



2025 Lower Long Lake Water Quality Review

Introduction

The goals of this testing protocol were to monitor various water quality parameters of the lake, compare results to historical data, and identify any potential risks to the health of Lower Long Lake. Water samples were taken at four different locations and tested for 14 parameters. Tests were conducted once in the spring and once in the late summer. Tests were conducted with a YSI ProDSS Multiparameter Water Quality Meter or LaMotte SMART2 Colorimeter.

Test results were compared to historical data from the report “Lower Long Lake 2024 WQ Report” by LakePro, Inc.

In this report, we included historical data from Water Quality Investigators. Their report provided annual averages for many of the parameters from 2002 to 2009. Including this data allows us to see more accurate trends in the water quality data. In order to make the analysis easier, we added annual averages for our data and trendlines on the graphs. The trend lines allow us to see the direction each water quality parameter is moving.

Results

Parameter	2025 Season		Status
	Average	Target Range	
Temperature	65.6 °F	Less Than 75 °F	● Healthy
Dissolved Oxygen	7.7 mg/L	4.0 – 12.0 mg/L	● Healthy
Total Phosphorus	73 ppb	0 – 100 ppb	● Healthy
Phosphate	44 ppb	0 – 100 ppb	● Healthy
Nitrate	49 ppb	0 – 200 ppb	● Healthy
Chlorophyll-a	2.2 ppb	0 – 7.3 ppb	● Healthy
Transparency	18.9 feet	More than 6.5 feet	● Healthy
pH	8.2 S.U.	7.0 – 9.0 S.U.	● Healthy
Total Dissolved Solids	510 ppm	0 – 1,000 ppm	● Healthy
Conductivity	725 ppm	0 – 1,500 ppm	● Healthy
Alkalinity	123 ppm	100 – 250 ppm	● Healthy
Sulfate	10.5 ppm	3 – 30 ppm	● Healthy
Fluoride	0.09 ppm	0.01 – 0.30 ppm	● Healthy
Chloride	139 ppm	0 – 230 ppm	● Healthy





Preface

2025 was LakePro's fifteenth year testing water quality on Lower Long Lake. The historical data reveals trends over the testing history. The trend lines on the following graphs show the change from 2002 to 2025. Each successive year of testing will provide more insight into how the lake changed.

Discussion

The results of this year's testing indicate that the water of Lower Long Lake remained outstanding throughout the summer. The results show that the aquatic environment was very suitable to support natural wildlife. Also, the lake was safe for recreational uses, such as swimming, boating, fishing, etc., as there are no signs of pollution.

The **Temperature** of the surface water was more typical for spring testing, averaging 53.3 Fahrenheit. The temperature then increased into the late summer as expected. The **Dissolved Oxygen** in the lake remained excellent throughout the summer. Furthermore, the sufficient oxygen concentration was a positive attribute headed into winter when ice seals the lake off from atmospheric oxygen.

The concentrations of both **Total Phosphorus** and Phosphate were within the target range throughout the summer. **Phosphate** is the usable form of phosphorus.

Nitrate concentrations remained well within the target range throughout the summer and decreased slightly compared to the previous year. Responsible fertilizer use and good land management practices within the watershed are important to minimize additional nutrient inputs to the lake.

We measured **chlorophyll-a** as a direct indicator of phytoplankton production. Concentrations increased gradually over the course of the summer as environmental conditions became more favorable for algal growth, and the seasonal average was slightly higher than the previous year. However, chlorophyll levels remained within the target range during all sampling events across the four sites.

The **Transparency** was excellent during every test, measuring deeper than most other lakes that we tested. Transparency can be affected by many different factors, including suspended solids, organic material, dissolved solids, acids, and algae growth. The clear water is generally a positive attribute, but it also allows more sunlight to reach the lake bottom to fuel plant growth.

The **pH** was within the target during all testing events.

Total Dissolved Solids (TDS) and **conductivity** remained within their designated target ranges during all tests. This year's results indicated a slight decrease in both parameters, suggesting a small reduction in the concentration of dissolved ions in the water.

Alkalinity remained within the target range throughout the summer but decreased slightly toward late summer. Increased biological activity during the summer can influence carbon dioxide levels in the water, which in turn affects the lake's carbonate buffering system. Despite this seasonal change, alkalinity has remained relatively stable over the monitoring history.

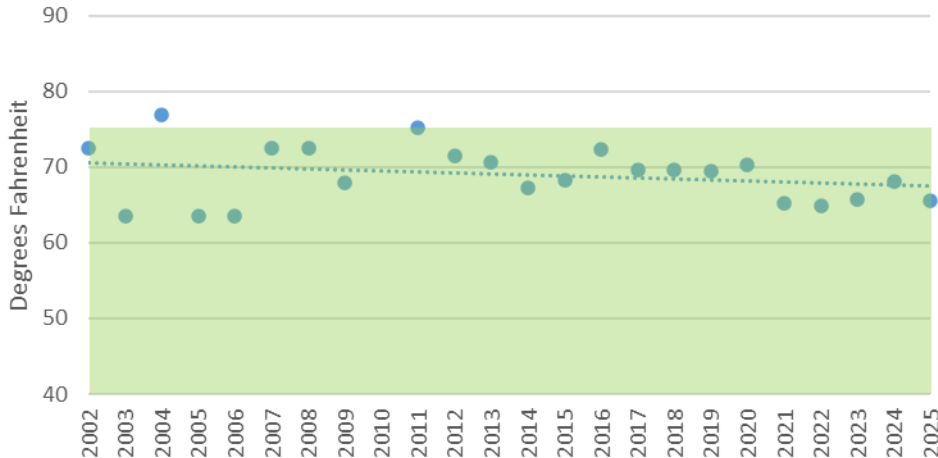
The **Sulfate**, **Fluoride**, and **Chloride** were all within their target ranges for the entire summer.





Historical Trends

Lake Temperature

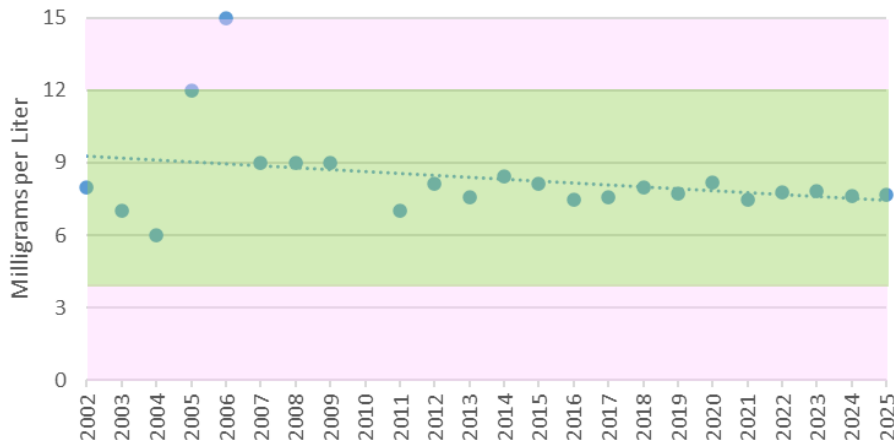


Temperature (°F)		
	May	September
Site 1	53.4	77.8
Site 2	53.2	78.0
Site 3	53.5	77.9
Site 4	53.1	77.5
Season Average		65.6

Target Range: < 75°F

The historical temperature record shows minimal long-term change. Observed fluctuations are largely attributable to differences in sampling dates and natural year-to-year weather variation rather than a sustained shift in lake temperature. With a dataset now spanning 2002 through 2025, the trend line represents a more reliable depiction of long-term conditions and provides a stronger basis for evaluating future changes in the lake.

Dissolved Oxygen

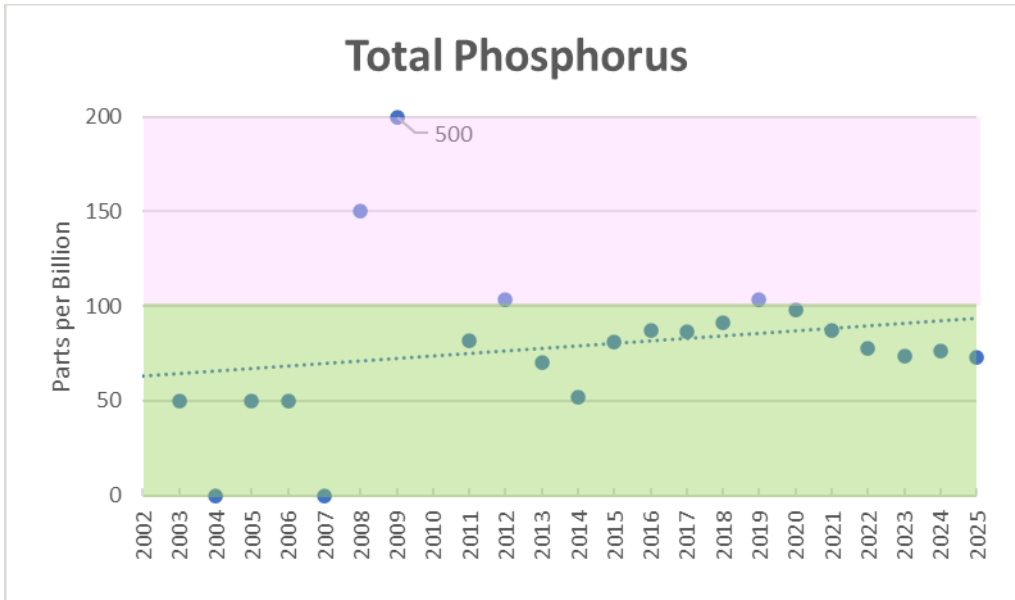


Dissolved Oxygen		
	May	September
Site 1	7.8	7.5
Site 2	7.4	7.6
Site 3	8.0	7.8
Site 4	7.9	7.5
Season Average		7.7

Target Range: 4.0 – 12.0 mg/L

The dissolved oxygen trend showed a slight decrease over the testing history. In 2025, we observed a steady concentration of oxygen. Monitoring the trend line will persist, and if a more pronounced decline occurs, we will advise additional measures accordingly.

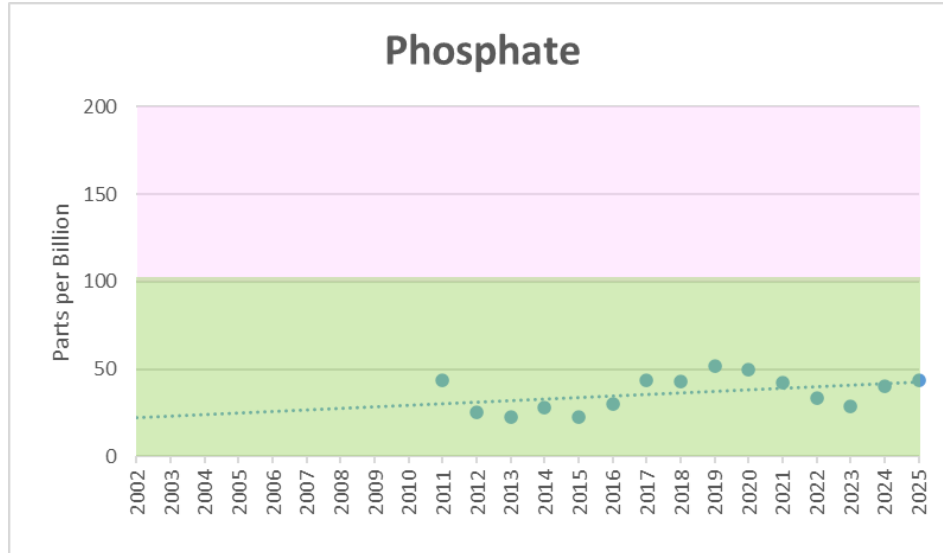




Total Phosphorus		
	May	September
Site 1	105	50
Site 2	90	40
Site 3	110	60
Site 4	70	60
Season Average		73

Target Range: 0 – 100 ppb

The annual average total phosphorus concentrations increased gradually through 2019. However, the past five years have shown a decline, with levels comparable to those observed in 2022. Lakes naturally accumulate nutrients over time through the process of eutrophication. State regulations restricting phosphorus fertilizers, along with ongoing aquatic plant management, may help reduce phosphorus inputs to the lake moving forward. Overall, the phosphorus concentrations observed remain very favorable for a large lake within a heavily developed watershed.

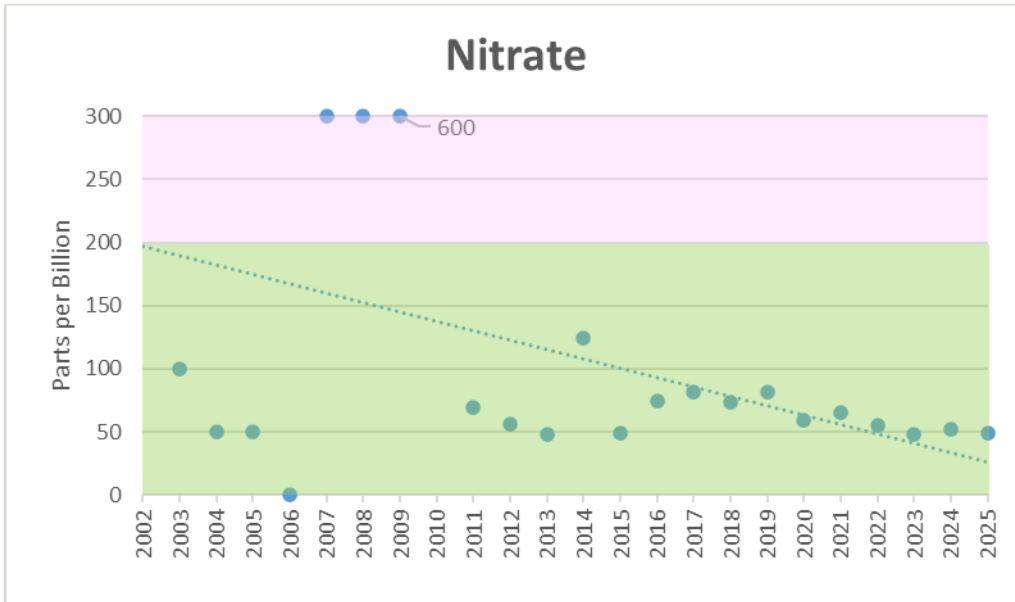


Phosphate		
	May	September
Site 1	50	40
Site 2	40	30
Site 3	50	40
Site 4	50	50
Season Average		44

Target Range: 0 – 100 ppb

Phosphate (SRP) is the form of phosphorus that is usable to aquatic plants. The phosphate data also showed a slightly upward trend since we began testing this parameter in 2011. Because SRP typically represents only a small fraction of total phosphorus, minor changes in nutrient recycling within the lake can cause SRP concentrations to rise even while overall phosphorus levels remain stable or gradually decrease.

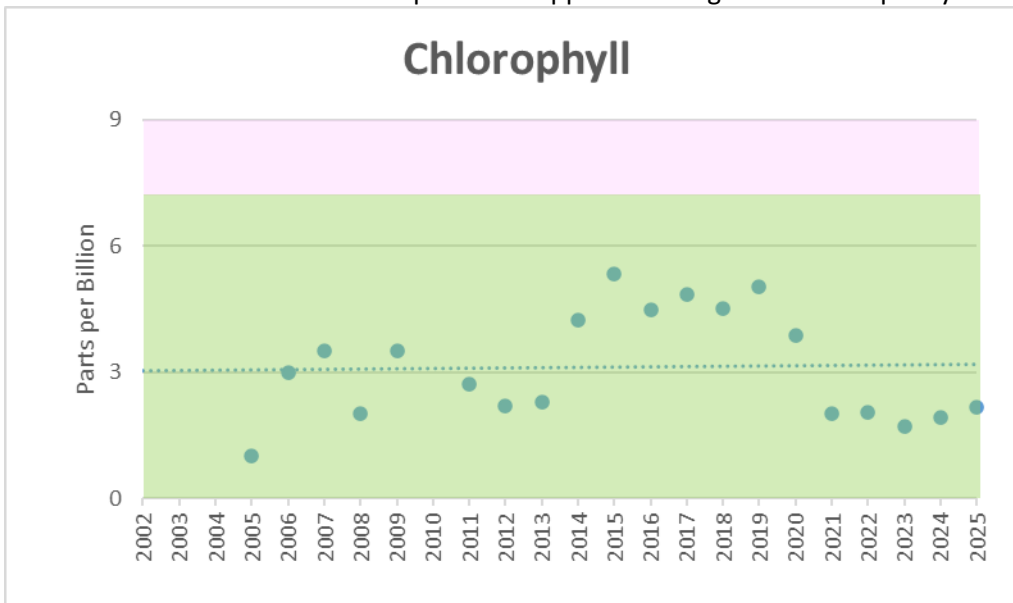




Nitrate		
	May	September
Site 1	70	30
Site 2	60	50
Site 3	70	30
Site 4	60	20
Season Average		49

Target Range: 0 – 200 ppb

Nitrate is another important nutrient that supports the growth of aquatic plants and algae. Higher concentrations were observed during the early years of monitoring, while more recent data show a general decline, resulting in an overall downward historical trend. Continued awareness of shoreline property management practices will help minimize additional nutrient inputs and support the long-term water quality of the lake.

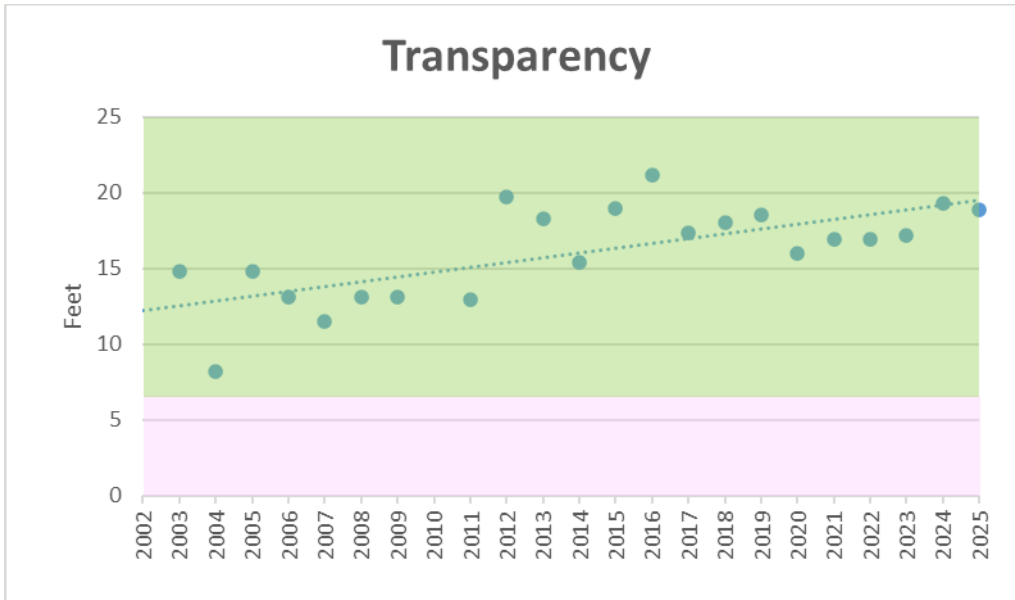


Chlorophyll		
	May	September
Site 1	0.8	3.2
Site 2	1.2	3.5
Site 3	0.6	3.8
Site 4	0.8	3.4
Season Average		2.2

Target Range: 0 – 7.2 ppb

Chlorophyll-a is used as an indicator of the amount of algae present in the water column and is a common measure of lake productivity. Monitoring results show moderate variability throughout the historical record, which is expected due to differences in weather patterns, temperature, and nutrient availability. Several years in the mid-portion of the dataset showed somewhat elevated values; however, recent measurements have declined and now fall within the lower range of the historical record. Overall, chlorophyll-a concentrations remain low, which is altered with lake management activities.

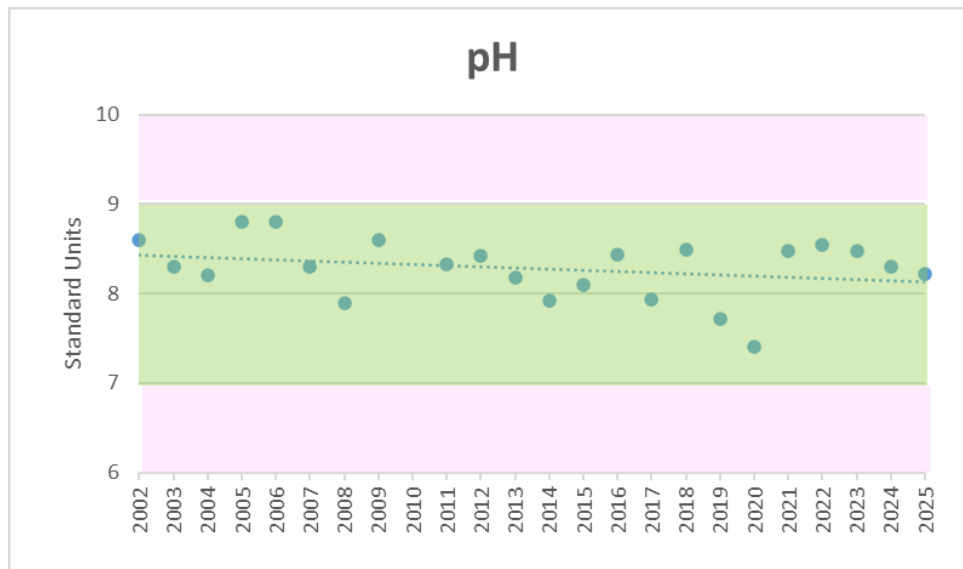




Transparency		
	May	September
Site 1	19.3	18.1
Site 2	19.7	18.6
Site 3	19.1	18.4
Site 4	19.5	18.1
Season Average		18.9

Target Range: > 6.5 feet

Transparency was affected by total dissolved solids, total suspended solids, algae growth, and rain frequency and amount. Overall, the transparency of the lake increased over the testing history



pH		
	May	September
Site 1	8.1	8.2
Site 2	7.9	8.4
Site 3	8.2	8.7
Site 4	8.1	8.2
Season Average		8.2

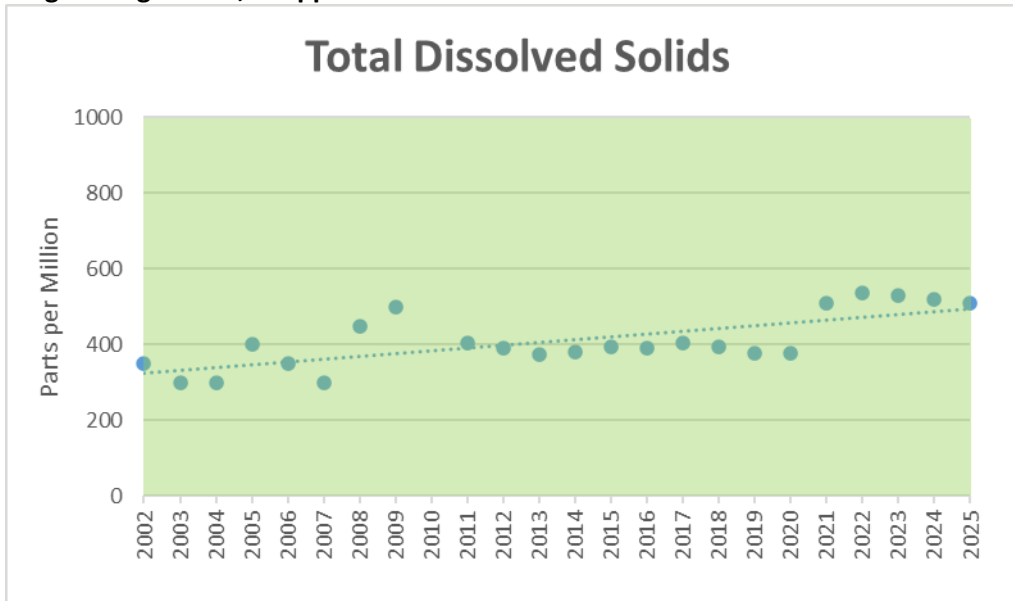
Target Range: 7.0 – 9.0 S.U.

There was a slight decrease in pH over the testing history, but it stayed in the target range of 7 to 9. We will look for the pH to remain level in future years. If the pH ever drops drastically, we will look for the cause of that change in order to mitigate the trend.



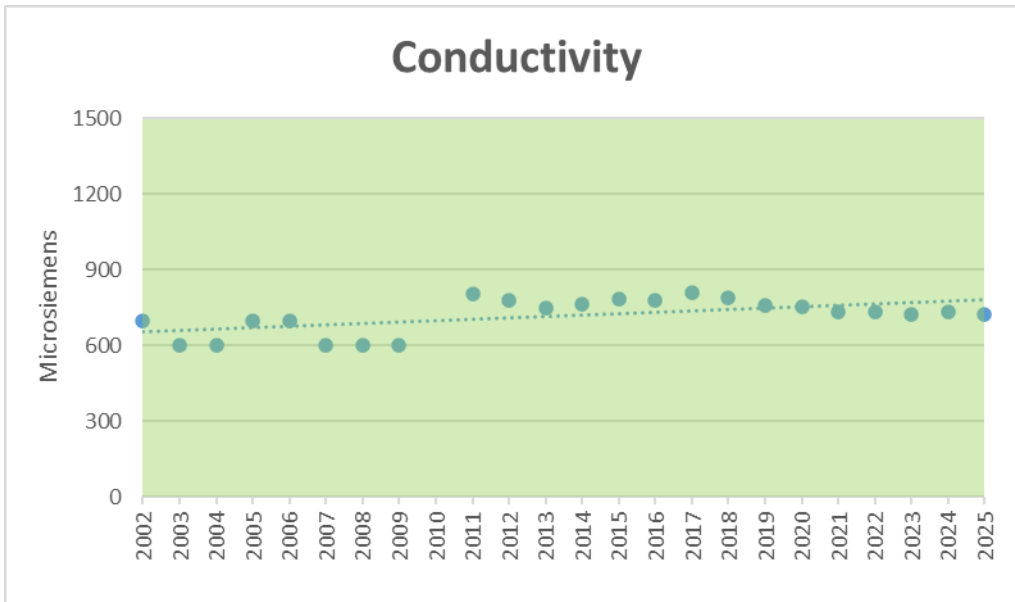


Target Range: 0 – 1,000 ppm



Total Dissolved Solids		
	May	September
Site 1	536	480
Site 2	537	484
Site 3	539	482
Site 4	537	481
Season Average		510

The Total Dissolved Solids showed a slight upward trend over the testing history. This is common for inland lakes as they accumulate more substances from their watershed and the atmosphere. In 2025, we observed similar results to the past few years, even dipping a little lower than what was recorded in 2024.

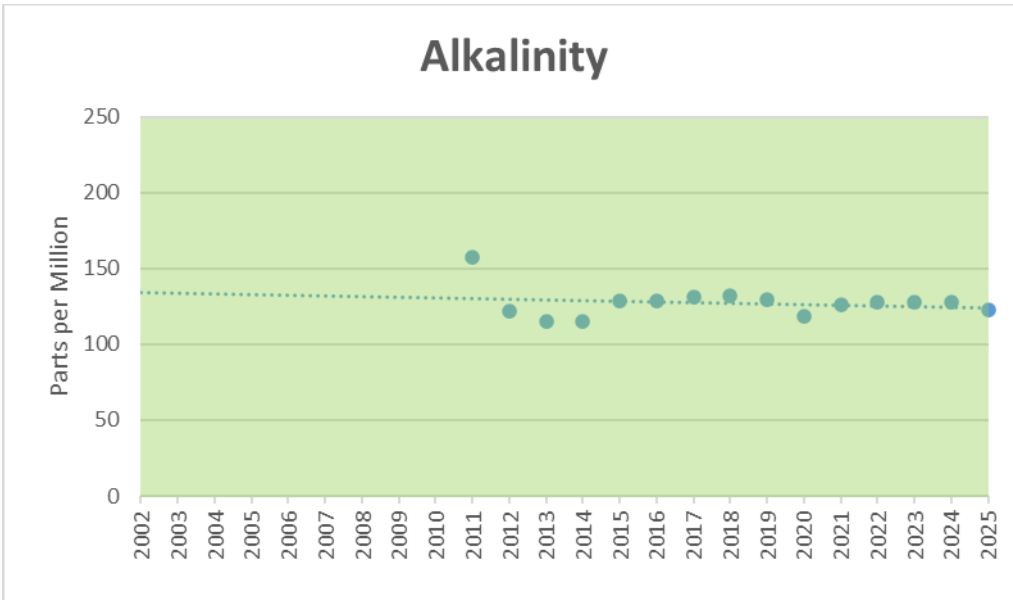


Conductivity		
	May	September
Site 1	719	730
Site 2	724	727
Site 3	717	729
Site 4	720	734
Season Average		725

Target Range: 0 – 1,500 μ S

Like the TDS, Conductivity showed a slight upward trend. Conductivity is an extension of TDS and measures the number of ionic molecules in the water (which conduct electricity, usually salts).

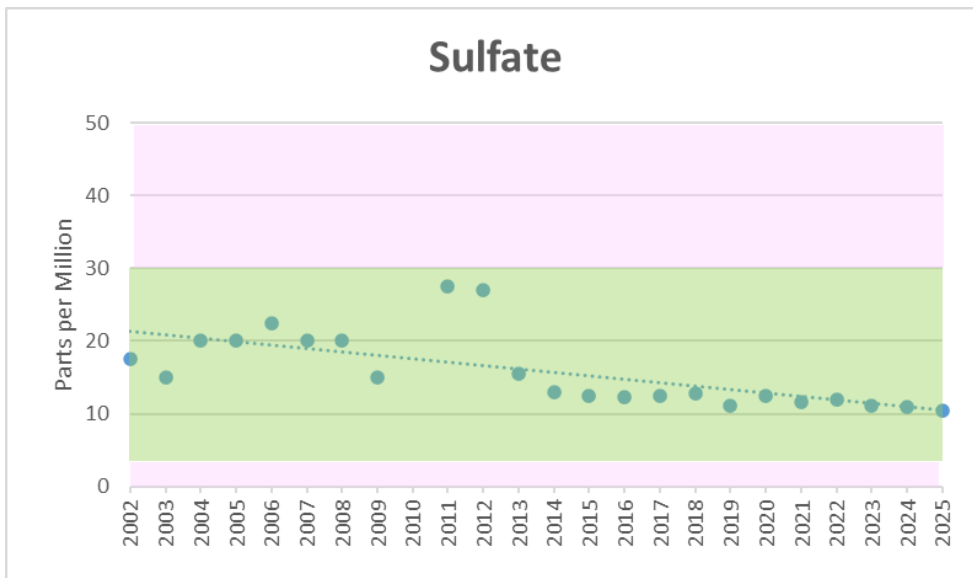




Alkalinity		
	May	September
Site 1	126	126
Site 2	124	124
Site 3	127	127
Site 4	123	123
Season Average		123

Target Range: 0 – 250 ppm

LakePro started testing this parameter in 2011. Since then, the alkalinity has decreased slightly. Alkalinity works as a buffer to stabilize the pH when foreign substances enter the lake, so it is important this parameter stay at a healthy level to protect the lake from other changes.



Sulfate		
	May	September
Site 1	12.0	12.0
Site 2	9.0	9.0
Site 3	10.0	10.0
Site 4	11.0	11.0
Season Average		10.5

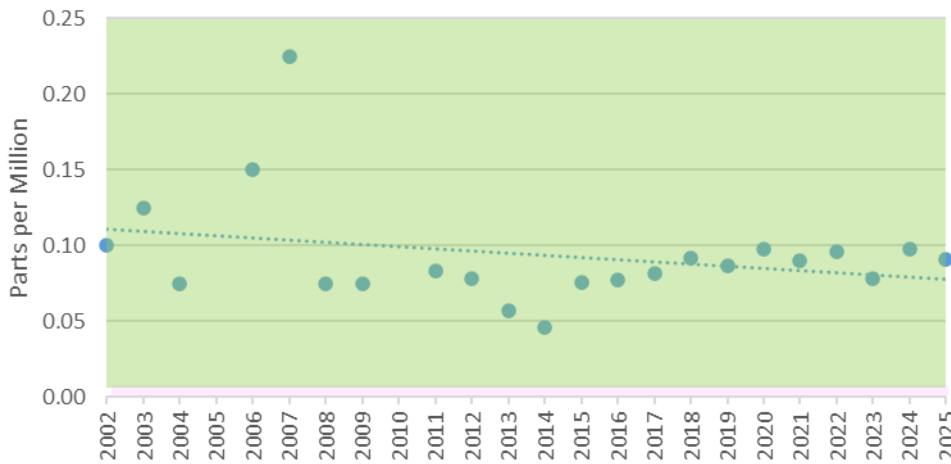
Target Range: 3 – 30 ppm

Calcium sulfate and magnesium sulfate are common minerals in surface water, so some sulfate should be present. Elevated levels of sulfate can indicate pollution. Over the testing history, sulfate remained within the target range and decreased toward the bottom of the target range.





Fluoride

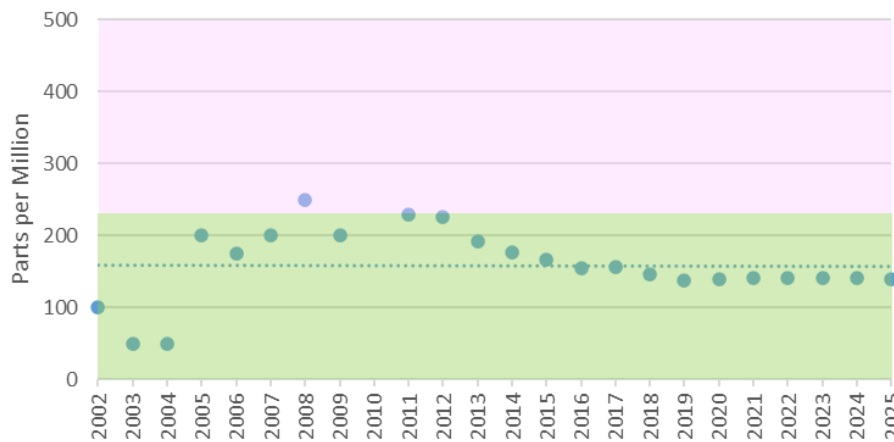


Fluoride		
	May	September
Site 1	0.09	0.09
Site 2	0.10	0.10
Site 3	0.09	0.09
Site 4	0.08	0.08
Season Average		0.09

Target Range: 0.01 – 0.30 ppm

Fluoride occurs naturally in groundwater, so some may be present in the lake surface water. Elevated levels can indicate pollution, but are not physiologically harmful. Over the testing history, fluoride remained comfortably within the target range.

Chloride



Chloride		
	May	September
Site 1	146	146
Site 2	143	143
Site 3	141	141
Site 4	139	139
Season Average		139

Target Range: 0 – 230 ppm

Chloride is a major anion found in water. This substance may be due to the natural process of water passing through salt formations in the earth or may be evidence of the intrusion of pollution from industrial processes or road salting. The trend was slightly upward due to high concentrations from 2005 to 2012. Since then, there has been a steady downward trend that has leveled off since 2018.





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Conclusion

Overall, the water quality of **Lower Long Lake** remained excellent throughout the 2025 monitoring season. All tested parameters fell within their respective target ranges, indicating a healthy aquatic system capable of supporting fish, wildlife, and recreational activities. Transparency remained exceptional, nutrient concentrations were well controlled, and biological indicators such as chlorophyll-a confirmed that algal productivity remained moderate.

The expanded dataset now spanning 2002 through 2025 provides a strong historical perspective on the lake's condition. While minor fluctuations occur from year to year due to weather, seasonal conditions, and natural biological processes, the overall trends indicate that the lake has maintained stable and favorable water quality over the monitoring period.

Despite being located within a highly developed watershed, Lower Long Lake continues to perform exceptionally well compared to many similar inland lakes. Continued responsible shoreline practices, careful nutrient management, and ongoing monitoring will help ensure that this high level of water quality is maintained for future generations.

The residents and lake association should take pride in the stewardship efforts that have helped protect this valuable resource. With continued cooperation and sound management practices, Lower Long Lake is well positioned to remain a high-quality recreational and ecological asset in the years ahead.

Thanks for choosing TIGRIS/LakePro,

Michael Smith
Operations Manager
Environmental Science





Analysis Information

- Temperature:** The water temperature directly affects the amount of oxygen that can dissolve into the water. The temperature of surface waters is not indicative of the entire water column.
- Transparency:** The ability of light to penetrate the water column is determined by the amount of dissolved and suspended particles in the water. Although aesthetically desirable, transparent water allows increased light to reach the lakebed and may result in vegetation growth.
- pH:** pH is a measure of acidity or alkalinity. pH is a general measure of lake health and can roughly indicate the range of other measurements such as alkalinity and hardness.
- TDS:** Total Dissolved Solids is the amount of all organic and inorganic substances in the water in a molecular or ionized state. Higher values generally indicate richer and more productive water. Lower values usually indicate cleaner and less productive water.
- Conductivity:** Conductivity is a measure of the ability of water to conduct electricity. Dissolved ions in the water increase conductivity, thus TDS and Conductivity are closely related.
- Alkalinity:** Alkalinity refers to the ability of the water to neutralize acids, mainly through the hydrogenation of carbonate ions. Therefore, the alkalinity is expressed as “ppm as CaCO₃”. However, other basic molecules in the water can also contribute to alkalinity.
- Dissolved Oxygen:** D.O. is a measure of the amount of oxygen dissolved in the water. This oxygen is available to fish and other animals for respiration. Vegetation generally increases DO, particularly during the day and early evening. Animals and other respiring organisms consume the oxygen, mostly during the day. Oxygen is also added to the lake through wave action, rain, fountains and aerators.
- Total Phosphorus:** Phosphorus is an essential nutrient for plant growth. However, concentrations exceeding 100 ppb can impair the water and results in nuisance vegetation growth.
- Phosphates:** Phosphate is the form of phosphorous that is most readily available to plants and algae.
- Nitrate:** Nitrogen is also essential for plant growth. Nitrate is the predominant form of nitrogen in water. Excessive nitrate concentrations may also result in pollution and increased vegetation.
- Chlorophyll-a:** Chlorophyll-a is a direct measurement of the amount of green pigment produced by plants and phytoplankton. This indicates the amount of plant growth and is used to calculate a Trophic State Index.
- Sulfate:** Sulfate occurs naturally as minerals, such as calcium sulfate and magnesium sulfate. In fresh water, sulfate is usually the second or third most abundant anion. Other sources of sulfate include water material from pulp mills, steel mills, food processing operations, and municipal wastes. Under low oxygen conditions, sulfate can be reduced to hydrogen sulfide gas, which smells like rotten eggs.
- Fluoride:** Fluoride may occur naturally or be added to public drinking water supplies.
- Chloride:** Chloride is one of the major anions found in water and sewage. The presence of chlorides may be due to water passing through salt formations in the earth or pollution from industrial processes, domestic wastes, or road salt. The salt content of water affects the





distribution of plant and animal life in an aquatic system, based on the amount of slat they can tolerate.

Fecal Coliforms: Non-fecal coliforms are naturally found as soil organisms. Fecal Coliforms, such as *E. coli*, are coliforms found in the intestines of warm-blooded animals and humans. The presence of fecal coliforms indicates contamination from either animals or humans.

Trophic States

Oligotrophic: Water is very clear. Nutrient levels are generally low. Plant and algae productivity are also low. Sufficient dissolved oxygen in the bottom, cooler waters allow cold-water fish to survive, such as salmon and trout.

Mesotrophic: Water is moderately clear. Nutrient levels are slightly elevated. Plant and algae productivity are present, but generally not a nuisance. Oxygen and temperature in the lower portion of the lake allow walleye and perch to survive.

Eutrophic: Water is not clear due to high nutrients levels, increased turbidity, and excessive algal growth. There is no oxygen in the bottom, cooler waters, restricting the lake to warm water species, such as bass and bluegill.

Hypereutrophic: Nutrient levels are extremely high, promoting very high algae productivity. Blue-green algae blooms are likely. High turbidity and algae growth make the water opaque. Little plant growth is restricted to invasive plants. The only fish that can survive this environment are rough fish, such as carp, catfish, and mudminnows.

Sample Sites:

