



Lakewatch

The Alberta Lake Management Society
Volunteer Lake Monitoring Program

Hilda Lake Report

2024

Updated November 25, 2025

Lakewatch is made possible
with support from:



ALBERTA LAKE MANAGEMENT SOCIETY'S LAKEWATCH PROGRAM

LakeWatch has several important objectives, one of which is to collect and interpret water quality data from Alberta's Lakes. Equally important is educating lake users about aquatic environments, 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 the widest 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 leaders in stewardship give us hope that our water resources will not be the limiting factor in the health of our environment.

If you require data from this report, please contact ALMS for the raw data files.

ACKNOWLEDGEMENTS

The LakeWatch program is made possible through the dedication of its volunteers. A special thanks to Paul Kip for their commitment to collecting data at Hilda Lake. We would also like to thank Katherine Cundict and Jordyn Lajeunesse, who were summer technicians in 2024. Executive Director Bradley Peter and Program Manager Brittany Onsyk were instrumental in planning and organizing the field program. This report was prepared by Brittany Onsyk and Bradley Peter.

BEFORE READING THIS REPORT,
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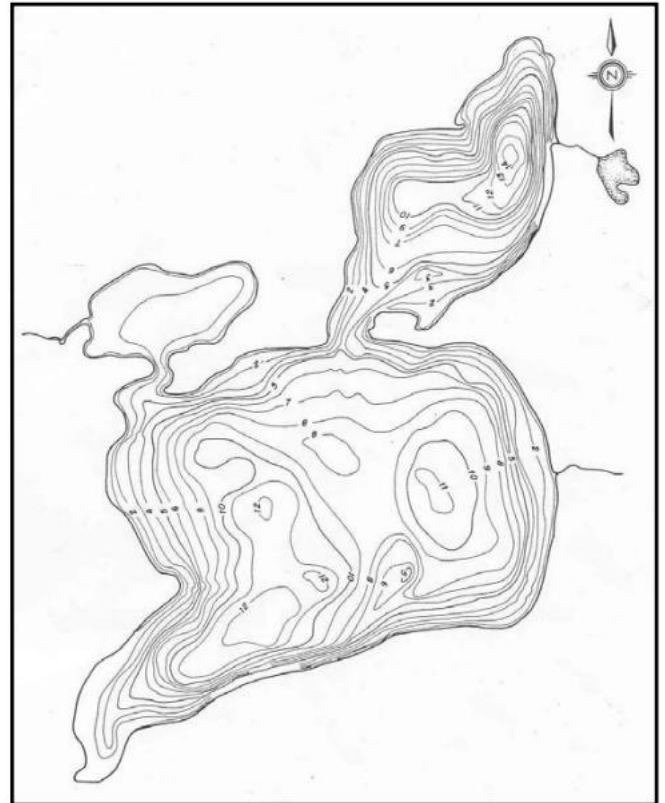
HILDA LAKE

Hilda Lake is a small lake (3.62 km²) located in the Beaver River Basin near Cold Lake. Hilda Lake lies within the central mixedwood subregion of the boreal forest natural region.¹ Much of the watershed and shoreline surrounding the lake is crown land, with two campgrounds and two multi-lot rural subdivisions along the east side of the lake. In-situ oil sand operations are also abundant within the Hilda Lake watershed.

Crane Lake flows into Hilda Lake via a small creek. Water continues from Hilda to Ethel Lake downstream, eventually feeding into the Beaver River and ultimately to the Hudson Bay.²

Hilda Lake has a maximum depth of 12 m, and an average depth of 6 m overall.³ Hilda Lake has a large drainage basin that is 24 times the size of the lake (approximately 87 km² to 4 km²).³ Water levels have been relatively stable at Hilda Lake, indicating that groundwater likely plays an important role in maintaining the water level at Hilda Lake.⁴

The lake supports some sport fish species, including northern pike (*Esox lucius*), walleye (*Sander vitreus*), and to a lesser extent yellow perch (*Perca flavescens*) and burbot (*Lota lota*).



Bathymetric map of Hilda Lake.

¹ Strong, W.L. and K.R. Leggat. 1981. Ecoregions of Alberta. Alta. En. Nat. Resour., Resour. Eval. Plan. Div., Edmonton.

² Alberta Conservation Association, Government of Alberta. 1998. Assessment of the Status of the Sport Fishery for Walleye at Hilda Lake, 1997.

³ Government of Alberta. 2011. Water Quality Conditions and Long-Term Trends in Alberta Lakes.

⁴ J.J. Gibson, S.J. Birks, Y. Yi, M.C. Moncur, P.M. McEachern. 2016. Stable isotope mass balance of fifty lakes in central Alberta: Assessing the role of water balance parameters in determining trophic status and lake level.



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 2024 for Hilda Lake was 10 µg/L (Table 2), falling into the mesotrophic, or moderately productive trophic classification. TP ranged from a minimum of 9 µg/L on July 18, to a maximum of 13 µg/L on September 16 (Figure 1).

The average chlorophyll-*a* concentration in 2024 was 3.77 µg/L (Table 2), similarly falling into the mesotrophic classification. Chlorophyll-*a* was lowest at 2.50 µg/L on August 15 and peaked at 5.1 µg/L on September 16 (Figure 1).

The average total Kjeldahl nitrogen (TKN) concentration was 1.2 mg/L (Table 2). TKN levels were relatively stable all summer (Figure 1).

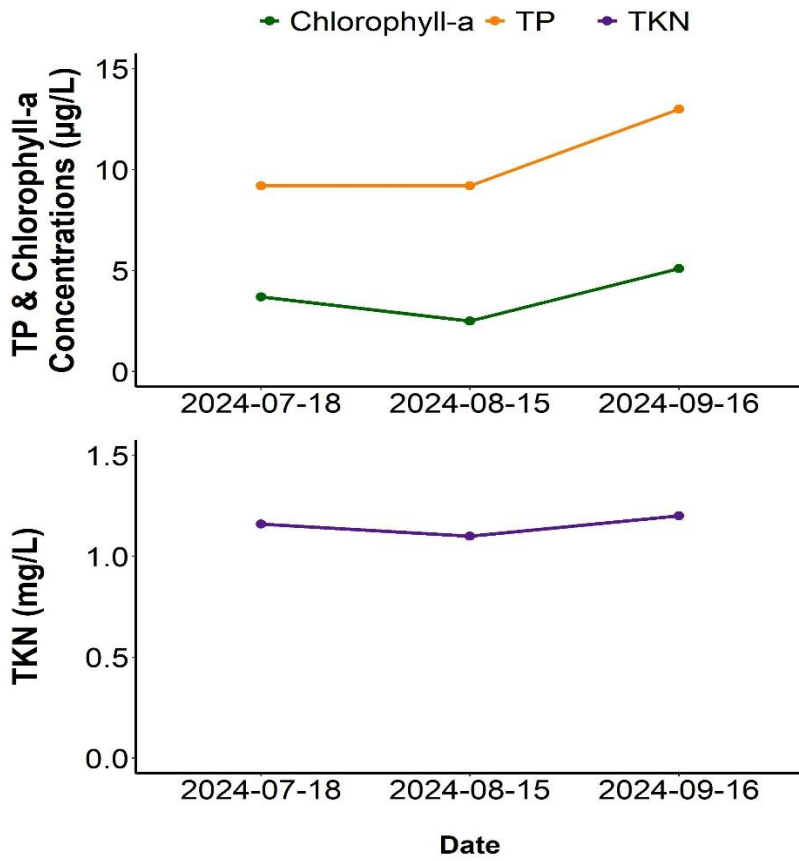


Figure 1. Total Phosphorus, Chlorophyll-*a*, and Total Kjeldahl Nitrogen concentrations measured over the course of the summer at Hilda Lake in 2024.

Average pH was measured as 8.85 in 2024, buffered by moderate alkalinity (427 mg/L CaCO₃) and bicarbonate (427 mg/L HCO₃). Aside from bicarbonate, sodium and magnesium were higher than all other major ions, and contributed to a high average conductivity of 873 μS/cm (Figure 2, top; Table 2). Hilda Lake falls within the mid-range ion concentrations of LakeWatch lakes sampled in 2024 (Figure 2, bottom).

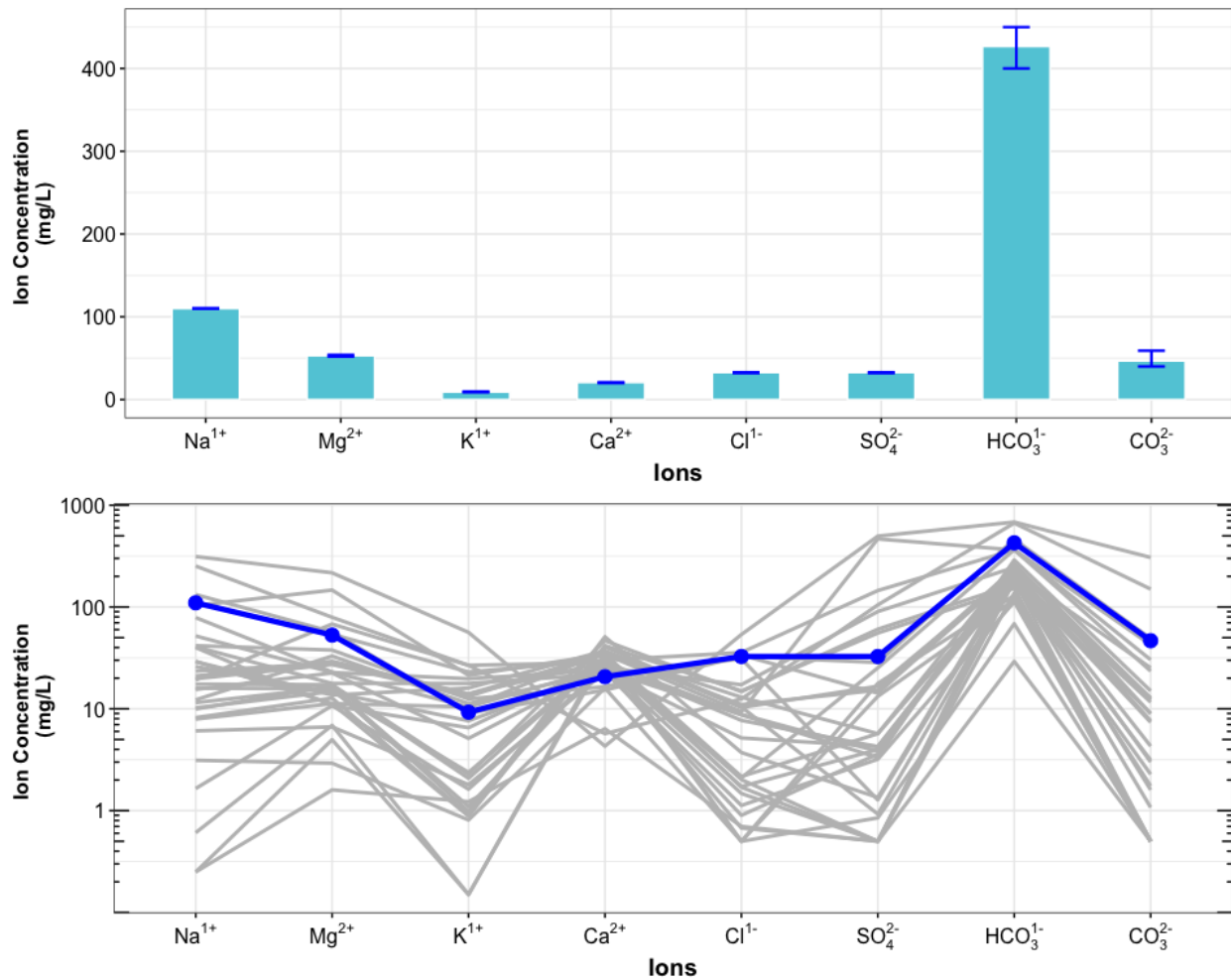


Figure 2. Average levels of cations (sodium = Na¹⁺, magnesium = Mg²⁺, potassium = K¹⁺, calcium = Ca²⁺) and anions (chloride = Cl¹⁻, sulphate = SO₄²⁻, bicarbonate = HCO₃¹⁻, carbonate = CO₃²⁻) from 3 measurements over the course of the summer at Hilda Lake. Top) bars indicate range of values measured, and bottom) Schoeller diagram of average ion levels at Hilda Lake (blue line) compared to 26 lake basins (gray lines) sampled through the LakeWatch program in 2024 (note log₁₀ scale on y-axis of bottom figure).



Metals

Metals will naturally be present in aquatic environments due to in-lake processes or the erosion of rocks, or introduced to the environment from human activities such as urban, agricultural, or industrial developments. Many metals have a unique guideline as they may become toxic at higher concentrations. Where current metal data are not available, historical concentrations for 27 metals have been provided (Table 3).

Metals were measured at Hilda Lake in 2024 (Table 3). No metals exceeded the CCME chronic guideline for the protection of aquatic life in 2024.⁴

⁴ Canadian Water Quality Guidelines. 2019. Canadian Council of Ministers of the Environment. <https://ccme.ca/en/resources#>.

WATER CLARITY AND EUPHOTIC 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 depth. Two times the Secchi depth equals the euphotic depth – the depth to which there is enough light for photosynthesis.

The average euphotic depth of Hilda Lake in 2024 was 5.93 m, corresponding to a Secchi Depth of 2.96 m (Table 2). Euphotic depth showed minimal variation over the season, ranging from as shallow as 5.6 m on July 18 to as deep as 6.2 m on August 15 (Figure 3).

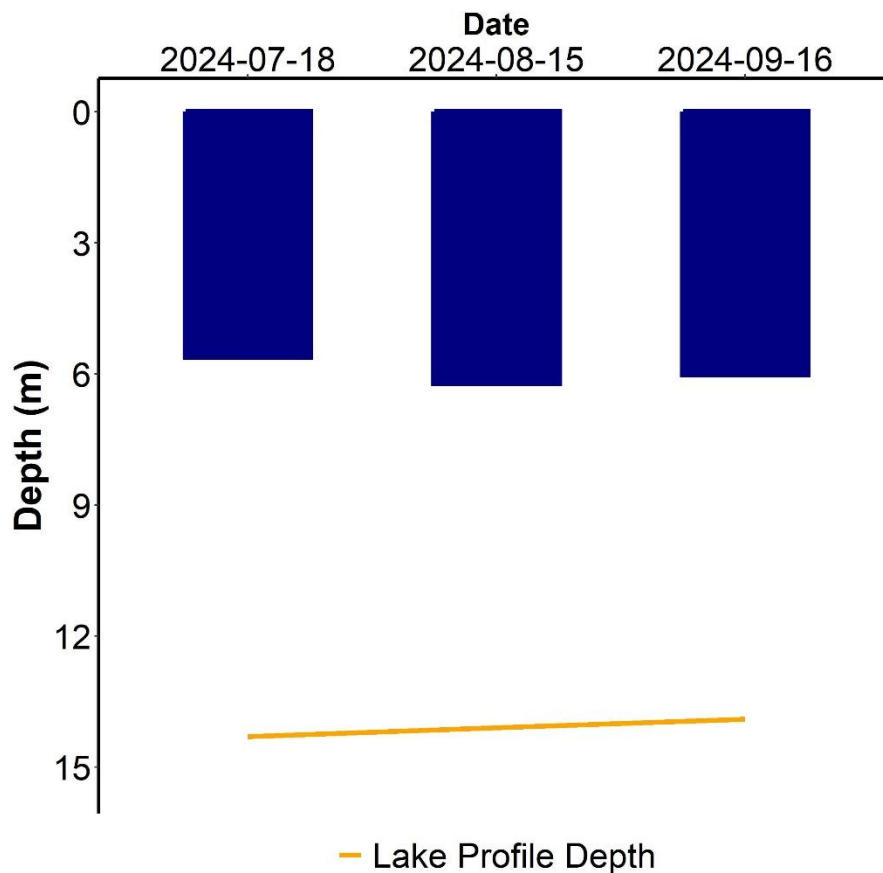


Figure 3. Euphotic depth values measured 3 times over the course of the summer at Hilda Lake in 2024.



WATER TEMPERATURE AND DISSOLVED OXYGEN

Water temperature and dissolved oxygen (DO) 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.

Surface temperatures at Hilda Lake varied throughout the summer, with the July 18 sampling trip having the warmest temperatures at 26.22°C (Figure 4). These hot surface water temperatures line up with a hot period recorded from July 16-18 (Figure 5). The lake showed thermal stratification during each sampling trip where the warm surface temperatures (epilimnion) dropped at a certain depth within the water column (thermocline), and the bottom layer of water (hypolimnion) approached 4°C.

Hilda Lake was well oxygenated in the surface waters on all sampling dates, measuring above the CCME guidelines of 6.5 mg/L dissolved oxygen⁵ (Figure 4b). During all sampling events, dissolved oxygen can be seen decreasing sharply at the thermocline, or mixing depth, at approximately 6 m (Figure 4). Past this depth, the water became anoxic where dissolved oxygen decreases to near 0 mg/L.

Hilda Lake was well stratified during each sampling event, meaning there is a clear differentiation between warm surface water and cooler, denser water near the bottom of the lake. This stratification prevents mixing of the lake water, and results in lower dissolved oxygen below the thermocline. Near the bottom of the lake, oxygen will also be consumed through decomposition, further reducing oxygen levels.

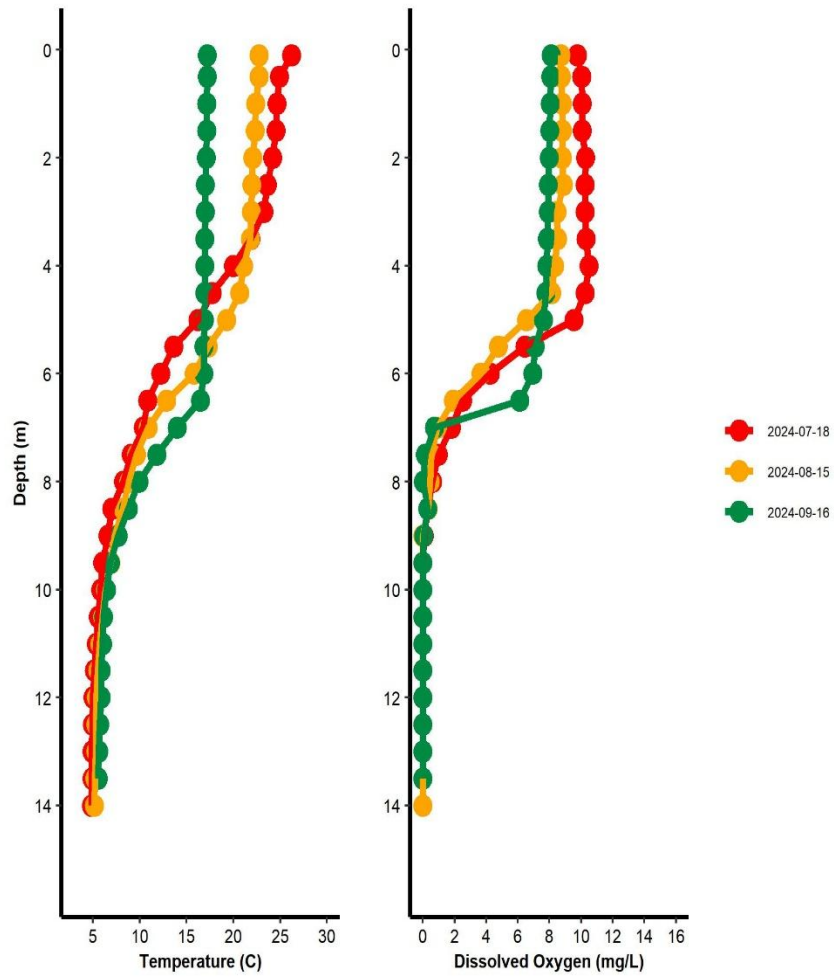


Figure 4. Temperature (°C) and dissolved oxygen (mg/L) profiles for Hilda Lake measured over the course of the summer of 2024.



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 one of the most common cyanobacteria toxins. In Alberta, recreational guidelines for microcystin are set at 10 µg/L. Blue-green algae advisories are managed by Alberta Health Services. Recreating in algal blooms, even if microcystin concentrations are not above guidelines, is not recommended.

Microcystin levels in Hilda Lake fell below the recreational guideline of 10 µg/L⁶ during every sampling event in 2024. Despite low levels of microcystin detected during sampling events, caution should be observed in areas of the lake where significant cyanobacteria accumulation occurs.

Table 1. Microcystin concentrations measured four times at Hilda Lake in 2024.

Date	Microcystin Concentration (µg/L)
07/18/2024	< 0.1
08/15/2024	< 0.1
09/16/2024	0.11
Average	0.07

⁶ Health Canada. 2022. Guidelines for Canadian Recreational Water Quality.



INVASIVE SPECIES

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 can change lake conditions which can then lead to toxic cyanobacteria blooms, decrease the amount of nutrients needed for fish and other native species, and cause millions of dollars in annual costs for repair and maintenance of water-operated infrastructure and facilities. Spiny water flea pose a concern for Alberta because they alter the abundance and diversity of native zooplankton, as they are aggressive zooplankton predators. Through over-predation, they will impact higher trophic levels such as fish. They also disrupt fishing equipment by attaching in large numbers to fishing lines.

Monitoring for aquatic invasive species involved sampling with a 63 µm plankton net. This monitoring is designed to detect juvenile Dreissenid mussel veligers and spiny water flea. No zebra mussels, quagga mussels, or spiny water flea were detected in Hilda Lake in 2024.

Eurasian watermilfoil is a non-native aquatic plant that poses a threat to aquatic habitats in Alberta because it grows in dense mats preventing light penetration through the water column, reduces oxygen levels when the dense mats decompose, and outcompetes native aquatic plants. Eurasian watermilfoil can look similar to the native Northern watermilfoil, thus genetic analysis is ideal for suspect watermilfoil species identification.

Watermilfoil was collected from Hilda Lake on the September 16 sampling trip. The specimen was confirmed to be Northern Watermilfoil (*Myriophyllum sibiricum*).

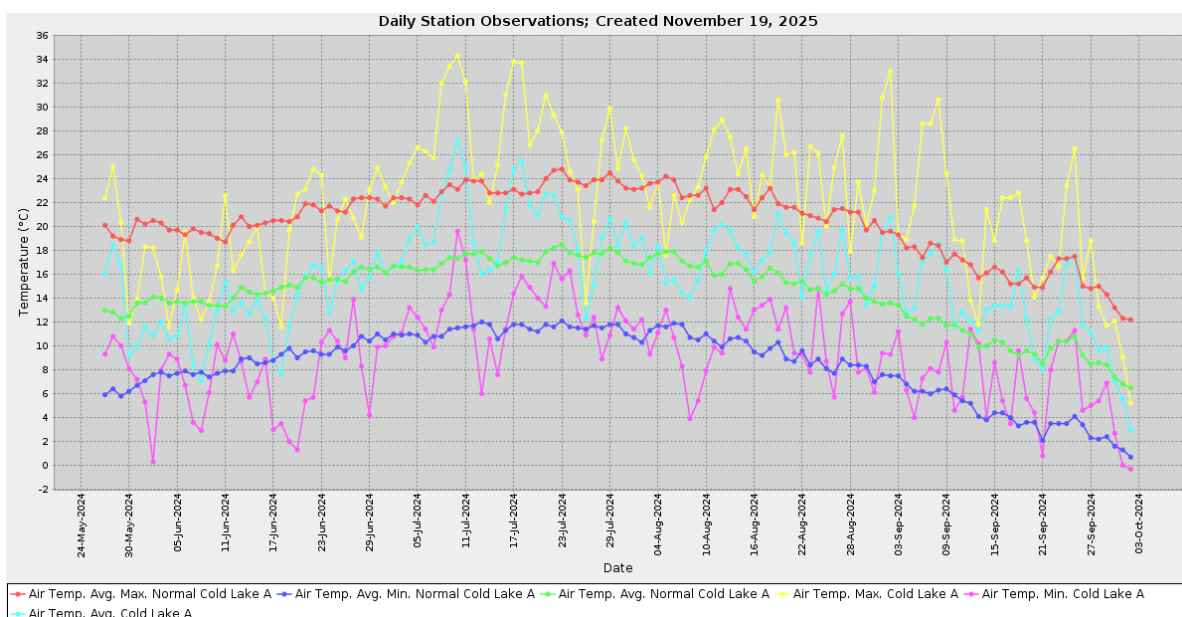
WEATHER AND LAKE STRATIFICATION

Air temperature will directly impact lake temperatures, and result in different temperature layers (stratification) throughout the lake, depending on its depth. Wind will also impact the degree to which a lake mixes, and how it will stratify. The amount of precipitation that falls within a lake's watershed will have important implications, depending on the context of the watershed and the amount of precipitation that has fallen. Solar radiation represents the amount of energy that reaches the earth's surface, and has implications for lake temperature & productivity.

In 2024, Hilda Lake experienced a warmer and windier summer compared to normal, with less than normal accumulated precipitation (Figure 5). Although it was warmer overall, the beginning of the sampling season was unseasonably cold and wet, with the month of June being cooler than normal, and breaking the record for coldest temperature recorded on both June 2 and 20. The lowest temperature recorded was on June 2 at 0.3°C. July was the warmest month, with the average temperature being 19.9°C. 2024 broke numerous heat records, including the hottest day recorded on July 10 at 34.3°C. September also broke heat records on numerous days.

Hilda Lake received about normal precipitation in the summer of 2024 (303 mm total). June was unseasonably wet, with over 67 mm of precipitation falling in the first two weeks of the month. Precipitation fell in short bursts over the remaining summer months, with over 10 mm of precipitation occurring on numerous days over the summer.

Strong winds were also observed throughout the sampling season.



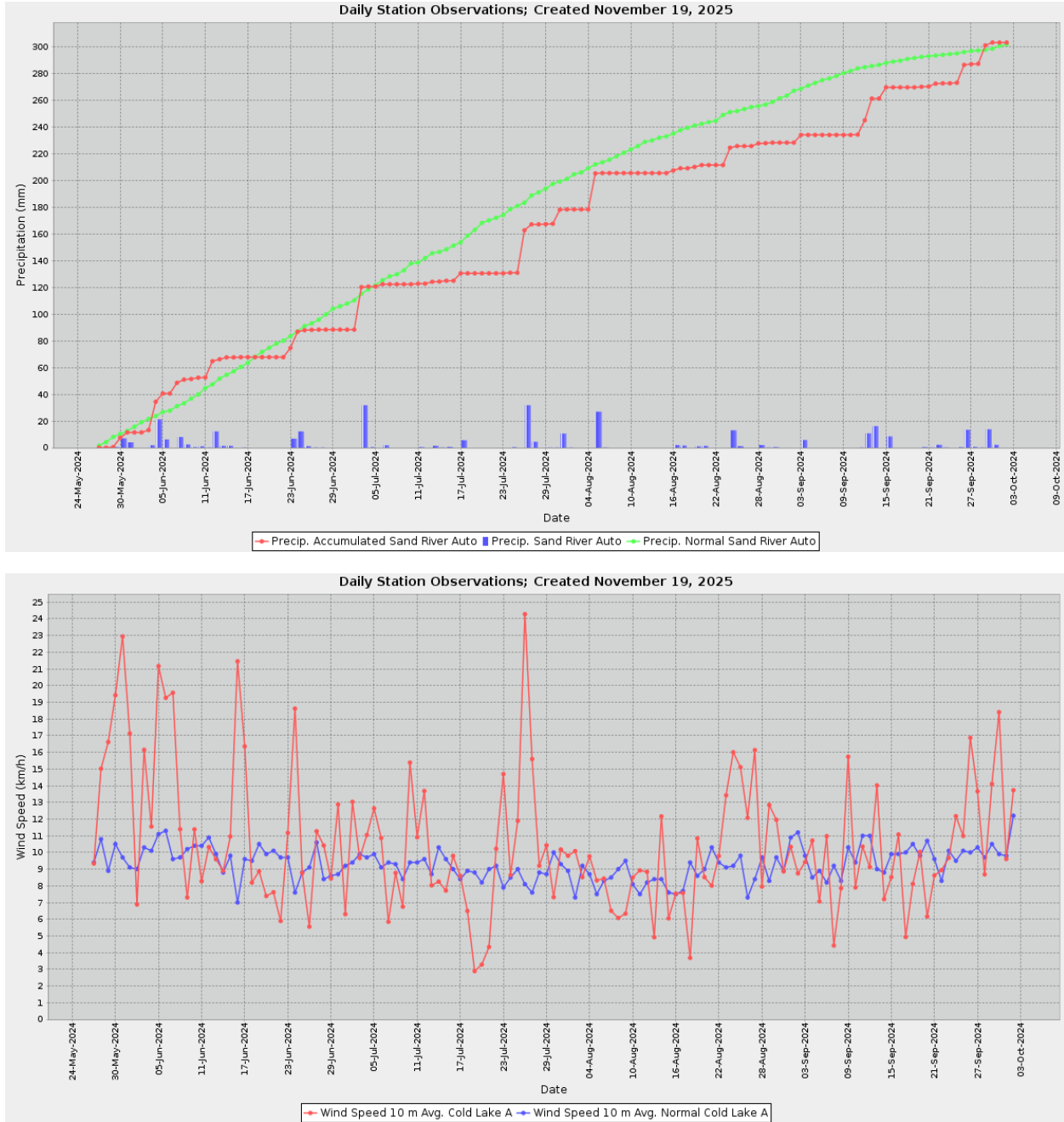


Figure 5. Air temperature ($^{\circ}\text{C}$) and wind speed (km/h) measured from Cold Lake A weather station southeast of Hilda Lake. Precipitation (cm) measured from Sand River weather station northwest of Crane Lake. Weather data provided by Agriculture, Forestry and Rural Economic Development, Alberta Climate Information Service (ACIS) <https://acis.alberta.ca>.

WATER LEVELS

There are many factors influencing water quantity. Some of these factors include the size of the lake's 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 at Hilda Lake in 2024 have been relatively stable since 2021 (Figure 7). Lake levels have fluctuated by less than 1 m since the beginning of the historical record (1980) (Figure 8). Stable lake levels observed over time is a good indication that Hilda Lake receives inflow from groundwater.²



Figure 7. Water levels measured at Hilda Lake in metres above sea level (masl) from 2020-2024. Data retrieved from Environment Canada and Alberta Environment and Parks Real-Time Hydrometric Data (<https://wateroffice.ec.gc.ca/>).

² Alberta Environment. 2006. Cold Lake-Beaver River Surface Water Quantity and Aquatic Resources State of the Basin Report.

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

Parameter	1986	1990	1991	1993	1997	2004	2005	2006	2007	2011	2018	2024
TP (µg/L)	48	27	25	16	19	16	19	20	23	20	13	10
TDP (µg/L)	29	10	17	8	11	7	6	11	8	12	8	4
Chlorophyll-a (µg/L)	4.1	11.2	5	-	3.5	4.8	4.1	3	3.8	6.1	5.4	3.8
Secchi depth (m)	2.80	3.50	2.70	3.75	3.75	2.81	2.75	2.75	2.19	3.42	2.70	2.97
TKN (mg/L)	1.2	1.4	-	1.3	1.2	1.4	1.3	1.3	1.3	1.3	1.2	1.2
NO ₂ -N and NO ₃ -N (µg/L)	2	11	-	2	3	3	9	5	2	3	2	2
NH ₃ -N (µg/L)	-	102	-	16	12	14	17	18	18	-	15	8
DOC (mg/L)	18	19	-	20	19	21	21	22	22	21	19	18
Ca ²⁺ (mg/L)	20	20	-	19	21	-	-	-	-	-	22	21
Mg ²⁺ (mg/L)	-	50	-	51	47	-	-	-	-	-	50	53
Na ⁺ (mg/L)	85	96	-	104	95	116	114	116	111	112	108	110
K ⁺ (mg/L)	8	8	-	9	9	10	10	10	10	10	9	9
SO ₄ ²⁻ (mg/L)	20	30	-	24	31	38	35	37	34	25	30	33
Cl ⁻ (mg/L)	23	25	-	28	27	34	32	32	32	32	31	33
CO ₃ ²⁻ (mg/L)	29	-	-	-	29	47	41.7	40.7	34.7	33.7	31.4	46.7
HCO ₃ ²⁻ (mg/L)	379	-	-	-	395.5	444	440.67	445	456	460.67	448	427
pH	8.9	8.8	-	8.91	8.85	8.99	8.94	8.95	8.85	8.86	8.78	8.85
Conductivity (µS/cm)	743	791	-	839	793	892	883	883	871	880	846	873
Hardness (mg/L)	-	256	-	257	-	-	-	-	-	-	260	270
TDS (mg/L)	413	466	-	485	452	534	518	526	521	512	502	513
Microcystin (µg/L)	-	-	-	-	-	-	0.11	0.08	0.14	0.08	0.11	0.07
Total Alkalinity (mg/L CaCO ₃)	359	393	-	418	372	442	431	433	431	434	416	427

Table 3. Concentrations of metals measured in Hilda Lake. The CCME heavy metal Guidelines for the Protection of Freshwater Aquatic Life (unless otherwise indicated) are presented for reference. Note that metal sample collection method changed in 2016 from composite to single surface grab at the profile location.

Metals	2004	2005	2006	2007	2011	2024	Guidelines
Aluminum (µg/L)	11.8	5.06	10.98	9.6	5.01	4.7	100 ^a
Antimony (µg/L)	0.049	0.045	0.041	0.044	0.035	0.035	/
Arsenic (µg/L)	2.3	2.21	1.95	2.13	2.28	2.25	5
Barium (µg/L)	21	20.8	21.3	21.6	23.8	24.6	/
Beryllium (µg/L)	0.0015	0.0015	0.0015	0.0033	0.0015	0.0015	100 ^{c,d}
Bismuth (µg/L)	0.0013	0.0048	0.0102	0.0013	5e-04	0.0015	/
Boron (µg/L)	265	250.5	278.5	219.5	258	239	1500
Cadmium (µg/L)	0.026	0.002	0.003	0.008	0.002	0.005	0.36 ^b
Chromium (µg/L)	0.61	0.3365	0.3395	0.3415	0.282	0.05	/
Cobalt (µg/L)	0.023	0.01395	0.02905	0.03385	0.0123	0.052	500, 1000 ^{c,d}
Copper (µg/L)	0.46	0.145	0.322	1.482	0.212	0.13	4 ^b
Iron (µg/L)	6.2	1	18.3	25.3	5.71	3.6	300
Lead (µg/L)	0.125	0.059	0.055	0.11	0.016	0.007	7 ^b
Lithium (µg/L)	64.6	65.35	68.65	53.75	64.5	59.4	2500 ^d
Manganese (µg/L)	3.84	6.94	6.64	10.23	5.83	4.21	130 ^e
Molybdenum (µg/L)	0.704	0.647	0.667	0.607	0.476	0.443	73
Nickel (µg/L)	0.002	0.002	0.002	0.056	0.002	0.07	150 ^b
Selenium (µg/L)	0.21	0.24	0.374	0.578	0.435	0.7	1
Silver (µg/L)	3e-04	0.0024	0.0017	3e-04	3e-04	5e-04	0.25
Strontium (µg/L)	109	103.7	106	105.5	106	109	/
Thallium (µg/L)	0.0021	0.0134	0.0073	0.0011	1e-04	0.001	0.8
Thorium (µg/L)	0.01	0.146	0.009	0.011	0.003	0.003	/
Tin (µg/L)	0.06	0.03	0.01	0.03	0.01	0.03	/
Titanium (µg/L)	0.67	0.697	0.881	0.974	0.711	0.53	/
Uranium (µg/L)	0.168	0.176	0.176	0.177	0.159	0.154	15
Vanadium (µg/L)	0.363	0.272	0.27	0.21	0.178	0.178	100 ^{c,d}
Zinc (µg/L)	7.3	1.54	1.04	0.96	0.45	0.7	30 ^f

Values represent means of total recoverable metal concentrations.

^a Based on pH ≥ 6.5

^b Based on 2016 avg. water hardness (as CaCO₃) with CCME equation

^c Based on CCME Guidelines for Agricultural use (Livestock).

^d Based on CCME Guidelines for Agricultural Use (Irrigation).

^e Based on CCME Manganese variable calculation (https://ccme.ca/en/chemical/129#_aqf_fresh_concentration) using 2016 avg. water hardness (as CaCO₃) and avg. pH

^f Based on 2016 avg. water hardness (as CaCO₃), avg. pH, and avg. DOC with CCME equation

A forward slash (/) indicates an absence of data or guidelines.