Coes Reservoir
2025 Water Quality Report

The City *of* Worcester
Department of Sustainability and Resilience
Lakes and Ponds Program

Summary

The following report is presented by the City of Worcester Department of Sustainability and Resilience (DSR) Lakes and Ponds Program (L&P). It details the program's water quality monitoring results, management activities and outreach efforts at Coes Reservoir in 2025. The "State of the Lake" will be rated "Excellent", "Good", "Fair", or "Poor" based on the results' implications on water quality and recreational value. This report will also outline projects and opportunities the City of Worcester's Lakes and Ponds Program (L&P) intends to implement at Coes Reservoir in 2026.

Coes Reservoir is impacted by the urban environment. Coes can face challenges including invasive aquatic plants, lake closures due to cyanobacteria or fecal bacteria, and low water clarity. However, management by community groups and the City of Worcester Lakes and Ponds Program has led to water quality that supports a healthy ecosystem and a wide variety of recreational opportunities.

In 2025, Coes Reservoir received a score of "Good." Continue reading to learn more about this rating and L&P's work on Coes Reservoir.

Background

Coes Reservoir is a 90-acre impoundment of Tatnuck Brook, located between the Columbus Park and Webster Square neighborhoods of western Worcester. It is approximately 16 feet deep at its deepest point, which is in the southern portion of the lake. Coes Reservoir is bordered on the west side by Mill Street, a highly trafficked roadway. The northern end of the lakeshore is largely residential, with commercial zoning along Mill Street on the western side. The southern portion has a public beach, playground, and access to a trail system around the eastern side of the lake.

Coes Reservoir is located at the end of a chain of mill ponds along Tatnuck Brook, which extends south from Holden. Tatnuck Brook exits Worcester's drinking water supply at the Holden 2 Reservoir and is designated a Coldwater Fish Resource (CFR) by MassWildlife. Flowing south into Worcester, Tatnuck Brook is impounded several times as the watershed becomes more developed. Coes Reservoir was

created when Tatnuck Brook was dammed in the mid-1800's to supply waterpower to the Coes Knife Factory. Due to its long industrial history, the area has a legacy of industrial pollutants that led to remediation and reconstruction of the dam site in 2006.

Figure 1 – *A boardwalk provides universal access to the eastern shore of Coes Reservoir.*

Coes Reservoir is a valuable recreational resource. Ample public access includes a public beach, a universal access park and playground, a nature viewing boardwalk and fishing pier (see Figure 1), and a new kayak launch at Binienda Beach on Mill Street that hosts kayak and paddleboard rentals. Coes Reservoir boasts a popular fishery, where anglers can catch largemouth bass, chain pickerel, yellow perch, black crappie, bullhead, bluegill, and carp. MassWildlife stocks rainbow trout at Coes Reservoir annually in the spring.

As an urban lake, Coes Reservoir is impacted by many of the pressures of the city. It is listed on the Massachusetts Impaired Waters 303d List as Category 4c for the invasive plants Eurasian Milfoil (*Myriophyllum spicatum*) and Water Chestnut (*Trapa natans*). It has not received a Total Maximum Daily Load (TMDL), or nutrient budget. However, management by community groups and the Lakes and Ponds Program has led to water quality that supports a healthy ecosystem and a wide variety of recreational opportunities.

This report details the results of water quality monitoring programs in 2025, as well as the projects the City of Worcester's Lakes and Ponds Program (L&P) intends to implement in 2026. To provide context for the 2025 data, the following paragraph highlights L&P's key findings from 2024.

In 2024, Coes Reservoir received an overall score of "Good". The reservoir remained open throughout the season with no closures due to cyanobacteria or fecal bacteria exceedances. Preventative copper sulfate treatments in July and September effectively managed rising cyanobacteria levels, ensuring safe recreational access. Beach *E. coli* results remained well below recreational thresholds. Dissolved oxygen depletion was confined to deeper areas of the water column, and most of the water column maintained sufficient levels of oxygen for aquatic life. After years of invasive aquatic plant management, in 2024 the Water Chestnut population was significantly reduced, and herbicide treatment was not necessary. This allowed for successful management utilizing only hand pulls.

To view full reports from all previous seasons, please visit WorcesterMA.gov/bluespace.

Management Summary

Coes Reservoir has had management plans for cyanobacteria and invasive aquatic plants since 2018.

In 2025, cyanobacteria at Coes Reservoir were actively managed to prevent lake closures and public health impacts. From late may through mid-July, cyanobacteria cell counts remained low. In late July, testing results indicated potential exponential growth of cyanobacteria and a copper sulfate treatment was scheduled to prevent a bloom. The treatment was effective, and populations remained low for the remainder of the season.

Coes Reservoir's invasive aquatic plant management plan continued in 2025. L&P has historically used a combination of physical removal and the contact herbicide imazamox (trade name: Clearcast) to address the ongoing Water Chestnut infestation in the northern portion of the lake. After years of ongoing management, in 2024 the Water Chestnut population was significantly reduced, and herbicide treatment was no longer necessary. L&P and the Tatnuck Brook Watershed Association (TBWA) co-hosted a community hand pulling event in late June where volunteers removed all visible Water Chestnut plants throughout the lake. A follow up hand pull was conducted by a lake management company in late July to remove any remaining plants. While some regrowth is expected in future years, this is expected to be manageable through hand pulling.

Sampling Analysis and Overview

Sampling from multiple locations within a waterbody and its watershed leads to better understanding of the water that enters the lake, how it is transformed within, and the water leaving the lake. To account for these changes over space and time, L&P samples at sites in tributaries, at the surface and bottom of mid-lake sites, and the outlet.

Tributaries, or inlets, are streams flowing into a lake or pond. They collect surface runoff from rain or snowmelt along with some groundwater and carry it through the stream channel to the waterbody. In some cases, tributaries make up a large portion of the water going into the lake, and the quality of the water in these tributaries can give insight into where certain impairments in the lake originate. Outlets are the major exits for water in the lake. Most L&P water quality parameters are measured at the major natural tributaries and outlets of the lakes.

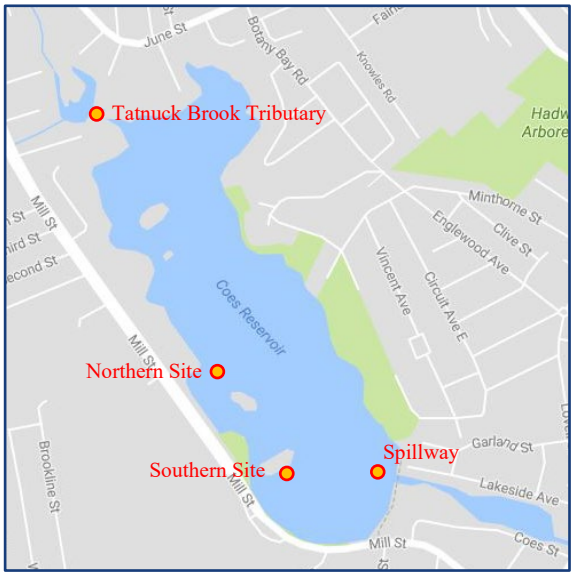


***Figure 2** - Coes Reservoir map and approximate sampling locations.*

Coes Reservoir was sampled twice monthly in 2025 from May through October at four locations: its major tributary, Tatnuck Brook; two deep parts of the reservoir (the northern is about 12 feet deep and the southern is about 14 feet deep); and the outlet at the spillway located at the southern end of the reservoir (see Figure 2). At the in-lake locations, probe measurements and water samples were collected 1 foot below the surface of the water ("surface") and 2 feet above the bottom of the lake ("bottom"). Parameters evaluated on every sampling day included Secchi disk transparency, temperature, dissolved

oxygen (DO), pH, total phosphorus (TP), total dissolved phosphorus (TDP), and *Escherichia coli* (*E. coli*). Samples analyzed for total suspended solids (TSS), ammonia (NH_3), and nitrate (NO_3) were collected once a month.

Central Massachusetts experienced fluctuating drought conditions during 2025. The year began under Level 2 - Significant drought, worsened to Level 3 - Critical in February - March, and improved through spring, returning to Normal by early May. Conditions remained Normal through most of the summer monitoring season before drought returned at Level 2 - Significant in September - October and eased to Level 1 - Mild in November - December. Dry conditions in the summer and fall led to low flow conditions at the inlet and outlet of Coes Reservoir (see Figure 3). Three sampling days in 2025 were considered "wet weather" with 24-hour rainfall totals exceeding 0.25 inches. Those days include 18-Jun (0.33 in), 10-Jul (0.68 in), and 21-Aug (1.1 in). Results from wet weather days are denoted with the raincloud symbol in the figures.

Samples for cyanobacteria cell density were collected by a contractor as needed. Additionally, the City of Worcester Department of Inspectional Services tested for *E. coli* as an indicator of harmful pathogens on a weekly basis during the swimming season at Binienda Beach.

Raw data are displayed and explained below. No statistical analysis has been performed. In some cases, results were so low the laboratory equipment could not reliably measure them. This is known as a result below the laboratory reporting limit, and is expressed with the less-than symbol (<) before the reporting limit. For example, an undetected result with a reporting limit of 1.0 mg/L is shown as <1.0 mg/L. Ratings of "Excellent", "Good", "Fair", and "Poor" for reported values are based on the Massachusetts Department of Environmental Protection's SMART Monitoring Watershed Report Card Criteria.

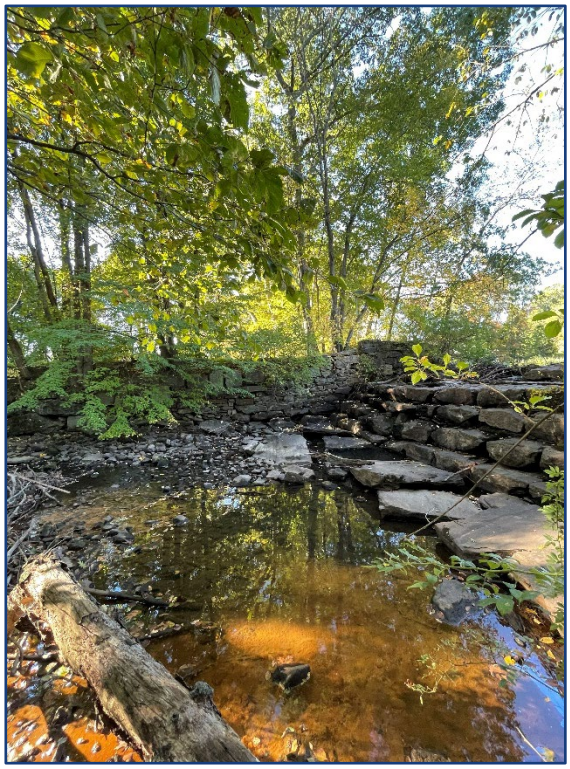


Figure 3 – *As rainfall was below average during the summer and fall of 2025, Coes Reservoir's sole tributary, Tatnuck Brook often exhibited low flow.*

Quality Assurance/Quality Control

The Lakes and Ponds Program uses Quality Assurance/Quality Control (QAQC) checks to ensure that data are representative of local conditions and meet precision and accuracy standards. QAQC check results identify data that must be flagged and/or censored before being shared and QAQC checks can highlight issues that affect data quality. When data fail to meet acceptable criteria for these checks, they are either flagged as being slightly less robust or are censored entirely. Flagged data points are marked with a red flag icon and censored data are not included in this report. For more information on L&P's data quality, please contact greenworcester@worcesterma.gov.

Fecal Bacteria

Recreational contact with water contaminated by certain fecal bacteria may cause illness. *Escherichia coli*, or *E. coli* are a type of bacteria found in the digestive tract of warm-blooded animals including geese, pets, and humans. While most strains are harmless, some can cause illness. These bacteria enter the water in many ways, including direct contact with animal waste, runoff from the shoreline and impervious surfaces like paved roadways during rainstorms, leaking septic tanks, and illicit sewer connections that empty sewage to the stormwater system. The Commonwealth of Massachusetts has strict regulations for bathing beaches, and the City of Worcester Department of Inspectional Services collects samples for *E. coli* at public beaches weekly during the swimming season to ensure that the water is safe for direct contact, closing beaches if the results are above the recreational threshold of 235 *E. coli*/100 mL. L&P also collects *E. coli* samples at select tributaries. Water samples collected by L&P and Inspectional Services are analyzed by separate labs for *E. coli* using different techniques with different units. Please note that *E. coli*/100 mL and MPN/100 mL are directly comparable.

Fecal Bacteria at Coes Reservoir. In 2025, Binienda Beach (Mill St.) was never closed due to fecal bacteria exceedances. Results from beach testing conducted by Inspectional Services ranged between <1.0 and 218.7 *E. coli*/100mL, with no results exceeding the recreational limit (see Table 1). L&P collected samples for *E. coli* in Coes Reservoir's main tributary, Tatnuck Brook. Results ranged from 34.51 to 3545.00 MPN/100 mL. Two of 10 results were above 1260.00 MPN/100mL or in the range considered "Poor", two of which were on wet weather days. *E. coli* presence tends to be highly localized, and conditions in the tributary and the beach may be quite different as the data show. Despite occasional "Poor" results in Tatnuck Brook, *E. coli* did not significantly reduce recreational opportunities. Because of this, Coes Reservoir received a rating of "Good" for *E. coli* in 2025.

TATNUCK BROOK	
DATE	RESULT
1-May	53.71
15-May	390
5-Jun	Not Taken
18-Jun	1413.61
10-Jul	>2419.60
24-Jul	102.21
7-Aug	34.51
21-Aug	3545
4-Sep	14.64
18-Sep	435.17
1-Oct	52.01
21-Oct	Not Taken
Collected by L&P	

MILL ST. BEACH	
DATE	RESULT
23-Jun	218.7
30-Jun	47.9
7-Jul	35.5
14-Jul	178.9
21-Jul	12.1
28-Jul	65.7
4-Aug	27.5
11-Aug	17.5
18-Aug	166.4
25-Aug	13.9
Collected by COW Inspectional Services	

Excellent	*Good*
Fair	*Poor*
Red Text = Beach Closure	

***Table 1** - In 2025, Binienda Beach was never closed due to fecal bacteria exceedances.* E. coli *results in Tatnuck Brook ranged between 35 and 3545 MPN/100 mL. two of 10 results were above 1260* E. coli*/100mL or in the range considered "Poor", two of which were on wet weather days. Samples from Tatnuck Brook were collected by L&P and samples from Binienda Beach were collected by Inspectional Services.*

Water Clarity

Water clarity is a measure of the transparency of water. Cyanobacteria and other microorganisms, eroded particles, and re-suspended bottom sediments are some factors that interfere with light penetration and reduce water transparency. Clear water allows sunlight to penetrate the depths of a waterbody, supporting growth of aquatic plants, which provide food, shelter, and oxygen to aquatic organisms. Clear water is also pleasant to the eye and may be safer for recreational contact. Turbid water, or water filled with particles, absorbs more heat from sunlight. This reduces the water's capacity to hold oxygen, creating favorable conditions for algal and cyanobacteria blooms, which further reduce clarity. Water clarity can

be measured with a Secchi disk or by quantifying Total Suspended Solids (TSS). A Secchi disk is a weighted black and white disk on a calibrated line that is lowered into the water until it is no longer visible. Secchi readings are collected on each lake visit by L&P. TSS is a measure of the dry weight of suspended particles in a given amount of water. TSS samples are taken once monthly and submitted to a lab for analysis.

Water Clarity at Coes Reservoir. Secchi clarity at the two in-lake sites in Coes Reservoir ranged between 3.25 ft and 8.75 ft (see Figure 4). Most readings fell between 4 and 10 ft, or in the range considered "Fair", although one result was lower than 4 ft, or in the range considered "Poor". Clarity readings were highest at the beginning and end of the season and lowest in July and August. Surface TSS at Coes Reservoir ranged between 1.4 and 6.6 mg/L, consistently falling below 10 mg/L, or in the range considered "Excellent". Results at the bottom ranged between 1.9 and 11.0 mg/L, with all but one lower than 10 mg/L. In Tatnuck Brook, TSS results were in a similar range, between 3.1 and 11.0 mg/L. At the outlet, TSS ranged between 1.5 and 7.0 mg/L, with all results falling below 10 mg/L. In 2025, most Secchi depth readings were considered "Fair". Because of this, water clarity in Coes Reservoir received a rating of "Fair" in 2025.

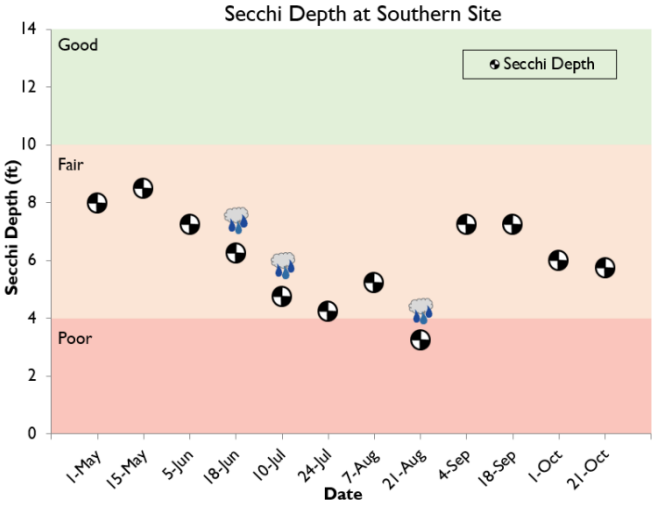


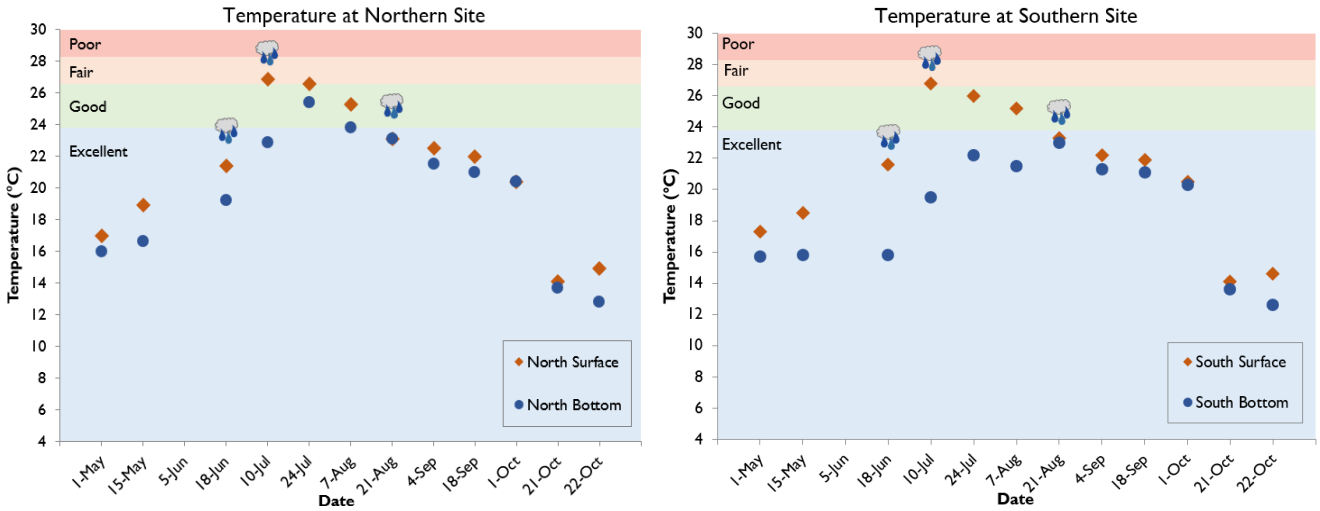
Figure 4 *- Secchi depth at the Southern in-lake site was primarily in the range considered "Fair", though one reading was in the range considered "Poor".*

Temperature

Water temperature impacts both the biology and chemistry of aquatic ecosystems. Because many organisms prefer to live in a narrow temperature range, understanding temperature across the area and depth of a water body is essential. Temperature also impacts the speed of chemical reactions and the ability of water to hold oxygen. Warmer water can hold less dissolved oxygen than colder water. Temperature dynamics in lakes can also impact the level of mixing occurring in the waterbody, affecting the distribution of oxygen, nutrients, and organic matter throughout the lake. Temperature was measured with a thermometer on a handheld probe at the water's surface at all sites and at the bottom for in-lake sites. To form a more complete picture of how temperature changes through the water column, depth profiles were created by taking measurements at 1-ft increments through the water column.

Temperature at Coes Reservoir. Surface water temperature at the in-lake sites rose at the beginning of the season, reaching the maximum at the Northern and Southern site on 10-Jul and generally decreasing into the fall (see Figures 5 and 6). Bottom temperatures at the Northern and Southern Sites were always lower than the surface but followed the same seasonal fluctuations.

To determine the extent of warming throughout the entire water column, depth profiles were taken at the Southern in-lake site (see Appendix). During the first two sampling sessions, temperature was relatively consistent throughout the water column. Profiles recorded between 18-Jun and 7-Aug exhibited



Figures 5 and 6 *- Bottom temperature at the in-lake sites was considered "Excellent" for all but two readings. Surface temperature was in the ranges considered "Good" and "Excellent" except for three readings in the range considered "Fair".*

temperature stratification, with the thermocline between 7 and 10 ft. The maximum temperature difference between the surface and deep water was 7.1° C, indicating relatively mild stratification.

Tatnuck Brook is the major tributary to Coes Reservoir. It is a Coldwater Fish Resource, a designation given to waterways that support cold water fish species such as trout. These fish require higher quality water than warm water species. The outlet of Coes Reservoir is the spillway at its southern end. Water temperature in Tatnuck Brook rose to levels challenging for cold water fish on several occasions (see Figure 7). Most temperature readings were above 15°C, and during the warmest parts of summer the brook's temperatures fell within the "Fair" category. Three readings were recorded above 20°C, the upper avoidance limit for cold water fish. The temperature at the lake outlet was on average 3.2°C higher than in Tatnuck Brook, demonstrating how much the brook warms while passing through Coes Reservoir. This season L&P rates temperature in Coes Reservoir as "Good".

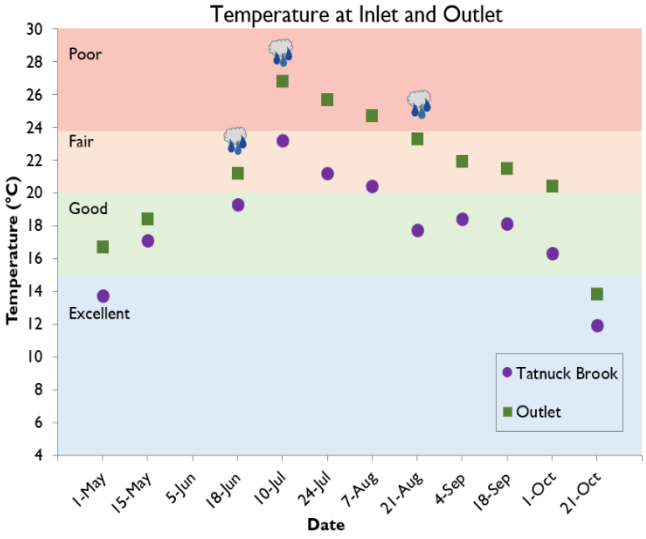
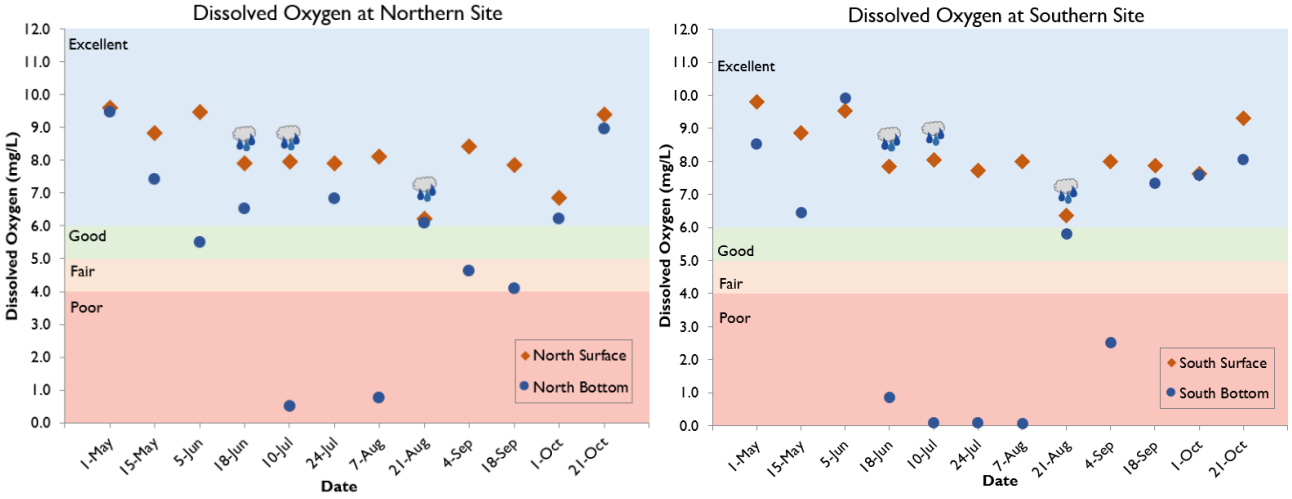


Figure 7 *- The temperature at the lake outlet was on average 3.2°C higher than in Tatnuck Brook, demonstrating how much water warms after passing through Coes Reservoir.*

Dissolved Oxygen

Oxygen dissolved in water is essential to aquatic life. Dissolved Oxygen (DO) is a highly variable parameter that is controlled by many factors, including temperature, pressure, aeration, diffusion, rate of photosynthesis, rate of respiration and more. When water temperature rises, water can hold less

dissolved oxygen, potentially stressing aquatic organisms. Thermal stratification, or layering in the water column based on temperature, can also create a barrier to waterbody mixing, creating areas with depleted DO in some deeper portions of waterbodies. Increased algal growth followed by excessive decomposition of organic material can also lead to low oxygen (hypoxic) conditions, potentially causing fish kills. DO was measured using a galvanic DO sensor on a handheld probe at the water's surface and two feet from the bottom at the in-lake locations. To form a more complete picture of how DO changes through the water column, depth profiles were created by taking measurements at 1-ft increments through the water column.



Figures 8 and 9 – *At the Northern and Southern sites, dissolved oxygen at the surface was categorized as "Excellent" throughout the season. Bottom dissolved oxygen ranged between the "Excellent" and "Poor" categories. "Poor" conditions were more prevalent at the Southern site.*

Dissolved Oxygen at Coes Reservoir. Surface DO ranged between 6.23 and 9.81 mg/L and followed a similar pattern throughout the season at the Northern and Southern Sites, with all but three results falling in the "Excellent" range (see Figures 8 and 9). Measurements at the bottom had a larger range, between 0.06 and 9.92 mg/L. At the Northern and Southern Sites, bottom DO was highest at the beginning and end of the season. At the Northern site, bottom DO was below 4 mg/L on 10-Jul and 7-Aug. At the Southern site bottom DO was below 4 mg/L and considered "Poor" between 18-Jun and 4-Sep, with one exception.

DO in Tatnuck Brook ranged widely between 2.79 and 9.82 mg/L (see Figure 10). At the

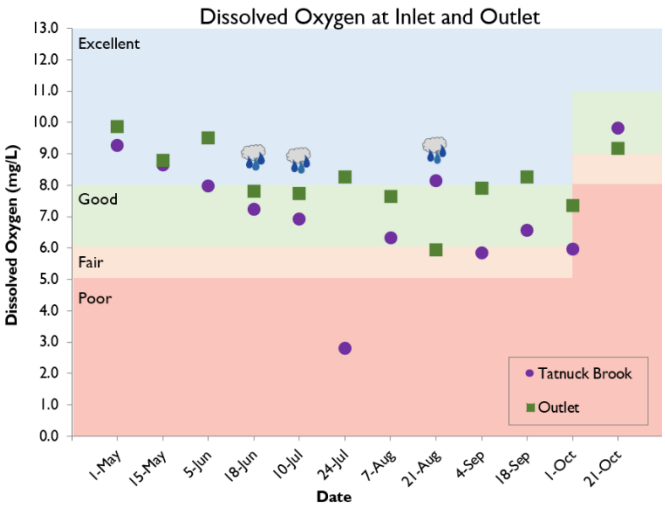


Figure 10 – *In Tatnuck Brook and the Coes Reservoir outlet, dissolved oxygen varied widely. Dissolved oxygen was in the range considered "Poor" on two occasions at Tatnuck Brook, and on one occasion at the outlet.*

outlet, DO ranged between 5.93 and 9.87 mg/L, with all the lowest readings recorded between July and September.

As observed from the depth profile data, the entire water column was adequately oxygenated during the first three sampling sessions (see Appendix). In mid-June, DO concentration began to drop below 4 mg/L, the lower avoidance limit for fish, in the deepest reaches of the water column. Throughout the season all water above 9 ft was adequately oxygenated. From late May through September, an oxycline was observed in which water below 8 - 10 ft was hypoxic. By mid-September, the water column was fully oxygenated to the end of the season. Though hypoxic conditions were observed on the bottom of the lake, a large portion of the water remained adequately oxygenated, and no fish kills were observed. Despite the presence of an oxycline during summer months, the top 8 feet of the water column always had suitable oxygen for aquatic life. L&P rates DO at Coes Reservoir in 2025 as "Good".

pH

pH is the concentration of hydrogen ions (H+) in a solution. The more H+ ions that are present, the more acidic the solution. On a scale of 0 - 14.0 units, 7.0 is a neutral pH. As pH increases from 7.0, the solution is more basic, and as pH decreases from 7.0, it becomes more acidic. In aquatic ecosystems, pH affects most chemical and biological processes including species distribution, growth rate, reproductive success, and nutrient dynamics in lakes. A high pH can promote chemical reactions that release phosphorus from lake sediments. Healthy lakes in our area have a pH between 6.5 and 8.5. pH was measured using an ion-selective electrode (ISE) pH sensor on a handheld monitoring probe. Readings are taken at the water's surface and two feet from the bottom.

pH at Coes Reservoir. Surface pH at the in-lake sites ranged between 7.21 and 8.76 over the course of the season (see Figure 11). The highest pH readings recorded by L&P at the Northern and Southern Sites this season were observed on 10-Jul. Bottom pH ranged between 6.65 and 7.79 and did not show a clear seasonal pattern. At Tatnuck Brook, pH ranged between 6.63 and 7.28 and was lowest between early July and early October. At the outlet, pH between 7.18 and 8.65, and closely followed the in-lake distribution.

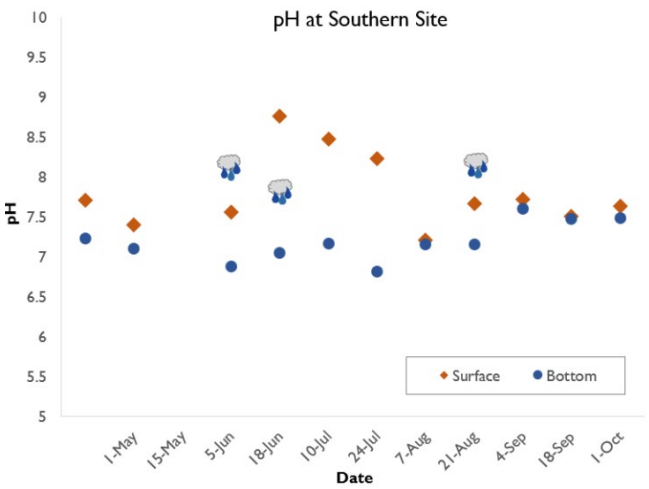


Figure 11 *- Surface pH was higher than bottom pH and fluctuated throughout the season.*

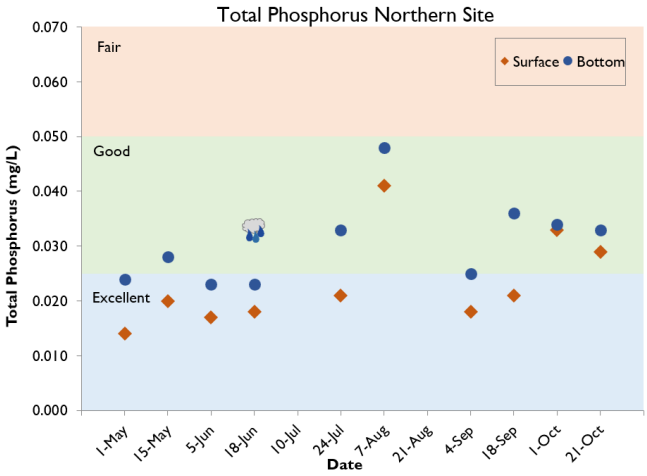


Figure 12 *- Surface total phosphorus at the Northern site was considered "Excellent" for most of the season, with three results in the "Good" category from August to the end of the season. Bottom total phosphorous started in the "Excellent" category, with more results in the "Good" category as the season went on.*

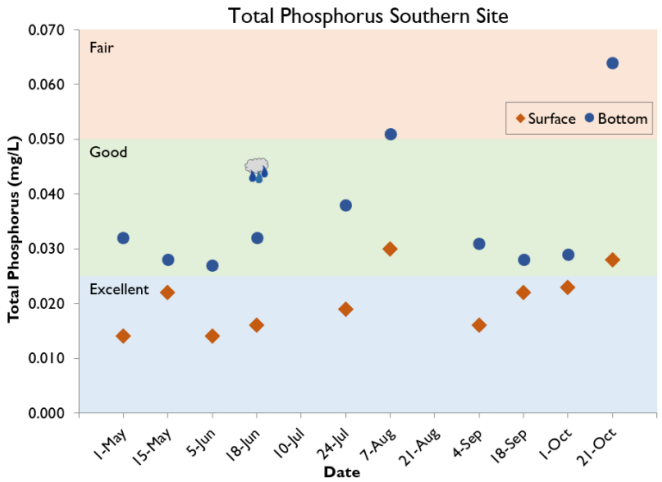


Figure 13 *- Surface total phosphorus at the Southern site was considered "Excellent" for most of the season, with two results in the "Good" category. Bottom total phosphorus was in the "Good" category for most of the season, with two "Fair" results.*

Nutrients

Nutrients, primarily nitrogen (N) and phosphorus (P), are food sources for aquatic plants and algae. Although plants and algae are the basis of aquatic food chains and necessary for a healthy lake ecosystem, an overabundance of nutrients can lead to issues such as harmful algal blooms and excessive plant growth. Common nutrient inputs to urban lakes and ponds include fertilizers, pet and goose waste, illicit sewer connections to the stormwater system, and runoff that flows over land into the stormwater system. Additionally, under the right conditions, P can be released from the sediments at the bottom of the lake, becoming more available for uptake by organisms. To examine the nutrients present in program lakes, L&P collects samples for several compounds and submits them to an external lab for analysis. To measure N, samples are collected for nitrate (NO_3) and ammonia (NH_3) at all sites monthly. To measure P, samples are collected for total phosphorus (TP) twice a month at all sites, and total dissolved phosphorus (TDP) twice a month at all bottom sites. TDP is analyzed to understand how much P is dissolved in the water and available for use by aquatic organisms.

Nutrients at Coes Reservoir. At the in-lake sites, TP on the surface ranged from 0.014 to 0.041 mg/L, with some results considered "Good" and most within the "Excellent" range (see Figures 12 and 13). Recorded surface TP was highest on 7-Aug at both sites. Bottom TP was always higher and ranged from 0.023 to 0.064 mg/L. Samples were also collected for TDP at the bottom in the Northern and Southern Sites. Results were consistently in the range considered "Excellent".

TP results in Tatnuck Brook ranged between 0.023 and 0.095 mg/L (see Figure 14). At the outlet results were generally lower, ranging between 0.015 and 0.033 mg/L, with most results in the category considered "Excellent".

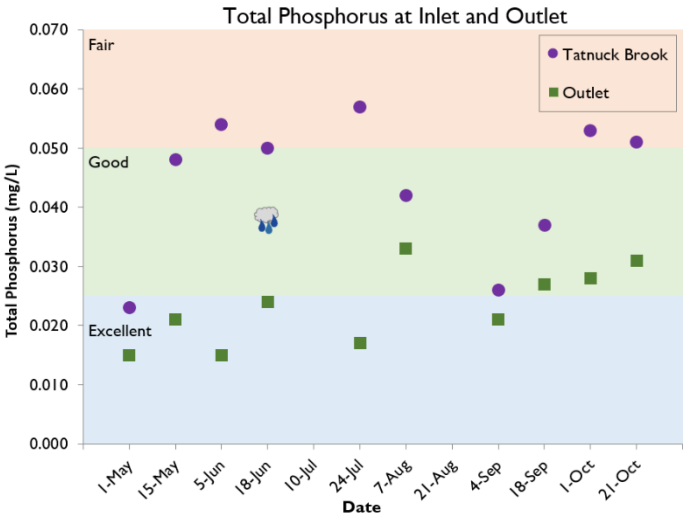


Figure 14 *– Total Phosphorus was higher at the inlet than the outlet, with 4 of 10 results in the ranges considered "Fair" and "Poor". Results from the outlet were mostly in the range considered "Excellent".*

At the in-lake sites, NO_3 results from surface and bottom samples indicated low concentrations, ranging between <0.050 and 0.123 mg/L. All results were below 0.6 mg/L and in the range considered "Excellent". NO_3 results from Tatnuck Brook were below 0.6 mg/L but considerably higher than in-lake results, ranging between 0.076 and 0.237 mg/L and within the "Excellent" category.

At the in-lake sites, NH_3 results from surface and bottom samples indicated low concentrations, with all but one result below 0.15 mg/L and in the range considered "Excellent". NH_3 results from Tatnuck Brook were usually higher than in-lake results, ranging between <0.075 and 0.456 mg/L. At the outlet all but one NH_3 result was below the reporting limit.

As surface TP concentrations were generally in categories considered "Excellent" and "Good", nutrients in Coes Reservoir received a rating of "Good" in 2025. However, based on observations in past seasons, Coes Reservoir is susceptible to cyanobacteria blooms in this range of concentration.

Cyanobacteria

Cyanobacteria are naturally occurring microorganisms in waterbodies. Using sunlight and nutrients such as N and P, cyanobacteria use photosynthesis to gain energy similarly to plants. While normal at low densities in healthy ecosystems, under the right conditions some species of cyanobacteria can reproduce quickly and cause potentially harmful blooms. In addition to being unsightly and smelly, cyanobacteria blooms can produce toxins that are harmful to humans and pets. Blooms also have the potential to create hypoxic conditions that can cause fish kills. To understand the abundance of cyanobacteria and support decisions regarding lake management and safe access, L&P contracts regular samples for cyanobacteria cell counts at Coes Reservoir to determine bloom risk. When results are above the recreational threshold of 70,000 cells/mL the waterbody must be closed to recreation until cell counts fall. During cyanobacteria blooms L&P may also contract samples for cyanotoxins to establish whether they are present in

concentrations that could be harmful. When possible and necessary, L&P uses preventative lake treatments such as algaecide to stop cyanobacteria growth in the early stages of a bloom before cell counts exceed the recreational threshold.

Cyanobacteria at Coes Reservoir. There were no closures due to cyanobacteria exceedances at Coes Reservoir in 2025. Cyanobacteria cell counts remained low in the early season, beginning to increase in early July (see Figure 15). Due to a result of 42,400 cells/mL indicating potential exponential growth, a preventative algaecide treatment was conducted on 31-Jul. Cell count results remained low for the remainder of the season. Coes Reservoir was never closed due to cyanobacteria bloom conditions in 2025. Because of this, Coes Reservoir received a rating of "Good" for cyanobacteria.

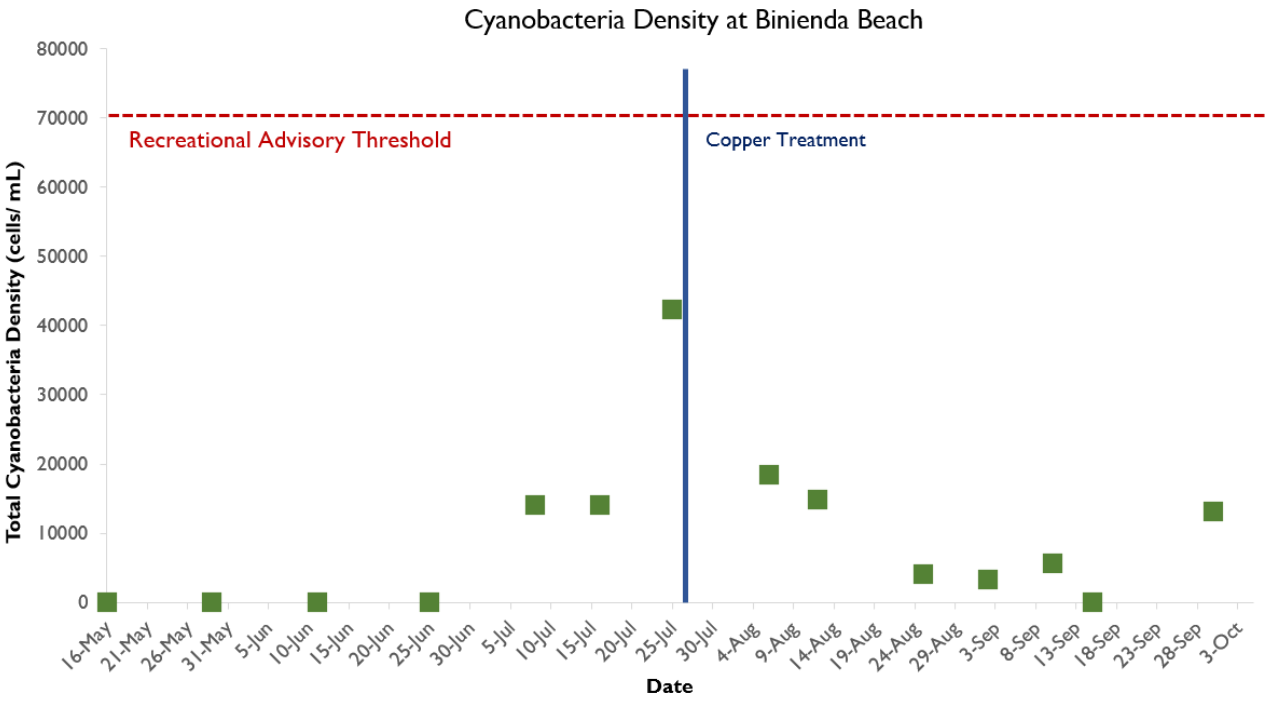


Figure 15 *– In 2025 cyanobacteria cell density never exceeded 70,000 cells/mL, the threshold for recreational advisory and lake closure. A Copper Sulfate treatment was conducted on 31-Jul to slow the growth of cyanobacteria.*

Invasive Aquatic Plants and Animals

An invasive plant or animal is an organism that is not native to the region and outcompetes local flora and fauna. The absence of natural constraints, like predators or environmental limitations, allows invasive plants and animals to reproduce at a rapid rate. When invasive aquatic plants and animals become too numerous or dominant, they can overtake available space, disrupting local ecosystems and making recreation more difficult. Invasive organisms can arrive at new locations by hitching a ride on boats, pets, or boots. Some are released with good intentions as a beautiful addition to a landscape or sport fishing opportunity. Professional surveys and visual inspections from L&P staff are used to make management decisions regarding invasive species.

Invasive Aquatic Plants and Animals at Coes Reservoir. Coes Reservoir is managed for several invasive aquatic plants: Water Chestnut (*Trapa natans*) (see Figure 16), Fanwort (*Cabomba caroliniana*), and Eurasian Milfoil (*Myriophyllum spicatum*). Curly-Leaf Pondweed (*Potamogeton crispus*) has also been noted with peak growth in early spring, though the species has not been documented in contracted aquatic plant surveys nor actively managed. L&P plans to conduct a targeted survey in spring 2026 to better assess its distribution and potential impacts. Before the utilization of chemical treatments, Milfoil and Water Chestnut threatened to overtake the entire reservoir. To manage populations of these plants, L&P has used a combination of physical removal and herbicide strategies. A successful systemic herbicide treatment of fluridone (trade name: Sonar) in 2019 significantly reduced the Fanwort and Milfoil density through the present. Dense Water Chestnut growth has been managed annually by L&P at Coes Reservoir since 2017. Invasive Water Chestnut populations commonly require a minimum of eight to twelve years to eradicate and remove most of the seed bank, with sparse growth continuing in later years. After years of consistent management of dense growth, the remaining Water Chestnut can be managed with volunteer and contracted hand pulls. L&P and the Tatnuck Brook Watershed Association (TBWA) co-hosted a community hand pulling event in late June where 15 volunteers removed 50 pounds of water chestnut plants throughout the lake. A follow-up contracted hand pull removed the remaining visible plants. While hand pulling will remain necessary for years to come, it is expected that more robust techniques will not be necessary if hand pulling events receive sufficient volunteers.

Figure 16 – *A reduced population of invasive Water Chestnut at Coes Reservoir was managed with volunteer and contracted hand pulls in 2025.*

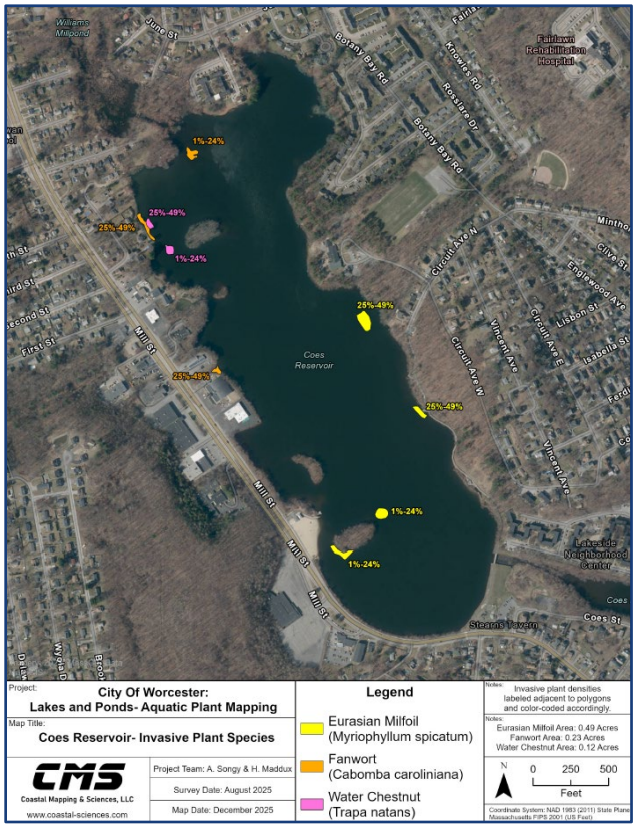


Figure 17 – *A plant survey was conducted in August of 2025, which confirmed small remnant populations of Eurasian Milfoil and Fanwort, and two small patches of water chestnut.*

A professional plant survey in August 2025 (see Figure 17) confirmed small remnant populations of Eurasian Milfoil and Fanwort, and a few remaining Water Chestnut plants. L&P will manage these small populations in 2026 to prevent further expansion

Industrial Contaminants

Worcester is a post-industrial urban center and legacy pollutants and emerging contaminants of concern from industrial processes are potential threats to recreational waters. These contaminants may cause negative health and environmental effects. Every few years, L&P tests for a range of these compounds on both a wet and dry weather event. Because most industrial contaminants are legacy pollutants, contamination levels are not expected to change much year to year. In 2022, L&P tested for 74 volatile organic compounds (VOCs), 72 semi volatile organic compounds (SVOCs), 9 polychlorinated biphenyls (PCBs), petroleum hydrocarbons (TPH), 23 perfluoroalkyl substances (PFAS), 21 pesticides, 10 herbicides, and 22 heavy metals. No results of concern were detected. See the 2022 Coes Reservoir Water Quality Report or contact greenworcester@worcesterma.gov for more information. The follow up monitoring planned for summer 2025 was rescheduled to spring 2026 due to program capacity and greater wet weather sampling opportunities.

State of the Lake

In 2025, Coes Reservoir received a score of "Good". The reservoir remained open throughout the season with no closures due to cyanobacteria or fecal bacteria exceedances. A preventative copper sulfate treatment in late July effectively managed rising cyanobacteria levels, ensuring safe recreational access. Beach *E. coli* results remained well below recreational thresholds. Despite occasional "Poor" results in Tatnuck Brook, *E. coli* did not significantly reduce recreational opportunities, leading to a rating of "Good". Water clarity was considered "Fair" overall, though L&P observed one reading in the "Poor" category in late summer. Most temperature readings were in the "Excellent" and "Good" categories, leading to an overall rating of "Good". Dissolved oxygen levels were rated "Good" overall, with hypoxia confined to deeper areas during late summer and most of the water column maintaining sufficient levels of oxygen for aquatic life. As surface TP concentrations were generally in categories considered "Excellent" and "Good", nutrients in Coes Reservoir received a rating of "Good" in 2025. After years of invasive aquatic plant management, the Water Chestnut population has been significantly reduced, allowing for successful management utilizing only hand pulls.

Despite challenges outlined in this report, Coes Reservoir continues to support a healthy ecosystem and recreational use. L&P will continue monitoring and management efforts to improve and preserve the reservoir's water quality and recreational value into the future.

Ongoing Projects and Plan for 2026

Water Quality Monitoring

In 2026, the Lakes and Ponds Program will continue to monitor Coes Reservoir to track changes in water quality and implement cyanobacteria and invasive aquatic plant management plans. L&P will continue to

contract cyanobacteria cell counts to better understand cyanobacteria population dynamics and inform management and public health decisions. In 2026 L&P will conduct sampling for industrial contaminants.

Tatnuck Brook Project: Collaboration with Worcester State University. Coes Reservoir is the last of a chain of waterbodies along Tatnuck Brook, which stretches from Holden through western Worcester. Other lakes on the brook include Cooks Pond, Patch Reservoir, Patch Pond, and Coes Pond. Previously, consistent water quality monitoring has been restricted to Coes Reservoir due to funding and staffing constraints. Since 2022, the Lakes and Ponds Program has collaborated with Worcester State University (WSU) researchers and students to expand sampling into Patch Reservoir, Cooks Pond, and additional sections of Tatnuck Brook. Collaborators from WSU used L&P methodologies to collect samples in these waterbodies on the same days the Lakes and Ponds Program samples in Coes Reservoir. This allows us to directly compare waterbody results to better understand dynamics throughout the watershed and create more informed management plans in future years. This work continued in 2025 at Patch Reservoir and Cooks Pond. Reports from these investigations have been included alongside the four program lakes and can be found at WorcesterMA.gov/bluespace. The WSU Tatnuck Brook Project will continue in 2026, subject to funding.

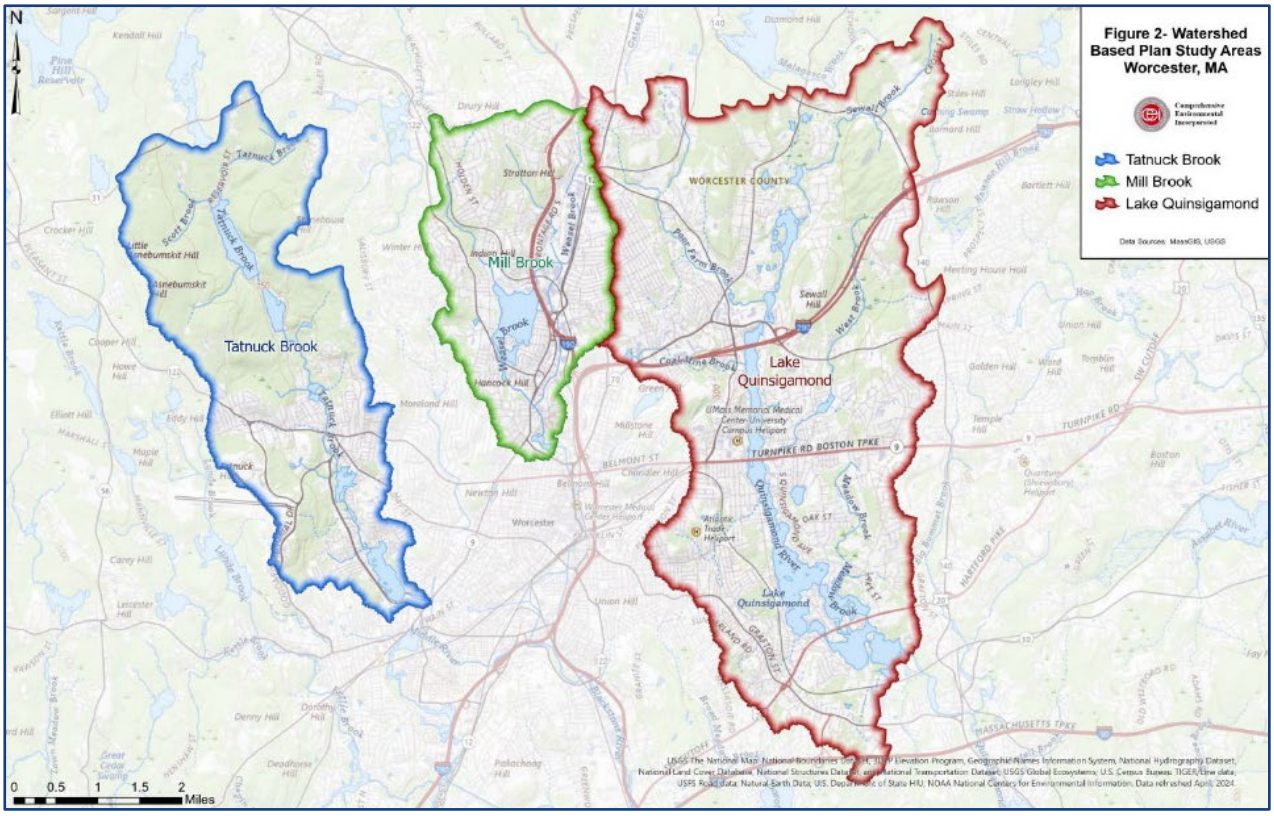


Figure 18 – *The Lakes and Ponds Program has contracted a consultant to develop watershed-based plans to reduce nonpoint source pollution in the City's three main recreational sub-watersheds. This project will identify pollutant loads and load reduction targets and provide stakeholders with a roadmap to restoration and protection. Image credit: Comprehensive Environmental Inc (CEI).*

Lake Management

The Lakes and Ponds Program has contracted a consultant to develop watershed-based plans to reduce nonpoint source pollution in the City's three main recreational sub-watersheds (see Figure 18). These plans will be based on the U.S. EPA's 9-Element watershed-based planning framework and make future projects aimed at reduction of nonpoint source pollution eligible for state and federal grant funding. A plan is being created for Tatnuck Brook Watershed, beginning at the outlet of Worcester's reservoir system. This project will identify pollutant loads and load reduction targets and provide stakeholders with a roadmap to restoration and protection.

Since the project's kickoff in late 2024, the project team has used data collected by L&P and other sources to model stormwater and nutrient dynamics. These models estimate pollutant volumes entering waterbodies, evaluate how the lake ecosystems respond, and establish goals for reducing pollutants and improving water quality.

At public workshops in April 2025, community members provided insight into possible pollutant sources throughout the watershed (see Figure 19). This local expertise guided field assessments to identify locations suitable for stormwater control measures, such as bioretention basins, shoreline restoration, erosion prevention, or infrastructure upgrades. High-level conceptual designs were prepared for potential project sites to explore feasibility and cost-effectiveness. More detailed plans will be developed for selected sites to guide implementation. In 2026, the project will review institutional and community practices and recommend initiatives to further reduce nutrient pollution and protect local water resources. The draft plan will be discussed at an upcoming public meeting. Community feedback will be integrated into the plan to create the final version.

Figure 19 *- A community member identifies areas in Tatnuck Brook Watershed to be examined by the consultant during watershed surveys.*

Stormwater Infrastructure Improvements. In 2025, L&P leveraged funding from the American Rescue Plan Act (ARPA) to install two particle separators in stormwater drainage lines discharging into Tatnuck Brook. Particle separators are units installed in the stormwater system which typically use either chambered systems or swirl concentrators to trap and remove sediment from stormwater. The retained sediment is removed from the separator through periodic maintenance, reducing sediment and nutrient input into waterbodies. The improvements were completed in 2025.

Goose Fencing. In 2021, L&P began implementing a goose fencing pilot project that aimed to reduce the number of beach closures at Coes Reservoir by humanely keeping geese away from the beach. Geese usually enter the beach from the water and are uncomfortable when there are barriers between the beach and the water as the water is their escape route from land predators. L&P has worked with lifeguards at City beaches to pilot different fencing methods since 2021 with varied results due to fence design,

lifeguard availability, and quick acclimation of geese. In 2026, L&P will continue to refine the approach to deterring geese from City beaches to reduce the risk of beach closures due to fecal bacteria exceedances.

Volunteer Invasive Species Removal. In 2025, L&P and the Tatnuck Brook Watershed Association (TBWA) co-hosted a community hand pulling event in late June where 15 volunteers removed 50 pounds of water chestnut plants throughout the lake. In 2024, residents began reporting an infestation of the invasive plant Purple Loosestrife (*Lythrum salicaria*) in wetland areas surrounding Coes Reservoir. For the second time, L&P and TBWA co-hosted a volunteer hand pulling event to remove loosestrife plants before seeds developed (see Figure 20). L&P will host additional volunteer removal events in 2026.

Figure 20 – *Volunteers remove Purple Loosestrife from the wetlands of Coes Reservoir.*

Education and Outreach

Educational Programming. Since its inception, the Lakes and Ponds Program has partnered with groups such as local schools, Mass Audubon, the EcoTarium, Worcester JCC, and local watershed associations to provide educational programming in which students learn about water quality issues that affect recreation on our waterways and get hands-on experience in environmental monitoring methods.

In 2021, the Tatnuck Brook Watershed Association (TBWA) began hosting an event at Coes Reservoir called the Coes Aquatic Science Day (see Figure 21). Starting in 2023, this annual event was held as a field trip for local fifth graders to discover the aquatic environment through a series of activities where they have used water quality meters, learned about aquatic macroinvertebrates, looked at cyanobacteria under a microscope, explored a 3D replica of a watershed, simulated the impact of dams, and collected fish with a large seine net. L&P looks forward to continuing to support TBWA in this event in 2026.

Figure 21 – *Local 5th graders learn water quality monitoring methods at the 2025 Aquatic Science Day.*

The Lakes and Ponds Program is looking to expand opportunities for educational field trips. If you are affiliated with a school and would like to discuss holding a program together, please email us at greenworcester@worcesterma.gov.

Text Message Alert System. In 2023, the Lakes and Ponds Program launched a text message alert system allowing residents to sign up to receive up-to-date information on lake access to guide upcoming visits.

Text messages alert residents when a beach is closed for fecal bacteria exceedances, or if a boat ramp is closed because a lake is receiving an invasive aquatic plant treatment. To sign up for the text message alert system, please visit WorcesterMA.gov/bluespace.

To learn more about Lakes and Ponds Program offerings, please see WorcesterMA.gov/bluespace.

Appendix: Depth Profiles

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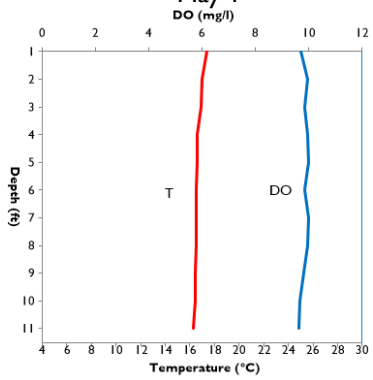

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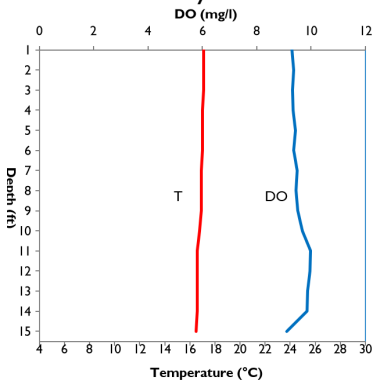

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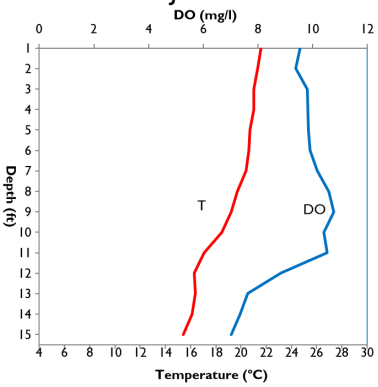

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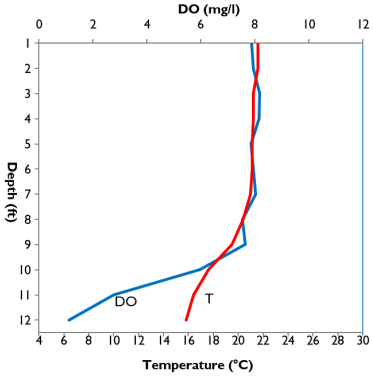

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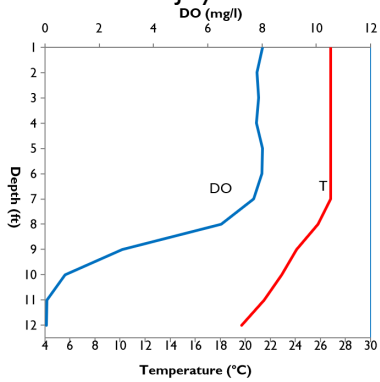

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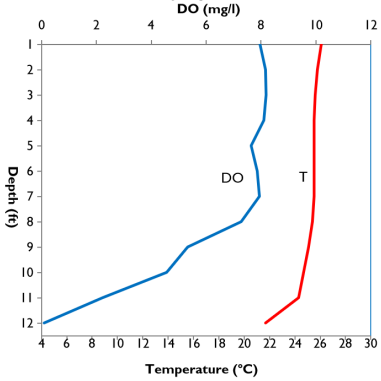

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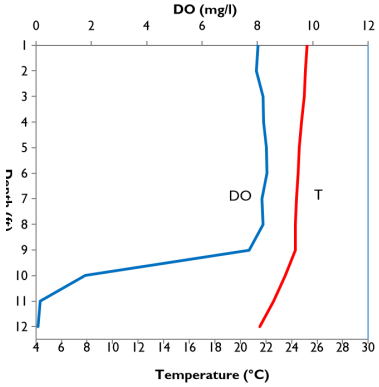

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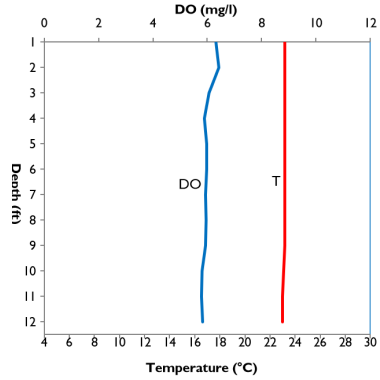

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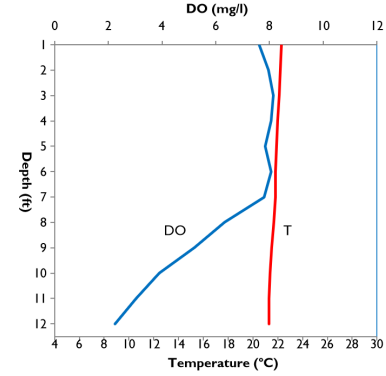

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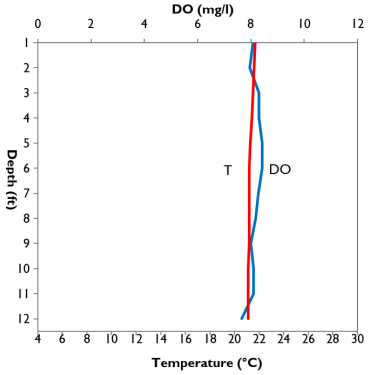

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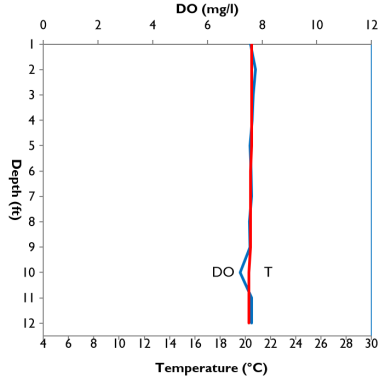

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