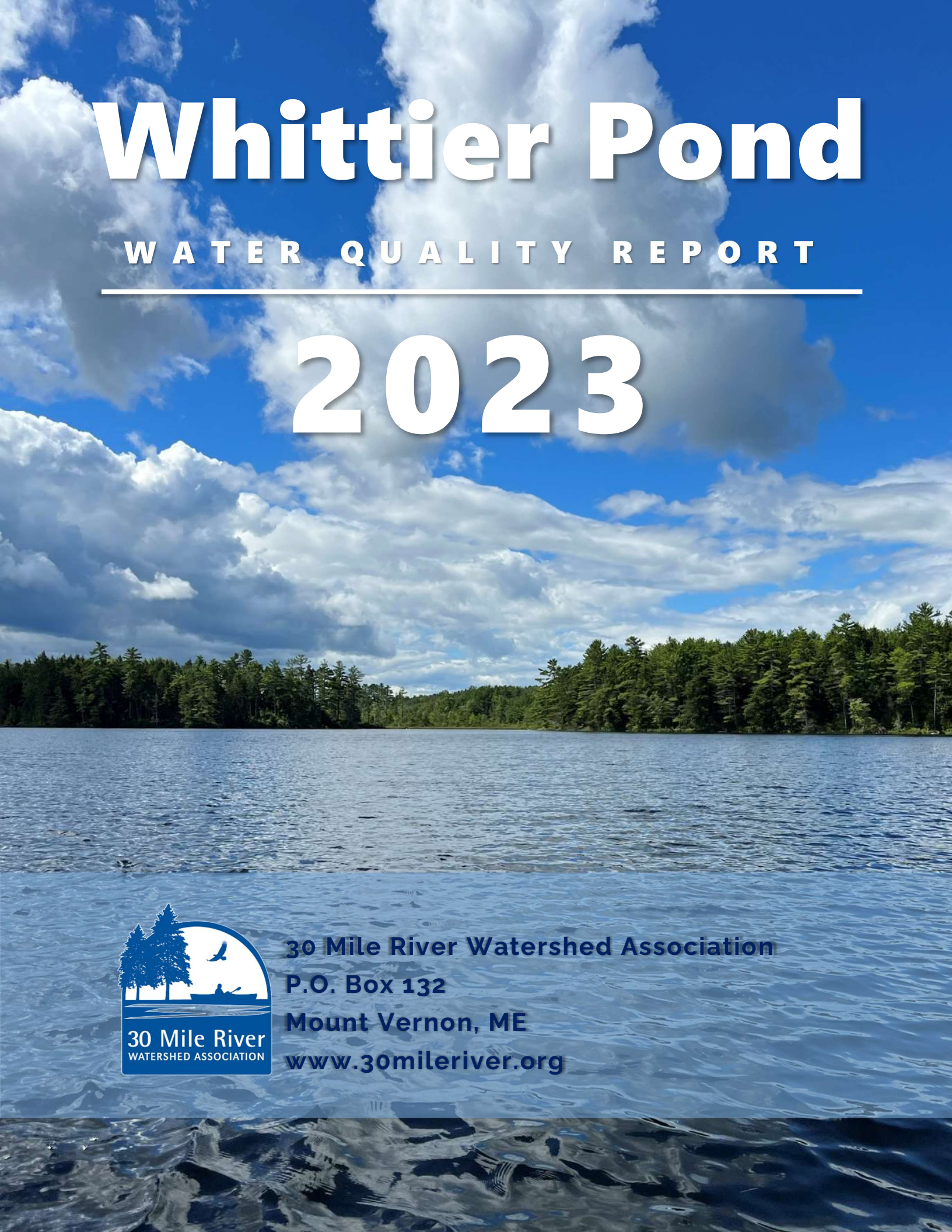
Whittier Pond

WATER QUALITY REPORT

2023



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2023 Whittier Pond Water Quality Report

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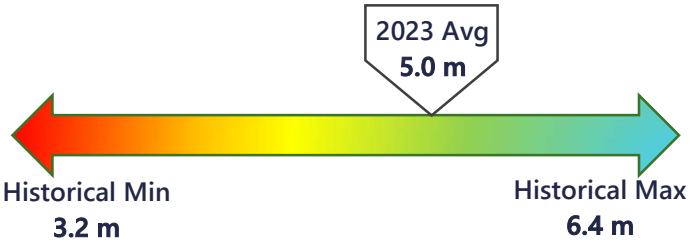
2023 Water Quality Summary[1]

Monitoring on Whittier Pond occurred April through October in 2023 by Whitney Baker and Silas Mohlar of 30 Mile River Watershed Association (30 Mile) and local volunteers.

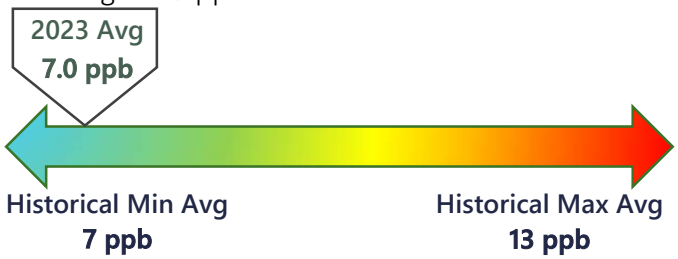
Water clarity readings in 2023 ranged from 3.90 meters (July 18th) to 5.76 meters (April 15th) with an annual average of 5.0 meters. Fifteen (15) total readings were collected over fourteen monitoring days in 2023.

Water Clarity (m)	
2023 Water Clarity Average	5.0
Historical SDT Average	4.9
Maine Lakes SDT Average	4.8



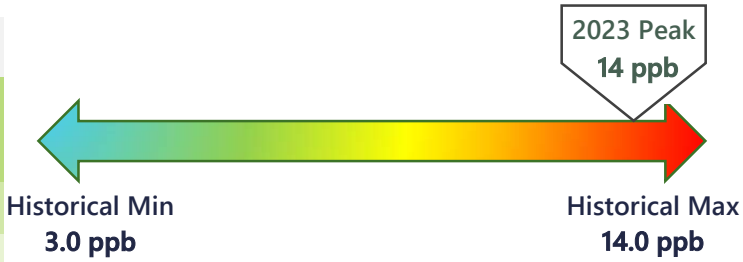
Three (3) samples were collected and analyzed for **Total Phosphorus**. Laboratory results ranged from 7 ppb (parts per billion) to 8 ppb with an average of 7 ppb.

Total Phosphorus (ppb)	
2023 TP Average	7.0
Historical TP Average	9.0
Maine Lakes TP Average	12



Chlorophyll was measured three (3) times in 2023. Results ranged from 8 ppb (August 14th) to 14 ppb (July 18th) with an annual average of 10.3 ppb.

Chlorophyll-a (ppb)	
2023 Chl-a Average	10.3
2023 Peak Chl-a	14.0
Historical Chl-a Average	6.0
Maine Lakes Chl-a Average	5.4



Three (3) **Dissolved Oxygen (DO)** profiles were collected in 2023. Anoxia (DO <2 ppm) was first encountered at 5 meters and the area grew slightly to include waters 4 meters and deeper by September.

[1] Scale bars illustrate the range of data collected for each parameter over the historical monitoring record for general comparison with the 2023 monitoring results. The blue end represents the historical minimum (best), and the red end represents the historical maximum (worst) of all monitoring data collected.

Overview

Whittier Pond is a small 55-acre pond located in the town of Vienna in Kennebec County, ME. Whittier Pond has a maximum depth of 6 m (19 ft) and an average depth of just 3 m (10 ft). The watershed area draining to the pond is roughly 0.4 square miles. Water from Whittier Pond flows to a single outlet located at the southwest end of the pond that flows south into to the north end of Parker Pond.

Water quality data was collected during 13 years between 2008 and 2023 by Maine DEP, Lake Stewards of Maine, certified volunteers monitors, and more recently, 30 Mile River Watershed Association.

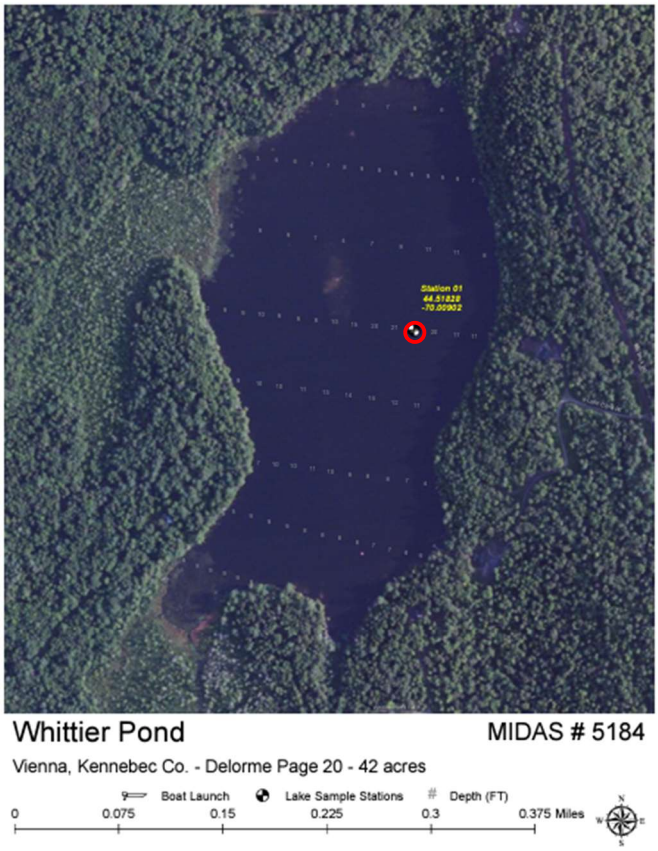


Figure 1. Station 01, Whittier Pond, Vienna, Maine.

Water Quality Monitoring in 2023

In 2023, 30 Mile River staff Whitney Baker and Silas Mohlar visited Whittier Pond three (3) times throughout the season. Water quality data was collected once in July, August, and September. Parameters include Secchi disk transparency, dissolved oxygen and temperature, phosphorus, chlorophyll, and advanced chemistry parameters (pH, Alkalinity, Color, and Conductivity). Monitoring on Whittier Pond takes place at the deepest spot in the pond - aka Station 01 (Figure 1). 12 additional secchi disk readings taken by volunteers, Sheri Shunney, and Ned & Kay Van Woert are also included in this report.

(Left) 30 Mile Program Leader & Field Technician, Silas Mohlar, paddles back to shore during a monitoring trip on Whittier Pond in 2023.

Secchi Disk Transparency (Water Clarity)

Secchi disk transparency (SDT) is an indicator of water clarity. To measure water clarity, a black and white disk is lowered into the water and the reading is taken at the depth at which it is no longer visible. Factors that affect water clarity include algal growth, zooplankton densities, natural water color, and suspended silt or sediment particles.

Water Clarity (m)	
2023 Water Clarity Average	5.0
Historical SDT Average	4.9
Maine Lakes SDT Average	4.8

Water clarity readings in 2023 ranged from 3.90 meters (July 18th) to 5.76 meters (April 15th) with an annual average of 5.0 meters. Fifteen (15) total readings were collected over fourteen monitoring days in 2023 (Figure 2).

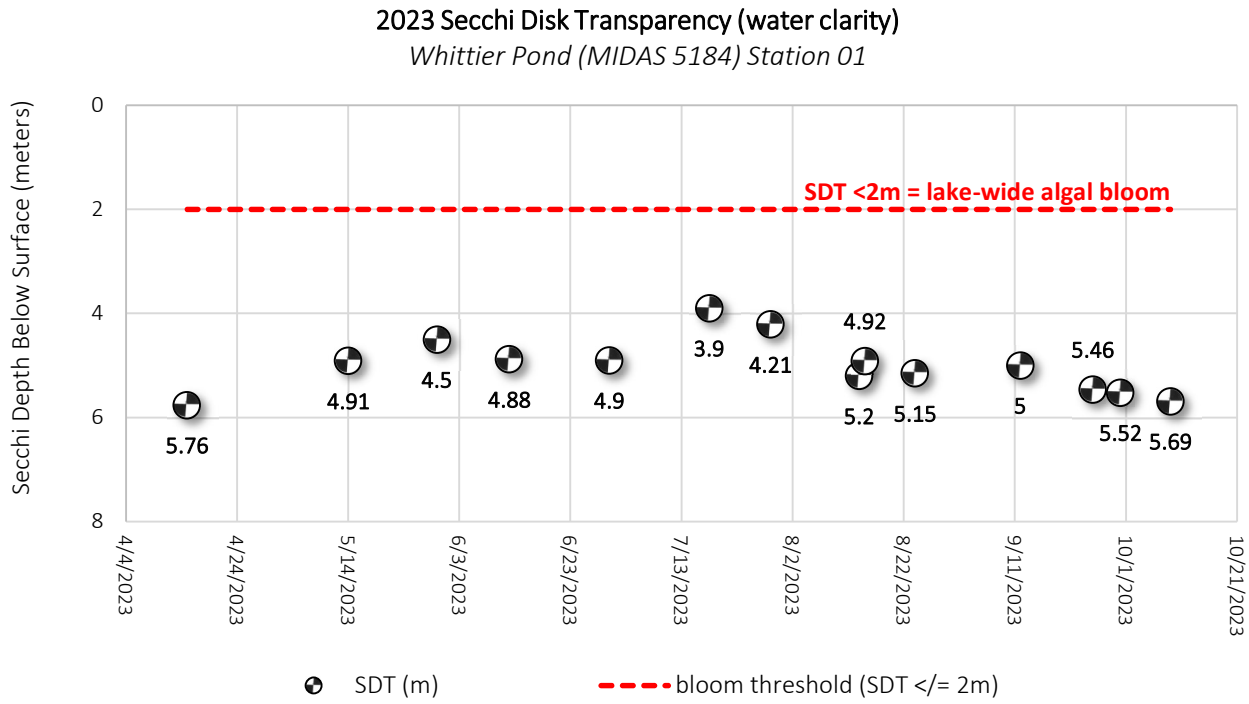


Figure 2. 2023 Secchi Disk Transparency, Whittier Pond, Station 1

Historically, SDT readings have ranged from 3.3 m (2013) to 6. m (2022) with an average annual reading of 4.88 m. (Figure 3).

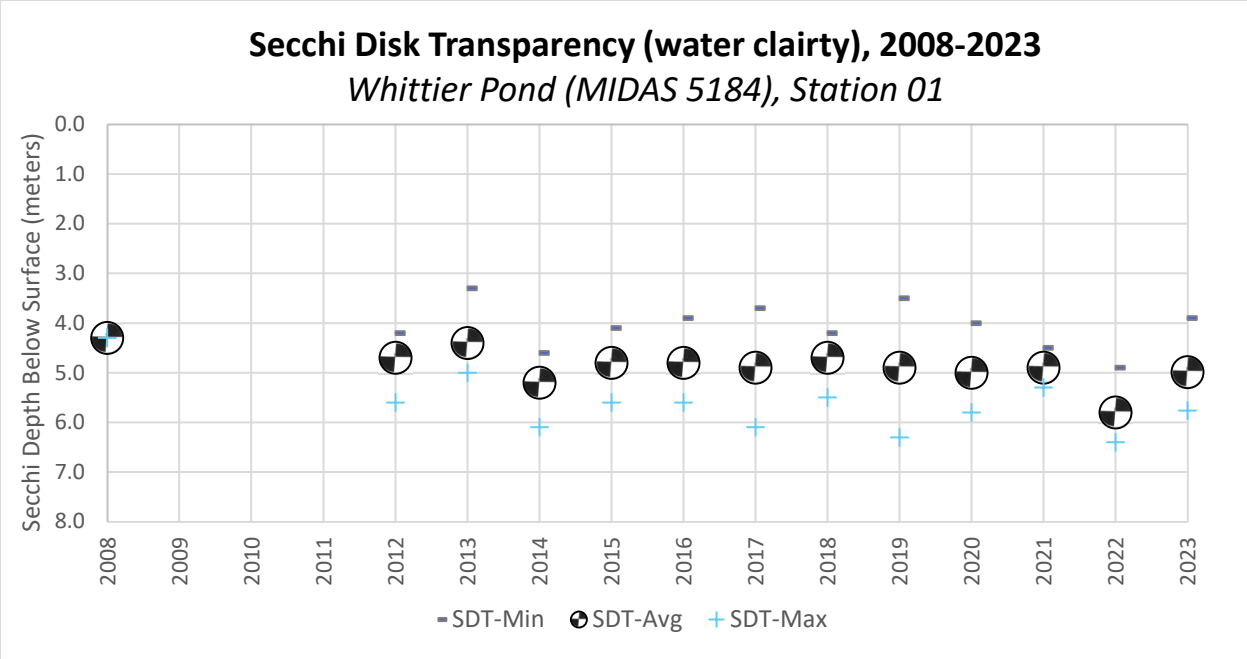


Figure 3. Whittier Pond Historical Secchi Disk Transparency, Station 1, 2008-2023

Dissolved Oxygen and Temperature

Dissolved oxygen (DO) is a critical indicator of the health of the lake system. DO is produced through photosynthesis, consumed during respiration and decomposition, and is influenced by wind, wave action, weather events, and lake productivity. A good supply of oxygen is essential for fish and other aquatic species, with most fish species requiring a DO concentration of 5 mg/L or more. *Anoxia* can occur when DO drops below 2 mg/L. As lake water is warmed during the summer, deep lakes will form three distinct temperature layers. There is a warm layer at the surface (epilimnion), a thin transitional layer (metalimnion or thermocline), and a deep cold layer (hypolimnion). The change in water temperature and density at the metalimnion acts as a physical barrier that prevents mixing of the upper and lower layers for several months during the warm summer months.

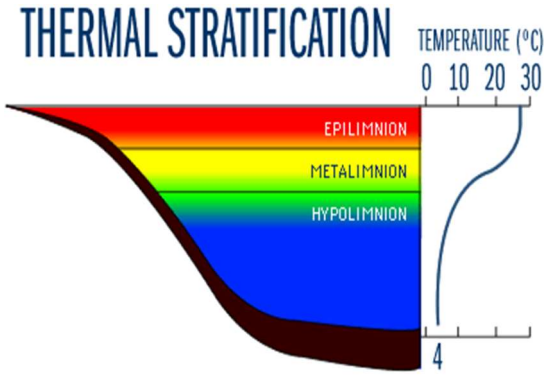


Figure 4. Thermal stratification in a deep lake. Image source: www.waterontheweb.org.

As lakes become more biologically productive in the summer, oxygen can decline as decomposition occurs in deep areas of the lake. While oxygen loss at the bottom of a deep lake is common in the summer months, excessive loss of oxygen may indicate a stressed and changing ecosystem with some lakes at

more of a risk than others depending on sediment chemistry[2].

Three (3) DO and temperature profiles were collected in 2023. DO <5 ppm was documented in each profile collected in waters 4 meters and deeper. DO <2 ppm (anoxia) was first documented at a depth of 5 meters in July, with the zone of anoxic water persisting in waters 4 meters and deeper through August & September (Figure 4).

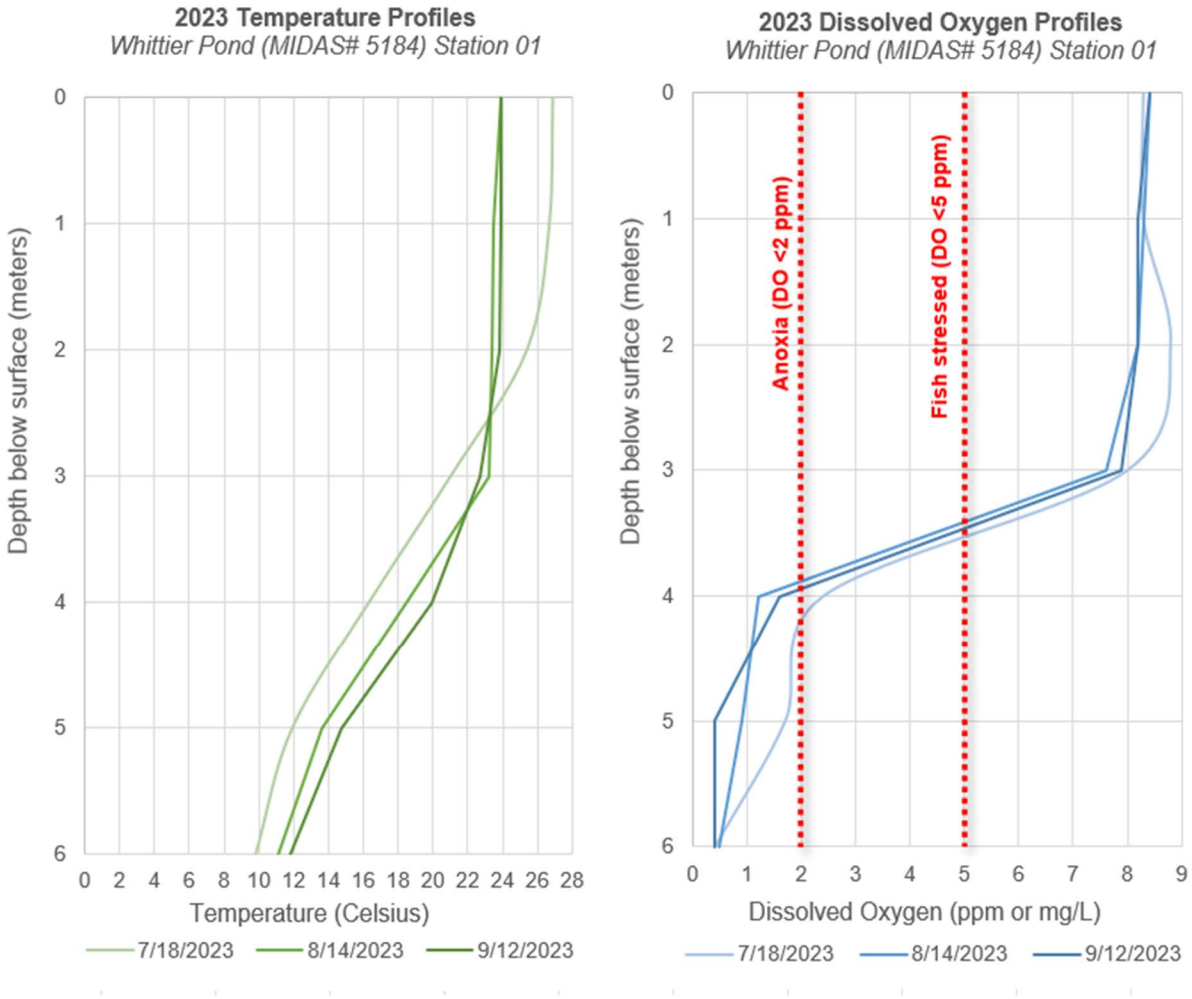


Figure 5. 2023 Dissolved Oxygen and Temperature Profiles, Station 1

[2]Some lakes in Maine may be more vulnerable than others to internal phosphorus loading, a phenomenon that can occur when deep waters become anoxic (DO loss <2 ppm) resulting in phosphorus release from the bottom sediments exposed to anoxic waters.

Along with previous years data, oxygen depletion in deeper waters was documented in 2023. Despite the possibility of being able to support cold water fish species, Whittier Pond only supports a warm water fishery, with smallmouth and largemouth bass being the principal fisheries[3].

Water surface temperatures through the monitoring season ranged from 23.9 C (75.0 F) to 26.9 C (80.4 F) with an average surface water temperature of 24.9 C (76.8 F) throughout the three month DO & temp monitoring period. Continued collection of bi-weekly DO and temperature profiles will identify trends and changes occurring in Whittier Pond in order to better understand variations in thermal stratification and the extent and severity of the low DO and anoxic zones throughout the monitoring season.

Total Phosphorus (TP)

Total Phosphorus (ppb)	
2023 TP Average	7
Historical TP Average	7
Maine Lakes TP Average	12

Phosphorus is the nutrient that most influences the growth of algae in lakes. Because its natural occurrence in lakes is very small, phosphorus "limits" the growth of algae in lake ecosystems. Small increases in phosphorus in lake water can cause substantial increases in algal growth, hindering lake health as well as the economic, recreational, and aesthetic value of the lake. Tracking in-lake phosphorus levels over time is another way of monitoring change in lake water quality trends.

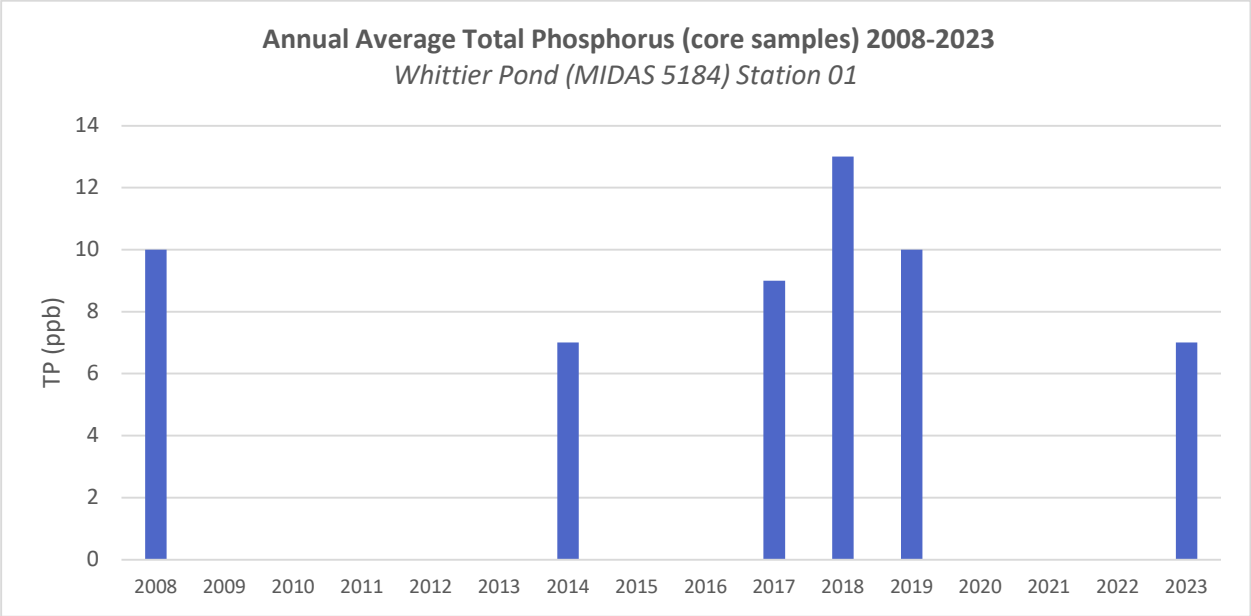


Figure 6. Annual Average Total Phosphorus data (epilimnetic core samples) collected 2008-2023, Station 1.

[3] Maine Department of Inland Fisheries & Wildlife. Lake Survey Maps – Whittier Pond. Accessed online: https://www.maine.gov/ifw/docs/lake-survey-maps/kennebec/whittier_pond_vienna_twp.pdf.

Six (6) samples were collected by 30 Mile staff this year and analyzed for Total Phosphorus (TP). Samples were collected monthly between July and September. Three (3) of the phosphorus samples were collected from the top layer of Whittier Pond using an integrated core sampler and are referred to as "epilimnetic core samples". Laboratory results for epilimnetic core samples collected in 2023 ranged from 7 ppb (August 14th & September 12th) to 8 ppb (July 18th) with annual average of 7 ppb.

Generally speaking, in-lake phosphorus concentrations (epilimnetic core samples) less than 10-12 ppb are ideal. Lakes with in-lake phosphorus concentrations of 13 ppb or more are able to sustain algal blooms, and blooms become frequent as in-lake average concentrations approach 20 ppb. Historically, in-lake phosphorus concentration in Whittier Pond has been collected six years (2008, 2014, 2017, 2018, 2019, & 2023) out of the 15-year monitoring record, with results ranging from 7 ppb (2014 & 2023) to 13 ppb (2018) with an annual average of 9 ppb (Figure 5).

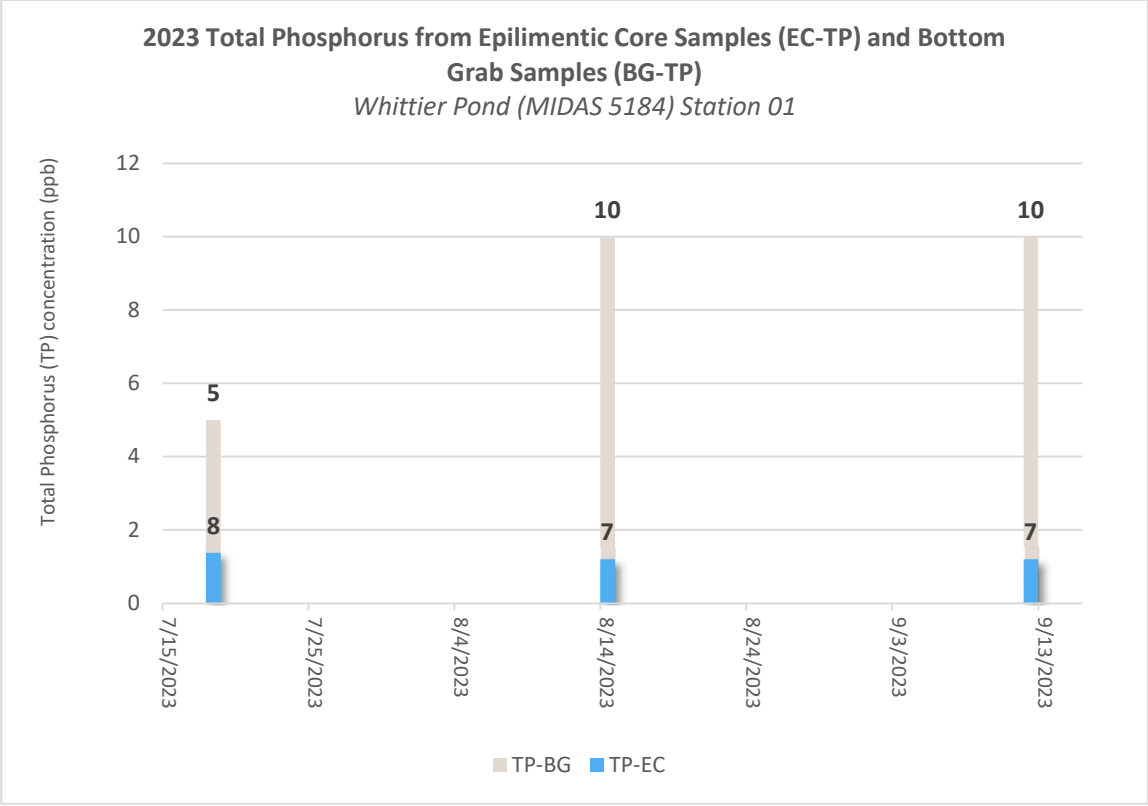


Figure 7. 2023 TP core sample and TP bottom grab sample results from Whittier Pond.

In 2023, three (3) samples were collected from the bottom of Whittier Pond using a Kemmerer grab sampler; this type of sample is known as a "bottom grab". Bottom grabs are collected when anoxia is encountered anywhere in the dissolved oxygen profile and help us determine if there is active phosphorus release from bottom sediments exposed to anoxic conditions. Laboratory results for bottom grab samples collected in 2023 were 5 ppb (7/18/23) and 10 ppb (8/14/23 &

9/12/23) with an annual average of 8 pp. This season was the first-time bottom grab samples have been taken during Whittier Pond's 15-year monitoring record.

Chlorophyll (Chl-a)

Chl-a (ppb)	
2023 Chl-a Average	10.3
2023 Peak Chl-a	14
Historical Chl-a Average	6
Maine Lakes Chl-a Average	5.4

Chlorophyll is found in plants (including algae) and is used to convert sunlight into energy.
Measuring the concentration of Chlorophyll in lake water helps us estimate the algae population in the lake. Chlorophyll was measured 3 (three) times in 2023. Results ranged from 8 ppb to 14 ppb, with a 2023 annual average of 10.3 ppb. Historical monitoring chl-a results collected between 2008-2023 have ranged from 3.0 ppb (2014) to 14 ppb (2023) with a historical annual average of 6.0 ppb.

pH

pH	
2023 pH	7.4
Historical pH Average	7.2
Maine Lakes Average	6.44

pH helps determine which plant and animal species can live in the lake, and it governs biochemical processes that take place. The pH scale ranges from 0-14, with 7 being neutral. Water is increasingly acidic below 7, and increasingly alkaline above 7. A one unit change in pH represents a tenfold change in acidity or alkalinity. The pH scale is the inverse log of the hydrogen ion concentration.

pH was measured 1 (one) time during the 2023 season on August 14th with a result of 7.4. Historically, pH has been data has been collected during 4 (four) years throughout the 15-year monitoring record. Results have ranged from 7 (2008) to 7.4 (2023) with a historical average of 7.2.

True Color

Color (PCU)	
2023 Color	28
Historical Color Average	24
Maine Lakes Color Average	20.7

Water color refers to the concentration of natural dissolved organic acids. This includes natural tannins and lignins dissolved in the water, often resulting in "tea" or "root beer" colored water. "True Color" is measured in Platinum Cobalt Units (PCU) after all particulates (including algae cells) have been filtered

out of the sample. Colored lakes (>25 PCU) can have reduced transparency readings and increased phosphorus values. However, this does not mean the lakes produce more algae. The color simply reduces the transparency such that the reading is not a good measure of algal biomass. Chlorophyll-a (Chl-a) is the best indicator of algal productivity in colored lakes and should be used if possible.

One sample taken on August 14th was analyzed for true color and had a result of 28 PCU. Historically, color has been analyzed three (3) years out of the 15-year monitoring period ranging from 13 PCU (2018) to 30 PCU (2014) for a historical average of 24 PCU.

Conductivity

Conductivity (uMHOS/cm)	
2023 Conductivity	40.6
Historical Conductivity Average	39
Maine Lakes Conductivity Average	51.1

Conductivity measures the ability of water to carry electrical current and is directly related to the dissolved ions (charged particles) present in the water. Fishery biologists can use conductivity values to calculate fish yield estimates because conductivity will generally increase if there is an increase of pollutants entering the lake or pond. Stormwater runoff from developed areas and roadways is the most common pollutant in Maine lakes that can raise conductivity values. Conductivity is measured in micromhos per centimeter (uMHOS/cm).

One sample taken on August 14th was analyzed for conductivity and had a result of 40.6 uMHOS/cm. Historically, conductivity has been analyzed during three years of the 15-year monitoring record, with results ranging from 34 uMHOS/cm (2014) to 42 uMHOS/cm (2018) for a historical average of 39 uMHOS/cm.

Alkalinity

Alkalinity (mg/L)	
2023 Alkalinity	13
Historical Alkalinity Average	13
Maine Lakes Alkalinity Average	11.7

Alkalinity is also referred to as “buffering capacity.” It is a measure primarily of naturally available bicarbonate, carbonate, and hydroxide ions in the water and is measured in milligrams per liter (mg/L). Measuring alkalinity is important to determining a lake’s ability to neutralize acidic pollution from rainfall or snowmelt. Lakes with alkalinity values >20 mg/L are considered well buffered against pH changes over time. Lakes with low or zero alkalinity may have more variation in pH levels that can sometimes result in damage to aquatic life.

One sample taken on August 14th was analyzed for alkalinity and had a result of 13 mg/L. Historically, alkalinity has been analyzed three years throughout the 15-year monitoring record, with results ranging from 12 mg/L (2008) to 14 mg/L (2014) for a historical average of 13 mg/L.

Discussion

Thanks to a grant from the John Sage Foundation, 30 Mile was able to make 2023 the organization's first year of monitoring Whittier Pond. Historical data presented in this report includes all monitoring data collected on Whittier Pond through 2022, submitted by both volunteer monitors and state agencies, that has undergone a thorough QA/QC process at Maine DEP. 2023 data on this report is from 30 Mile and local volunteers only.

Since 2012, thanks in large part to local volunteers, a robust water clarity dataset for Whittier Pond is beginning to form. This year's average of 5.0 meters is nearly identical to the historical average of 4.9 meters. Although the lowest reading this year of 3.9 meters, is the 5th worst reading since 2012, it's a trend that's being seen across the 30 Mile River Watershed and not particular to Whittier Pond. 2023 was a particularly wet season, with an unprecedented rainstorm in early May delivering a large amount of polluted stormwater runoff into the lake. This likely increased the mass of algae in the lake this year, which resulted in more biological productivity and decomposition – processes that consume oxygen in the water. This is likely in part the reason why the 2023 secchi reading average was down and the annual chl-a concentration average was the highest on record for Whittier Pond. This makes it difficult to compare this year's data to that collected years prior, which saw a lot less precipitation and emphasizes the importance to continue monitoring Pocasset Lake consistently every year.

Five years of consecutive data collection for any given parameter will provide the baseline condition of the pond. 10 years of consecutive data collection is needed to meet the minimum data thresholds for determining trends. This effort will continue to develop a robust dataset that can help our community identify and address water quality concerns in Whittier Pond.

Near real-time data for Whittier Pond's clarity (Secchi depth), and dissolved oxygen and temperature profiles can be found online at https://30mileriver.org/whittier-pond/, along with a link to the historical dataset and depth map.

Next Steps

1. Continue monthly baseline monitoring three times each summer to monitor seasonal and annual variability across all parameters, and better document changes and trends over time.

2. **Deliver LakeSmart programming** to the landowners on Whittier Pond, to provide education about polluted stormwater runoff, phosphorus, and the effects of watershed development on lake water quality. For more information about this awesome program visit: https://www.lakes.me/lakesmart. To request a free LakeSmart evaluation from 30 Mile staff visit: https://30mileriver.org/lakesmart/