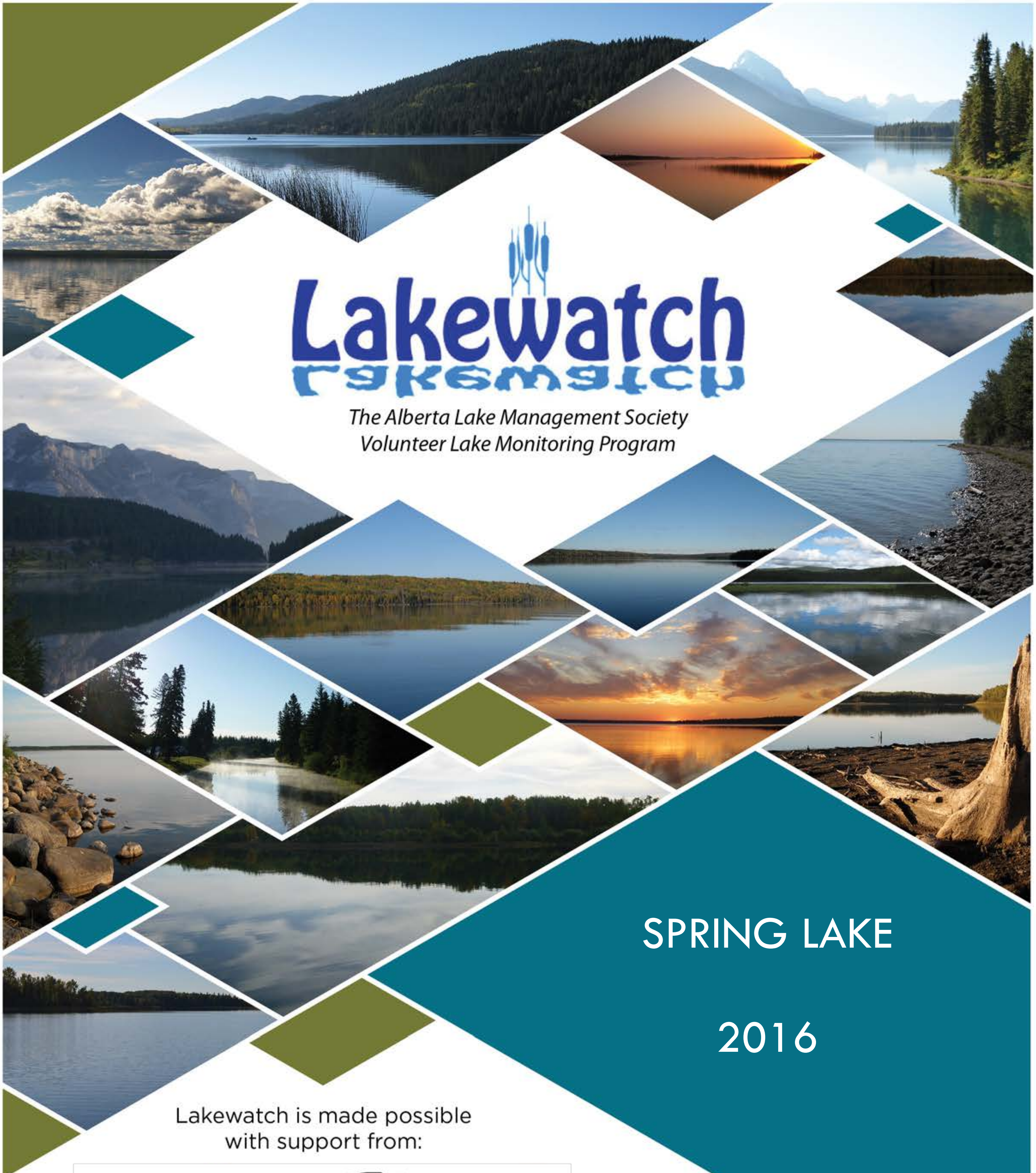

Lakewatch

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

SPRING LAKE

2016

Lakewatch is made possible
with support from:

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Environment and Climate Change Canada / Environnement et Changement climatique Canada
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Cargill
LICA Lakeland Industry & Community Association
Beaver River Watershed Alliance
Red Deer River Watershed Alliance
MD61 Wainwright

ALBERTA LAKE MANAGEMENT SOCIETY'S LAKEWATCH PROGRAM

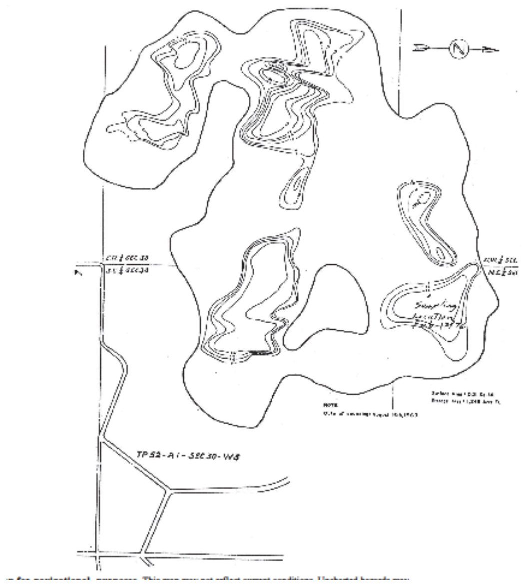
LakeWatch has several important objectives, one of which is to collect and interpret water quality data on Alberta Lakes. Equally important is educating lake users about their aquatic environment, encouraging public involvement in lake management, and facilitating cooperation and partnerships between government, industry, the scientific community and lake users. LakeWatch Reports are designed to summarize basic lake data in understandable terms for a lay audience and are not meant to be a complete synopsis of information about specific lakes. Additional information is available for many lakes that have been included in LakeWatch and readers requiring more information are encouraged to seek those sources.

ALMS would like to thank all who express interest in Alberta's aquatic environments and particularly those who have participated in the LakeWatch program. These people prove that ecological apathy can be overcome and give us hope that our water resources will not be the limiting factor in the health of our environment.

ACKNOWLEDGEMENTS

The LakeWatch program is made possible through the dedication of its volunteers. We would like to extend a special thanks to Stan Otto for the time and energy put into sampling Spring Lake in 2016. We would also like to thank Alicia Kennedy, Ageleky Bouzetos, and Breda Muldoon who were summer technicians in 2016. Executive Director Bradley Peter was instrumental in planning and organizing the field program. Alicia Kennedy was instrumental in report design. This report was prepared by Bradley Peter and Laura Redmond. The Beaver River Watershed, the Lakeland Industry and Community Association, Environment Canada, and Alberta Environment and Parks are major sponsors of the LakeWatch program.

SPRING LAKE



Located 28 km west of Edmonton in Parkland County, Spring Lake is a popular summer village, and has been since the early 1900's. Also commonly known as Edmonton Beach Lake, Spring Lake hosts many cottagers and day-users from surrounding areas each year. Edmonton Beach Resort is located on the southeast corner of the lake, and offers a variety of recreational activities such as swimming, hiking, boating and camping.

The shores of Spring Lake were homesteaded in 1894, when it was then called Schimpf's Lake. The name has changed over the years with changing ownership, but the underground springs that feed the lake inspired the final name, Spring Lake[1]. Spring Lake is 2.4 km long and 2.2 km wide, with a large island in its eastern basin. The lake has an extensive littoral zone, and has a mean depth of less than 2 m. The shoreline is irregular, and years of water level variation have led to a grassy buffer zone along the majority of the shore. Since 1939, water levels have fluctuated from a high of 726.36 m to a low of 722.99 m in 1968. Water levels have remained relatively stable since the 1960s[2]. Spring Lake is located in the Moist Mixedwood subregion of the Boreal Mixedwood Ecoregion [3]. The surrounding areas are predominately agricultural land use activities.

The watershed area for Spring Lake is 4.97 km^2 and the lake area is 0.69 km^2. The lake to watershed ratio of Spring Lake is 1:7. A map of the Spring Lake watershed area can be found at http://alms.ca/wp-content/uploads/2016/12/Spring.pdf.

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[1] Stony Plain and District Historical Society. 1982. Along the fifth-A history of Stony Plain and district. Stony Plain Hist. Soc., Stony Plain

[2] Atlas of Alberta. 1990. University of Alberta Press.

[3] Strong, W.L. and K.R. Leggat. 1981. Ecoregions of Alberta. Alta. En. Nat. Resour., Resour. Eval. Plan. Div., Edmonton.

WATER CHEMISTRY

ALMS measures a suite of water chemistry parameters. Phosphorus, nitrogen, and chlorophyll-a are important because they are indicators of eutrophication, or excess nutrients, which can lead to harmful algal/cyanobacteria blooms. One direct measure of harmful cyanobacteria blooms are Microcystins, a common group of toxins produced by cyanobacteria. See Table 2 for a complete list of parameters.

The average total phosphorus (TP) concentration of Spring Lake in 2016 was 18 µg/L (Table 2). This classifies Spring Lake as mesotrophic. A maximum TP concentration of 21 ug/L was observed on the first three sampling trips to Spring Lake in 2016.

The average chlorophyll-*a* concentration was 10.2 µg/L, putting Spring Lake just into the eutrophic, or productive, classification (Table 2). Chlorophyll-*a* concentrations peaked at 18.2 µg/L on August 12, and then decreased to below 10 µg/L later in the summer (Figure 1).

TKN remained relatively stable over the course of the summer, with an average concentration of 1.48 mg/L (Table 2). TKN decreased to 1.3 mg/L on August 26, and then increased again to 1.5 mg/L (Figure 1).

Average pH measured as 8.19 in 2016, buffered by moderate alkalinity (136 mg/L $CaCO_3$) and bicarbonate (164 mg/L HCO_3). Magnesium, calcium and sulphate were the dominant ions contributing to a moderate conductivity measure of 770 uS/cm (Table 2).

METALS

Samples were analyzed for metals once throughout the summer (Table 3). In total, 27 metals were sampled for. It should be noted that many metals are naturally present in aquatic environments due to the weathering of rocks and may only become toxic at higher levels.

Metals were measured once at Spring Lake and all measured values fell within their respective guidelines (Table 3).

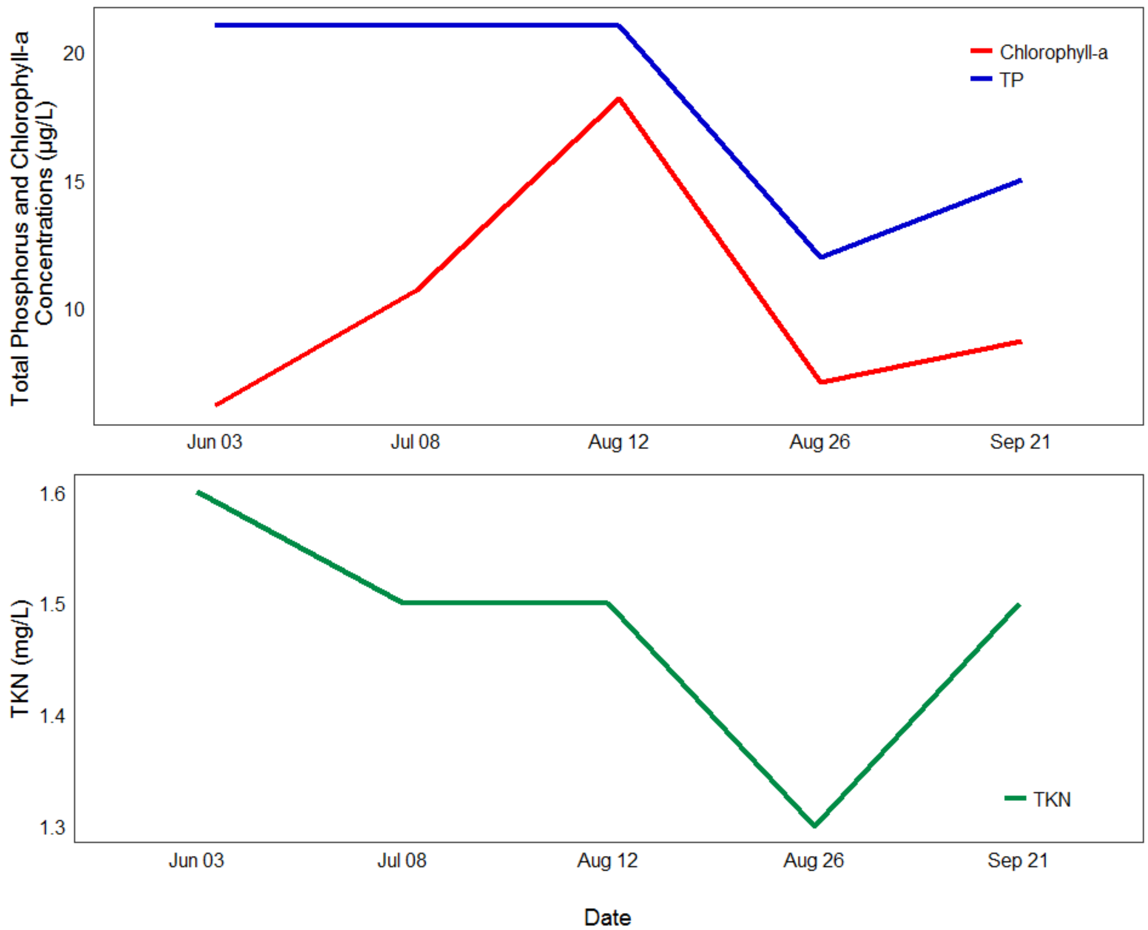

Figure 1- Total Phosphorus (TP), Total Kjeldahl Nitrogen (TKN), and Chlorophyll-*a* concentrations measured five times over the course of the summer at Spring Lake.

WATER CLARITY AND SECCHI DEPTH

Water clarity is influenced by suspended materials, both living and dead, as well as dissolved colored compounds in the water column. During the melting of snow and ice in spring, lake water can become turbid (cloudy) from silt transported into the lake. Lake water usually clears in late spring but then becomes more turbid with increased algal growth as the summer progresses. The easiest and most widely used measure of lake water clarity is the Secchi disk depth. Two times the Secchi disk depth equals the euphotic depth – the depth to which there is enough light for photosynthesis.

Average Secchi depth of Spring Lake was 2.7 m (Table 2). This classifies Spring Lake as mesotrophic. A maximum Secchi depth of 4.00 m was observed on June 3 (Figure 2). From July to September, Secchi depth remained stable at around 2.5 m. Given the depth of Spring Lake, most of the lake, except at the deepest point, is in the euphotic zone.

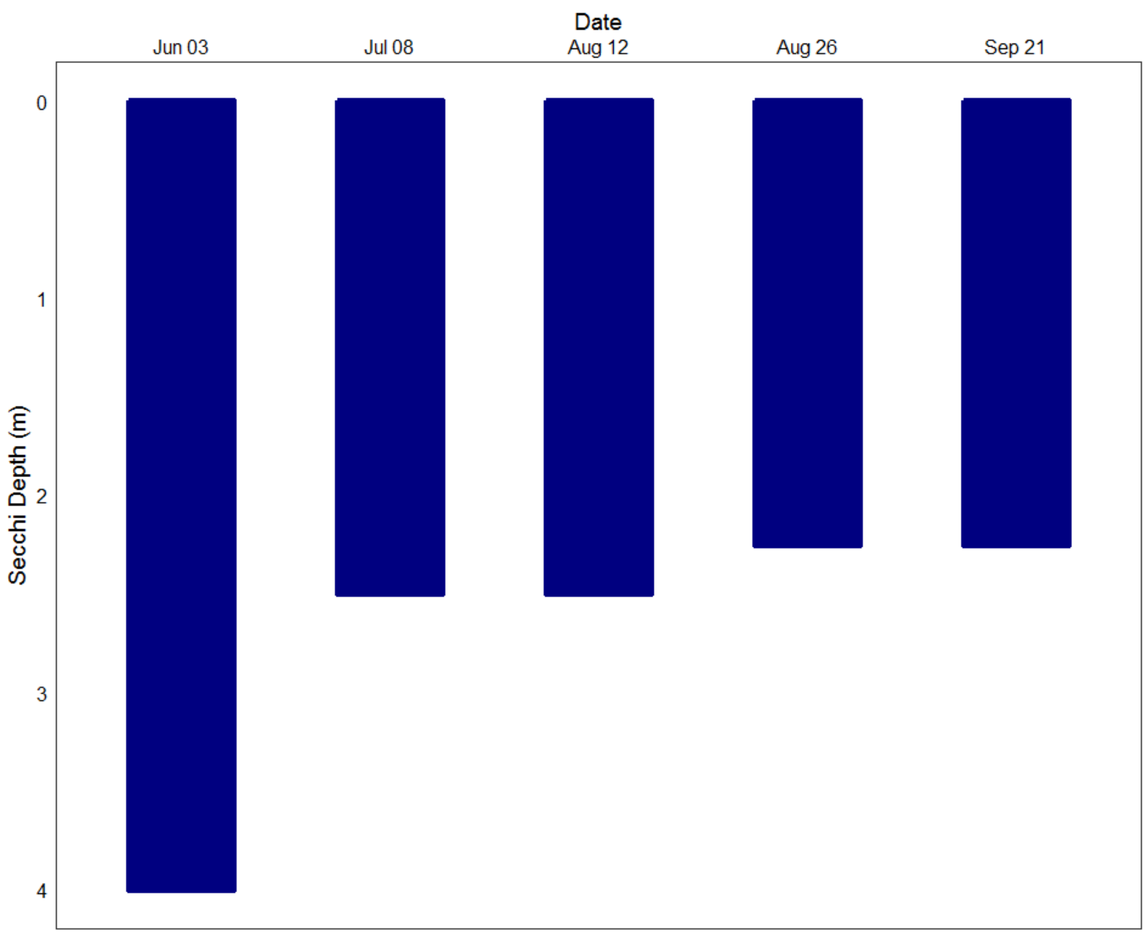

Figure 2 – Secchi depth values measured five times over the course of the summer at Spring Lake in 2016.

WATER TEMPERATURE AND DISSOLVED OXYGEN

Water temperature and dissolved oxygen profiles in the water column can provide information on water quality and fish habitat. The depth of the thermocline is important in determining the depth to which dissolved oxygen from the surface can be mixed. Please refer to the end of this report for descriptions of technical terms.

Water temperature varied over the course of the summer, with the maximum surface temperature being measured on July 8 as 23.12 °C (Figure 3a). Spring Lake was weakly thermally stratified on all dates except September 21, when the entire water column was around 13°C.

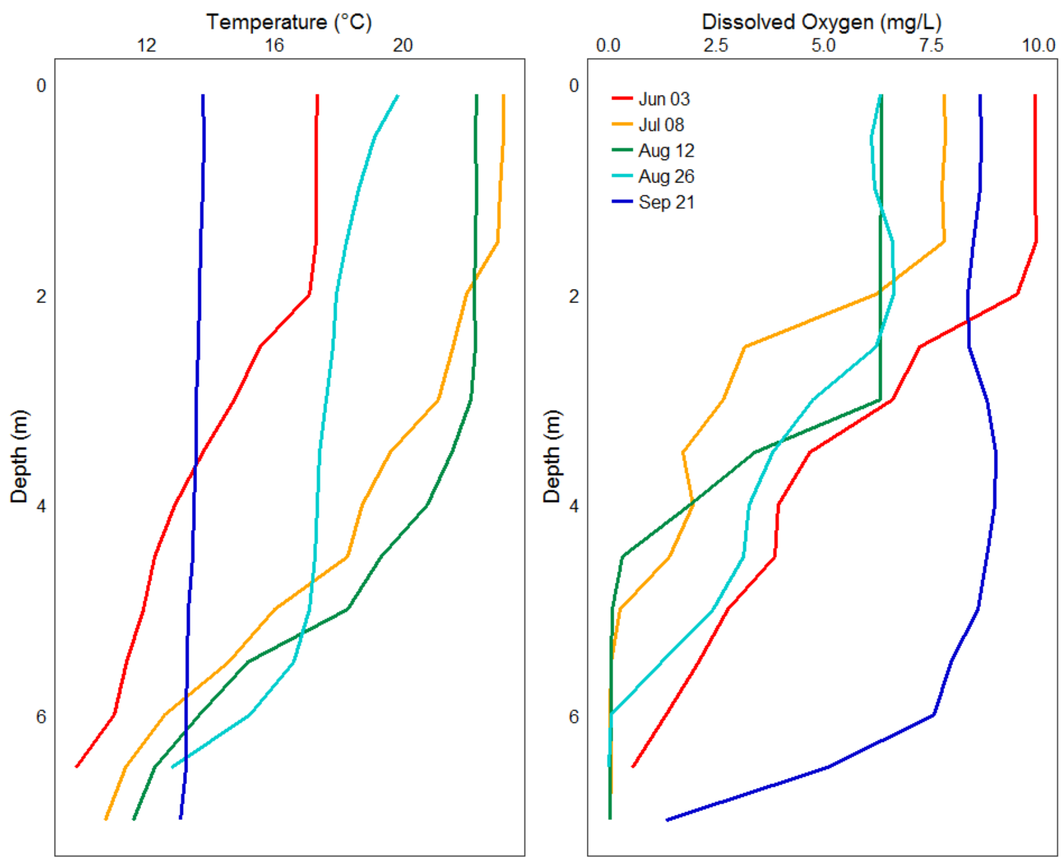

Figure 3 – a) Temperature (°C) and b) dissolved oxygen (mg/L) profiles for Spring Lake measured five times over the course of the summer of 2016.

Spring Lake remained well oxygenated at the surface throughout the summer, measuring above the Canadian Council for Ministers of the Environment guidelines of 6.5 mg/L for the Protection of Aquatic Life in June, July and September (Figure 3b). However, DO levels dropped slightly below this guideline in August. Due to weak thermal stratification and decomposition on the lake bottom, oxygen tended to decline with depth. In September, oxygen levels improved after a mixing of the water column.

MICROCYSTIN

Microcystins are toxins produced by cyanobacteria (blue-green algae) which, when ingested, can cause severe liver damage. Microcystins are produced by many species of cyanobacteria which are common to Alberta's Lakes, and are thought to be the one of the most common cyanobacteria toxins. In Alberta, recreational guidelines for microcystin are set at 20 µg/L.

Table 1 – Microcystin concentrations measured five times at Spring Lake in 2016. Microcystin levels remained below recommended guidelines on all sampling dates.

Date	Microcystin Concentration (µg/L)
Jun 3	0.05
Jul 8	0.16
Aug 12	0.11
Aug 26	0.05
Sep 21	0.10
Average	0.094

INVASIVE SPECIES MONITORING

Dreissenid mussels pose a significant concern for Alberta because they impair the function of water conveyance infrastructure and adversely impact the aquatic environment. These invasive mussels have been linked to creating toxic algae blooms, decreasing the amount of nutrients needed for fish and other native species, and causing millions of dollars in annual costs for repair and maintenance of water-operated infrastructure and facilities.

Monitoring involved two components: monitoring for juvenile mussel veligers using a plankton net and monitoring for attached adult mussels using substrates installed in each lake. In 2016, no invasive mussels were detected in Spring Lake.

Table 2: Average Secchi depth and water chemistry values for Spring Lake.

Parameter	2016
TP (µg/L)	18
TDP (µg/L)	5
Chlorophyll-*a* (µg/L)	10.2
Secchi depth (m)	2.7
TKN (mg/L)	1.48
NO_2 and NO_3 (µg/L)	3
NH_3 (µg/L)	55.2
DOC (mg/L)	16
Ca (mg/L)	41.8
Mg (mg/L)	59.4
Na (mg/L)	31.6
K (mg/L)	14.2
SO_4^{2-} (mg/L)	236
Cl^- (mg/L)	9.08
CO_3 (mg/L)	0.25
HCO_3 (mg/L)	164
pH	8.19
Conductivity (µS/cm)	770
Hardness (mg/L)	348
TDS (mg/L)	476
Microcystin (µg/L)	0.094
Total Alkalinity (mg/L $CaCO_3$)	136

Table 3: Concentrations of metals measured once in Spring Lake. The CCME heavy metal Guidelines for the Protection of Freshwater Aquatic Life (unless otherwise indicated) are presented for reference.

Metals (Total Recoverable)	2016	Guidelines
Aluminum µg/L	2.8	100[a]
Antimony µg/L	0.126	6[d]
Arsenic µg/L	2.34	5
Barium µg/L	63.2	1000[d]
Beryllium µg/L	0.004	100[c,e]
Bismuth µg/L	5.00E-04	/
Boron µg/L	248	1500
Cadmium µg/L	0.001	0.26[b]
Chromium µg/L	0.08	/
Cobalt µg/L	0.005	1000[e]
Copper µg/L	1.03	4[b]
Iron µg/L	7.7	300
Lead µg/L	0.016	7[b]
Lithium µg/L	106	2500[f]
Manganese µg/L	153	200[f]
Molybdenum µg/L	0.073	73[c]
Nickel µg/L	0.004	150[b]
Selenium µg/L	0.14	1
Silver µg/L	0.001	0.25
Strontium µg/L	341	/
Thallium µg/L	0.00045	0.8
Thorium µg/L	0.005	/
Tin µg/L	0.024	/
Titanium µg/L	0.76	/
Uranium µg/L	0.255	15
Vanadium µg/L	0.27	100[e,f]
Zinc µg/L	1.5	30

Values represent means of total recoverable metal concentrations.
[a] Based on pH ≥ 6.5
[b] Based on water hardness > 180mg/L (as $CaCO_3$)
[c] CCME interim value.
[d] Based on Canadian Drinking Water Quality guideline values.
[e] Based on CCME Guidelines for Agricultural use (Livestock Watering).
[f] Based on CCME Guidelines for Agricultural Use (Irrigation).
A forward slash (/) indicates an absence of data or guidelines.