Carbon			
			Nitrate/nitrite (mg N/L)	Total Kjeldahl Nitrogen (mg/L)	Total Nitrogen (mg/L)	Dissolved Phosphorus (mg/L)	Total Particulate Phosphorus (mg/L)	Total Phosphorus (mg/L)	Total Inorganic Carbon (mg/L)	Total Organic Carbon (mg/L)	Dissolved Organic Carbon (mg/L)	Total Carbon (mg/L)
<i>Analytical DL</i>			<i>0.0051/0.010</i>	<i>0.20</i>	<i>0.20</i>	<i>0.0010/0.0030</i>	<i>0.0028/0.0042</i>	<i>0.0010/0.0030</i>	<i>0.50</i>	<i>0.50</i>	<i>0.50</i>	<i>1.0</i>
<u>Replicates</u>												
Mercer Creek	1-Sep-20	MC-WB	<0.010	1.18	1.18	0.0117	0.0264	0.0382	40.5	13.3	13.1	53.8
		REP-2A	<0.010	1.13	1.13	0.0126	0.0267	0.0393	41.2	13.6	13.4	54.8
		REP-2B	<0.010	1.13	1.13	0.0127	0.0254	0.0382	42.0	13.9	13.4	55.9
		Mean	<0.010	1.15	1.15	0.0123	0.0262	0.0386	41.2	13.6	13.3	54.8
		SD	-	0.029	0.029	0.00055	0.00068	0.00064	0.75	0.30	0.17	1.05
		PRSD	-	3	3	4	3	2	2	2	1	2
Lake St. Martin	2-Sep-20	LSM1	<0.010	1.30	1.30	0.0086	0.0162	0.0247	34.1	13.4	13.1	47.5
		REP-1A	<0.010	1.29	1.29	0.0073	0.0181	0.0254	34.1	13.5	12.8	47.6
		REP-1B	<0.010	1.27	1.27	0.0098	0.0163	0.0260	34.9	12.9	13.4	47.8
		Mean	<0.010	1.29	1.29	0.0086	0.0169	0.0254	34.4	13.3	13.1	47.6
		SD	-	0.015	0.015	0.00125	0.00107	0.00065	0.46	0.32	0.30	0.15
		PRSD	-	1	1	15	6	3	1	2	2	0
Fairford River	13-Oct-20	FR1	<0.010	1.41	1.41	0.0061	0.0314	0.0375	34.2	12.8	11.9	47.0
		REP-2A	<0.010	1.17	1.17	0.0059	0.0274	0.0333	34.7	12.3	12.2	47.0
		REP-2B	<0.010	1.59	1.59	0.0064	0.0284	0.0348	34.3	12.2	11.5	46.4
		Mean	<0.010	1.39	1.39	0.0061	0.0291	0.0352	34.4	12.4	11.9	46.8
		SD	-	0.211	0.211	0.00025	0.00208	0.00213	0.26	0.32	0.35	0.35
		PRSD	-	15	15	4	7	6	1	3	3	1
<u>Blanks</u>												
Field Blanks	3-Sep-20	WB-2A	<0.0051	<0.20	<0.20	<0.0010	<0.0028	<0.0010	0.64	<0.50	<0.50	<1.0
	2-Sep-20	WB-1A	<0.0051	<0.20	<0.20	<0.0010	<0.0028	<0.0010	1.31	<0.50	<0.50	1.3
	13-Oct-20	WB-2A	<0.0051	<0.20	<0.20	<0.0010	<0.0028	<0.0010	0.66	<0.50	<0.50	<1.0
Trip Blanks	3-Sep-20	WB-2B	<0.0051	<0.20	<0.20	<0.0010	<0.0028	<0.0010	<0.50	<0.50	<0.50	<1.0
	2-Sep-20	WB-1B	<0.0051	<0.20	<0.20	<0.0010	<0.0028	<0.0010	<0.50	<0.50	<0.50	<1.0
	13-Oct-20	WB-2B	<0.0051	<0.20	<0.20	<0.0010	<0.0028	<0.0010	<0.50	<0.50	<0.50	<1.0

Table A2-1. continued.

Waterbody	Sampling Date	Sample ID	Routine Chemistry				Water Clarity			Algal Pigments	
			Laboratory pH (pH units)	Laboratory Conductivity (µmhos/cm)	Total Dissolved Solids (mg/L)	Hardness, as CaCO ₃ (mg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	True Colour (CU)	Chlorophyll <i>a</i> (µg/L)	Phaeophytin <i>a</i> (µg/L)
<i>Analytical DL</i>			<i>0.10</i>	<i>1</i>	<i>4.0/20</i>	<i>0.2</i>	<i>1.0</i>	<i>0.1</i>	<i>5.0</i>	<i>0.10</i>	<i>0.10</i>
<u>Replicates</u>											
Mercer Creek	1-Sep-20	MC-WB	8.06	1090	628	255	8.5	6.57	15.9	6.77	4.54
		REP-2A	8.07	1090	636	250	8.8	6.06	17.8	7.40	4.84
		REP-2B	8.03	1090	632	263	6.4	4.57	18.7	6.78	4.82
		Mean	8.05	1090	632	256	7.9	5.73	17.5	6.98	4.73
		SD	0.021	0.0	4.0	6.6	1.31	1.04	1.43	0.361	0.168
		PRSD	0	0	1	3	17	18	-	5	4
Lake St. Martin	2-Sep-20	LSM1	8.53	1050	618	234	17.8	11.7	5.0	8.00	2.09
		REP-1A	8.55	1040	597	237	16.6	11.5	6.5	7.39	1.82
		REP-1B	8.54	1050	620	241	17.5	11.4	5.8	7.97	2.38
		Mean	8.54	1047	612	237	17.3	11.5	5.8	7.79	2.10
		SD	0.010	5.8	12.7	3.5	0.62	0.15	0.75	0.344	0.280
		PRSD	0	1	2	1	4	1	-	4	13
Fairford River	13-Oct-20	FR1	8.30	1150	626	252	42.0	30.9	5.7	10.9	2.48
		REP-2A	8.35	1150	620	243	44.3	33.8	7.1	11.2	2.63
		REP-2B	8.34	1140	622	242	42.6	32.4	6.9	10.5	2.47
		Mean	8.33	1147	623	246	43.0	32.4	6.6	10.9	2.53
		SD	0.026	5.8	3.1	5.5	1.19	1.45	0.76	0.35	0.090
		PRSD	0	1	0	2	3	4	-	3	4
<u>Blanks</u>											
Field Blanks	3-Sep-20	WB-2A	5.53	<1.0	<4.0	<0.20	<1.0	<0.10	<5.0	<0.10	<0.10
	2-Sep-20	WB-1A	5.38	1.2	<4.0	<0.20	<1.0	<0.10	<5.0	<0.10	<0.10
	13-Oct-20	WB-2A	6.06	3.3	<4.0	<0.20	<1.0	0.22	<5.0	<0.10	<0.10
Trip Blanks	3-Sep-20	WB-2B	5.45	<1.0	<4.0	<0.20	<1.0	<0.10	<5.0	<0.10	0.11
	2-Sep-20	WB-1B	5.45	<1.0	<4.0	<0.20	<1.0	<0.10	<5.0	<0.10	0.2
	13-Oct-20	WB-2B	5.85	1.2	<4.0	<0.20	<1.0	<0.10	<5.0	<0.10	<0.10

Table A2-2. QA/QC results for metals and major ions (mg/L). Percent relative standard deviation (PRSD) values greater than 18 are indicated in red bold. Results for all blanks are less than five times the analytical detection limit.

Waterbody	Sampling Date	Sample ID	ALS ID	Aluminum (Al)		Antimony (Sb)		Arsenic (As)		Barium (Ba)	
				Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>				<i>0.0010</i>	<i>0.0030</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00010</i>
<u>Replicates</u>											
Mercer Creek	1-Sep-20	MC-WB	L2497954-4	0.0037	0.0804	0.00015	0.00016	0.00215	0.00215	0.0442	0.0449
		REP-2A	L2497954-8	0.0050	0.0727	0.00021	0.00018	0.00215	0.00213	0.0452	0.0455
		REP-2B	L2497954-9	0.0032	0.0526	0.00017	0.00018	0.00209	0.00215	0.0461	0.0454
		Mean		0.0040	0.0686	0.00018	0.00017	0.00213	0.00214	0.0452	0.0453
		SD		0.00093	0.01435	0.000031	0.000012	0.000035	0.000012	0.00095	0.00032
		PRSD		-	21	-	-	2	1	2	1
Lake St. Martin	2-Sep-20	LSM1	L2498786-1	0.0038	0.0947	0.00016	0.00018	0.00226	0.00225	0.0383	0.0411
		REP-1A	L2498786-6	0.0040	0.0941	0.00016	0.00018	0.00230	0.00222	0.0377	0.0402
		REP-1B	L2498786-7	0.0045	0.0982	0.00017	0.00025	0.00235	0.00231	0.0378	0.0408
		Mean		0.0041	0.0957	0.00016	0.00020	0.00230	0.00226	0.0379	0.0407
		SD		0.00036	0.00221	0.000006	0.000040	0.000045	0.000046	0.00032	0.00046
		PRSD		-	2	-	-	2	2	1	1
Fairford River	13-Oct-20	FR1	L2516048-4	0.0086	0.220	0.00019	0.00021	0.00206	0.00213	0.0442	0.0475
		REP-2A	L2516048-6	0.0143	0.220	0.00019	0.00020	0.00205	0.00220	0.0450	0.0471
		REP-2B	L2516048-7	0.0155	0.206	0.00019	0.00020	0.00208	0.00219	0.0450	0.0479
		Mean		0.0128	0.215	0.00019	0.00020	0.00206	0.00217	0.0447	0.0475
		SD		0.00369	0.00808	0.000000	0.000006	0.000015	0.000038	0.00046	0.00040
		PRSD		29	4	-	-	1	2	1	1
<u>Blanks</u>											
Field Blanks	3-Sep-20	WB-2A	L2498784-6	<0.0010	<0.0030	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	2-Sep-20	WB-1A	L2498786-5	<0.0010	<0.0030	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010
	13-Oct-20	WB-2A	L2516048-8	<0.0010	<0.0030	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Trip Blanks	3-Sep-20	WB-2B	L2498784-7	<0.0010	<0.0030	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	2-Sep-20	WB-1B	L2498784-8	<0.0010	<0.0030	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	13-Oct-20	WB-2B	L2516048-9	<0.0010	<0.0030	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010

Table A2-2. continued.

Waterbody	Sampling Date	Sample ID	Beryllium (Be)		Bismuth (Bi)		Boron (B)		Cadmium (Cd)	
			Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>			<i>0.00010</i>	<i>0.00010</i>	<i>0.000050</i>	<i>0.000050</i>	<i>0.010</i>	<i>0.010</i>	<i>0.0000050</i>	<i>0.0000050</i>
<u>Replicates</u>										
Mercer Creek	1-Sep-20	MC-WB	<0.00010	<0.00010	<0.000050	<0.000050	0.096	0.085	<0.0000050	<0.0000050
		REP-2A	<0.00010	<0.00010	<0.000050	<0.000050	0.090	0.080	<0.0000050	<0.0000050
		REP-2B	<0.00010	<0.00010	<0.000050	<0.000050	0.091	0.084	<0.0000050	<0.0000050
		Mean	<0.00010	<0.00010	<0.000050	<0.000050	0.092	0.083	<0.0000050	<0.0000050
		SD	-	-	-	-	0.0032	0.0026	-	-
		PRSD	-	-	-	-	3	3	-	-
Lake St. Martin	2-Sep-20	LSM1	<0.00010	<0.00010	<0.000050	<0.000050	0.088	0.089	<0.0000050	<0.0000050
		REP-1A	<0.00010	<0.00010	<0.000050	<0.000050	0.094	0.085	<0.0000050	<0.0000050
		REP-1B	<0.00010	<0.00010	<0.000050	<0.000050	0.094	0.091	<0.0000050	<0.0000050
		Mean	<0.00010	<0.00010	<0.000050	<0.000050	0.092	0.088	<0.0000050	<0.0000050
		SD	-	-	-	-	0.0035	0.0031	-	-
		PRSD	-	-	-	-	4	3	-	-
Fairford River	13-Oct-20	FR1	<0.00010	<0.00010	<0.000050	<0.000050	0.113	0.110	<0.0000050	0.0000090
		REP-2A	<0.00010	<0.00010	<0.000050	<0.000050	0.112	0.110	<0.0000050	0.0000058
		REP-2B	<0.00010	<0.00010	<0.000050	<0.000050	0.111	0.113	<0.0000050	0.0000105
		Mean	<0.00010	<0.00010	<0.000050	<0.000050	0.112	0.111	<0.0000050	0.00000843
		SD	-	-	-	-	0.0010	0.0017	-	0.00000240
		PRSD	-	-	-	-	1	2	-	-
<u>Blanks</u>										
Field Blanks	3-Sep-20	WB-2A	<0.00010	<0.00010	<0.000050	<0.000050	<0.010	<0.010	<0.0000050	<0.0000050
	2-Sep-20	WB-1A	<0.00010	<0.00010	<0.000050	<0.000050	<0.010	<0.010	<0.0000050	<0.0000050
	13-Oct-20	WB-2A	<0.00010	<0.00010	<0.000050	<0.000050	<0.010	<0.010	<0.0000050	<0.0000050
Trip Blanks	3-Sep-20	WB-2B	<0.00010	<0.00010	<0.000050	<0.000050	<0.010	<0.010	<0.0000050	<0.0000050
	2-Sep-20	WB-1B	<0.00010	<0.00010	<0.000050	<0.000050	<0.010	<0.010	<0.0000050	<0.0000050
	13-Oct-20	WB-2B	<0.00010	<0.00010	<0.000050	<0.000050	<0.010	<0.010	<0.0000050	<0.0000050

Table A2-2. continued.

Waterbody	Sampling Date	Sample ID	Calcium (Ca)		Cesium (Cs)		Chloride (Cl)	Chromium (Cr)		Cobalt (Co)	
			Dissolved	Total	Dissolved	Total	Dissolved	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>			0.05	0.050	0.000010	0.000010	0.10/0.20	0.00010	0.00010	0.00010	0.00010
<u>Replicates</u>											
Mercer Creek	1-Sep-20	MC-WB	38.9	39.3	<0.000010	<0.000010	200	<0.00010	0.00021	<0.00010	<0.00010
		REP-2A	37.9	39.0	<0.000010	<0.000010	201	<0.00010	0.00018	<0.00010	<0.00010
		REP-2B	40.1	40.2	<0.000010	<0.000010	199	<0.00010	0.00014	<0.00010	<0.00010
		Mean	39.0	39.5	<0.000010	<0.000010	200	<0.00010	0.00018	<0.00010	<0.00010
		SD	1.10	0.62	-	-	1.0	-	0.000035	-	-
		PRSD	3	2	-	-	1	-	-	-	-
Lake St. Martin	2-Sep-20	LSM1	33.8	36.4	<0.000010	0.000010	198	<0.00010	0.00025	<0.00010	0.00012
		REP-1A	33.9	35.5	<0.000010	0.000012	200	<0.00010	0.00020	<0.00010	0.00010
		REP-1B	33.7	35.1	<0.000010	0.000028	200	<0.00010	0.00025	<0.00010	0.00012
		Mean	33.8	35.7	<0.000010	0.000017	199	<0.00010	0.00023	<0.00010	0.00011
		SD	0.10	0.67	-	0.0000099	1.2	-	0.000029	-	0.000012
		PRSD	0	2	-	-	1	-	-	-	-
Fairford River	13-Oct-20	FR1	44.3	44.8	<0.000010	0.000033	205	<0.00010	0.00053	<0.00010	0.00018
		REP-2A	42.4	44.2	<0.000010	0.000030	206	<0.00010	0.00049	<0.00010	0.00018
		REP-2B	41.4	45.7	<0.000010	0.000029	206	<0.00010	0.00046	<0.00010	0.00018
		Mean	42.7	44.9	<0.000010	0.000031	206	<0.00010	0.00049	<0.00010	0.00018
		SD	1.47	0.75	-	0.0000021	0.6	-	0.000035	-	0.000000
		PRSD	3	2	-	-	0	-	-	-	-
<u>Blanks</u>											
Field Blanks	3-Sep-20	WB-2A	<0.050	<0.050	<0.000010	<0.000010	<0.10	<0.00010	<0.00010	<0.00010	<0.00010
	2-Sep-20	WB-1A	<0.050	0.066	<0.000010	<0.000010	<0.10	<0.00010	<0.00010	<0.00010	<0.00010
	13-Oct-20	WB-2A	<0.050	<0.050	<0.000010	<0.000010	<0.10	<0.00010	<0.00010	<0.00010	<0.00010
Trip Blanks	3-Sep-20	WB-2B	<0.050	<0.050	<0.000010	<0.000010	<0.10	<0.00010	<0.00010	<0.00010	<0.00010
	2-Sep-20	WB-1B	<0.050	<0.050	<0.000010	<0.000010	<0.10	<0.00010	0.00014	<0.00010	<0.00010
	13-Oct-20	WB-2B	<0.050	<0.050	<0.000010	<0.000010	<0.10	<0.00010	<0.00010	<0.00010	<0.00010

Table A2-2. continued.

Waterbody	Sampling Date	Sample ID	Copper (Cu)		Iron (Fe)		Lead (Pb)		Lithium (Li)	
			Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>			<i>0.00020</i>	<i>0.00050</i>	<i>0.010</i>	<i>0.010</i>	<i>0.000050</i>	<i>0.000050</i>	<i>0.0010</i>	<i>0.0010</i>
<u>Replicates</u>										
Mercer Creek	1-Sep-20	MC-WB	0.00020	<0.00050	<0.010	0.068	<0.000050	0.000101	0.0351	0.0309
		REP-2A	0.00021	<0.00050	<0.010	0.070	<0.000050	0.000094	0.0322	0.0308
		REP-2B	<0.00020	<0.00050	<0.010	0.047	<0.000050	0.000083	0.0326	0.0314
		Mean	<0.00020	<0.00050	<0.010	0.062	<0.000050	0.000093	0.0333	0.0310
		SD	0.000007	-	-	0.0127	-	0.0000091	0.00157	0.00032
		PRSD	-	-	-	-	-	10	5	1
Lake St. Martin	2-Sep-20	LSM1	0.00026	<0.00050	<0.010	0.082	<0.000050	0.000201	0.0322	0.0325
		REP-1A	0.00026	<0.00050	<0.010	0.079	<0.000050	0.000198	0.0343	0.0312
		REP-1B	0.00026	<0.00050	<0.010	0.085	<0.000050	0.000223	0.0344	0.0328
		Mean	0.00026	<0.00050	<0.010	0.082	<0.000050	0.000207	0.0336	0.0322
		SD	0.000000	-	-	0.0030	-	0.0000137	0.00124	0.00085
		PRSD	-	-	-	4	-	7	4	3
Fairford River	13-Oct-20	FR1	0.00032	0.00071	<0.010	0.246	<0.000050	0.000364	0.0387	0.0364
		REP-2A	0.00031	0.00067	<0.010	0.235	<0.000050	0.000348	0.0390	0.0368
		REP-2B	0.00033	0.00069	<0.010	0.232	<0.000050	0.000356	0.0383	0.0379
		Mean	0.00032	0.00069	<0.010	0.238	<0.000050	0.000356	0.0387	0.0370
		SD	0.000010	0.000020	-	0.0074	-	0.0000080	0.00035	0.00078
		PRSD	-	-	-	3	-	2	1	2
<u>Blanks</u>										
Field Blanks	3-Sep-20	WB-2A	<0.00020	<0.00050	<0.010	<0.010	<0.000050	<0.000050	<0.0010	<0.0010
	2-Sep-20	WB-1A	<0.00020	<0.00050	<0.010	<0.010	<0.000050	<0.000050	<0.0010	<0.0010
	13-Oct-20	WB-2A	<0.00020	<0.00050	<0.010	<0.010	<0.000050	<0.000050	<0.0010	<0.0010
Trip Blanks	3-Sep-20	WB-2B	<0.00020	<0.00050	<0.010	<0.010	<0.000050	<0.000050	<0.0010	<0.0010
	2-Sep-20	WB-1B	<0.00020	<0.00050	<0.010	<0.010	<0.000050	<0.000050	<0.0010	<0.0010
	13-Oct-20	WB-2B	<0.00020	<0.00050	<0.010	<0.010	<0.000050	<0.000050	<0.0010	<0.0010

Table A2-2. continued.

Waterbody	Sampling Date	Sample ID	Magnesium (Mg)		Manganese (Mn)		Mercury (Hg)		Molybdenum (Mo)	
			Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>			<i>0.0050</i>	<i>0.0050</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00000050</i>	<i>0.00000050</i>	<i>0.000050</i>	<i>0.000050</i>
<u>Replicates</u>										
Mercer Creek	1-Sep-20	MC-WB	38.3	38.9	0.00038	0.00759	<0.00000050	0.00000056	0.00218	0.00219
		REP-2A	37.8	38.8	<0.00010	0.00769	<0.00000050	0.00000060	0.00223	0.00219
		REP-2B	39.5	39.0	<0.00010	0.00726	<0.00000050	0.00000064	0.00210	0.00219
		Mean	38.5	38.9	0.00016	0.00751	<0.00000050	0.00000060	0.00217	0.00219
		SD	0.9	0.10	-	0.000225	-	0.00000040	0.000066	0.000000
		PRSD	2	0	-	3	-	-	3	0
Lake St. Martin	2-Sep-20	LSM1	36.4	36.3	<0.00010	0.00915	<0.00000050	0.00000081	0.00232	0.00229
		REP-1A	37.0	34.5	<0.00010	0.00891	<0.00000050	0.00000078	0.00234	0.00228
		REP-1B	38.0	36.7	<0.00010	0.00933	<0.00000050	0.00000082	0.00231	0.00238
		Mean	37.1	35.8	<0.00010	0.00913	<0.00000050	0.00000080	0.00232	0.00232
		SD	0.8	1.17	-	0.000211	-	0.00000021	0.000015	0.000055
		PRSD	2	3	-	2	-	-	1	2
Fairford River	13-Oct-20	FR1	34.4	39.8	0.00013	0.0161	<0.00000050	0.00000105	0.00228	0.00241
		REP-2A	33.3	40.4	0.00011	0.0156	<0.00000050	0.00000114	0.00221	0.00233
		REP-2B	33.6	40.2	<0.00010	0.0161	<0.00000050	0.00000116	0.00222	0.00240
		Mean	33.8	40.1	<0.00010	0.01593	<0.00000050	0.00000112	0.00224	0.00238
		SD	0.6	0.31	0.000042	0.000289	-	0.00000059	0.000038	0.000044
		PRSD	2	1	-	2	-	-	2	2
<u>Blanks</u>										
Field Blanks	3-Sep-20	WB-2A	<0.0050	<0.0050	<0.00010	<0.00010	<0.00000050	<0.00000050	<0.000050	<0.000050
	2-Sep-20	WB-1A	<0.0050	<0.0050	<0.00010	<0.00010	<0.00000050	<0.00000050	<0.000050	<0.000050
	13-Oct-20	WB-2A	<0.0050	<0.0050	<0.00010	<0.00010	<0.00000050	<0.00000050	<0.000050	<0.000050
Trip Blanks	3-Sep-20	WB-2B	<0.0050	0.0051	<0.00010	<0.00010	<0.00000050	<0.00000050	<0.000050	<0.000050
	2-Sep-20	WB-1B	<0.0050	<0.0050	<0.00010	<0.00010	<0.00000050	<0.00000050	<0.000050	<0.000050
	13-Oct-20	WB-2B	<0.0050	<0.0050	<0.00010	<0.00010	<0.00000050	<0.00000050	<0.000050	<0.000050

Table A2-2. continued.

Waterbody	Sampling Date	Sample ID	Nickel (Ni)		Phosphorus (P)		Potassium (K)		Rubidium (Rb)	
			Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>			<i>0.00050</i>	<i>0.00050</i>	<i>0.030</i>	<i>0.030</i>	<i>0.050</i>	<i>0.050</i>	<i>0.00020</i>	<i>0.00020</i>
<u>Replicates</u>										
Mercer Creek	1-Sep-20	MC-WB	<0.00050	0.00069	<0.030	0.041	9.90	9.89	0.00403	0.00401
		REP-2A	0.00052	0.00063	<0.030	0.044	10.1	10.1	0.00403	0.00406
		REP-2B	0.00052	0.00063	<0.030	0.037	9.94	10.0	0.00411	0.00399
		Mean	<0.00050	0.00065	<0.030	0.041	9.98	10.0	0.00406	0.00402
		SD	0.000156	0.000035	-	0.0035	0.106	0.11	0.000046	0.000036
		PRSD	-	-	-	-	1	1	1	1
Lake St. Martin	2-Sep-20	LSM1	<0.00050	0.00071	<0.030	<0.030	9.45	9.45	0.00427	0.00440
		REP-1A	<0.00050	0.00065	<0.030	<0.030	9.87	9.62	0.00410	0.00427
		REP-1B	<0.00050	0.00072	<0.030	0.032	10.0	9.79	0.00423	0.00438
		Mean	<0.00050	0.00069	<0.030	<0.030	9.77	9.6	0.00420	0.00435
		SD	-	0.000038	-	-	0.287	0.17	0.000089	0.000070
		PRSD	-	-	-	-	3	2	2	2
Fairford River	13-Oct-20	FR1	0.00053	0.00109	<0.030	0.034	10.4	10.3	0.00409	0.00451
		REP-2A	0.00051	0.00104	<0.030	0.039	9.63	10.4	0.00402	0.00448
		REP-2B	<0.00050	0.00104	<0.030	0.033	10.2	10.6	0.00406	0.00448
		Mean	<0.00050	0.00106	<0.030	0.035	10.1	10.4	0.00406	0.00449
		SD	0.000156	0.000029	-	0.0032	0.40	0.15	0.000035	0.000017
		PRSD	-	-	-	-	4	1	1	0
<u>Blanks</u>										
Field Blanks	3-Sep-20	WB-2A	<0.00050	<0.00050	<0.030	<0.030	<0.050	<0.050	<0.00020	<0.00020
	2-Sep-20	WB-1A	<0.00050	<0.00050	<0.030	<0.030	<0.050	<0.050	<0.00020	<0.00020
	13-Oct-20	WB-2A	<0.00050	<0.00050	<0.030	<0.030	<0.050	<0.050	<0.00020	<0.00020
Trip Blanks	3-Sep-20	WB-2B	<0.00050	<0.00050	<0.030	<0.030	<0.050	<0.050	<0.00020	<0.00020
	2-Sep-20	WB-1B	<0.00050	<0.00050	<0.030	<0.030	<0.050	<0.050	<0.00020	<0.00020
	13-Oct-20	WB-2B	<0.00050	<0.00050	<0.030	<0.030	<0.050	<0.050	<0.00020	<0.00020

Table A2-2. continued.

Waterbody	Sampling Date	Sample ID	Selenium (Se)		Silicon (Si)		Silver (Ag)		Sodium (Na)	
			Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>			<i>0.000050</i>	<i>0.000050</i>	<i>0.050</i>	<i>0.10</i>	<i>0.000010</i>	<i>0.000010</i>	<i>0.050</i>	<i>0.050</i>
<u>Replicates</u>										
Mercer Creek	1-Sep-20	MC-WB	0.000078	<0.000050	3.88	4.04	<0.000010	<0.000010	133	127
		REP-2A	0.000105	<0.000050	3.80	4.01	<0.000010	<0.000010	126	124
		REP-2B	0.000069	<0.000050	3.70	3.80	<0.000010	<0.000010	126	127
		Mean	0.000084	<0.000050	3.79	3.95	<0.000010	<0.000010	128	126
		SD	0.0000187	-	0.090	0.131	-	-	4.0	1.7
		PRSD	-	-	2	3	-	-	3	1
Lake St. Martin	2-Sep-20	LSM1	0.000076	0.000076	4.11	4.52	<0.000010	<0.000010	129	126
		REP-1A	0.000073	0.000080	4.26	4.36	<0.000010	<0.000010	131	125
		REP-1B	0.000079	0.000102	4.21	4.52	<0.000010	<0.000010	134	128
		Mean	0.000076	0.000086	4.19	4.47	<0.000010	<0.000010	131	126
		SD	0.0000030	0.0000140	0.076	0.092	-	-	2.5	1.5
		PRSD	-	-	2	2	-	-	2	1
Fairford River	13-Oct-20	FR1	0.000092	0.000101	4.55	4.90	<0.000010	<0.000010	133	141
		REP-2A	0.000058	0.000109	4.47	4.96	<0.000010	<0.000010	129	147
		REP-2B	0.000056	0.000086	4.58	4.93	<0.000010	<0.000010	128	149
		Mean	0.000069	0.000099	4.53	4.93	<0.000010	<0.000010	130	146
		SD	0.0000202	0.0000117	0.057	0.030	-	-	2.6	4.2
		PRSD	-	-	1	1	-	-	2	3
<u>Blanks</u>										
Field Blanks	3-Sep-20	WB-2A	<0.000050	<0.000050	<0.050	<0.10	<0.000010	<0.000010	<0.050	<0.050
	2-Sep-20	WB-1A	<0.000050	<0.000050	<0.050	<0.10	<0.000010	<0.000010	<0.050	<0.050
	13-Oct-20	WB-2A	<0.000050	<0.000050	<0.050	<0.10	<0.000010	<0.000010	<0.050	<0.050
Trip Blanks	3-Sep-20	WB-2B	<0.000050	<0.000050	<0.050	<0.10	<0.000010	<0.000010	<0.050	<0.050
	2-Sep-20	WB-1B	<0.000050	<0.000050	<0.050	<0.10	<0.000010	<0.000010	<0.050	<0.050
	13-Oct-20	WB-2B	<0.000050	<0.000050	<0.050	<0.10	<0.000010	<0.000010	<0.050	<0.050

Table A2-2. continued.

Waterbody	Sampling Date	Sample ID	Strontium (Sr)		Sulphate (SO4) Dissolved	Sulphur (S)		Tellurium (Te)		Thallium (Tl)	
			Dissolved	Total		Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>			<i>0.00010</i>	<i>0.00020</i>	<i>0.30/0.60</i>	<i>0.50</i>	<i>0.50</i>	<i>0.00020</i>	<i>0.00020</i>	<i>0.000010</i>	<i>0.000010</i>
<u>Replicates</u>											
Mercer Creek	1-Sep-20	MC-WB	0.257	0.257	97.5	31.7	31.6	<0.00020	<0.00020	<0.000010	<0.000010
		REP-2A	0.270	0.267	98.6	30.3	31.6	<0.00020	<0.00020	<0.000010	<0.000010
		REP-2B	0.258	0.258	97.6	29.7	31.6	<0.00020	<0.00020	<0.000010	<0.000010
		Mean	0.262	0.261	97.9	30.6	31.6	<0.00020	<0.00020	<0.000010	<0.000010
		SD	0.0072	0.0055	0.61	1.03	0.00	-	-	-	-
		PRSD	3	2	1	3	0	-	-	-	-
Lake St. Martin	2-Sep-20	LSM1	0.259	0.251	83.3	27.4	31.0	<0.00020	<0.00020	<0.000010	<0.000010
		REP-1A	0.252	0.255	83.3	28.5	30.1	<0.00020	<0.00020	<0.000010	<0.000010
		REP-1B	0.253	0.257	83.2	28.4	29.7	<0.00020	<0.00020	<0.000010	<0.000010
		Mean	0.255	0.254	83.3	28.1	30.3	<0.00020	<0.00020	<0.000010	<0.000010
		SD	0.0038	0.0031	0.06	0.61	0.67	-	-	-	-
		PRSD	1	1	0	2	2	-	-	-	-
Fairford River	13-Oct-20	FR1	0.265	0.296	92.1	33.3	33.7	<0.00020	<0.00020	<0.000010	<0.000010
		REP-2A	0.256	0.287	92.7	34.0	33.8	<0.00020	<0.00020	<0.000010	<0.000010
		REP-2B	0.255	0.295	92.5	33.4	34.5	<0.00020	<0.00020	<0.000010	<0.000010
		Mean	0.259	0.293	92.4	33.6	34.0	<0.00020	<0.00020	<0.000010	<0.000010
		SD	0.0055	0.0049	0.31	0.38	0.44	-	-	-	-
		PRSD	2	2	0	1	1	-	-	-	-
<u>Blanks</u>											
Field Blanks	3-Sep-20	WB-2A	0.00015	<0.00020	<0.30	<0.50	<0.50	<0.00020	<0.00020	<0.000010	<0.000010
	2-Sep-20	WB-1A	0.00027	0.00037	<0.30	<0.50	<0.50	<0.00020	<0.00020	<0.000010	<0.000010
	13-Oct-20	WB-2A	<0.00010	<0.00020	<0.30	<0.50	<0.50	<0.00020	<0.00020	<0.000010	<0.000010
Trip Blanks	3-Sep-20	WB-2B	<0.00010	<0.00020	<0.30	<0.50	<0.50	<0.00020	<0.00020	<0.000010	<0.000010
	2-Sep-20	WB-1B	<0.00010	<0.00020	<0.30	<0.50	<0.50	<0.00020	<0.00020	<0.000010	<0.000010
	13-Oct-20	WB-2B	<0.00010	<0.00020	<0.30	<0.50	0.68	<0.00020	<0.00020	<0.000010	<0.000010

Table A2-2. continued.

Waterbody	Sampling Date	Sample ID	Thorium (Th)		Tin (Sn)		Titanium (Ti)		Tungsten (W)	
			Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>			<i>0.00010</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00010</i>	<i>0.00030</i>	<i>0.00030</i>	<i>0.00010</i>	<i>0.00010</i>
<u>Replicates</u>										
Mercer Creek	1-Sep-20	MC-WB	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00354	<0.00010	<0.00010
		REP-2A	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00306	<0.00010	<0.00010
		REP-2B	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00214	<0.00010	<0.00010
		Mean	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00291	<0.00010	<0.00010
		SD	-	-	-	-	-	0.000711	-	-
		PRSD	-	-	-	-	-	24	-	-
Lake St. Martin	2-Sep-20	LSM1	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00373	<0.00010	<0.00010
		REP-1A	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00386	<0.00010	<0.00010
		REP-1B	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00437	<0.00010	<0.00010
		Mean	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00399	<0.00010	<0.00010
		SD	-	-	-	-	-	0.000338	-	-
		PRSD	-	-	-	-	-	8	-	-
Fairford River	13-Oct-20	FR1	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00988	<0.00010	<0.00010
		REP-2A	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00968	<0.00010	<0.00010
		REP-2B	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00910	<0.00010	<0.00010
		Mean	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	0.00955	<0.00010	<0.00010
		SD	-	-	-	-	-	0.000405	-	-
		PRSD	-	-	-	-	-	4	-	-
<u>Blanks</u>										
Field Blanks	3-Sep-20	WB-2A	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	<0.00030	<0.00010	<0.00010
	2-Sep-20	WB-1A	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	<0.00030	<0.00010	<0.00010
	13-Oct-20	WB-2A	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	<0.00030	<0.00010	<0.00010
Trip Blanks	3-Sep-20	WB-2B	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	<0.00030	<0.00010	<0.00010
	2-Sep-20	WB-1B	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	<0.00030	<0.00010	<0.00010
	13-Oct-20	WB-2B	<0.00010	<0.00010	<0.00010	<0.00010	<0.00030	<0.00030	<0.00010	<0.00010

Table A2-2. continued.

Waterbody	Sampling Date	Sample ID	Uranium (U)		Vanadium (V)		Zinc (Zn)		Zirconium (Zr)	
			Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
<i>Analytical DL</i>			<i>0.000010</i>	<i>0.000010</i>	<i>0.00050</i>	<i>0.00050</i>	<i>0.0010</i>	<i>0.0030</i>	<i>0.00020</i>	<i>0.00020</i>
<u>Replicates</u>										
Mercer Creek	1-Sep-20	MC-WB	0.00167	0.00160	0.00130	0.00186	<0.0010	<0.0030	<0.00020	<0.00020
		REP-2A	0.00168	0.00160	0.00125	0.00179	<0.0010	<0.0030	<0.00020	<0.00020
		REP-2B	0.00170	0.00162	0.00123	0.00173	<0.0010	<0.0030	<0.00020	<0.00020
		Mean	0.00168	0.00161	0.00126	0.00179	<0.0010	<0.0030	<0.00020	<0.00020
		SD	0.000015	0.000012	0.000036	0.000065	-	-	-	-
		PRSD	1	1	-	-	-	-	-	-
Lake St. Martin	2-Sep-20	LSM1	0.00168	0.00171	0.00156	0.00217	<0.0010	<0.0030	<0.00020	<0.00020
		REP-1A	0.00163	0.00169	0.00161	0.00209	<0.0010	<0.0030	<0.00020	<0.00020
		REP-1B	0.00163	0.00173	0.00163	0.00225	<0.0010	<0.0030	<0.00020	<0.00020
		Mean	0.00165	0.00171	0.00160	0.00217	<0.0010	<0.0030	<0.00020	<0.00020
		SD	0.000029	0.000020	0.000036	0.000080	-	-	-	-
		PRSD	2	1	-	-	-	-	-	-
Fairford River	13-Oct-20	FR1	0.00185	0.00178	0.00126	0.00222	<0.0010	<0.0030	<0.00020	<0.00020
		REP-2A	0.00189	0.00178	0.00123	0.00222	<0.0010	<0.0030	<0.00020	<0.00020
		REP-2B	0.00184	0.00178	0.00125	0.00215	<0.0010	<0.0030	<0.00020	<0.00020
		Mean	0.00186	0.00178	0.00125	0.00220	<0.0010	<0.0030	<0.00020	<0.00020
		SD	0.000026	0.000000	0.000015	0.000040	-	-	-	-
		PRSD	1	0	-	-	-	-	-	-
<u>Blanks</u>										
Field Blanks	3-Sep-20	WB-2A	<0.000010	<0.000010	<0.00050	<0.00050	<0.0010	<0.0030	<0.00020	<0.00020
	2-Sep-20	WB-1A	<0.000010	<0.000010	<0.00050	0.00051	<0.0010	<0.0030	<0.00020	<0.00020
	13-Oct-20	WB-2A	<0.000010	<0.000010	<0.00050	<0.00050	<0.0010	<0.0030	<0.00020	<0.00020
Trip Blanks	3-Sep-20	WB-2B	<0.000010	<0.000010	<0.00050	<0.00050	<0.0010	<0.0030	<0.00020	<0.00020
	2-Sep-20	WB-1B	<0.000010	<0.000010	<0.00050	<0.00050	<0.0010	<0.0030	<0.00020	<0.00020
	13-Oct-20	WB-2B	<0.000010	<0.000010	<0.00050	<0.00050	<0.0010	<0.0030	<0.00020	<0.00020

APPENDIX 3. RESULTS FOR ADDITIONAL PARAMETERS

Table A3-1. Laboratory results for additional parameters measured at selected sites in September 2020.

Parameter	Units	DL	BC-LSM	FR1	DR-A
			L2497954-5 1-Sep-20	L2497954-6 1-Sep-20	L2497954-7 2-Sep-20
Escherichia Coli	MPN/100mL	1	9	308	2
Microcystin	µg/L	0.20	<0.20	<0.20	<0.20
<u>Cyanobacteria cell count</u>					
Anabaena (Cyanophyceae)	cells/mL	1	-	372	60
Aphanocapsa (Cyanophyceae)	cells/mL	1	-	29700	49500
Aphanothece (Cyanophyceae)	cells/mL	1	-	310	-
Chroococcus (Cyanophyceae)	cells/mL	1	-	336	64
Gomphosphaeria (Cyanophyceae)	cells/mL	1	-	1550	550
Merismopedia (Cyanophyceae)	cells/mL	1	-	31700	66500
Planktolyngbya (Cyanophyceae)	cells/mL	1	160	19800	7920
Planktothrix (Cyanophyceae)	cells/mL	1	30	-	60
Pseudanabaena (Cyanophyceae)	cells/mL	1	220	-	-
Other blue-greens	cells/mL	1	-	74300	233000
Total cyanobacterial cell count	cells/mL	1	410	158000	358000
<u>Hydrocarbons</u>					
Benzene	mg/L	0.00050	<0.00050	<0.00050	<0.00050
Ethyl benzene	mg/L	0.00050	<0.00050	<0.00050	<0.00050
Toluene	mg/L	0.0010	<0.0010	<0.0010	<0.0010
o-Xylene	mg/L	0.00050	<0.00050	<0.00050	<0.00050
m+p-Xylenes	mg/L	0.00040	<0.00040	<0.00040	<0.00040
Xylenes (Total)	mg/L	0.00064	<0.00064	<0.00064	<0.00064
F1 (C6-C10)	mg/L	0.10	<0.10	<0.10	<0.10
F1-BTEX	mg/L	0.10	<0.10	<0.10	<0.10
F2-Naphth	mg/L	0.10	<0.10	<0.10	<0.10
F2 (C10-C16)	mg/L	0.10	<0.10	<0.10	<0.10
F3-PAH	mg/L	0.25	<0.25	<0.25	<0.25
F3 (C16-C34)	mg/L	0.25	<0.25	<0.25	<0.25
F4 (C34-C50)	mg/L	0.25	<0.25	<0.25	<0.25
Total Hydrocarbons (C6-C50)	mg/L	0.38	<0.38	<0.38	<0.38
Acenaphthene	mg/L	0.000020	0.000034	<0.000020	<0.000020
Acenaphthylene	mg/L	0.000020	<0.000020	<0.000020	<0.000020
Acridine	mg/L	0.000020	<0.000020	<0.000020	<0.000020
Anthracene	mg/L	0.000010	<0.000010	<0.000010	<0.000010
Benzo(a)anthracene	mg/L	0.000010	<0.000010	<0.000010	<0.000010
Benzo(a)pyrene	mg/L	0.0000050	<0.0000050	<0.0000050	<0.0000050
Benzo(b&j)fluoranthene	mg/L	0.000010	<0.000010	<0.000010	<0.000010
Benzo(g,h,i)perylene	mg/L	0.000020	<0.000020	<0.000020	<0.000020
Benzo(k)fluoranthene	mg/L	0.000010	<0.000010	<0.000010	<0.000010

Table A3-1. continued.

Parameter	Units	DL	BC-LSM	FR1	DR-A
			L2497954-5 1-Sep-20	L2497954-6 1-Sep-20	L2497954-7 2-Sep-20
Chrysene	mg/L	0.000020	<0.000020	<0.000020	<0.000020
Dibenzo(a,h)anthracene	mg/L	0.000050	<0.000050	<0.000050	<0.000050
Fluoranthene	mg/L	0.000020	<0.000020	<0.000020	<0.000020
Fluorene	mg/L	0.000020	<0.000020	<0.000020	<0.000020
Indeno(1,2,3-cd)pyrene	mg/L	0.000010	<0.000010	<0.000010	<0.000010
1-Methyl Naphthalene	mg/L	0.000020	<0.000020	<0.000020	<0.000020
2-Methyl Naphthalene	mg/L	0.000020	<0.000020	<0.000020	<0.000020
Naphthalene	mg/L	0.000050	<0.000050	<0.000050	<0.000050
Phenanthrene	mg/L	0.000050	<0.000050	<0.000050	<0.000050
Pyrene	mg/L	0.000010	<0.000010	<0.000010	<0.000010
Quinoline	mg/L	0.000020	<0.000020	<0.000020	<0.000020
B(a)P Total Potency Equivalent	mg/L	0.000030	<0.000030	<0.000030	<0.000030
<u>Pesticides</u>					
Aldrin	µg/L	0.0080	<0.0080	<0.0080	<0.0080
alpha-BHC	µg/L	0.0080	<0.0080	<0.0080	<0.0080
beta-BHC	µg/L	0.0080	<0.0080	<0.0080	<0.0080
gamma-hexachlorocyclohexane	µg/L	0.0080	<0.0080	<0.0080	<0.0080
delta-BHC	µg/L	0.0080	<0.0080	<0.0080	<0.0080
a-chlordane	µg/L	0.0080	<0.0080	<0.0080	<0.0080
g-chlordane	µg/L	0.0080	<0.0080	<0.0080	<0.0080
o,p-DDD	µg/L	0.0040	<0.0040	<0.0040	<0.0040
pp-DDD	µg/L	0.0040	<0.0040	<0.0040	<0.0040
o,p-DDE	µg/L	0.0040	<0.0040	<0.0040	<0.0040
pp-DDE	µg/L	0.0040	<0.0040	<0.0040	<0.0040
op-DDT	µg/L	0.0040	<0.0040	<0.0040	<0.0040
pp-DDT	µg/L	0.0040	<0.0040	<0.0040	<0.0040
Dieldrin	µg/L	0.0080	<0.0080	<0.0080	<0.0080
Endosulfan I	µg/L	0.0070	<0.0070	<0.0070	<0.0070
Endosulfan II	µg/L	0.0070	<0.0070	<0.0070	<0.0070
Diclofop-methyl	mg/L	0.00010	<0.00010	<0.00010	<0.00010
Triallate	mg/L	0.00010	<0.00010	<0.00010	<0.00010
Trifluralin	mg/L	0.00010	<0.00010	<0.00010	<0.00010