Basin Pond

WATER QUALITY REPORT

2023

30 Mile River Watershed Association
P.O. Box 132
Mount Vernon, ME
www.30mileriver.org

30 Mile River
WATERSHED ASSOCIATION

2023 Basin Pond Water Quality Report

TABLE OF CONTENTS

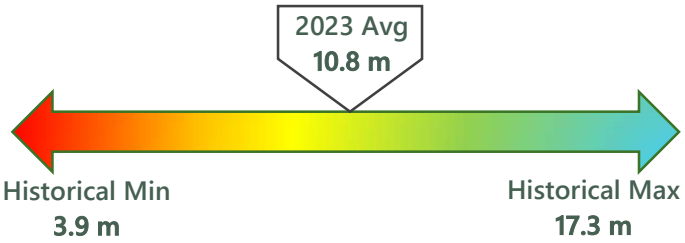
TABLE OF FIGURES

2023 Water Quality Summary[1]

Monitoring on Basin Pond occurred on ten (10) dates between May and October 2023 by Whitney Baker and Silas Mohlar of 30 Mile River Watershed Association (30 Mile).

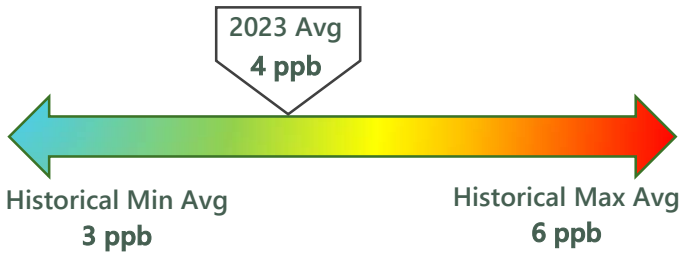
Water clarity readings in 2023 ranged from 9.2 meters (September 29th) to 11.8 meters (September 5th) with an annual average of 10.8 meters. 15 total readings were collected in 2023.

Water Clarity (m)	
2023 Water Clarity Average	10.8
Historical SDT Average	11.6
Maine Lakes SDT Average	4.8



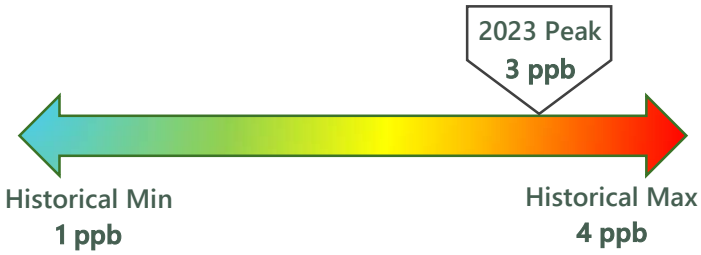
Five (5) samples were collected and analyzed for **Total Phosphorus**. Laboratory results ranged from 2 ppb (parts per billion) to 5 ppb with an average of 4 ppb.

Total Phosphorus (ppb)	
2023 TP Average	4
Historical TP Average	4
Maine Lakes TP Average	12



Chlorophyll was measured five (5) times in 2023. Chlorophyll results ranged from 1 ppb to 3 ppb with an average of 1.8 ppb.

Chlorophyll-a (ppb)	
2023 Chl-a Average	1.8
2023 Peak Chl-a	3.0
Historical Chl-a Average	1.5
Maine Lakes Chl-a Average	5.4



Ten **Dissolved Oxygen (DO)** profiles were collected in 2023. Anoxia (DO <2 ppm) was first encountered in deep waters at a depth of 30 m in June and increased slightly over the course of the summer to include waters 23 m and deeper by October. Oxygen loss is typical in the summer months in the deepest areas of Basin Pond.

[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

Basin Pond is located in the town of Fayette in Kennebec County, Maine and has a total watershed area of 94 acres (0.2 square miles). Basin Pond is spring fed and has a single outlet, located on the southwestern shoreline, that flows north to David Pond.

Basin Pond is deep for its size with a maximum depth of 32 m (106 ft) and an average depth of 13 m (42 ft). The lake has a surface area covering approximately 30 acres and can be accessed via a public launch located on the eastern shoreline, just a short hike from the end of Basin Road in Fayette.

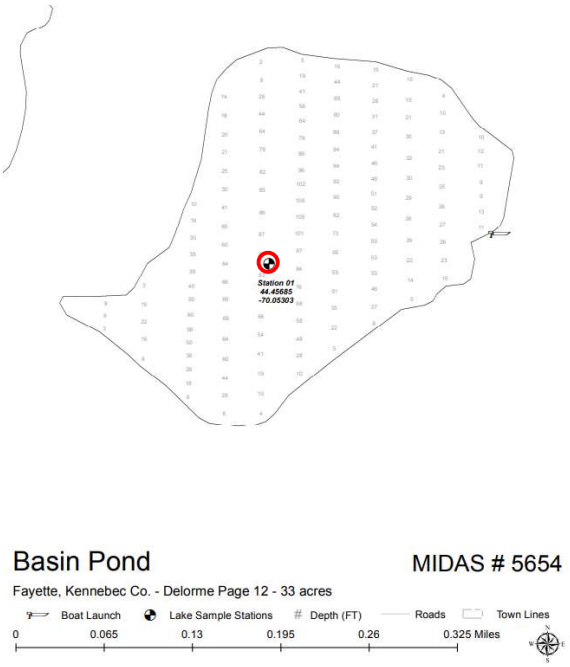


Figure 1. Basin Pond Monitoring Station, Maine DEP.

Water Quality Monitoring in 2023

Water quality monitoring on Basin Pond takes place at the deepest spot in the lake (Maine DEP Station 1), also known as the "deep spot", located roughly in the center of this small pond. Station 1 is 32 meters (106 ft) deep (Figure 1). Monitoring in 2023 was completed by 30 Mile River Watershed Association (30 Mile) staff with the help of volunteers. A special thanks to 2023 volunteer, Bob Harradon.

A calm September morning on Basin Pond.

Water quality data was collected on 10 dates between May and October. Parameters include Secchi disk transparency, dissolved oxygen and temperature, phosphorus, chlorophyll, and advanced chemistry parameters (pH, Alkalinity, Color, and Conductivity).

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)	
2022 Water Clarity Average	10.8
Historical SDT Average	11.6
Maine Lakes SDT Average	4.8

Water clarity readings in 2023 ranged from 9.0 meters (September 29th) to 11.8 meters (September 5th) with an annual average of 10.8 meters. 15 total readings were collected over 10 monitoring days in 2023 (Figure 2).

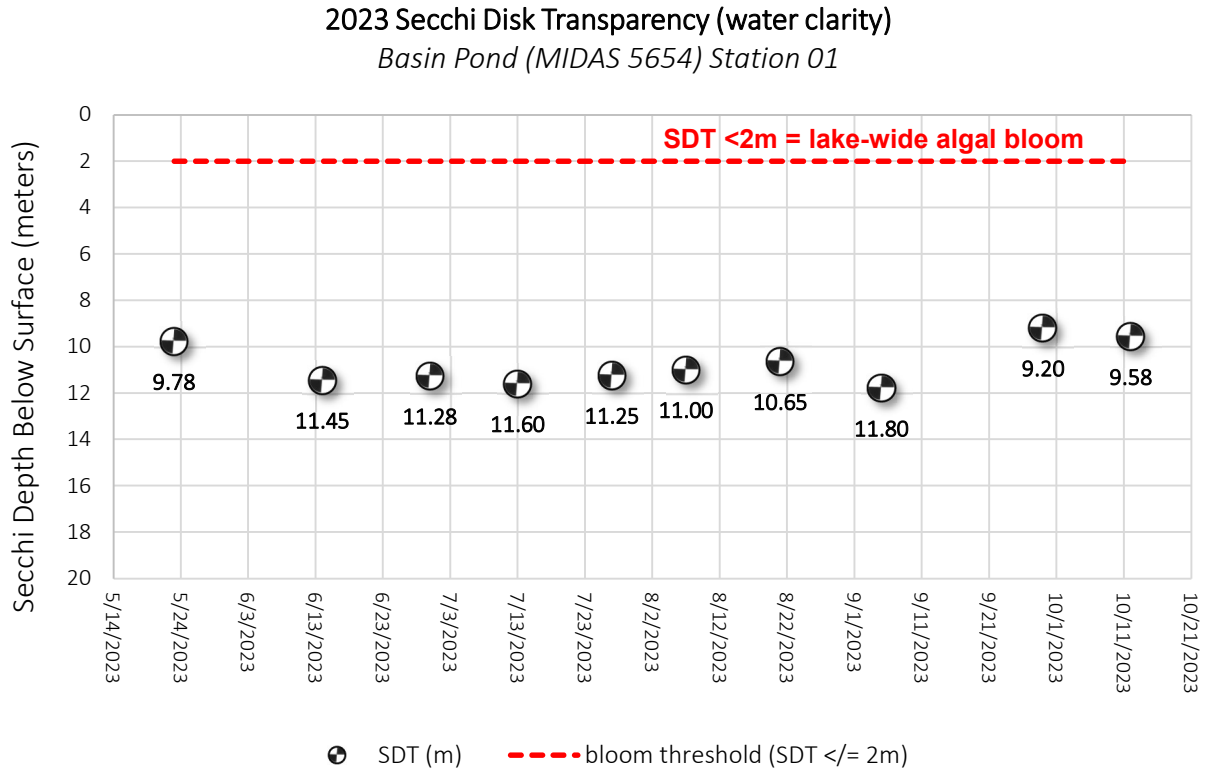


Figure 8. 2023 Secchi Disk Transparency, Station 1

SDT data has been collected during 24 years on Basin Pond; with the historical monitoring record spanning the past 40 years beginning in 1984. Historically, SDT readings have ranged from 3.9 m (2018) to 17.3 m (2019) with a historical average of 11.6 m. (Figure 3).

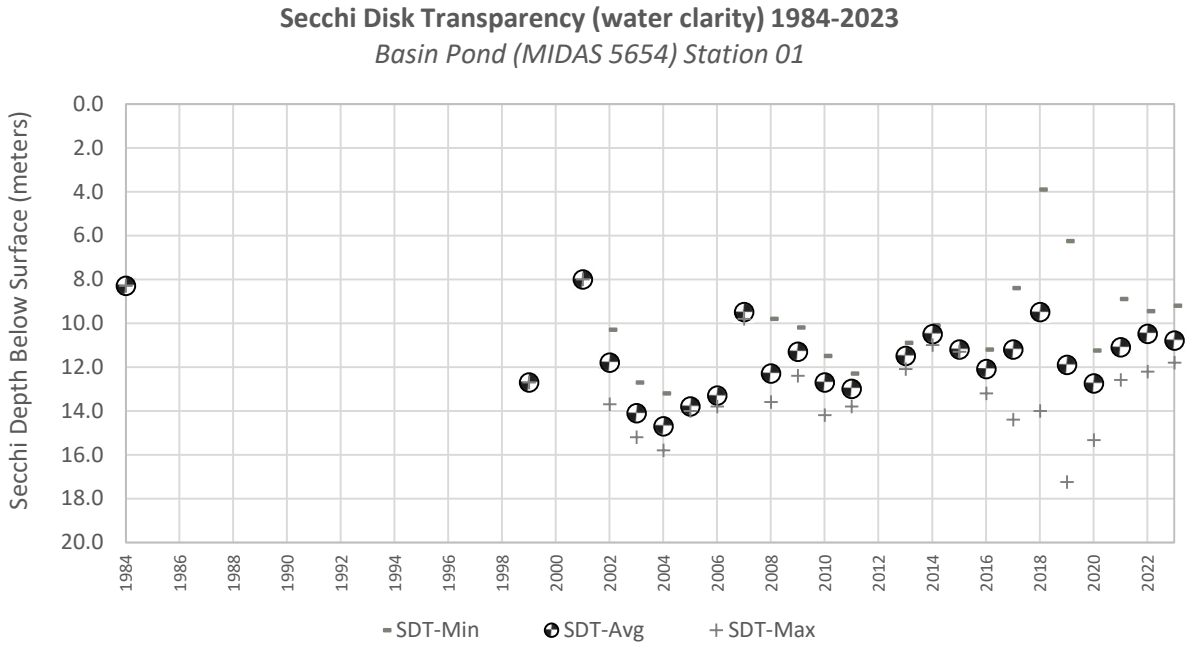


Figure 17. Historical Secchi Disk Transparency, Station 1, 1984-2023

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. 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), 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.

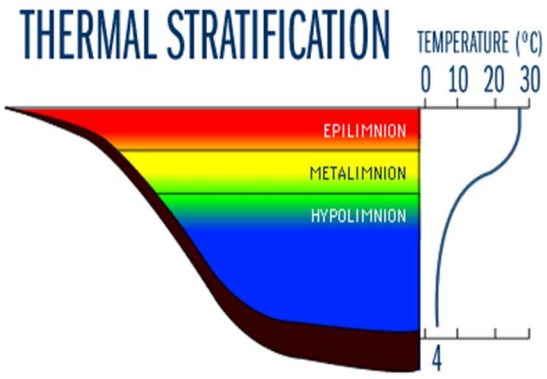


Figure 24. Thermal stratification in a deep lake. Image source: www.waterontheweb.org.

As the lake becomes more biologically productive in the summer, oxygen can decline in the hypolimnion as decomposition occurs in deep areas of the lake. Though some oxygen loss in deep lakes is considered normal, excessive loss of oxygen may indicate a stressed and changing ecosystem. Understanding the pattern and extent of oxygen loss in deep areas of Basin Pond is important to understanding changes between years and throughout a single season, and is

particular concerning for lakes that may be more vulnerable for internal phosphorus loading due to unique sediment chemistries.[2]

In Basin Pond, oxygen loss in the deepest waters occurs in July through September and is not uncommon in lakes as deep as Basin Pond. The extent of anoxia documented in the pond has remained consistent throughout the historical monitoring period starting in 1984, remaining confined to the deepest area of the lake.

Ten (10) DO and Temperature profiles were collected in 2023 (Figure 4). Anoxia (DO <2 ppm) was first encountered in deep waters at a depth of 30 meters in June and increased slightly over the course of the summer to include waters 23 meters and deeper by October – a typical pattern seen throughout Basin Pond's historical monitoring period.

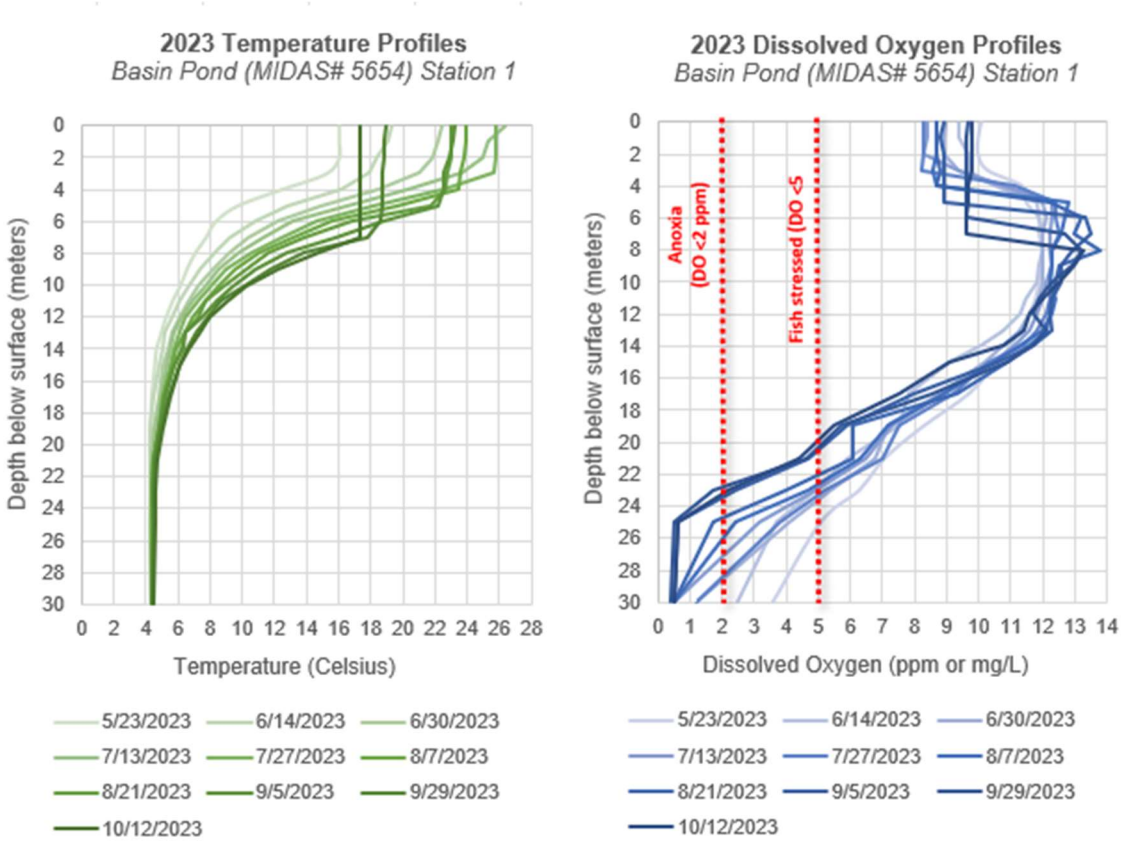


Figure 5. 2023 Dissolved Oxygen and Temperature Profiles, Station 1

With summertime oxygen depletion isolated to only the bottom 3-7 meters, Basin Pond is well suited to support cold-water fish species that rely on deep, cold-water refuge with an adequate

[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.

oxygen supply during the warm summer months. Basin Pond supports a principal fishery of splake[3], which are stocked annually by Maine Department of Inland Fisheries & Wildlife.[4]

Water surface temperatures through the monitoring season ranged from 16.1 C (61.0 F) to 26.4 C (79.5 F) with an average surface water temperature of 21.6 C (71.0 F) between May and October. Continued annual collection of bi-weekly DO and temperature profiles will identify trends and changes occurring in Basin Pond over time and will document variations in thermal stratification and the extent and severity of anoxic zones throughout the monitoring season.

Total Phosphorus

Total Phosphorus (ppb)	
2023 TP Average	4
Historical TP Average	4
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.

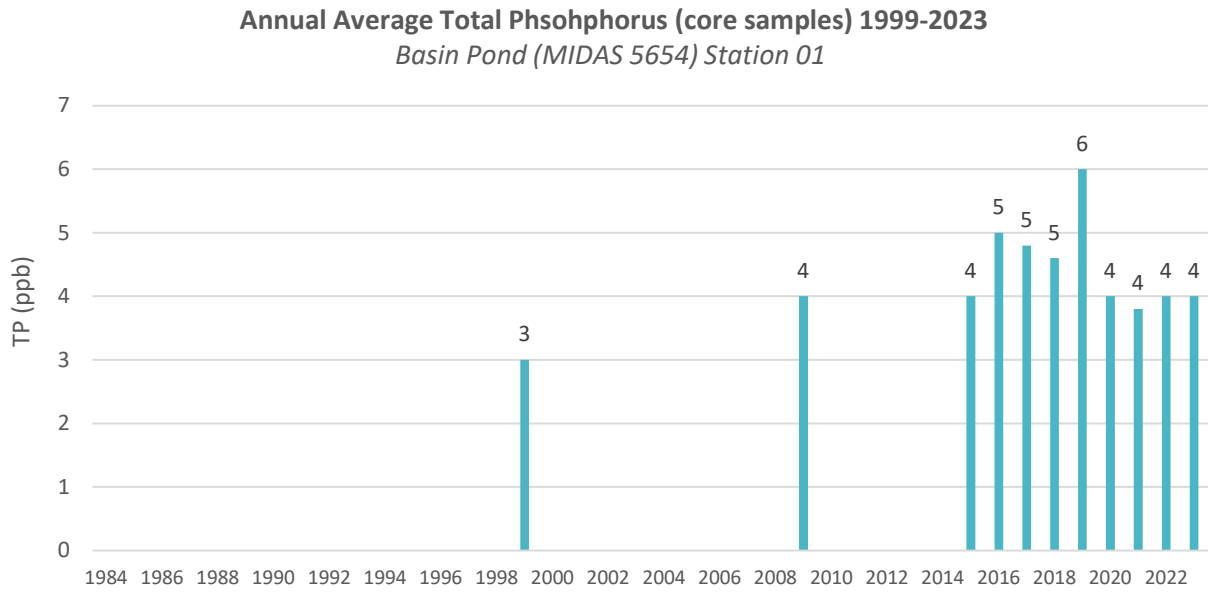


Figure 6. Annual Average Total Phosphorus data (epilimnetic core samples) collected 1999-2023, Station 1.

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

[4] Maine Department of Inland Fisheries & Wildlife. Annual Fish Stocking Reports. Accessed online: https://www.maine.gov/ifw/fishing-boating/fishing/fishing-resources/fish-stocking-report.html.

Nine (9) samples were collected by 30 Mile staff this year and analyzed for Total Phosphorus (TP). Samples were collected monthly between May and October. Five (5) of the phosphorus samples were collected from the surface of the 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 2 ppb to 5 ppb with an annual average of 4 ppb.

Generally speaking, in-lake phosphorus concentrations (epilimnetic core samples) less than 10 ppb are best. Lakes with in-lake phosphorus concentrations of 13 ppb or more are able to sustain algal blooms, and blooms become frequent as average concentrations approach 20 ppb. Historically, the annual average in-lake phosphorus concentration in Basin Pond has been very low, ranging from 3 ppb (1999) to 6 ppb (2019) with a historical average of 4 ppb (Figure 5).

In 2023, four (4) samples were collected from the bottom of Basin 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 ranged from 10 ppb to 29 ppb with an annual average of 18 ppb (Figure 6).

Historically, bottom grab samples were collected during ten (10) years starting in 1999. Annual average bottom grab TP concentrations have ranged from 12 ppb (1999 and 2015) to 33 ppb (2018) with an overall historical average of 19 ppb.

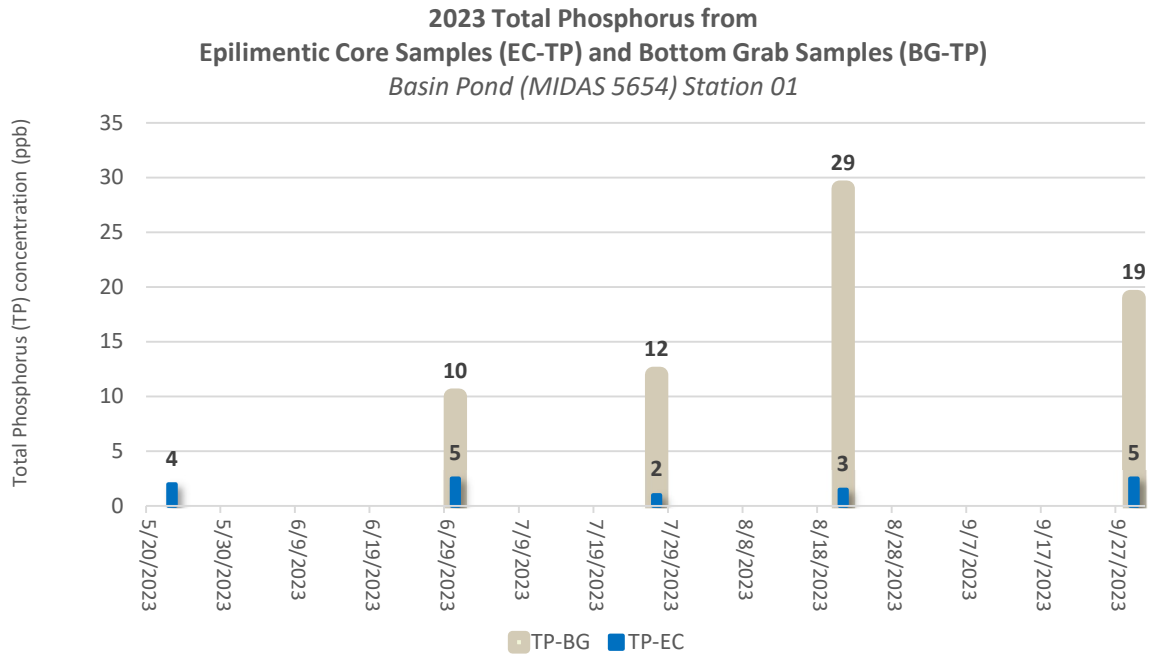


Figure 7. 2023 TP core sample and bottom grab sample results from Basin Pond.

Chlorophyll (Chl-a)

Chl-a (ppb)	
2023 Chl-a Average	1.8
2023 Peak Chl-a	3.0
Historical Chl-a Average	1.5
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 five (5) times in 2023, with results ranging from <1 ppb (September 29th) to 3 ppb June 30th and July 27th). Chl-a data has been collected during 10 years between 1999-2023 and results have ranged from 1 ppb (2017, 2018, 2019, 2021, 2022, 2023) to 4 ppb (2018) with a historical annual average of 1.5 ppb.

pH

pH	
2023 pH	7.0
Historical pH Average	6.7
Maine Lakes Average	6.44

pH affects the types of plant and animal species that can live in the lake and 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 one (1) time during the 2023 season on August 21st with a result of 7.0. Historically, pH data has been collected just 8 years since 1984 and have ranged between 5.8 (2015) and 7.1 (2018 and 2019) with an average of 6.7.

True Color

Color (PCU)	
2023 Color	< 5
Historical Color Average	2.7
Maine Lakes Color Average	21

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 in very colored lakes. “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 naturally 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. In this case, chlorophyll-a (Chl-a) is the best indicator of algal productivity.

One sample collected on August 21st was analyzed for true color - the result was <5 PCU. Historically, true color data were collected just six (6) years since 2005 and had ranged between 1 PCU (2015 and 2018) and 5 PCU (2022 and 2023) with a historical annual average of 2.7 PCU.

Conductivity

Conductivity (µMHOS/cm)	
2023 Conductivity	34
Historical Conductivity Average	28
Maine Lakes Conductivity Average	51

Conductivity measures the ability of water to carry an electrical current and is directly related to the dissolved ions (charged particles) present in water. Fishery biologists can use conductivity values to calculate fish yield estimates because conductivity will increase if there is an increase of pollutants entering a 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 (µMHOS/CM).

One sample taken on August 21st was analyzed for conductivity and had a result of 34 µMHOS/cm. Historically, conductivity data has been collected nine (9) years since 1984 and has ranged between 3 µMHOS/cm (2015) and 45 µMHOS/cm (2019) with a historical annual average of 28 µMHOS/cm.

Alkalinity

Alkalinity (mg/L)	
2023 Alkalinity	4
Historical Alkalinity Average	5
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 21st was analyzed for alkalinity and had a result of 4 mg/L. Historically, alkalinity data has been collected just seven (7) years since 1999 with results ranging between 3 mg/L (1999 and 2005) and 6 mg/L (2017 and 2019) with a historical average of 5 mg/L.

Discussion

2023 was 30 Mile's eighth year of monitoring Basin Pond's water quality. Historical data presented in this report includes all monitoring data collected through 2022, submitted by 30 Mile, volunteer

monitors, and state agencies, that has undergone a thorough QA/QC process at Maine DEP. Data included in this report for 2023 was collected by 30 Mile only.

This unique pond has exceptional water quality, very low phosphorus levels, and ranks 8th on the list of Maine's clearest lakes and ponds (based on 2017 data) largely due to its small, nearly undeveloped watershed and its unique morphology – a "kettle hole" pond created by the retreating glaciers over 12,000 years ago. Though one of the smallest ponds in the 30 Mile watershed, it is also one of the deepest at 32 meters maximum depth, second only to nearby Echo Lake at 36 meters deep.

Basin Pond has been of interest to the Maine academic community and has hosted many researchers that study paleolimnology as Basin Pond is known to have very well-preserved laminations in the sediments that make up its lakebed. The lake and its watershed should be a high priority for land conservation to preserve this rare pond and it's watershed. Though the shoreline is not developed, the pond is regularly used for recreation and can be accessed via a public carry-in boat launch at the end of Basin Road. Access is also provided to nearby homeowner's association members via a private access through the 57-acre conservation easement located on Basin's eastern shoreline. Several snowmobile/ATV and walking trails are also located within this small watershed.

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 the recent trend for any given parameter. 30 Mile's monitoring program will continue to develop a robust dataset that can help our community identify and address water quality concerns in Basin Pond.

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

Next Steps

1. Continue bi-weekly baseline monitoring between May and October each year to monitor seasonal and annual variability across all parameters and document changes and trends over time.

2. Work with abutting property owners to complete a survey of the Basin Pond drainage area to identify erosion and other non-point pollution sources that could be impacting the pond.