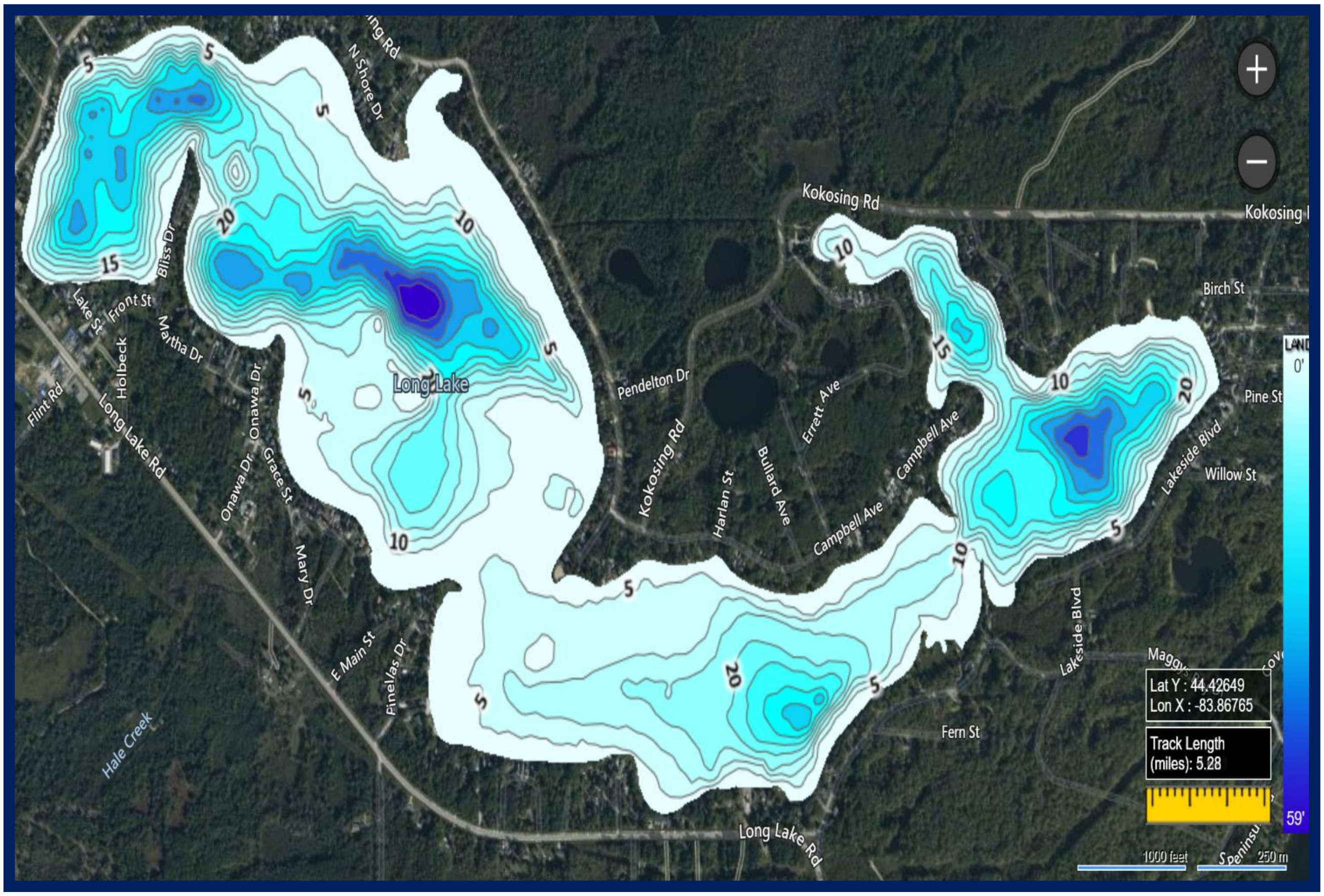
Restorative Lake Sciences

Long Lake 2025 Aquatic Vegetation, Water Quality, and 2026 Management Recommendations Report

December, 2025



Prepared for: **Long Lake Property Owners Association & Plainfield Township**

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A 2025 ANNUAL PROGRESS REPORT OF AQUATIC VEGETATION AND WATER QUALITY IN LONG LAKE IOSCO COUNTY, MICHIGAN

December, 2025

1.0 EXECUTIVE SUMMARY

Aquatic Vegetation Analyses and Treatments & Water Quality Assessments:

This report describes the current distribution of native and exotic submersed, floating-leaved, and emergent aquatic plants, including the exotic species, Eurasian Watermilfoil (*Myriophyllum spicatum;* EWM), Purple Loosestrife (*Lythrum salicaria*) and Starry Stonewort (*Nitellopsis obtusa)* within and around Long Lake, Iosco County, Michigan. During the original lake management plan study in August of 2012, Long Lake was infested with nearly 266 acres of EWM that was widely distributed around the lake. Genetic analysis of the stems showed that the milfoil was of the Eurasian strain and had not yet hybridized with native milfoils in the lake. A whole-lake survey of aquatic vegetation data conducted on May 20, 2025 indicated that 33.8 acres of invasive EWM approximately 32.8 acres of invasive Curly-leaf Pondweed were found and treated on May 28, 2025. There were also 15.2 acres of nuisance filamentous algae treated. An August 19, 2025 comprehensive survey revealed that 23.3 acres of Eurasian Watermilfoil was present along with 11 locations of Purple Loosestrife. The EWM was treated on September 3, 2025 with systemic ProcellaCOR® and contact diquat. Based on a September survey, the CLP and EWM treatments were very successful.

The biodiversity of native species such as Wild Celery (*Vallisneria americana*), Richardson's Pondweed (*Potamogeton richardsonii*), Northern Watermilfoil (*Myriophyllum sibiricum*), Coontail (*Ceratophyllum demersum*), and the low-growing Southern Naiad (*Najas guadalupensis*) remains high in areas previously dominated by the exotic EWM. This is favorable because these plants represent a great diversity of plant structures that house different macroinvertebrate communities which feed fish.

There are currently a total of 32 native aquatic plant species in and around Long Lake, which includes 23 submersed, 3 floating-leaved, and 6 emergent aquatic plant species.

Long Lake Water Quality Overview:

The water clarity of the lake continues to be moderately high and helps support abundant aquatic plant growth in many areas. Levels of nutrients such as phosphorus and nitrogen remain moderate compared to other lakes of similar size yet highly elevated at the bottom of the deepest basins, indicating internal loading. Total phosphorus and Total Kjeldahl Nitrogen levels are well above the eutrophic threshold across all bottom samples, and this could be due to runoff and the use of septic systems and fertilizers, and also the decay of submersed aquatic vegetation. Furthermore, these parameters will decline in quality with increased runoff and rainfall. The alkalinity and pH of the lake water are indicative of a well-buffered lake and are consistent with other Michigan inland lakes.

Phytoplankton communities within the lake appear to be balanced between the diatom and green-algae communities with fewer blue-green algae. Green algae and diatoms are the preferred food choices for zooplankton. Nutrient levels in the lake are high enough to create algal blooms in shallow or stagnant areas and also dense filamentous blooms in the main lake areas. Removal of too much submersed aquatic vegetation may result in accelerated growth of blue-green algal blooms and thus removal of nuisance natives should be highly selective.

Recommendations for 2026 and future lake improvements are provided in Section 5.0 at the end of this report.

2.0 AQUATIC PLANT SURVEY METHODS

The aquatic plant sampling methods used for lake surveys of macrophyte communities commonly consist of shoreline surveys, visual abundance surveys, transect surveys, AVAS surveys, and Point-Intercept Grid surveys. The Michigan Department of Environment, Great Lakes, and Energy (EGLE) prefers that an Aquatic Vegetation Assessment Site (AVAS) Survey, or a GPS Point-Intercept survey (or both) be conducted on most inland lakes following large-scale aquatic herbicide treatments to assess the changes in aquatic vegetation structure and to record the relative abundance and locations of native aquatic plant species. Due to the large size of Long Lake, a bi-seasonal GPS Point-Intercept grid matrix/AVAS survey is conducted to assess all aquatic species, including submersed, floating-leaved species, and emergent aquatic plants.

2.1 The GPS Point-Intercept Survey Method

While the EGLE AVAS protocol considers sampling vegetation using visual observations in areas around the littoral zone, the Point-Intercept Grid Survey method is meant to assess vegetation throughout the entire surface area of a lake (Madsen et *al*. 1994; 1996).

The points should be placed together as closely and feasibly as possible to obtain adequate information of the aquatic vegetation communities throughout the entire lake. At each GPS Point location the aquatic vegetation species presence and abundance are estimated. In between the GPS points, any additional species and their relative abundance are also recorded using sampling and other visual techniques. Once the aquatic vegetation communities throughout the lake have been recorded using the GPS points, the data can be placed into a Geographic Information System (GIS) software package to create maps showing the distribution and relative abundance of particular species. The GPS Point-Intercept method is particularly useful for monitoring aquatic vegetation communities through time and for identification of nuisance species that could potentially spread to other previously uninhabited areas of the lake.

The GPS Point-Intercept method survey conducted on May 20, 2025 and August 19, 2025 consisted of a whole-lake survey and scan (Figure 1) with 363 equidistantly-spaced grid points on Long Lake, using a Lowrance® 50-satellite GPS WAAS-enabled side-scanning unit (accuracy within 2 feet). A combination of rake tosses and visual data accounted for the observations in the survey. Areas that were deeper than 20 feet and not vegetated or that consisted of barren sand were not included in the data analysis. When the bottom was visible, visual data was collected. When no bottom was visible, the plants were confirmed using two rake tosses at each site.

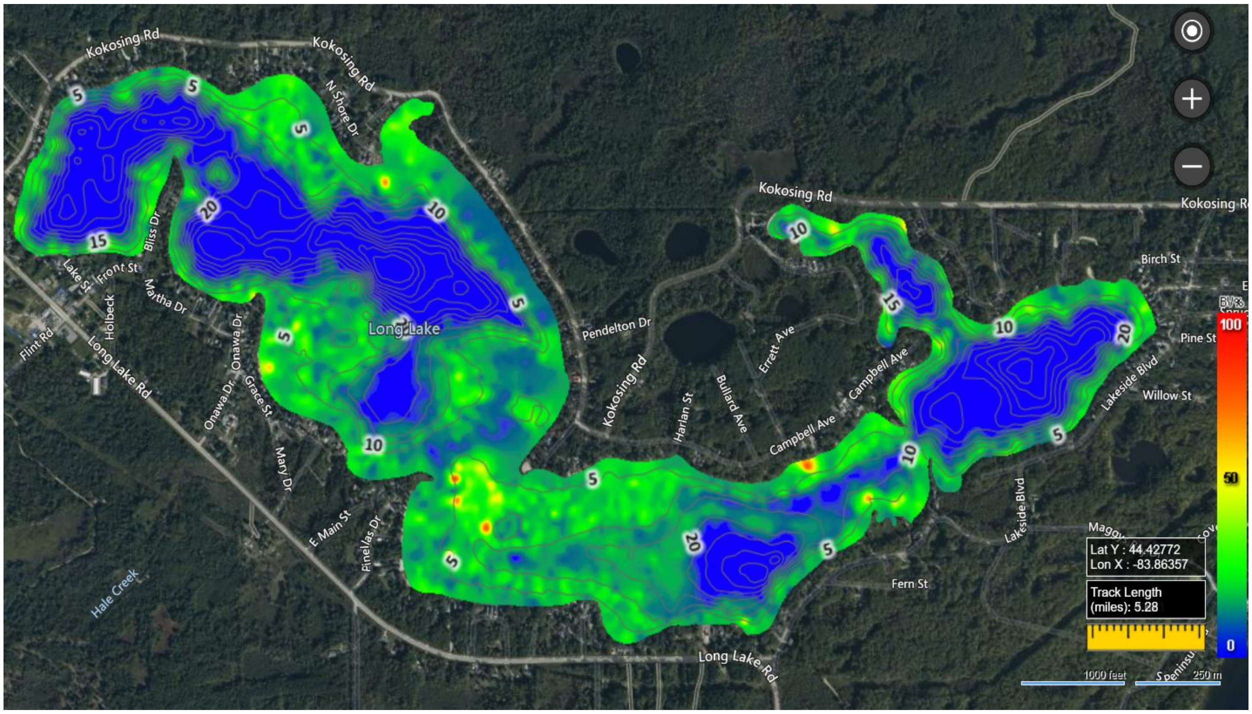

Figure 1. 2025 Aquatic vegetation biovolume map of Long Lake. Note: Blue denotes no vegetation; Green denotes low-growing vegetation; Red denotes high-growing vegetation.

3.0 AQUATIC PLANT SURVEY RESULTS FOR 2025

A preliminary whole-lake aquatic vegetation survey of Long Lake was conducted on May 20, 2025 and August 19, 2025 to determine the distribution and relative abundance of both invasive and native aquatic vegetation in and around Long Lake. Two additional lake visits occurred in mid-July and late September, 2025.

3.1 Long Lake Exotic Aquatic Plant Species (2025)

The May 20, 2025 comprehensive survey determined that 33.8 acres of EWM (Figure 2) and 32.8 acres of Curly-leaf Pondweed (Figure 3), and 15.2 acres of dense filamentous algae were present and required treatment. The initial treatment was conducted by PLM on May 28, 2025 and consisted of diquat and ProcellaCOR® to address the EWM and just diquat for the beds of CLP mixed with EWM. In addition, approximately 10.1 acres of algae were treated using chelated copper. The second comprehensive survey occurred on August 19, 2025 and determined the need for a 23.3-acre EWM treatment with ProcellaCOR® and diquat on September 3, 2025 along with 1 acre of nuisance native vegetation that was treated with flumioxazin at 200 ppb and 1 acre of algae treated with chelated copper. All treatments appeared to be successful with abundant non-nuisance natives remaining. Figures 4a, 4b, 4c and 4d below show the treatment locations in 2025.

Table 1. Change in EWM and CLP acres before and after herbicide treatment.

Invasive Aquatic Macrophyte Species	***Common Name***	***Acres Pre-Treatment 2025***	***Acres Post-Treatment 2025***
Myriophyllum spicatum	Eurasian Watermilfoil	22.7	0.0
Potamogeton crispus	Curly-leaf Pondweed	57.1	0.0

Figure 2. Eurasian Watermilfoil
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Figure 3. Curly-leaf Pondweed
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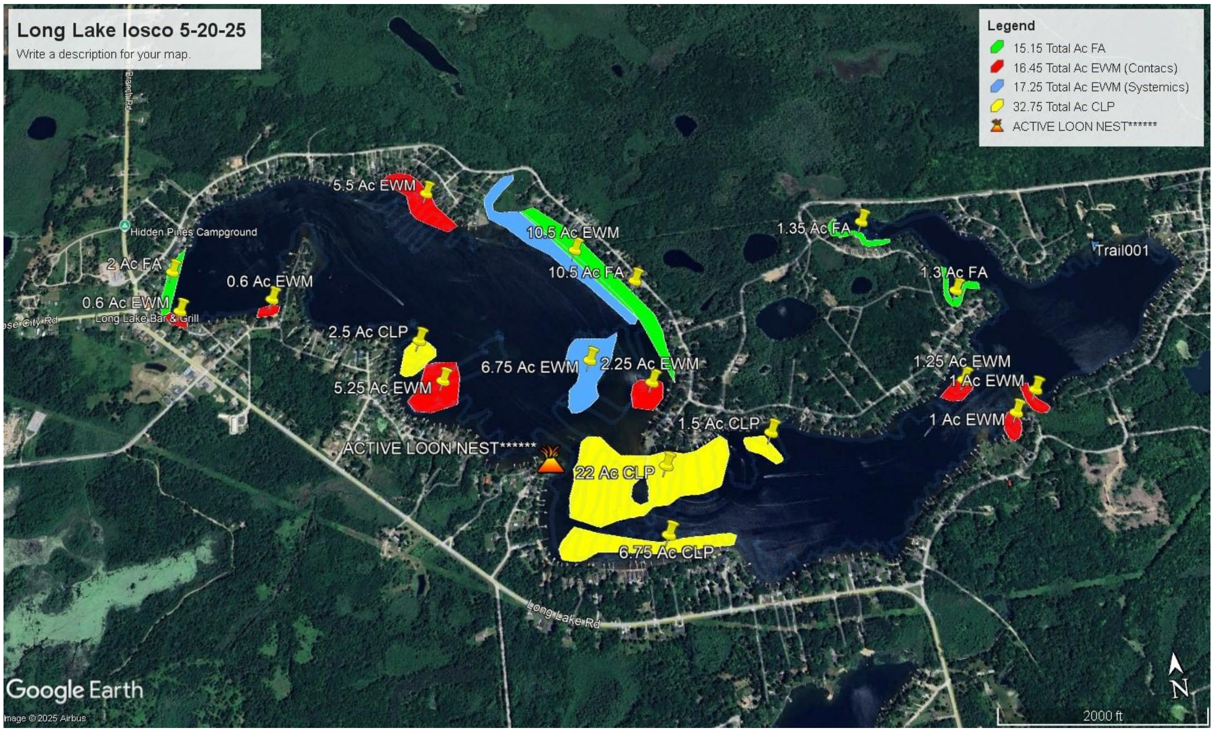


Figure 4a Long Lake treatment Map from May 20, 2025 survey.

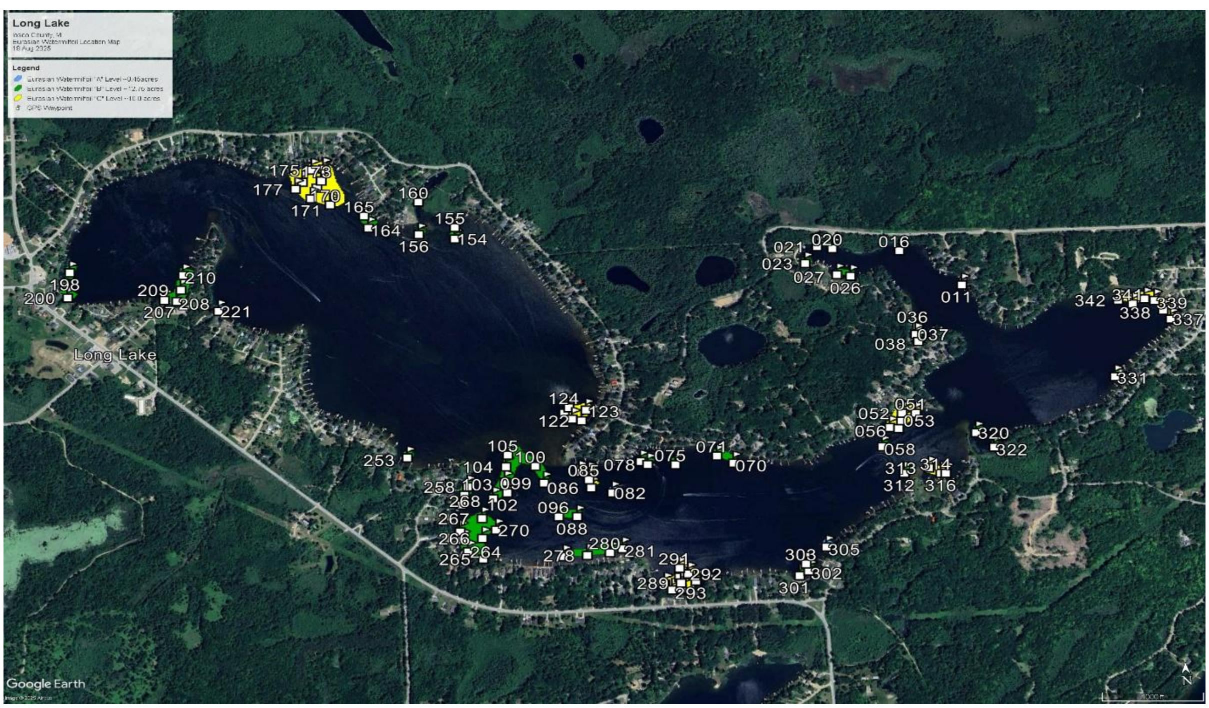


Figure 4b. Long Lake treatment map from the August 19, 2025 survey.

Figure 4c. Treatment map of Long Lake Purple Loosestrife “East” August 19, 2025.

Figure 4d. Treatment map for “West” Long Lake Purple Loosestrife (August 19, 2025).

3.2 Long Lake Native Aquatic Plant Species (2025)

During the August 19, 2025 survey, a total of 23 submersed, 3 floating-leaved, and 6 emergent aquatic plant species were found for a grand total of 32 species (Table 2). The table shows the relative abundance in percentage of littoral zone cover for each species. This indicates a high biodiversity of aquatic vegetation in Long Lake. The most common native aquatic plants included Chara, Fern-leaf Pondweed, and Whorled Watermilfoil.

Table 2. Percent cover of native aquatic plant species found in and around Long Lake during the August 19, 2025 survey.

Native Aquatic Plant Species	***Aquatic Plant Common Name***	***August 2025 % Cover***
Chara vulgaris	Muskgrass	46.8
Potamogeton illinoensis	Illinois Pondweed	3.6
Potamogeton foliosus	Thin-leaf Pondweed	1.9
Potamogeton amplifolius	Large-leaf Pondweed	18.4
Potamogeton praelongus	White-stem Pondweed	6.9
Potamogeton gramineus	Variable-leaf Pondweed	22.6
Potamogeton zosteriformis	Flat-stem Pondweed	10.3
Potamogeton richardsonii	Clasping-leaf Pondweed	27.1
Potamogeton robbinsii	Robbins Pondweed	0.6
Myriophyllum sibiricum	Northern Watermilfoil	2.9
Myriophyllum verticillatum	Whorled Watermilfoil	0.8
Nitella mucronata	Nitella	3.5
Najas guadalupensis	Southern Naiad	5.5
Najas flexilis	Slender Naiad	7.1
Sagittaria spp.	Sagittaria	0.3
Potamogeton pusillus	Small-leaf Pondweed	3.6
Megalodonta beckii	Water Marigold	0.8
Vallisneria americana	Wild Celery	18.8
Elodea canadensis	Common Waterweed	26.5
Ceratophyllum demersum	Coontail	4.9
Utricularia vulgaris	Bladderwort	2.2
Scirpus subterminalis	Submersed Bulrush	0.6
Potamogeton epihydrus	Ribbon-leaf Pondweed	3.1
Peltandra sp.	Arrow Arum	0.3
Nymphaea odorata	White Waterlily	12.0
Nuphar advena	Yellow Waterlily	6.5
Brasenia schreberi	Watershield	0.8
Typha latifolia	Cattails	3.9
Schoenoplectus acutus	Bulrushes	1.6
Pontedaria cordata	Pickerelweed	4.2

Decodon verticillatus	Swamp Loosestrife	0.4
Sparganium sp.	Burr Reed	0.5

4.0 LONG LAKE 2025 WATER QUALITY RESULTS

The quality of water is highly variable among Michigan inland lakes, although some characteristics are common among particular lake classification types. The water quality of Long Lake is affected by both land use practices and climatic events. Climatic factors (i.e., spring runoff, heavy rainfall) may alter water quality in the short term; whereas, anthropogenic (man-induced) factors (i.e. shoreline development, lawn fertilizer use) alter water quality over longer time periods. Furthermore, lake water quality helps to determine the classification of particular lakes (Table 3). Lakes that are high in nutrients (such as phosphorus and nitrogen) and chlorophyll-*a*, and low in transparency are classified as eutrophic; whereas those that are low in nutrients and chlorophyll-*a*, and high in transparency are classified as oligotrophic. Lakes that fall in between these two categories are classified as mesotrophic. Long Lake is classified as meso-eutrophic based on its moderate transparency and moderate nutrient and chlorophyll-*a* concentrations. This means that the lake has a moderate quantity of nutrients and high water clarity that can exacerbate aquatic plant and algae growth. A map showing all water quality sampling locations is shown below in Figure 5.

Lake Trophic Status	***Total Phosphorus ($\mu g\ L^{-1}$)***	***Chlorophyll-a ($\mu g\ L^{-1}$)***	***Secchi Transparency (feet)***
Oligotrophic	< 10.0	< 2.2	> 15.0
Mesotrophic	10.0 – 20.0	2.2 – 6.0	7.5 – 15.0
Eutrophic	> 20.0	> 6.0	< 7.5

Table 3. Lake Trophic Status Classification Table.

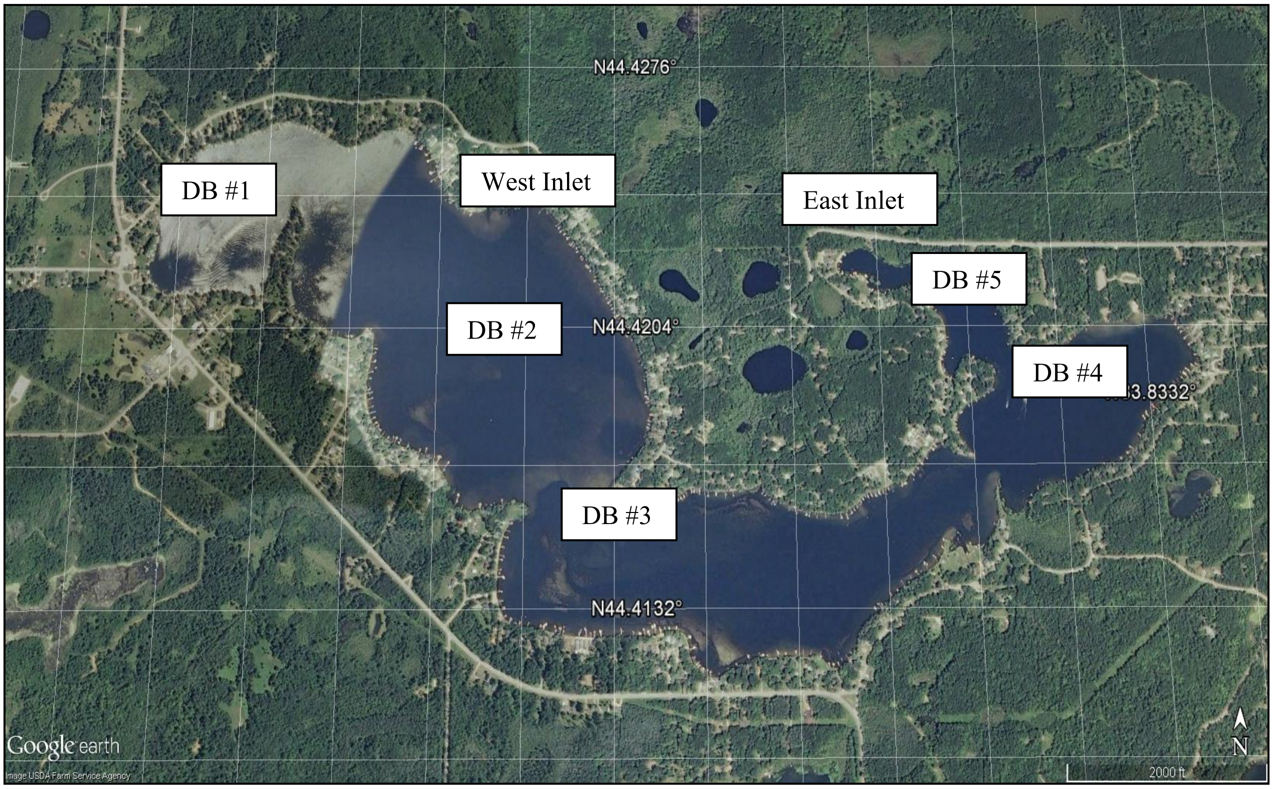


Figure 5: Water quality sampling locations Long Lake Iosco County, Michigan.

4.1 Long Lake Deep Basin Water Quality Data

Water quality parameters such as dissolved oxygen, water temperature, conductivity, turbidity, total dissolved solids, pH, total alkalinity, total phosphorus, total Kjeldahl nitrogen, Secchi transparency, chlorophyll-*a*, among others, all respond to changes in water quality and consequently serve as indicators of water quality change. These parameters were collected at the 5 deep basins of Long Lake on August 19, 2025. Water quality data collected in these locations are shown below in tables 4-9.

Dissolved Oxygen

Dissolved oxygen (DO) is a measure of the amount of oxygen that exists in the water column. In general, dissolved oxygen levels should be greater than 5 mg L^{-1} to sustain a healthy warm-water fishery. DO concentrations in Long Lake may decline if there is a high biochemical oxygen demand (BOD) where organismal consumption of oxygen is high due to respiration. DO is generally higher in colder waters and is measured in milligrams per liter (mg L^{-1}) with the use of a special meter and/or through the use of Winkler titration methods.

A decline in DO may cause increased release rates of phosphorus (P) from Long Lake bottom sediments if DO concentrations drop to near zero milligrams per liter. The August 19, 2025 DO levels ranged from a high of 8.6 mg L^{-1} at the surface to a low of 0.1 mg L^{-1} at the bottom. This means that the phosphorus locked in the sediments at the lake bottom is prone to release under these low DO conditions. This phosphorus release is what fuels the algae and aquatic plant growth.

Water Temperature

The water temperature of lakes varies within and among seasons and is nearly uniform with depth under winter ice cover because lake mixing is reduced when waters are not exposed to wind. When the upper layers of water begin to warm in the spring after ice-off, the colder, dense layers remain at the bottom. This process results in a “thermocline” that acts as a transition layer between warmer and colder water layers. During the fall season, the upper layers begin to cool and become denser than the warmer layers, causing an inversion known as “fall turnover”. In general, lakes with deep basins will stratify and experience turnover cycles. Water temperature is measured in degrees Celsius (ºC) or degrees Fahrenheit (ºF) with the use of a submersible thermometer. The August 19, 2025 water temperatures ranged from 23.9°C at the surface to 9.7°C at the bottom and thus differed by 14.2°C from top to bottom. Water temperatures for the inlets were 69.2°F for the West Inlet and 66°F for the East Inlet. Long Lake likely mixes shortly after ice off when the lake begins to set up a thermocline and the surface waters warm.

Conductivity

Conductivity is a measure of the amount of mineral ions present in the water, especially those of salts and other dissolved inorganic substances. Conductivity generally increases as the amount of dissolved minerals and salts in a lake increases, and also increases as water temperature increases. Conductivity is measured in micro-siemens per centimeter (µS cm^{-1}) with the use of a conductivity probe and meter. Conductivity values for Long Lake were moderate and ranged from 239-350 µS cm^{-1} on August 19, 2025, which is favorable for an inland lake. Values for the inlets were lower with 219 µS cm^{-1} observed at the West Inlet and 230 µS cm^{-1} observed at the East Inlet.

Turbidity

Turbidity is a measure of the loss of water transparency due to the presence of suspended particles. The turbidity of water increases as the number of total suspended particles increases. Turbidity may be caused from erosion inputs, phytoplankton blooms, stormwater discharge, urban runoff, re-suspension of bottom sediments, and by large bottom-feeding fish such as carp. Particles suspended in the water column absorb heat from the sun and raise the water temperature. Since higher water temperatures generally hold less oxygen, shallow turbid waters are usually lower in dissolved oxygen. Turbidity is measured in Nephelometric Turbidity Units (NTU's) with the use of a turbidity meter. The World Health Organization (WHO) requires that drinking water be less than 5 NTU's; however, recreational waters may be significantly higher than that. Turbidity ranged from 0.5-5.0 NTU's on August 19, 2025 and was highest near the lake bottom due to increased suspension of sediments into the water column that increase turbidity. Turbidity was favorable in the inlets and ranged from 2.0-4.0 NTU's. The lake bottom is predominately sandy substrate with some marl and silt, which increases the turbidity values near the lake bottom.

pH

pH is the measure of acidity or basicity of water. The standard pH scale ranges from 0 (acidic) to 14 (alkaline), with neutral values around 7. Most Michigan lakes have pH values that range from 6.5 to 9.5. Acidic lakes (pH < 7) are rare in Michigan and are most sensitive to inputs of acidic substances due to a low acid neutralizing capacity (ANC). pH is measured with a pH electrode and pH-meter in Standard Units (S.U). The pH of Long Lake water ranged from 7.6-8.4 S.U. and the pH of inlet water was 7.7-7.9 S.U. on August 19, 2025. From a limnological perspective, Long Lake is considered "slightly basic" on the pH scale.

Total Alkalinity

Total alkalinity is the measure of the pH-buffering capacity of lake water. Lakes with high alkalinity (> 150 mg L^{-1} of $CaCO_3$) are able to tolerate larger acid inputs with less change in water column pH. Many Michigan lakes contain high concentrations of $CaCO_3$ and are categorized as having "hard" water. Total alkalinity is measured in milligrams per liter of $CaCO_3$ through an acid titration method. The total alkalinity of Long Lake is considered "low" (< 150 mg L^{-1} of $CaCO_3$), and indicates that the water is not hard or highly alkaline. Total alkalinity ranged from 94-97 mg L^{-1} of $CaCO_3$ on August 19, 2025 among all deep basins. Total alkalinity may change on a daily basis due to the re-suspension of sedimentary deposits in the water and respond to seasonal changes due to the cyclic turnover of the lake water.

Total Phosphorus

Total phosphorus (TP) is a measure of the amount of phosphorus (P) present in the water column. Phosphorus is the primary nutrient necessary for abundant algae and aquatic plant growth. Lakes which contain greater than 20 µg L^{-1} of TP are defined as eutrophic or nutrient-enriched. TP concentrations are usually higher at increased depths due to higher release rates of P from lake sediments under low oxygen (anoxic) conditions. Phosphorus may also be released from sediments as pH increases. Total phosphorus is measured in micrograms per liter (µg L^{-1}) or in milligrams per liter (mg L^{-1}) with the use of a chemical autoanalyzer. The range of TP was <0.010-0.830 mg L^{-1}, with the highest values at the bottom of the deepest basin and the lowest values at the surface of all basins. These concentrations are within a normal range but would likely increase during periods of heavy rainfall and associated runoff. The inlets were significantly moderate in TP with a value of 0.070 mg L^{-1} in the West Inlet and <0.050 mg L^{-1} in the East Inlet.

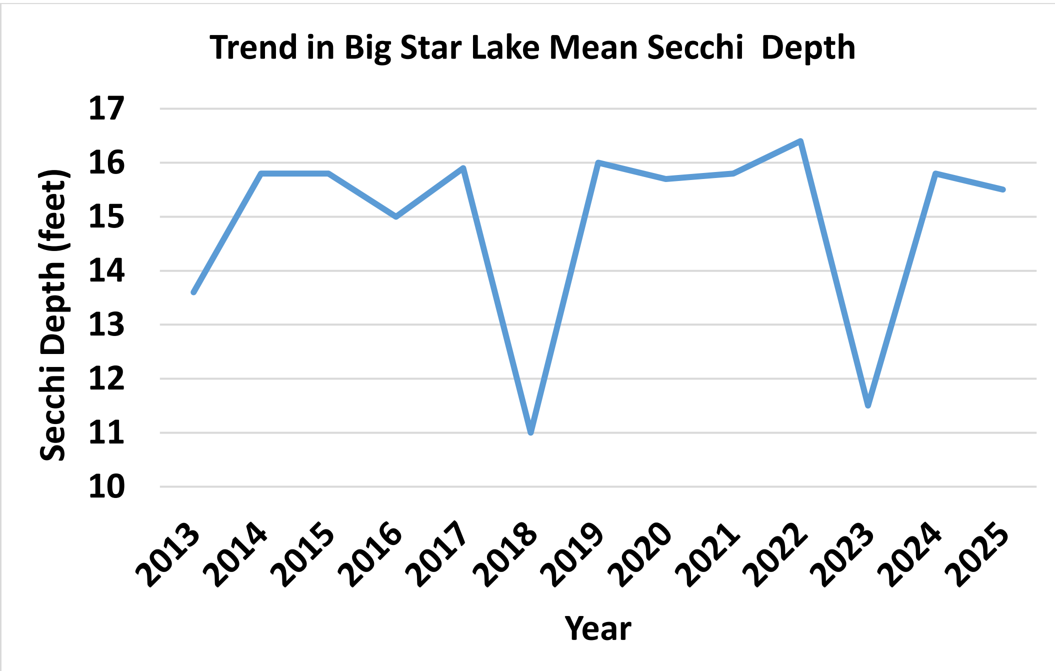
Total Kjeldahl Nitrogen

Total Kjeldahl Nitrogen (TKN) is the sum of all nitrogen forms in freshwater systems. Much nitrogen (amino acids and proteins) also comprises the bulk of living organisms in an aquatic ecosystem. Nitrogen originates from atmospheric inputs (i.e., burning of fossil fuels), wastewater sources from developed areas (i.e. runoff from fertilized lawns), agricultural lands, septic systems, and waterfowl droppings. It also enters lakes through groundwater or surface drainage, drainage from marshes and wetlands, or from precipitation (Wetzel, 2001). In lakes with an abundance of nitrogen (N: P > 15), phosphorus may be the limiting nutrient for phytoplankton and aquatic macrophyte growth. Alternatively, in lakes with low nitrogen concentrations (and relatively high phosphorus), the blue-green algae populations may increase due to the ability to fix nitrogen gas from atmospheric inputs. Lakes with a mean TKN value of 0.66 mg L^{-1} may be classified as oligotrophic, those with a mean TKN value of 0.75 mg L^{-1} may be classified as mesotrophic, and those with a mean TKN value greater than 1.88 mg L^{-1} may be classified as eutrophic. Long Lake contained highly variable values for TKN (<0.5-11.0 mg L^{-1}) on August 19, 2025. The inlets contained similar values at <0.5-3.0 mg L^{-1} for the West and East Inlets, respectively.

Secchi Transparency

Secchi transparency is a measure of the clarity or transparency of lake water, and is measured with the use of an 8-inch diameter standardized Secchi disk. Secchi disk transparency is measured in feet (ft) or meters (m) by lowering the disk over the shaded side of a boat around noon and taking the mean of the measurements of disappearance and reappearance of the disk.

Elevated Secchi transparency readings allow for more aquatic plant and algae growth. Eutrophic systems generally have Secchi disk transparency measurements less than 7.5 feet due to turbidity caused by excessive planktonic algae growth. The Secchi transparency of Long Lake on August 19, 2025 averaged 15.5 feet which is favorable. These Secchi transparency values are adequate to allow abundant growth of algae and aquatic plants in the majority of the littoral zone of the lake. Secchi transparency is variable and depends on the amount of suspended particles in the water (often due to windy conditions of lake water mixing) and the amount of sunlight present at the time of measurement.



Total Dissolved Solids

Total Dissolved Solids (TDS) is the measure of the amount of dissolved organic and inorganic particles in the water column. Particles dissolved in the water column absorb heat from the sun and raise the water temperature and increase conductivity. Total dissolved solids are often measured with the use of a calibrated meter in mg L^{-1}. Spring values are usually higher due to increased watershed inputs from spring runoff and/or increased planktonic algal communities. The concentration of TDS in Long Lake ranged from 153-225 mg L^{-1} in the lake water and from 136-149 mg L^{-1} in the inlets, with the highest value at the East Inlet. The inlet values indicate that solids are being transported to the lake from the land especially during intense rainfall events.

Chlorophyll-a and Phytoplankton Communities

Chlorophyll-*a* is a measure of the amount of green plant pigment present in the water, often in the form of planktonic algae. High chlorophyll-*concentrations* are indicative of nutrient-enriched lakes. Chlorophyll-*a* concentrations greater than 6.0 µg L^{-1} are found in eutrophic or nutrient-enriched aquatic systems, whereas chlorophyll-*a* concentrations less than 2.2 µg L^{-1} are found in nutrient-poor or oligotrophic lakes. Chlorophyll-*a* is measured in micrograms per liter (µg L^{-1}) with the use of an acetone extraction method and a spectrometer. The chlorophyll-*a* concentrations in Long Lake were determined by collecting a composite sample of the algae throughout the water column at each of the five deep basin sites from just above the lake bottom to the lake surface on August 19, 2025. The chlorophyll-*a* concentrations ranged from 3-12 µg L^{-1}, which was moderate and higher than in recent years and likely due to increased water temperatures and prolonged sunlight due to drought conditions in most areas.

Algal genera from a composite water sample collected over the deep basins of Long Lake on August 19, 2025 were analyzed under a compound bright field microscope. The genera present included the Chlorophyta (green algae): *Chlorella* sp., *Pediastrum* sp., *Rhizoclonium* sp., *Mougeotia* sp., *Scenedesmus* sp., and *Spirogyra* sp. The Cyanophyta (blue-green algae): *Oscillatoria* sp.; The Bascillariophyta (diatoms): *Synedra* sp*., Navicula* sp., *Fragillaria* sp., and *Stephanodiscus* sp., and *Cymbella* sp. The aforementioned species indicate a diverse algal flora and represent a relatively balanced freshwater ecosystem, capable of supporting a strong zooplankton community in favorable water quality conditions. The waters of Long Lake are rich in the diatoms and small green algae, which are indicators of good water quality and also support a robust fishery.

Table 4. August 19, 2025 Deep Basin #1 Water Quality Data

Depth ft	Water Temp ºC	DO mg L^{-1}	pH S.U.	Cond. µS cm^{-1}	Total Diss. Solids mg L^{-1}	Turb. NTU	Total Kjeldahl Nitrogen mg L^{-1}	Total Alk. mgL^{-1} $CaCO_3$	Total Phos. mg L^{-1}
0	23.6	8.5	8.2	253	163	0.5	<0.5	96	<0.010
21	14.7	4.2	7.9	253	163	3.0	<0.5	96	0.030
39	9.7	0.1	7.6	259	167	5.0	1.1	95	0.240

Table 5. August 19, 2025 Deep Basin #2 Water Quality Data

Depth ft	Water Temp ºC	DO mg L^{-1}	pH S.U.	Cond. µS cm^{-1}	Total Diss. Solids mg L^{-1}	Turb. NTU	Total Kjeldahl Nitrogen mg L^{-1}	Total Alk. mgL^{-1} $CaCO_3$	Total Phos. mg L^{-1}
0	23.9	8.4	8.4	255	164	0.5	<0.5	96	<0.010
30.0	15.8	2.1	8.0	255	164	2.0	<0.5	96	<0.010
60.0	10.8	0.2	7.8	260	167	4.0	1.2	95	0.410

Table 6. August 19, 2025 Deep Basin #3 Water Quality Data

Depth ft	*Water Temp ºC*	*DO mg L^{-1}*	*pH S.U.*	*Cond. µS cm^{-1}*	*Total Diss. Solids mg L^{-1}*	*Turb. NTU*	*Total Kjeldahl Nitrogen mg L^{-1}*	*Total Alk. mgL^{-1} $CaCO_3$*	*Total Phos. mg L^{-1}*
0	**23.2**	**8.6**	**8.4**	**290**	**188**	**0.5**	**<0.5**	**96**	**0.014**
18	**19.5**	**6.8**	**8.4**	**290**	**188**	**1.0**	**0.6**	**96**	**0.018**
34	**13.2**	**0.1**	**7.9**	**310**	**195**	**4.0**	**2.4**	**94**	**0.140**

Table 7. August 19, 2025 Deep Basin #4 Water Quality Data.

Depth ft	*Water Temp ºC*	*DO mg L^{-1}*	*pH S.U.*	*Cond. µS cm^{-1}*	*Total Diss. Solids mg L^{-1}*	*Turb. NTU*	*Total Kjeldahl Nitrogen mg L^{-1}*	*Total Alk. mgL^{-1} $CaCO_3$*	*Total Phos. mg L^{-1}*
0	**23.8**	**8.24**	**8.3**	**239**	**153**	**0.8**	**<0.5**	**96**	**<0.010**
27	**13.8**	**2.6**	**8.0**	**259**	**166**	**2.0**	**0.8**	**96**	**0.210**
54	**10.1**	**0.1**	**7.9**	**295**	**189**	**5.0**	**11.0**	**94**	**0.830**

Table 8. August 19, 2025 Deep Basin #5 Water Quality Data.

Depth ft	Water Temp ºC	DO mg L^{-1}	pH S.U.	Cond. µS cm^{-1}	Total Diss. Solids mg L^{-1}	Turb. NTU	Total Kjeldahl Nitrogen mg L^{-1}	Total Alk. mgL^{-1} $CaCO_3$	Total Phos. mg L^{-1}
0	22.9	8.56	8.3	241	155	2.0	0.5	97	<0.010
19	19.4	7.1	8.0	241	155	3.0	<0.5	95	<0.010
38	10.6	0.4	7.9	350	225	6.0	0.6	94	0.028

4.2 Long Lake Inlet Water Quality Data (2025)

The West and East Inlets on Long Lake have demonstrated that the nutrient concentrations originating from them is significantly higher than the concentrations that are ambient in the lake water. This means that the inlets are a threat to the water quality of the lake and prompt consideration of upstream BMP's should be implemented. Inlet water quality data collected on August 19, 2025 are shown below in Table 9.

Table 9. Long Lake inlet water quality data (August 19, 2025).

Location	Water Temp ºF	DO mg L^{-1}	pH S.U.	Cond. µS cm^{-1}	Turb. NTU	Total Kjeldahl Nitrogen mg L^{-1}	Total Diss. Solids mg L^{-1}	Total Phos. mg L^{-1}	Total Susp. Solids mg L^{-1}
West Inlet	69.2	7.5	7.7	230	2.0	<0.5	149	0.070	<10
East Inlet	66.0	6.9	7.9	219	4.0	3.0	136	<0.050	<10

5.0 LONG LAKE 2026 MANAGEMENT RECOMMENDATIONS

5.1 Long Lake Open Water Improvements

Aquatic vegetation surveys will be conducted in Late May or early June of 2026 with treatments to follow within a week or two of the survey. These surveys will prescribe treatments for EWM, CLP, and only nuisance native aquatic vegetation. It is critical to note that removal of too much aquatic vegetation can create a competitive advantage for algae which can proliferate throughout Long Lake.

An additional survey after the treatment(s) will determine the efficacy of the treatment and any follow-up treatment(s) that may be needed. EWM treatment may be treated with a combination of ProcellaCOR® and diquat as in 2025. CLP may be treated with Aquathol K® at a dose of 1-2 gal/acre. Diquat and/or Clipper® may be used on the nuisance native aquatic weeds. In recent years, algae became a concern on Long Lake and many other lakes due to intense rainfall and runoff and low wind conditions for an extended time period. Algae will be treated with chelated copper products if necessary and in localized near-shore conditions only as allowed by the EGLE permit. Algal blooms usually dissipate on their own and thus only very dense filamentous blooms should be addressed. Blue-green algae should never be treated with algaecides, and it can exacerbate the blooms.

In conclusion, water quality in Long Lake remains high but there is some concern about possible internal loading of phosphorus at the deepest basin which may be present during late summer due to a combination of runoff, decaying aquatic vegetation, and septic tank contributions. Water clarity is moderately high allowing light penetration to deeper water that helps support an abundant aquatic plant growth throughout many areas of the lake. Levels of nutrients such as phosphorus and nitrogen are moderate, but sufficient to support aquatic plant growth. Inlet nutrient concentrations often exceed in-lake nutrients levels and contribute to long-term eutrophication and potential algal growth.

Table 10. Proposed* 2026 budget for the continuation of the Long Lake Improvement Program.

Long Lake Improvement Strategy	*Estimated 2026 Annual Cost*
Herbicides for control of invasive aquatic EWM (approx. 15 acres)@ $693 per acre and CLP (approx. 70 acres)@ $183 per acre	$23,205
Herbicides for control of nuisance native aquatic vegetation (approx. 28 acres @$500 per acre)	$14,000
Professional Management Services[3] (water sampling, oversight of treatments, mapping, management)	$12,500
Contingency Funds (necessary for additional costs that may arise due to unpredictable circumstances)	$4,971
TOTAL ANNUAL ESTIMATED COST	$54,676

***Proposed lake management budget for Long Lake in 2026. Note: If EWM returns then additional cost may be needed. Use of reserve or roll-over funds from previous years may then be necessary. Budget for nuisance native aquatic plant growth may also be increased if necessary due to unexpected growth in shallow areas. This proposed budget may also be an over-estimation and is only a recommendation and may be altered by the LLPOA and the Township.**

6.0 LITERATURE CITED

Madsen, J.D., J.A. Bloomfield, J.W. Sutherland, L.W. Eichler, and C.W. Boylen. 1996. The aquatic macrophyte community of Onondaga Lake: Field survey and plant growth bioassays of lake sediments, *Lake and Reservoir Management* 12:73-79.

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