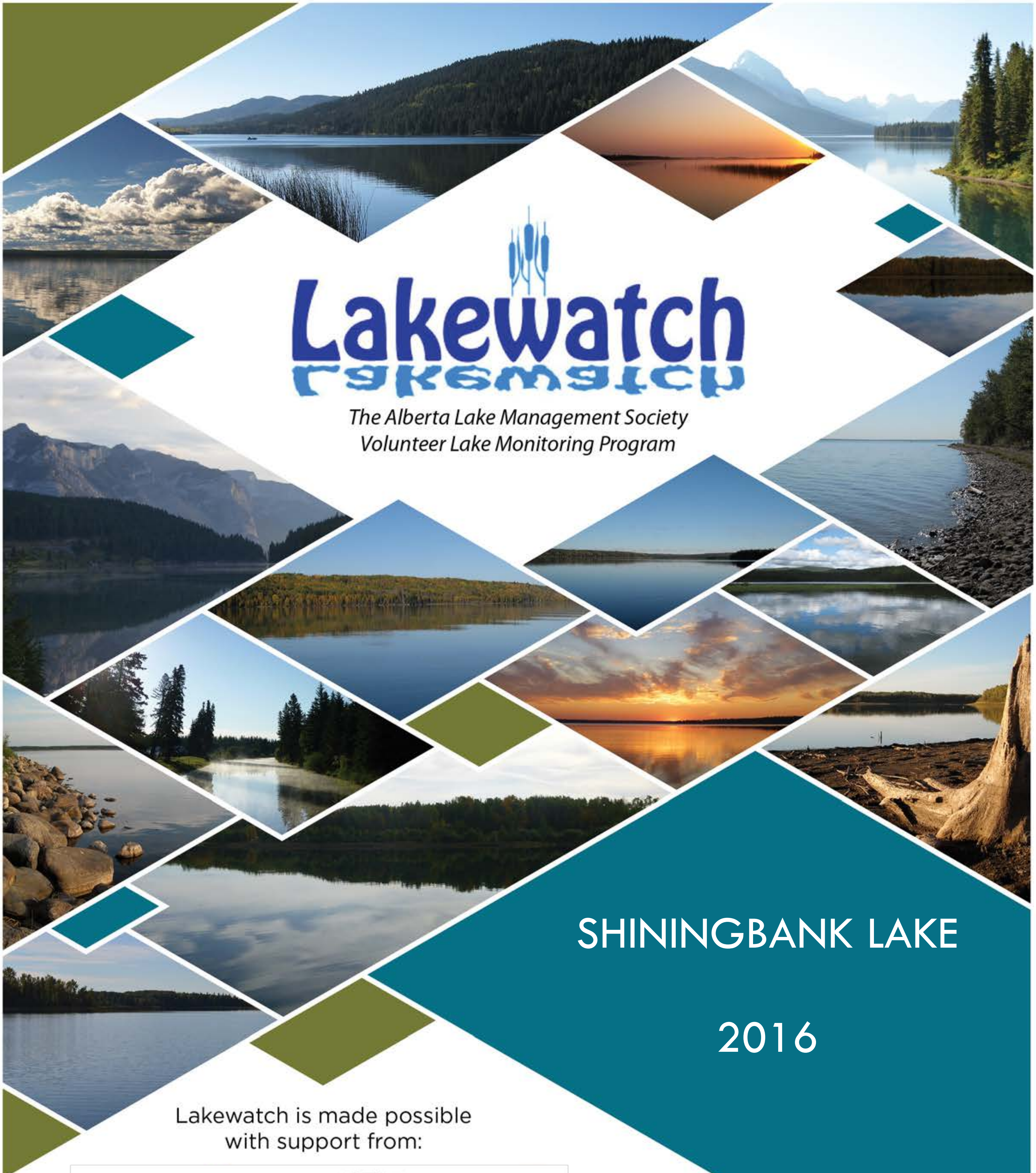

Lakewatch

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

SHININGBANK LAKE

2016

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Environment and Climate Change Canada / Environnement et Changement climatique Canada
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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 Calvin Kerr for the time and energy put into sampling Shiningbank 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.

SHININGBANK LAKE

Shiningbank Lake is located approximately 250 km west of Edmonton, and 24 km north of Peers along Hwy 32. The lake provides a recreational area for boating, swimming, fishing and camping. Campsites and boat launches are located on the south central shore, and day-use is available on the southwest shore. Swimmers should check local updates, as blue-green algae blooms have been observed between 2012 and 2015. Water quality is monitored at Shiningbank Lake Campground Beach weekly from May 30th to September 1st.

The surface area of Shiningbank Lake is 456 ha [1]. The surrounding areas are primarily farmland, but the lake itself lies within an aspen grove. Shiningbank Lake supports a summer sport fishery for walleye and northern pike, although both fisheries are classified as vulnerable [2].

The watershed area for Shiningbank Lake is 178.32 km^2 and the lake area is 4.56 km^2. The lake to watershed ratio of Shiningbank Lake is 1:39. A map of the Shiningbank Lake watershed area can be found http://alms.ca/wp-content/uploads/2016/12/Shiningbank.pdf.

Shining Bank Lake, 2016. Photo by Breda Muldoon

[1] Government of Alberta, 2009

[2] Blackburn, ACA 2004: http://www.ab-conservation.com/publications/report-series/status-of-the-summer-sport-fishery-for-walleye-and-northern-pike-at-shiningbank-lake-alberta-2004/

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 in 2016 was 43 µg/L (Table 2), classifying Shiningbank Lake as eutrophic, or productive. In June, TP levels were at a seasonal minimum of 17 µg/L, and increased to a maximum on August 2 with a concentration of 75 µg/L (Figure 1).

Average chlorophyll-*a* concentrations were 46.5 µg/L (Table 2), classifying Shiningbank Lake as hypereutrophic, or very productive. Chlorophyll-*a* concentrations peaked in early August and declined toward the final sample date in September.

The average TKN concentration measured in Shiningbank Lake in 2016 was 1.01 mg/L (Table 2). TKN peaked on August 2 at 1.5 mg/L, mirroring TP and chlorophyll-*a* concentrations (Figure 1).

Average pH measured as 8.46 in 2016, buffered by moderate alkalinity (198 mg/L $CaCO_3$) and bicarbonate (234 mg/L HCO_3). Calcium and sodium were the dominant ions contributing to a low conductivity measure of 388 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 Shiningbank Lake and all measured values fell within their respective guidelines (Table 3).

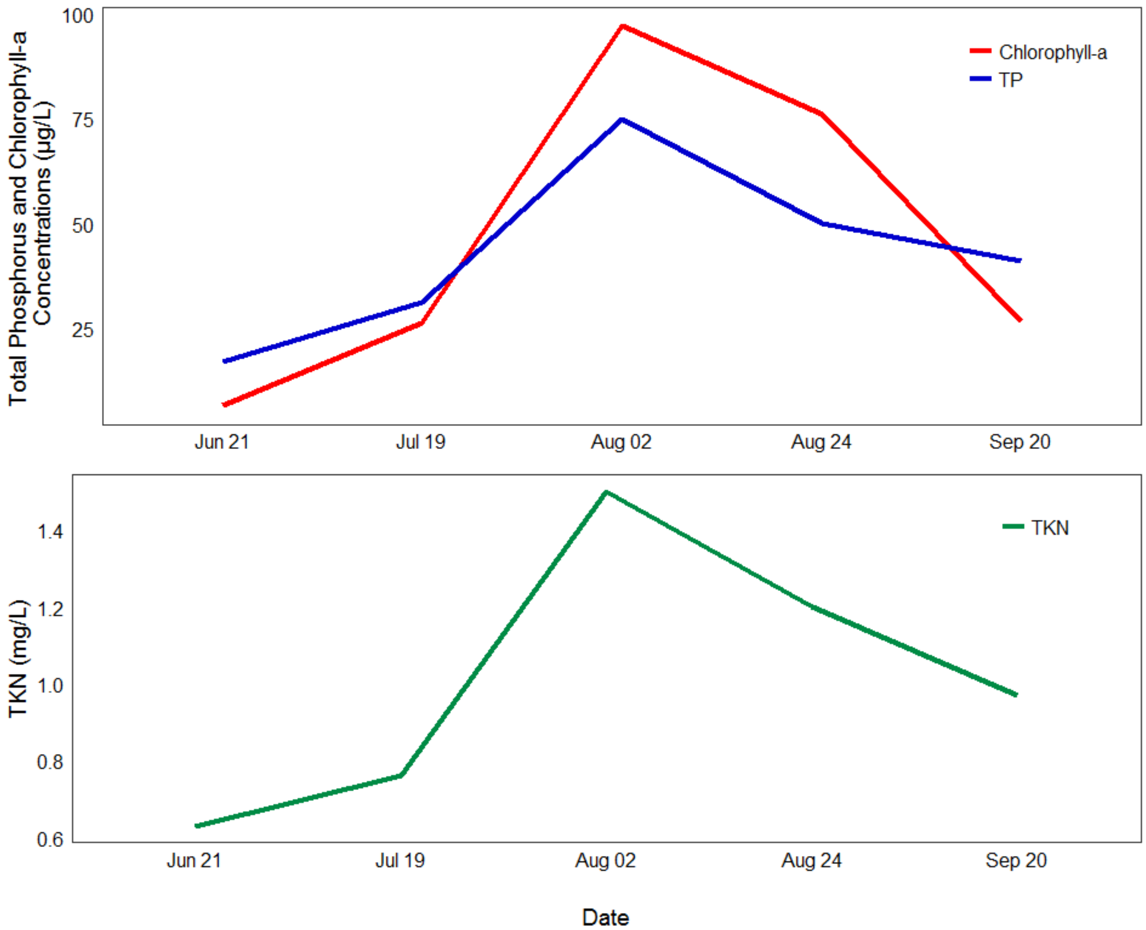

Figure 1- Total Phosphorus (TP), Total Kjeldahl Nitrogen (TKN), and Chlorophyll-*a* concentrations measured five times over the course of the summer at Shiningbank Lake.

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.

The average Secchi depth of Shiningbank Lake was 1.4 m (Table 2). This value puts Shiningbank Lake in the eutrophic, or productive, trophic status classification. As concentrations of chlorophyll-*a* increased throughout the summer, Secchi depth values declined. Chlorophyll-*a* (phytoplankton concentrations) appear to be the primary factor driving water clarity values at Shiningbank Lake.

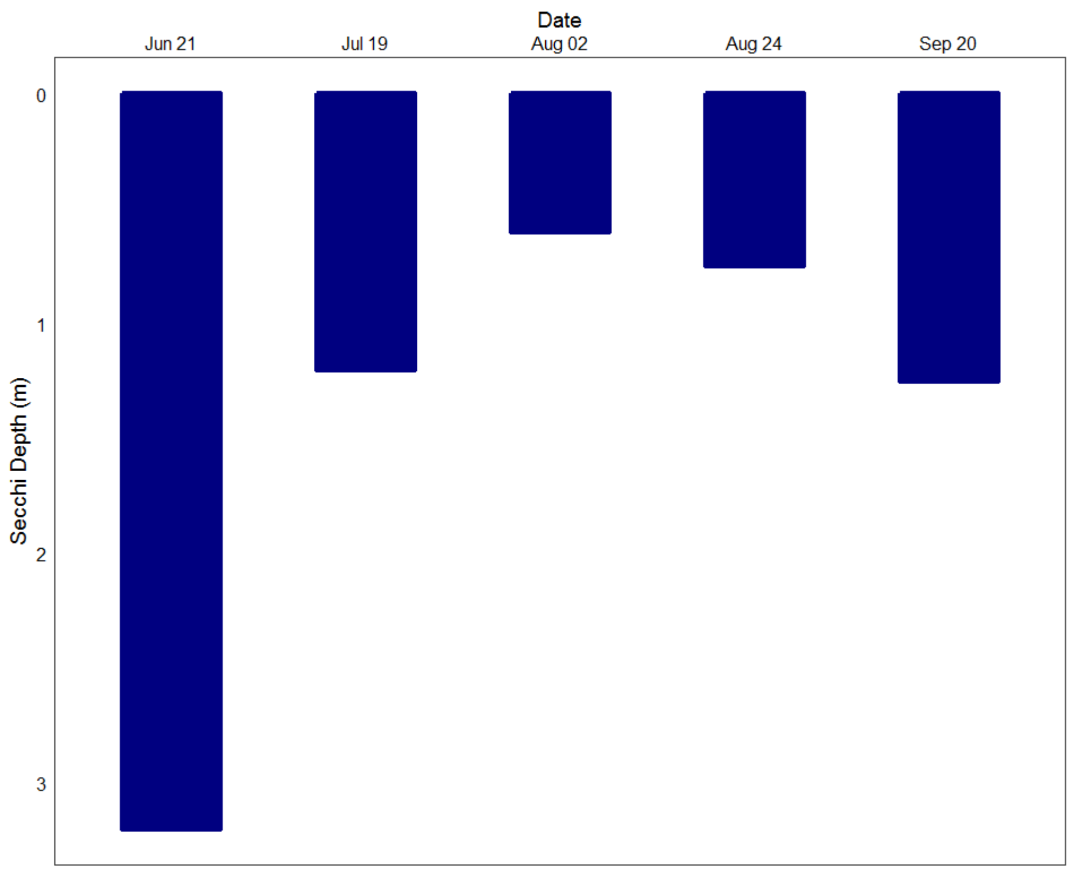

Figure 2 – Secchi depth values measured five times over the course of the summer at Shiningbank Lake in 2016.

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 temperatures varied across the 2016 sampling season at Shiningbank Lake. The maximum surface water temperature was measured on August 2 with a value of 20.89 °C (Figure 3a). Given that the maximum depth of Shiningbank Lake is only 5 m, thermal stratification was not achieved due to lake mixing. This classifies Shiningbank Lake as polymictic, because it mixes multiple times over the course of the summer. By September 20, the entire water column was ~14°C.

Shiningbank 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 (Figure ... ed.
Howev...

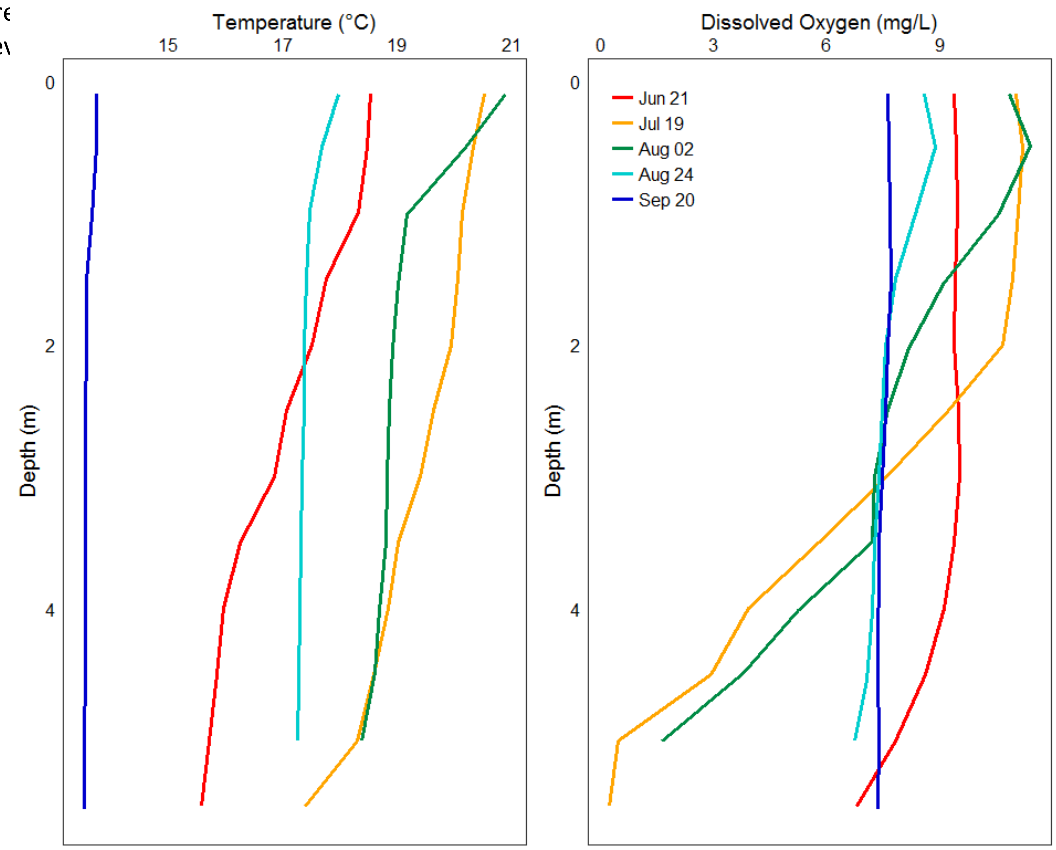

Figure 3 – a) Temperature (°C) and b) dissolved oxygen (mg/L) profiles for Shiningbank Lake measured five times over the course of the summer of 2016.

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 Shiningbank Lake in 2016. Microcystin levels remained below recommended guidelines on all sampling dates.

Date	Microcystin Concentration (μg/L)
Jun 21	0.05
Jul 19	0.10
Aug 2	0.17
Aug 24	0.87
Sep 20	0.38
Average	0.31

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 Shiningbank Lake.

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

Parameter	2016
TP (µg/L)	43
TDP (µg/L)	7
Chlorophyll-*a* (µg/L)	46.5
Secchi depth (m)	1.4
TKN (mg/L)	1.012
NO_2 and NO_3 (µg/L)	2.5
NH_3 (µg/L)	25
DOC (mg/L)	8.92
Ca (mg/L)	33.6
Mg (mg/L)	16.6
Na (mg/L)	31.2
K (mg/L)	2.68
SO_4^{2-} (mg/L)	12.2
Cl^- (mg/L)	0.86
CO_3 (mg/L)	4.51
HCO_3 (mg/L)	234
pH	8.46
Conductivity (µS/cm)	388
Hardness (mg/L)	152
TDS (mg/L)	228
Microcystin (µg/L)	0.314
Total Alkalinity (mg/L $CaCO_3$)	198

Table 3: Concentrations of metals measured once in Shiningbank 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	5.2	100[a]
Antimony μg/L	0.038	6[d]
Arsenic μg/L	0.854	5
Barium μg/L	54.9	1000[d]
Beryllium μg/L	0.004	100[c,e]
Bismuth μg/L	5×10^{-4}	/
Boron μg/L	32.1	1500
Cadmium μg/L	0.001	0.26[b]
Chromium μg/L	0.05	/
Cobalt μg/L	0.001	1000[e]
Copper μg/L	0.26	4[b]
Iron μg/L	48.2	300
Lead μg/L	0.01	7[b]
Lithium μg/L	18.1	2500[f]
Manganese μg/L	27.4	200[f]
Molybdenum μg/L	0.646	73[c]
Nickel μg/L	0.09	150[b]
Selenium μg/L	0.03	1
Silver μg/L	0.001	0.25
Strontium μg/L	284	/
Thallium μg/L	0.0012	0.8
Thorium μg/L	0.002	/
Tin μg/L	0.007	/
Titanium μg/L	1.51	/
Uranium μg/L	0.547	15
Vanadium μg/L	0.15	100[e,f]
Zinc μg/L	0.6	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.