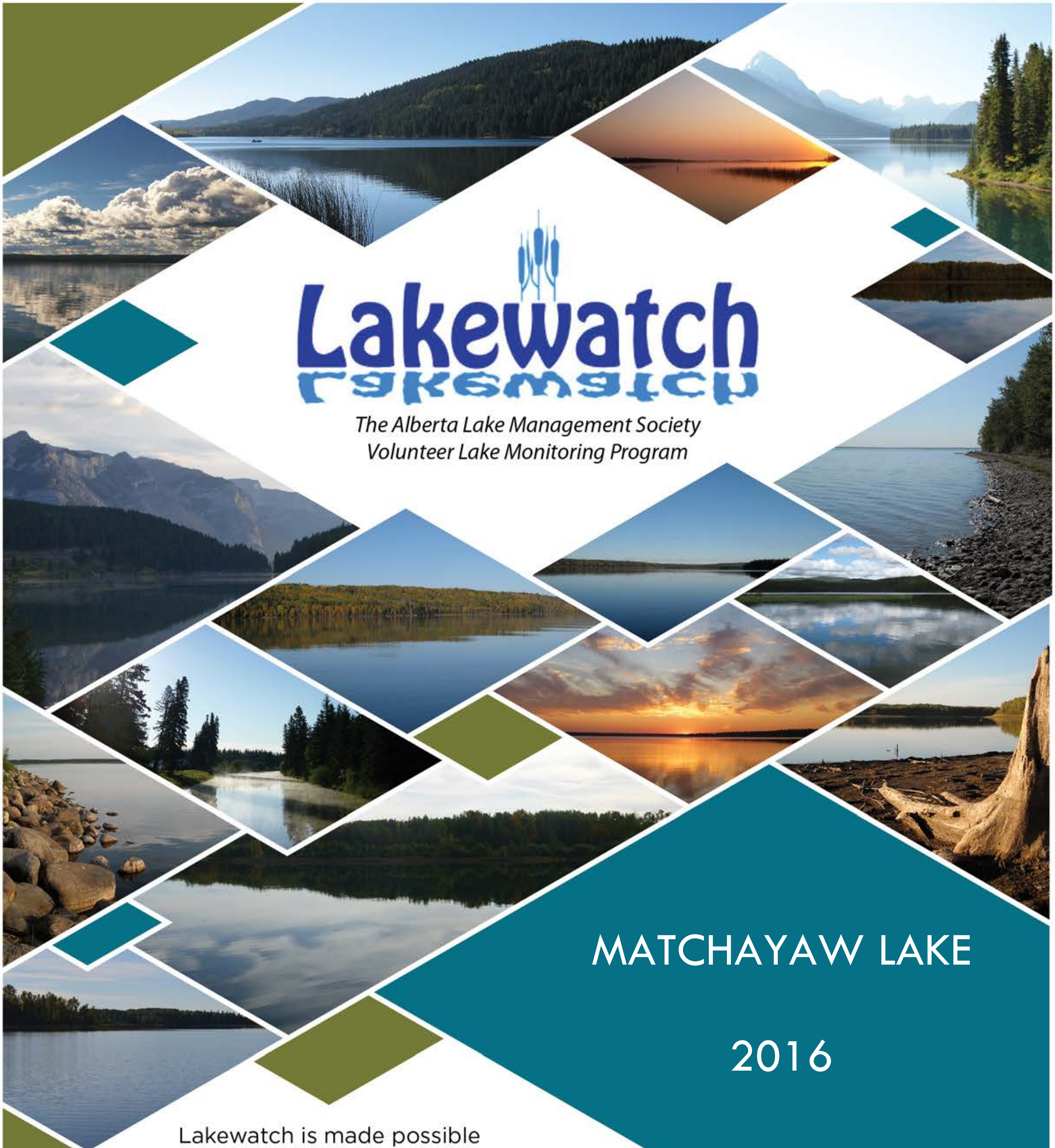

# Lakewatch

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

# MATCHAYAW LAKE

# 2016

Lakewatch is made possible
with support from:

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MD 61 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 all the volunteers who assisted with or helped to arrange lake sampling, including Donna Crowe, Brenda & Keith & Miguel McNicol, Dan & Katie & Barry Chivers, and Tom Cockle. 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.

# MATCHAYAW LAKE

Matchayaw lake is located in Lac Ste. Anne County, approximately 60 km northwest of Edmonton, near the town of Onoway. The lake's official name is a Cree term, however, it may also be referred to by the English translation. The name Matchayaw is Cree for "devil", or "place of evil". Matchayaw Lake lies in the Dry Mixedwood natural subregion, and the lakeshore is mostly undeveloped with the exception of some private residential lots. The hamlet of Bilby is located on the south shore, and, just south of Bilby is the Bilby Natural Area which is a popular destination for day-hikes and birding. Imrie Park, located just east of Onoway on the shores of the lake, is a 216 acre park donated by Mary Louise Imrie, one of Edmonton's first female architects. The park is operated by the Onoway Fish & Game Association, and in the summer provides camping facilities, a day-use area, and walking trails.

Matchayaw Lake. Photo by Laticia McDonald 2015


Sturgeon River Watershed; red circle marks Matchayaw Lake. Map from the City of St. Albert.

In the winter, the walking trails are groomed for cross-country skiiers. No ATV usage is permitted in the park. Boating is permitted on the lake, and a boat launch is located at the northeast end of the lake, shortly after the bridge crossing the Sturgeon River. The lake has a surface area measuring 2.11 $km^2$, and its maximum depth has been recorded as 8 m. The lake is fed by Kilini Creek from the southwest and the Sturgeon River from the north. The Sturgeon River exits the lake from the northwest shore. Matchayaw Lake lies within the Athabasca River Basin, and also lies within the smaller Sturgeon River watershed, which includes areas surrounding Isle Lake and Lac Ste. Anne.

# 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 was 42 µg/L in 2016, classifying Matchayaw Lake as eutrophic, or productive. TP fluctuated over the course of the season, and peaked at a maximum concentration of 77 µg/L on September $4^{th}$ (Figure 1). Recent TP concentrations fall well below the historically measured values (Table 1). More data is needed to understand any trends in Matchayaw Lake.

Chlorophyll-*a* concentrations also varied in 2016 (Figure 1). The average chlorophyll-*a* concentration of Matchayaw Lake was 49.2 µg/L (Table 2), which puts it into the hypereutrophic, or highly productive trophic classification. The maximum concentration of chlorophyll-*a*of 94.2 µg/L was measured on August 14. Despite low TP concentrations compared to historical values, chlorophyll-*a* concentrations have not exhibited similar declines.

Total Kjeldahl Nitrogen (TKN) concentrations increased in the summer, and decreased in the fall in 2016 (Figure 1). The average TKN concentration of Matchayaw Lake was 1.5 mg/L.

Average pH measured as 8.33 in 2016, buffered by moderate alkalinity (254 mg/L $CaCO_3$) and bicarbonate (308 mg/L $HCO_3$). Sodium and sulphate were the dominant ions contributing to a moderate conductivity measure of 656 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 Matchayaw Lake and all measured values are listed in Table 3. All metals were within the recommended guidelines for the Protection of Freshwater Aquatic Life.

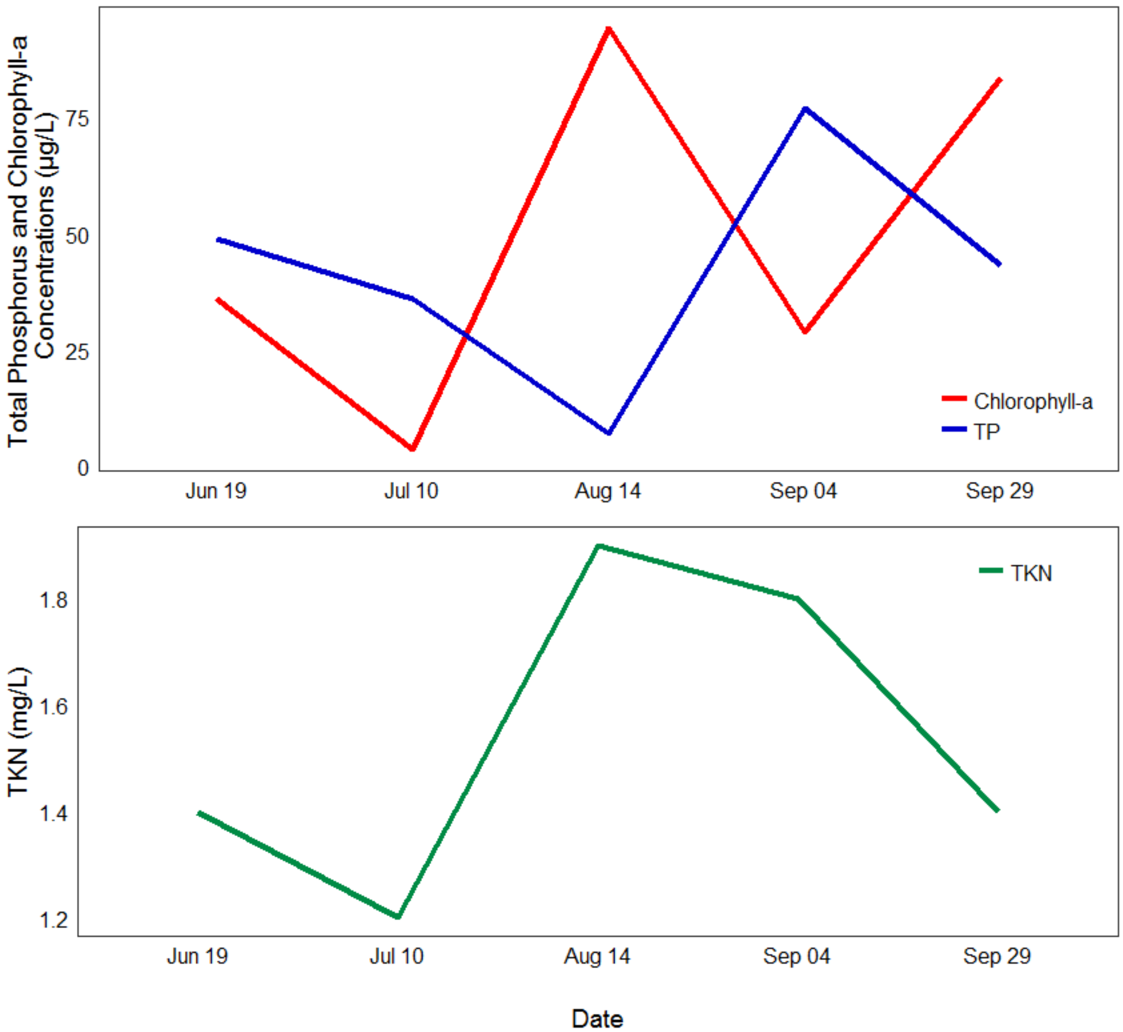


Figure 1- Total Phosphorus (TP), Total Kjeldahl Nitrogen (TKN), and Chlorophyll-*a* concentrations measured five times over the course of the summer at Matchayaw Lake.

## 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.***

Water clarity was low for most of the sampling season at Matchayaw Lake. The average Secchi depth was 1.75 m in 2016. Despite low water clarity, Secchi depth increased on July 10 to the seasonal maximum of 4.25 m. This increase in water clarity coincided with the only stratification event observed in Matchayaw Lake in 2016.

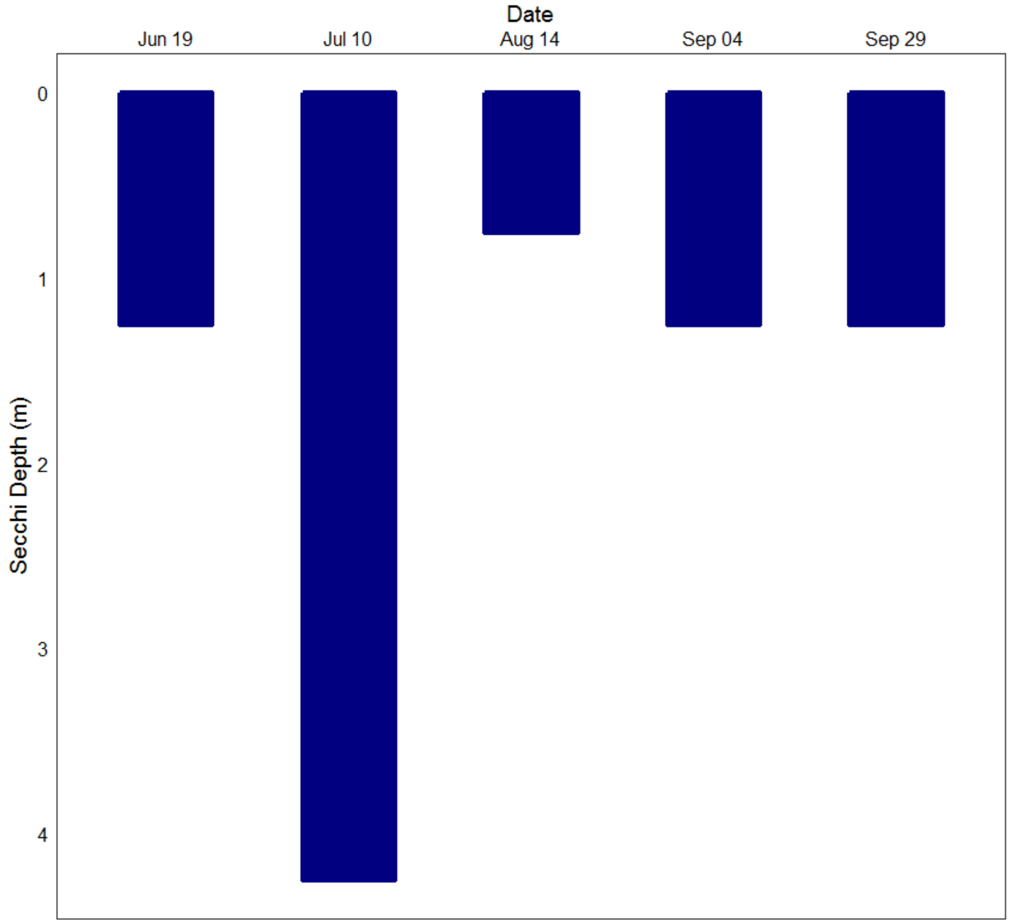


Figure 2 – Secchi depth values measured five times over the course of the summer at Matchayaw Lake in 2016.

## 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 across the sampling season in Matchayaw Lake. The maximum surface temperature (22 °C) was measured on August 14 (Figure 3a). By September 29, the entire water column was approximately 12.5 °C. Matchayaw Lake was only thermally stratified on July 10, one of the warmest visits.

Matchayaw Lake remained well oxygenated at the surface throughout most of the season, measuring above the Canadian Council for Ministers of the Environment guidelines of 6.5 mg/L for the Protection of Aquatic Life for three of the five visits (Figure 3b). On July 10 and September 4, surface water oxygen levels fell below the recommended guideline. Matchayaw Lake reached anoxia from June until August. Thermal separation of oxygenated waters and the process of decomposition, which consumes oxygen at the lakebed, could have contributed to oxygen decline. Given the lack of thermal stratification in September, the entire water column remained oxygenated.

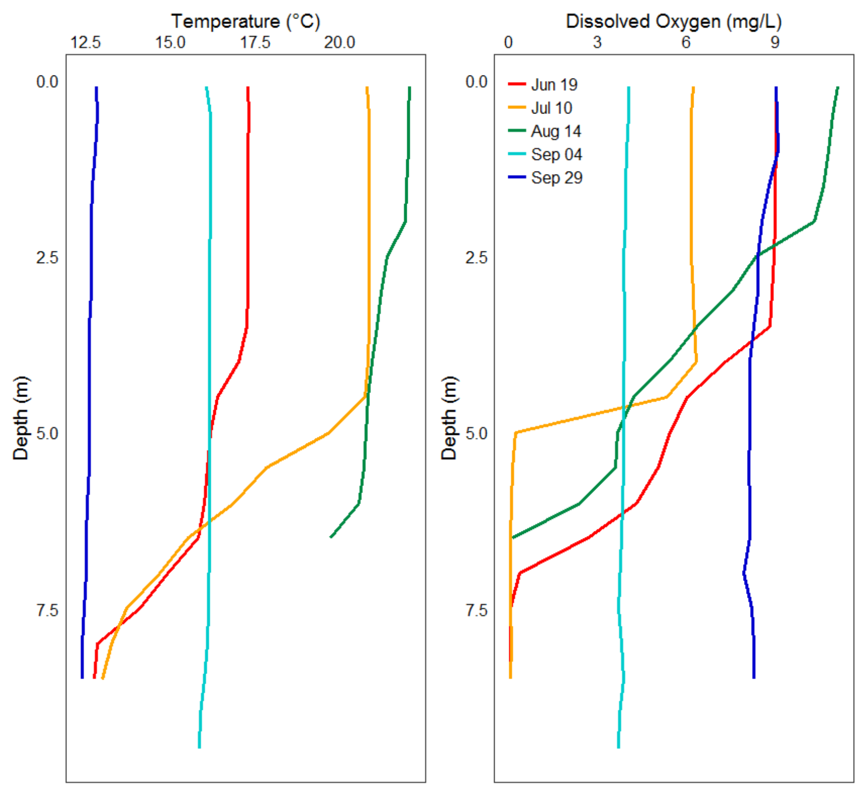


Figure 3 – a) Temperature (°C) and b) dissolved oxygen (mg/L) profiles for Matchayaw Lake measured five times over the course of the summer of 2016.

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

| **Date** | **Microcystin Concentration (µg/L)** |
|---|---|
| Jun 19 | 0.05 |
| Jul 10 | 0.05 |
| Aug 14 | 3.43 |
| Sep 4 | 2.32 |
| Sep 29 | 1.33 |
| **Average** | 1.44 |

## 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 Matchayaw Lake.

## WATER LEVELS

***There are many factors influencing water quantity. Some of these factors include the size of the lakes drainage basin, precipitation, evaporation, water consumption, ground water influences, and the efficiency of the outlet channel structure at removing water from the lake. Requests for water quantity monitoring should go through Alberta Environment and Parks Monitoring and Science division.***

Water levels in Matchayaw Lake have remained relatively stable since Alberta Environment began monitoring the lake in 1978 (Figure 4). Since 1978, Matchayaw Lake water levels have fluctuated between 678.6 m asl and 679.7.1 m asl.

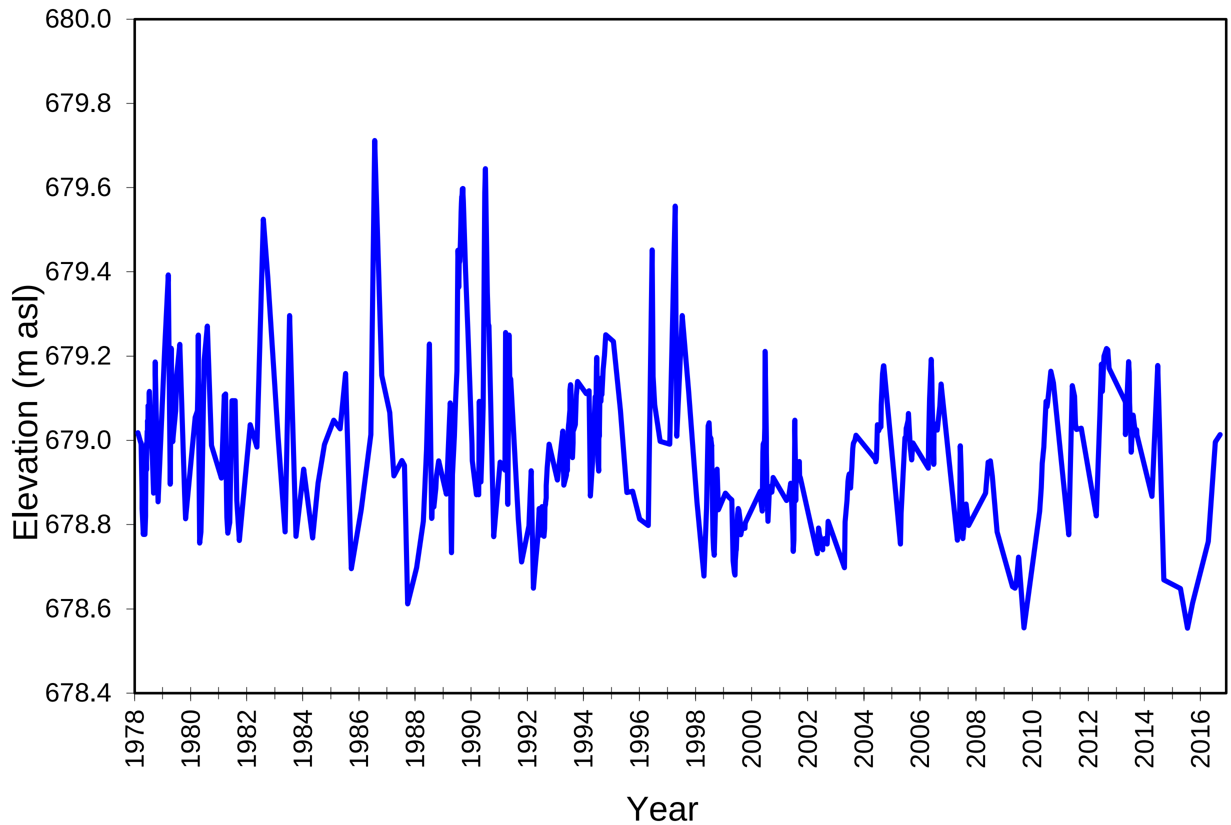


Figure 4- Water levels measured in meters above sea level (m asl) from 1978- 2016. Data retrieved from Alberta Environment.

Table 2: Average Secchi depth and water chemistry values for Matchayaw Lake. Historical values are given for reference.

| Parameter | 1995 | 1996 | 2001 | 2007 | 2015 | 2016 |
|---|---|---|---|---|---|---|
| TP (µg/L) | 135.19 | 110.03 | 102 | 100 | 59 | 42 |
| TDP (µg/L) | 23.6 | 113 | / | 42.8 | 17 | 21 |
| Chlorophyll-*a* (µg/L) | 24.8 | 28.4 | 71 | 40.4 | 43.9 | 49.2 |
| Secchi depth (m) | 3.35 | 2.54 | 2.11 | 1.25 | 0.95 | 1.75 |
| TKN (mg/L) | / | 1.4 | 1.3 | 1.7 | 1.7 | 1.5 |
| $NO_2$ and $NO_3$ (µg/L) | 55.1 | 13 | 10 | 13 | 2.3 | 2.5 |
| $NH_3$ (µg/L) | / | 90 | 51 | 126 | 85 | 180.2 |
| DOC (mg/L) | / | / | / | 18 | 15 | 14.4 |
| Ca (mg/L) | 37 | 41 | 27 | 49.6 | 29 | 31.2 |
| Mg (mg/L) | 18.2 | 14.1 | 18 | 19.6 | 17.4 | 20 |
| Na (mg/L) | 73 | 36.6 | 76 | 74.2 | 69 | 91 |
| K (mg/L) | 6.3 | 7.5 | 6 | 7.3 | 8 | 7.42 |
| $SO_4^{2-}$ (mg/L) | 56 | 30.15 | 72 | 81.75 | 62 | 70.8 |
| $Cl^-$ (mg/L) | 7.96 | 6.88 | 9 | 19.48 | 19.8 | 17.2 |
| $CO_3$ (mg/L) | 10.5 | 3.95 | 19 | 16 | 6.25 | 2.2 |
| $HCO_3$ (mg/L) | 309.4 | 230.5 | 246 | 289 | 264 | 308 |
| pH | 8.22 | 8.31 | 9.00 | 8.44 | 8.52 | 8.33 |
| Conductivity (µS/cm) | 598 | 440 | 605 | 636 | 596 | 656 |
| Hardness (mg/L) | 167 | 161 | / | 205 | 144 | 160 |
| TDS (mg/L) | 355 | 240 | 7 | 402 | 344 | 394 |
| Microcystin (µg/L) | / | / | / | 1.06 | 0.05 | 1.44 |
| Total Alkalinity (mg/L $CaCO_3$) | 260.8 | 195.5 | 233 | 250 | 228 | 254 |

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

| Metals (Total Recoverable) | 2015 | 2016 | Guidelines |
|---|---|---|---|
| Aluminum µg/L | 52.3 | 6.1 | 100[a] |
| Antimony µg/L | 0.081 | 0.071 | 6[d] |
| Arsenic µg/L | 1.547 | 1.49 | 5 |
| Barium µg/L | 54.33 | 53.5 | 1000[d] |
| Beryllium µg/L | 0.0073 | 0.004 | 100[c,e] |
| Bismuth µg/L | 0.0023 | 0.003 | / |
| Boron µg/L | 95.83 | 94.7 | 1500 |
| Cadmium µg/L | 0.005 | 0.001 | 0.26[b] |
| Chromium µg/L | 0.2200 | 0.03 | / |
| Cobalt µg/L | 0.082 | 0.017 | 1000[e] |
| Copper µg/L | 0.653 | 0.59 | 4[b] |
| Iron µg/L | 18.23 | 15.8 | 300 |
| Lead µg/L | 0.135 | 0.018 | 7[b] |
| Lithium µg/L | 28.67 | 32.6 | 2500[f] |
| Manganese µg/L | 34.13 | 136 | 200[f] |
| Molybdenum µg/L | 0.6840 | 0.578 | 73[c] |
| Nickel µg/L | 0.406 | 0.324 | 150[b] |
| Selenium µg/L | 0.073 | 0.29 | 1 |
| Silver µg/L | 0.0027 | 0.001 | 0.25 |
| Strontium µg/L | 278 | 275 | / |
| Thallium µg/L | 0.0014 | 0.001 | 0.8 |
| Thorium µg/L | 0.0107 | 0.0013 | / |
| Tin µg/L | 0.021 | 0.024 | / |
| Titanium µg/L | 1.160 | 1.03 | / |
| Uranium µg/L | 1.203 | 1.07 | 15 |
| Vanadium µg/L | 0.310 | 0.23 | 100[e,f] |
| Zinc µg/L | 0.77 | 0.8 | 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.