# Data Scorecard and Action Plan

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| **From:** | Alejandro Reyes, CLM and Project Manager |
| **cc:** | Luke Gervase, CLM; Lindsey Kollmer |
| **Date:** | April 2026 |
| **Re:** | Roaring Brook Lake Data Scorecard<br>Town of Putnam Valley<br>Putnam Valley, New York |
| **Project No.:** | 2502546 |

GEI Consultants Inc. (GEI) is pleased to present this summary of 2025 monitoring and data scorecard to the Town of Putnam Valley (TOPV) and the Roaring Brook Lake Property Owners Association (RBLPOA).

## Summary of Monitoring Events

Building off the previous years' sampling and action plan for Roaring Brook Lake, the lake was monitored for water quality at one station from May to October 2025. Aquatic plant sampling was also conducted In August.

## In-Lake Water Quality Monitoring

### *Methodology*

In-lake monitoring in 2025 consisted of seven monitoring trips from May to October (approximately once per month) sampling the south lake main station (Station 1).

At the monitoring station, water clarity data was collected using a viewscope and Secchi disk. Both clarity readings with and without the viewscope are taken to stay consistent with past Citizen Statewide Lake Assessment Program (CSLAP) methodology (without scope) and to provide a more accurate reading (with scope). Temperature and oxygen profiles were taken at 0.5-meter increments from the surface to the bottom of the lake using a Aquatroll 500 multiparameter probe with sensors calibrated according to manufacturer's specifications.

Nutrient samples at Station 1 were taken at three depths (surface, middle, bottom or approximately 0.5 meters, 2.5 meters, and 4.5 meters) and were analyzed for total phosphorus (TP) and total nitrogen (TN). Cyanobacteria samples were taken using a 3-meter integrated hose sampler and zooplankton samples were taken using a zooplankton net that is lowered to around 0.5 meters off the bottom and raised at approximately a rate of one meter per second to best capture the zooplankton.

## *Evaluating Lake Water Quality Status*

While state standards for TP and Secchi disk readings exist, these standards represent the worst case, do not exceed values, and are not directly relevant to Roaring Brook Lake. The lake does not come close to exceeding each value throughout the season, so a more conservative evaluation system specific to Roaring Brook Lake is needed.

GEI uses a three-part water quality evaluation system for each key parameter. This is intended to take advantage of all the past data collected in the lake and to examine long-term trends, not only single values. The proposed system is as follows:

- Each parameter receives a score out of three at the end of the field season. One point is awarded if the seasonal average does not exceed the established upper threshold value. When parameters exceed the threshold value, lakes are at risk for high algal abundance and frequent desired use impairments such as swimming closures, etc.
- One point is awarded if the seasonal average for the parameter exceeds, or is at, the optimal value, which is a value that we would ideally like to see the lake maintain. These optimal values are indicative of extremely low algae favorable conditions, where harmful algae blooms (HABs) are not expected to be present at all.
- One point is awarded if the trend is not increasing over a 5-year period. This is intended to capture declines in water quality that do not reach to the level of the upper threshold. Declines in water quality parameters are not good signs for the lake, even if the values themselves are not of concern individually. A 5-year timeframe is used to account for yearly differences in precipitation and weather.
- For example, for a given year if water clarity averages 2.5 meters over the summer season, and the values have not been decreasing over a 5-year period, the water clarity year's score would be a 2/3. One point was awarded because the seasonal average was greater than 2 meters and one point was awarded because there was no decrease in values over the 5-year period. Since the value was not greater than the optimal value, a third point was not awarded.

The parameters included in this measure include water clarity, TP, TN and chlorophyll a (Table 1).

**Table 1. Parameters Included in the Optimal and Threshold Value Matrix for Evaluating Lake Status**

| Parameter | Optimal Value | Threshold Limit |
|---|---|---|
| Water Clarity | >3 meters | <2 meters |
| Surface Total Phosphorus | <10 µg/L | >20 µg/L |
| Surface Total Nitrogen | <200 µg/L | >600 µg/L |
| Chlorophyll a | <2 µg/L | >10 µg/L |

Scores across all parameters can be summed to give the lake an overall score for the year (Table 2). This score can be tracked over time to evaluate how the lake has been faring in terms of water quality. The TOPV and RBLPOA monitoring scheme for future years should aim to continue to adequately sample for all these parameters at least monthly or on a more frequent basis.

# *Results*

## Data Scorecard

**Table 2. Data Scorecard for Roaring Brook Lake in 2025**

| Parameter | Seasonal Average at or Better than Optimal Value | Seasonal Average Not Above Threshold Value | Long Term Trend | 2025 Score |
|---|---|---|---|---|
| Water Clarity (m) | 0 | 1 | 1 | **2** |
| Surface Total Phosphorus (µg/L) | 0 | 1 | 1 | **2** |
| Surface Total Nitrogen (µg/L) | 0 | 1 | 1 | **2** |
| Chlorophyll a | 0 | 1 | 1 | **2** |
| **Total** | **0/3** | **3/3** | **4/4** | **8/12** |

The 2025 score indicates that the lake is in great condition, with no single parameter losing a point on having seasonal averages above the threshold and no concerning long term trends. This means that while the lake is not in optimal water quality condition, it is still meeting its desired uses.

## Water Clarity

Water clarity in 2025 was desirable throughout the recreational season (Figure 1), with the greatest clarity measured in mid-August (3.8 meters). Clarity values were the worst (water was less clear) in early May and October landing right around the 2-meter threshold. Mean clarity in 2025 was slightly improved compared to 2024, but for the most part has stayed similar for the past 5 years (Figure 2).

**Figure 1. Water Clarity Measurements (without a viewscope) from 2025 Provided by CSLAP and GEI. Red dashed line indicates the New York State narrative limit for eutrophic waterbodies at 2 meters. Blue line indicates the optimal value of 3 or more meters.**

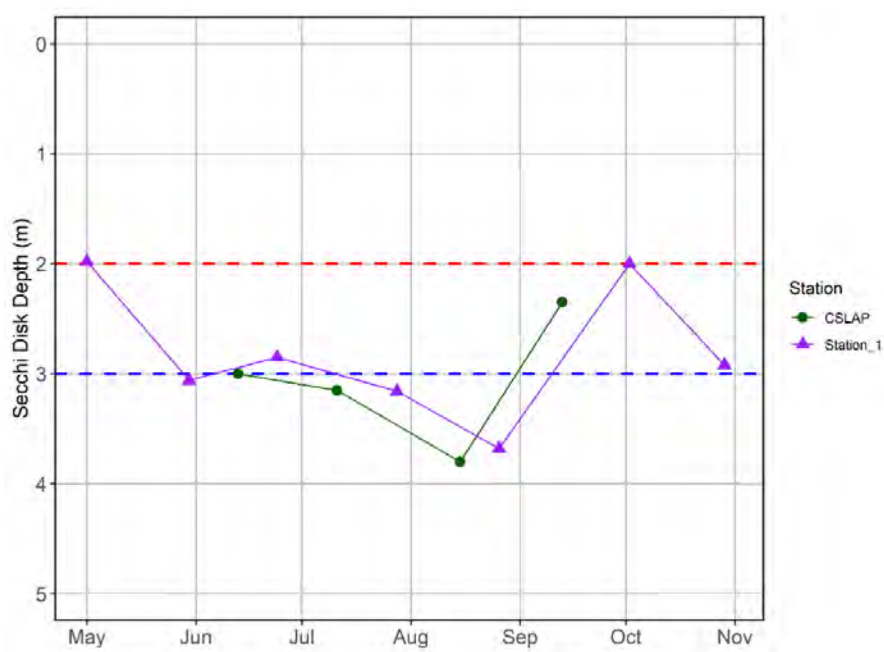
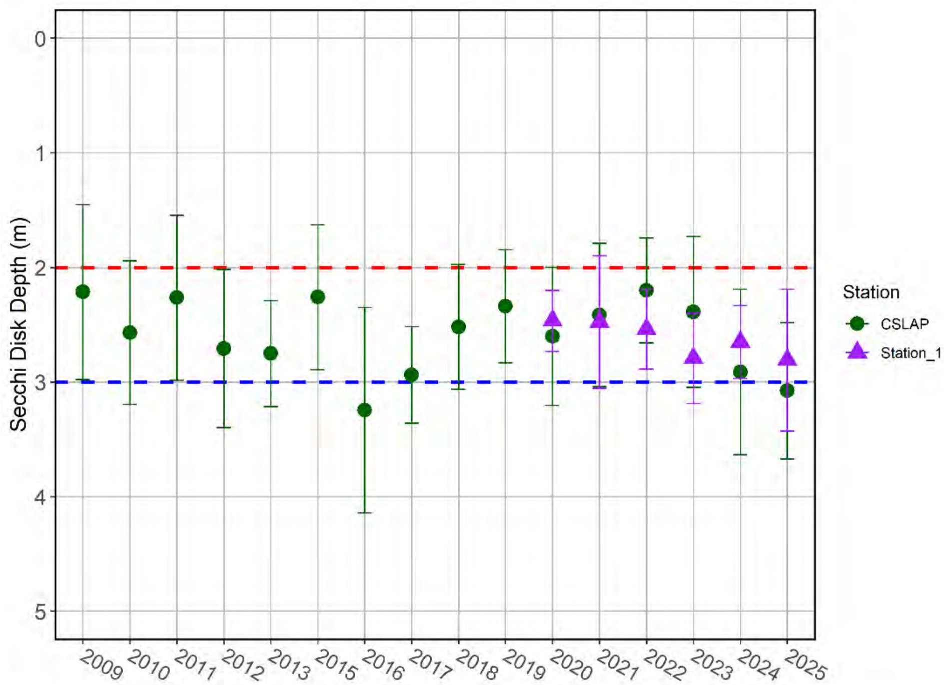


**Figure 2. Water Clarity Measurements (without a viewscope) for all Historical Data Collected on Roaring Brook Lake. Data sources include CSLAP data (green circles) and NEAR/GEI monitoring Station 1 (purple triangle). Red dashed line indicates the threshold limit (2 m), and the blue line indicates the optimal value (3 m). Error bars represent one standard deviation.**

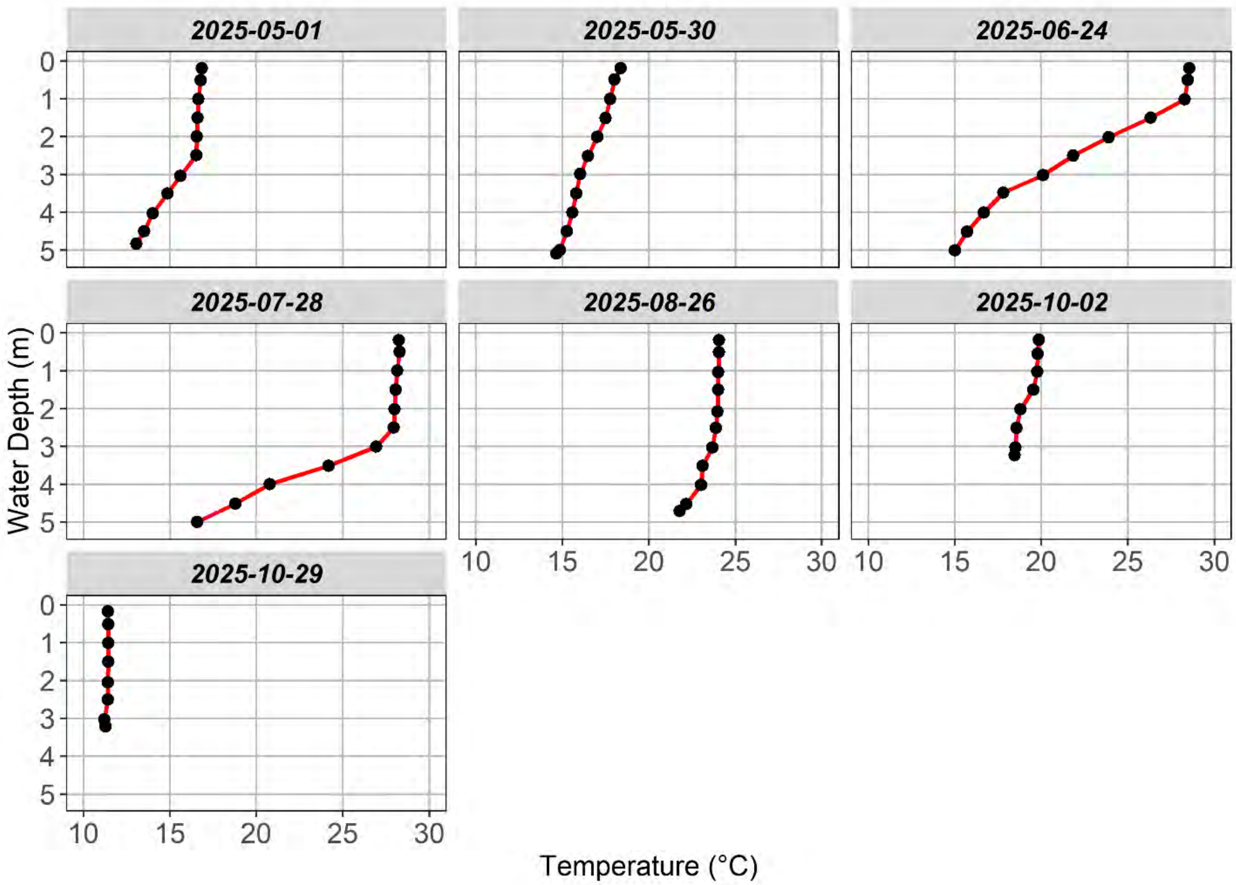



## Temperature

Lake temperature profiles followed a typical seasonal pattern. Thermal stratification is beginning as soon as early May and continues to warm as the summer continues. Stratification is strong in June and July with a mixed epilimnion at the surface (a general rule of thumb is that the larger the difference between the surface and bottom temperature values on temperature plots, the stronger the stratification; Figure 3). In August, the lake appears to have undergone recent mixing with cooler, uniform temperatures throughout the water column and slightly cooler temperatures at the bottom. This may be a result of cooler temperatures and heavy rain that happened a few days prior to sampling (1.79 inches on August 21, 2025; CLIMOD2 Station: SHRUB OAK). October shows a continued and significant drop in water temperature and with mixing throughout the water column.

Compared to last year's temperature data, the temperature patterns of the lake in 2025 were very similar to 2024. The main difference between 2024 and 2025 was the thickness of the epilimnion in the June sampling which only extended from the surface to 1 meter deep in 2025 compared to extending from the surface to 3 meters deep in 2024. The difference may be caused by the slightly later date that the profile was taken in 2024 combined with the warmer temperatures in the days leading up to that sampling date, causing more warming in the lake in that year. Other than in June, the two years experienced very similar temperature patterns that also match with previous years' temperature data.

**Figure 3. Water Temperature Profiles from Roaring Brook Lake's Station 1 in 2025. The two profiles taken in October reach the bottom at a shallower depth because the lake was in a drawdown.**




Roaring Brook Lake's average thermocline depth, epilimnion depth, and hypolimnion thickness was calculated for each year from 2019 to 2025. The thermocline in a lake is the depth at which the greatest change in temperature occurs. The average thermocline depth ranged from 2.8 to 4.4 meters with an average of 3.5 meters across all years (Table 3). The epilimnion, or the upper layer of the lake in which every meter is within 1°C, ranged from 2.1 to 3.0 meters in depth averaging 2.5 meters across all years. The hypolimnion, or the lower layer of the lake in which every meter is within 1°C, ranged from 0.0 to 1.0 meters. Typically, the hypolimnion was 0.0 meters thick, or nonexistent, because the metalimnion extended to the bottom of the lake or the lake was fully mixed (meaning no distinct layers). However, a few years had instances in which a hypolimnion was present on one or multiple dates, leading to an average thickness greater than zero. 2025 had shallower than average thermocline depth and epilimnion depth but was within expected variation in terms of thermal structure. Due to the shallow depth of Roaring Brook, it is expected that the thermal structure would shift year to year, based on temperature, precipitation and wind patterns.

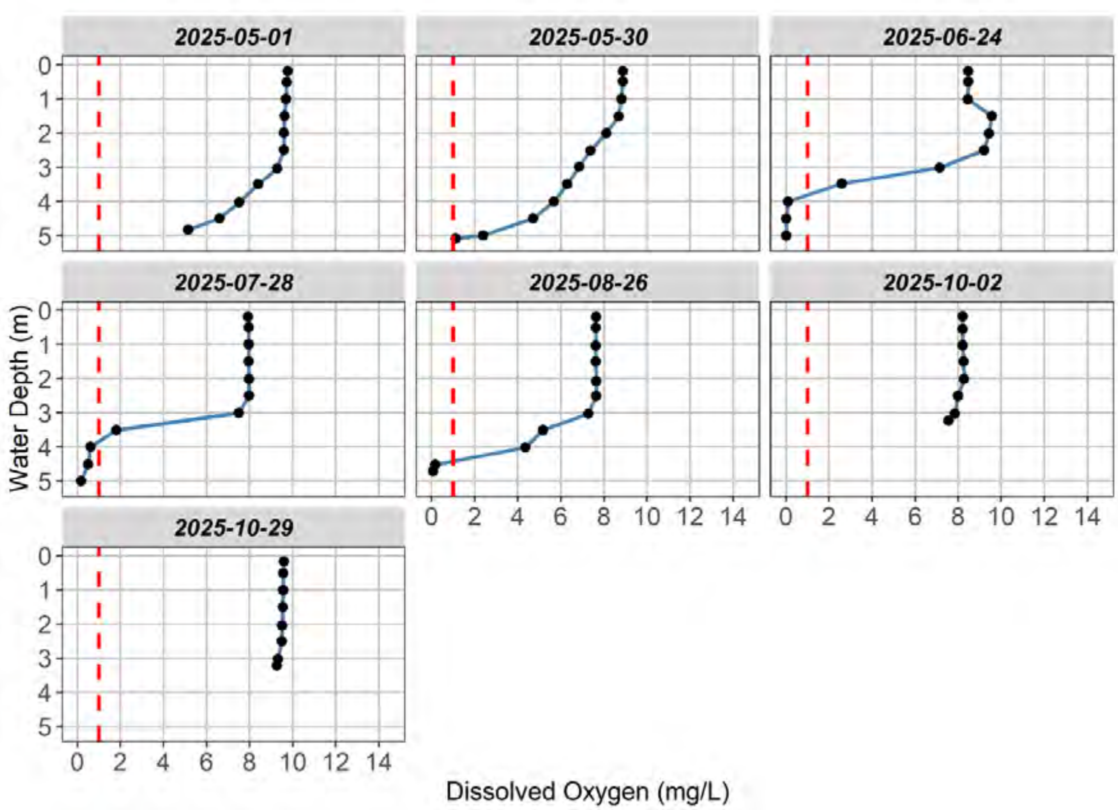
**Table 3. Average Thermocline Depth, Epilimnion Depth, and Hypolimnion Depth for 2019 to 2025 at Station 1**

| Year | Average Thermocline Depth (m) | Average Epilimnion Depth (m) | Average Hypolimnion Thickness (m) |
|---|---|---|---|
| 2019 | 3.6 | 3.0 | 0.0 |
| 2020 | 3.5 | 2.3 | 0.0 |
| 2021 | 3.8 | 2.8 | 0.2 |
| 2022 | 4.4 | 2.4 | 0.0 |
| 2023 | 2.8 | 2.1 | 1.0 |
| 2024 | 3.5 | 2.8 | 0.5 |
| 2025 | 2.9 | 2.2 | 0.5 |

## Dissolved Oxygen

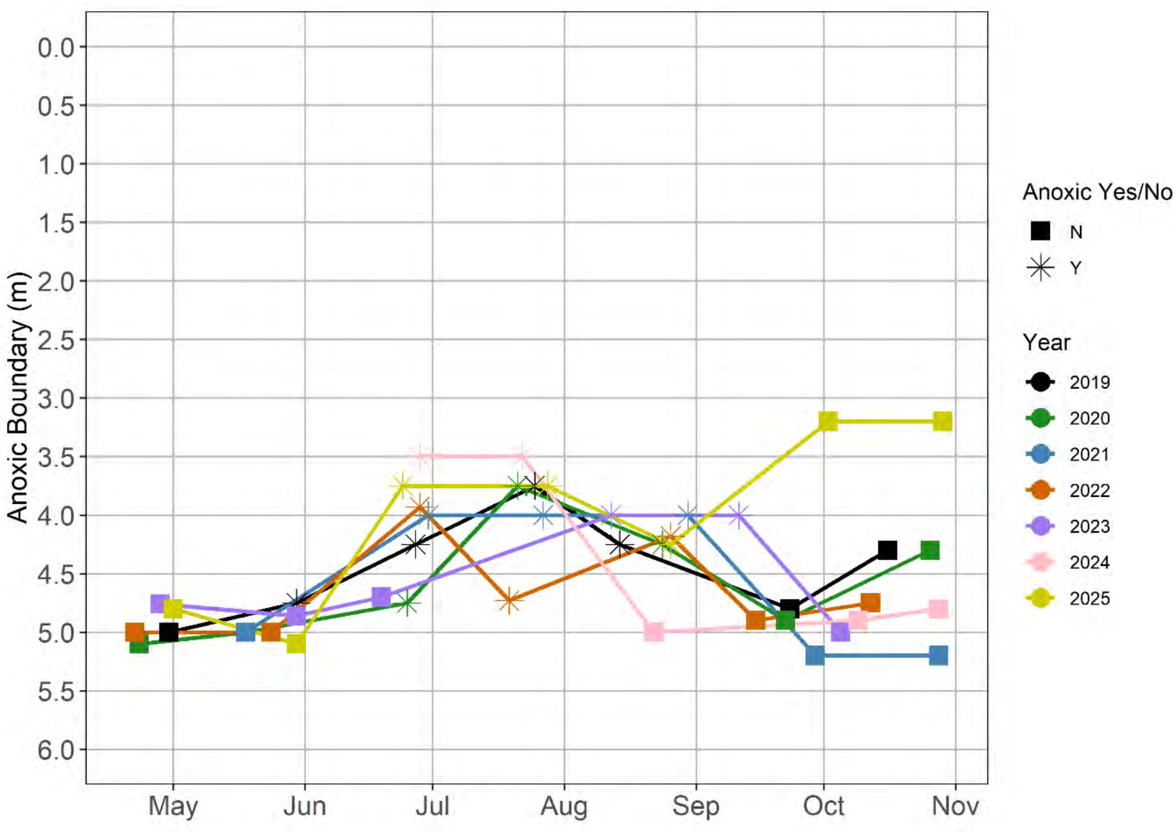
In 2025, the average surface and bottom dissolved oxygen concentrations at Station 1 were in line with typical concentrations seen in previous years. All surface concentrations were higher than the 5.0 mg/L minimum daily average standard set by the New York State Department of Environmental Conservation (NYSDEC; Figure 4). Bottom DO concentrations in 2025 were anoxic (less than 1 mg/L), in the months of June, July, and August as is the usual pattern for Roaring Brook Lake.

**Figure 4. DO Profiles from Station 1 in 2025. Values left of the red dashed line indicate anoxic (less than 1 mg/L) conditions. The two profiles taken in October reach the bottom at a shallower depth because the lake was in a drawdown.**



The anoxic boundary in 2025 showed a similar pattern as previous years (Figure 5). The anoxic boundary present in June of 2025 was shallower than most years, but every other month was very similar to previous data. Similarly to previous years, there was no anoxic water present in September/October. The shallow depth of the squares is an artifact of the drawdown that occurred in 2025 and simply indicates that the bottom was around 3.4 meters with no anoxia present. It is important to track the anoxic boundary over time as this is an indicator of the severity of the internal nutrient load. The higher the boundary in the water column, the more sediment area is exposed to anoxic conditions, increasing the area that can release phosphorus and nitrogen into the water column. The anoxic boundary this year mostly tracked with historic values so it is not alarming, but it should continue to be monitored.

**Figure 5. Anoxic Boundary at Station 1 in 2019 to 2025. Star and square point shapes indicate either anoxic (star) or oxic (DO concentrations greater than 1 mg/L; square) sampling dates. For example, for the sampling on July 28, 2025, there was anoxic water present at an estimated depth of 3.25 meters, while on October 2, 2025, all DO values were above 1 mg/L, hence no anoxic water (only squares).**




## Total Phosphorus

In 2025, surface TP concentrations were in line with historical concentrations, averaging 13.9 µg/L, between the optimal and threshold values (Figure 6). The low TP concentrations observed over the past few years makes it difficult for the lake to sustain thick, lake wide algae blooms as seen in other local lakes. Cyanobacteria can still grow and proliferate in Roaring Brook Lake, as evident by the infrequent shoreline algae scums that are reported. Low phosphorus concentrations in the surface waters are likely the difference between the scum showing up and going away in a few hours versus sustained, lake-wide blooms that will close swimming for the entire season.

Once a year, the bottom TP concentrations tend to spike (Figure 7). This year, the spike in bottom TP was minimal and occurred on July 28$^{th}$, during which the lake had been experiencing anoxia at the bottom for at least a little over a month. Anoxic water can set off a series of chemical reactions at the water-sediment interface that release nutrients such as phosphorus and nitrogen into the overlying water, called internal loading, which could explain the minor spike. Surface and middle phosphorous concentrations were low all year with little to no evidence of spiking, matching previous years monitored. Bottom phosphorus concentrations resembled previous years, exhibiting a spike, but with low concentrations in the rest of the months.

**Figure 6. Surface TP for all Historical Data Collected on Roaring Brook Lake During the Summer Season (June through September). Data sources include CSLAP data (green circles) and NEAR/GEI monitoring Station 1 (purple triangle). ed dashed line indicates the threshold limit (20 µg/L), and the blue dashed line indicates the optimal value (10 µg/L). Error bars represent one standard deviation.**

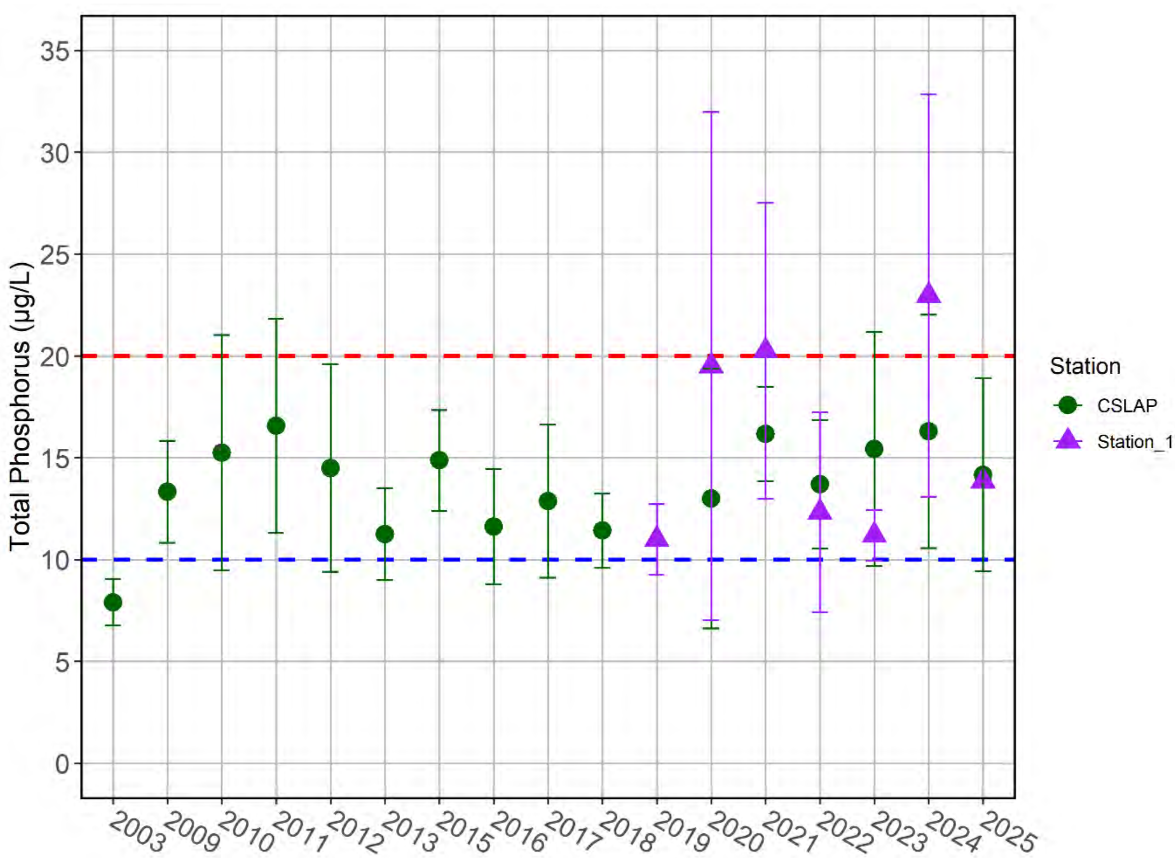
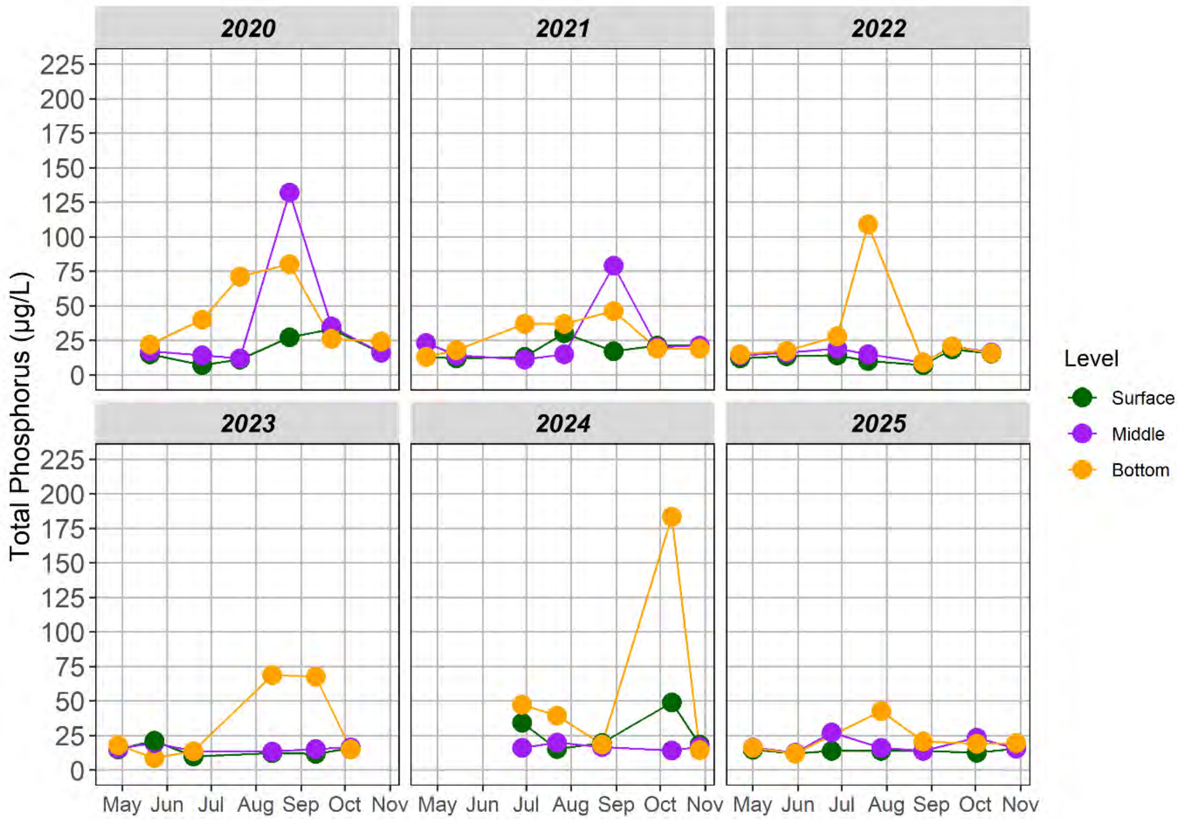


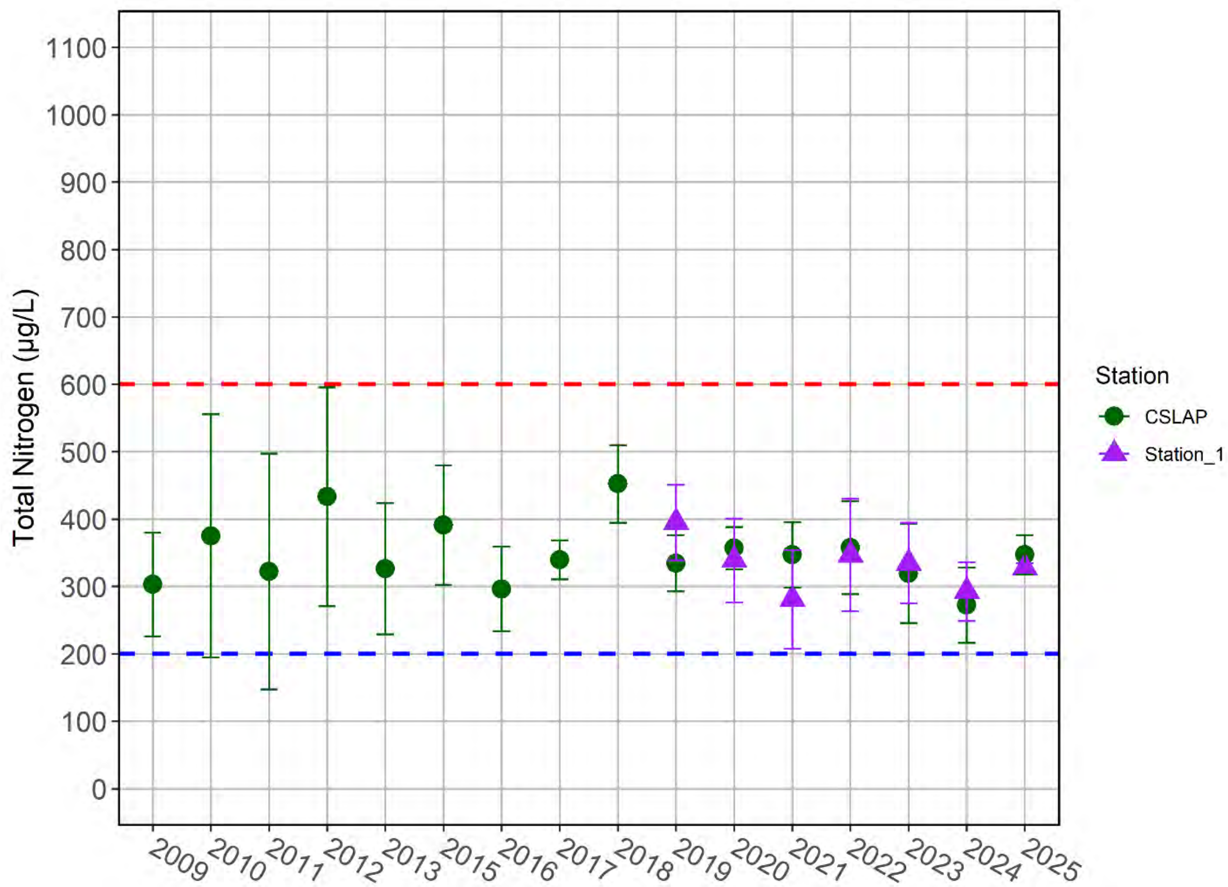
**Figure 7. Surface, Middle, and Bottom TP Concentrations on Roaring Brook Lake from 2020 to 2025**




## Total Nitrogen

The TN concentrations in 2025 at Station 1 averaged 404.71 µg/L which is slightly higher than the average concentrations in the past 5 years (Figure 8). Historically, TN has varied between 300 and 500 µg/L and there has not been any consistent increase or decrease in TN concentrations over the entire sampling period (2009-2025), but there does seem to be a decrease in concentration from 2018 to 2024. Lakes with high TN concentrations have excessive growth of filamentous algae and floating aquatic plants like duckweed (*Lemna minor*). Fortunately, this has not been documented on Roaring Brook Lake.

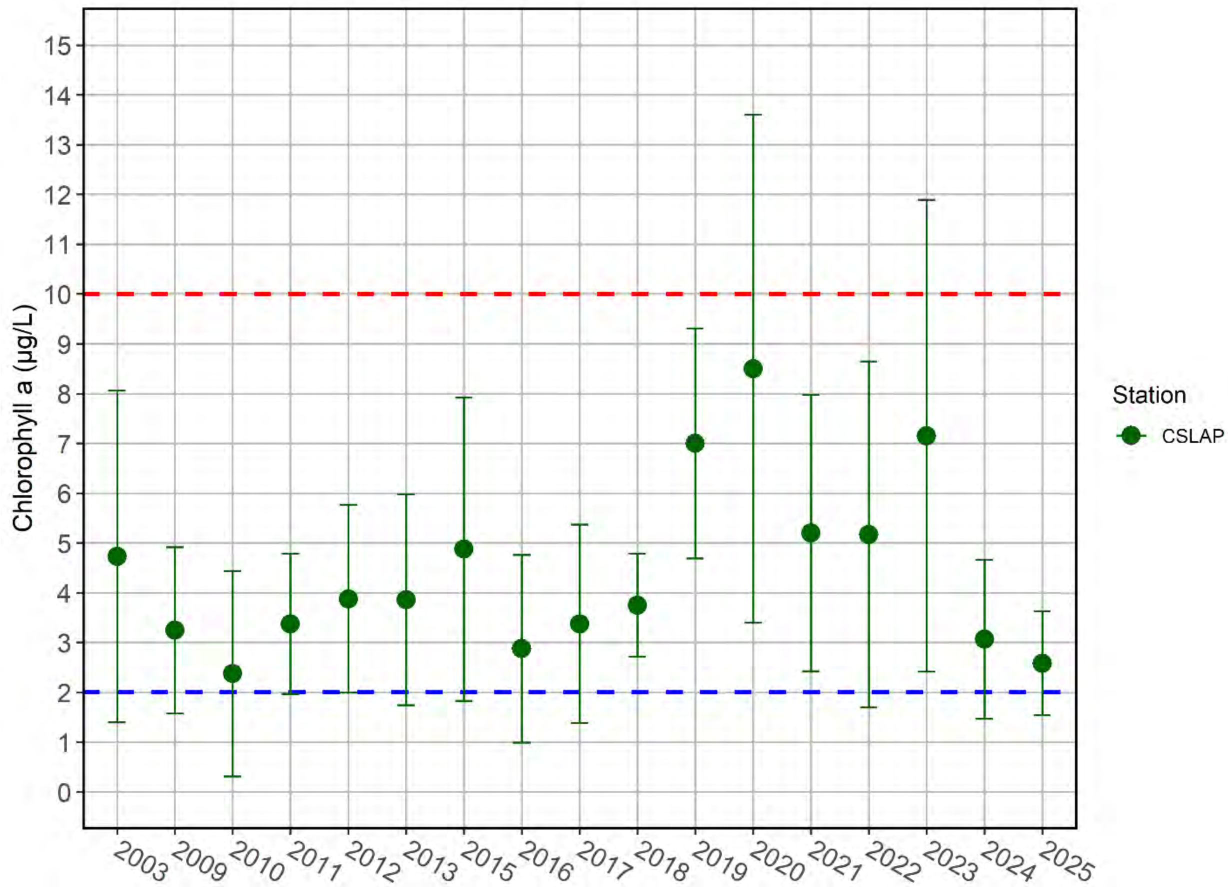
**Figure 8. Surface TN for all Historical Data Collected on Roaring Brook Lake During the Summer Season (June through September). Data sources include CSLAP Data (green circles) and NEAR/GEI Station 1 (purple triangle). Red dashed line indicates the threshold limit (600 µg/L), and the blue line indicates the optimal value (200 µg/L). Error bars represent one standard deviation. Please note that an outlier value from the 2020 CSLAP data set was removed in the data.**




## Chlorophyll a

Mean Chlorophyll a concentrations in Roaring Brook Lake in 2025 was low, similar to 2024 and is one of the lowest mean concentrations seen in the historical dataset (Figure 9). Chlorophyll a is a surrogate for algae abundance so the lower the chlorophyll a concentration, the lower amounts of algae are present in the lake.

**Figure 9. Mean Surface Chlorophyll a Concentrations for all Historical Data Collected on Roaring Brook Lake During the Summer Season (June through September). Red dashed line indicates the threshold limit (10 µg/L), and the blue line indicates the optimal value (2 µg/L). Error bars represent one standard deviation.**




## *Zooplankton*

Total zooplankton abundance was lower in 2025 as compared to previous years (Figure 10). Rotifers dominated the community numerically in 2024 followed by copepods, then cladocerans. The dominant cladocerans in 2025 were *Bosmina sp.* and *Daphnia sp.* which had lower density than in previous years. (Northeast Aquatic Research 2020; 2021). Cyclopoids dominated the copepod assemblage in 2024 as seen in previous years, however calanoids were present each year (Table 4). Ratio of calanoids to cyclopoids in lakes has been proposed as an indicator of eutrophication, as calanoids are considered sensitive to increase in nutrient concentrations (Min et al. 2021). The presence of calanoids are a positive sign for Roaring Brook Lake.

**Figure 10. Mean Zooplankton Group Abundance in 2019, 2020, 2024 and 2025**

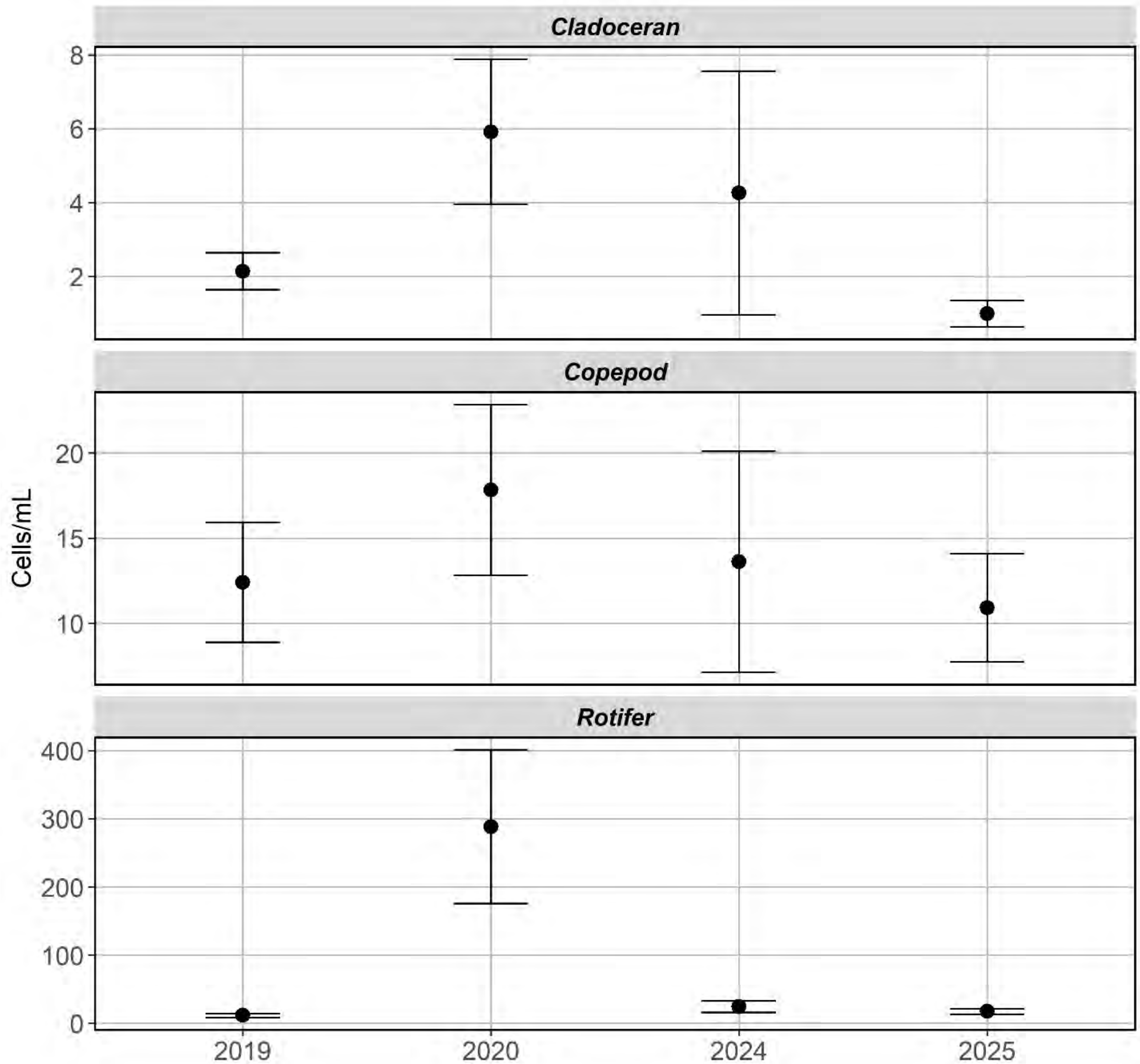


**Table 4. Mean Number of Zooplankton Individuals per Sample Year at Roaring Brook Lake. Standard error is in parentheses. Note in 2020, only total rotifers were counted instead of individual genera.**

| Zooplankton Group | Sub Group | 2019 | 2020 | 2024 | 2025 |
|---|---|---|---|---|---|
| Cladoceran | Bosmina sp. | 1.53 (0.71) | 0.90 (0.20) | 0 | 1.71 (1.12) |
| | Ceriodaphnia sp. | 2.09 (0.75) | 5.33 (1.98) | 0 | 0.19 (0.19) |
| | Chydorus sp. | 0 | 1.30 (0) | 0 | 0 |
| | Daphnia sp. | 6.03 (1.53) | 10.45 (4.13) | 7.10 (5.12) | 2.09 (0.71) |
| | Diaphanasoma sp. | 0 | 0.70 (0) | 0 | 0 |
| | Holopedium sp. | 0.39 (0.20) | 0 | 0 | 0 |
| | Unid_cladoceran | 0.67 (0.39) | 0 | 0 | 0 |
| Copepod | Calanoid | 1.99 (0.72) | 2.50 (1.02) | 1.98 (0.68) | 1.90 (0.95) |
| | Cyclopoid | 7.19 (1.97) | 10.12 (1.83) | 6.65 (5.35) | 5.51 (0.54) |
| | Nauplii | 28.06 (7.50) | 35.78 (9.47) | 31.13 (14.55) | 25.33 (6.83) |
| Rotifer | Ascomorpha sp. | 2.57 (1.27) | 0 | 13.30 (0) | 25.54 (17.89) |
| | Asplanchna sp. | 0.71 (0.56) | 0 | 0 | 1.71 (1.12) |
| | Collotheca sp. | 1.53 (0.91) | 0 | 0 | 0 |
| | Conochilus sp. | 20.47 (17.62) | 0 | 34.23 (11.76) | 25.31 (11.61) |
| | Filinia sp. | 0.07 (0.07) | 0 | 0 | 0 |
| | Gastropus sp. | 0 | 0 | 26.65 (18.65) | 1.33 (0.92) |
| | Kellicottia sp. | 7.47 (3.79) | 0 | 18.00 (16.70) | 1.51 (0.68) |
| | Keratella sp. | 42.89 (12.34) | 0 | 41.35 (20.75) | 62.30 (11.32) |
| | Polyarthra sp. | 16.66 (6.06) | 0 | 61.33 (59.33) | 55.06 (19.72) |
| | Rotifer sp. | 0 | *288.65 (112.62) | 0 | 0 |
| | Trichocerca sp. | 0.57 (0.40) | 0 | 5.77 (2.36) | 0.77 (0.50) |
| | Unidentified Rotifer sp. | 22.26 (13.85) | 0 | 4.00 (0.00) | 0.19 (0.19) |

Length distributions of cladocerans and copepods in 2025 indicate a shift towards smaller zooplankton, with most sizes below 0.6mm (Figure 11). The dashed lines in Figure 11 and Figure 12 indicate the fish predation threshold for lakes. If most of the zooplankton lengths are below 0.6mm, fish predation (planktivory) is presumed to be significant for the ecosystem, as larger plankton would have been removed, reducing the filtering capacity (Brooks and Dodson 1965). If most zooplankton lengths are above 0.6mm, planktivory is not significant for the ecosystem. Fish herbivory is size selective, meaning that fish usually feed on the larger individuals, with smaller zooplankton being prey to only larval fish and other zooplankton/invertebrates. Mean zooplankton lengths in 2025 were lower than seen in previous years (Figure 12). The zooplankton length data indicates that the population may be starting to be affected by fish predation.

**Figure 11. Length Frequency Distribution of Copepods and Cladocerans in Roaring Brook Lake in 2019, 2020, and 2024. The vertical dashed line indicates the threshold size for significant fish predation.**

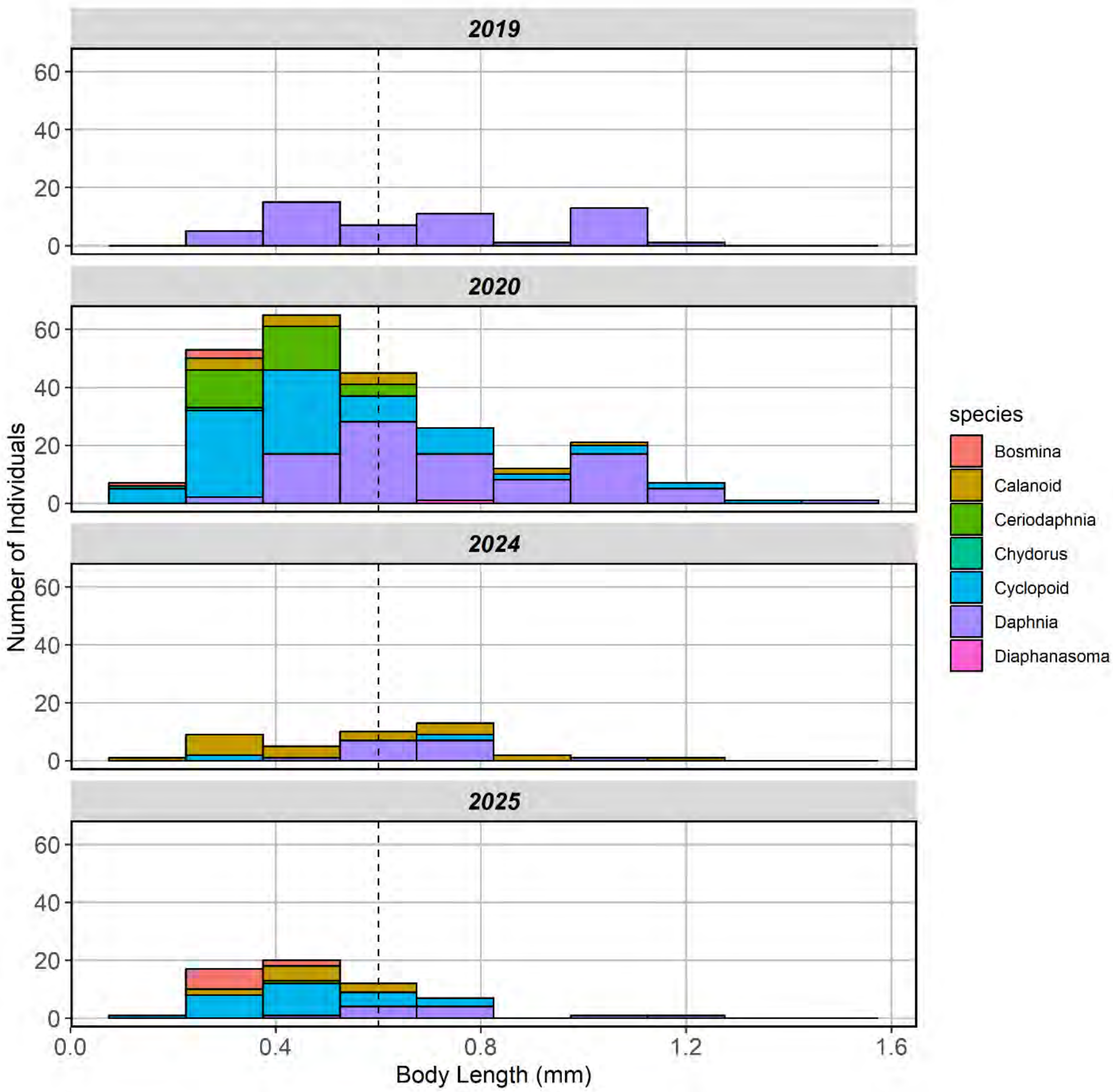
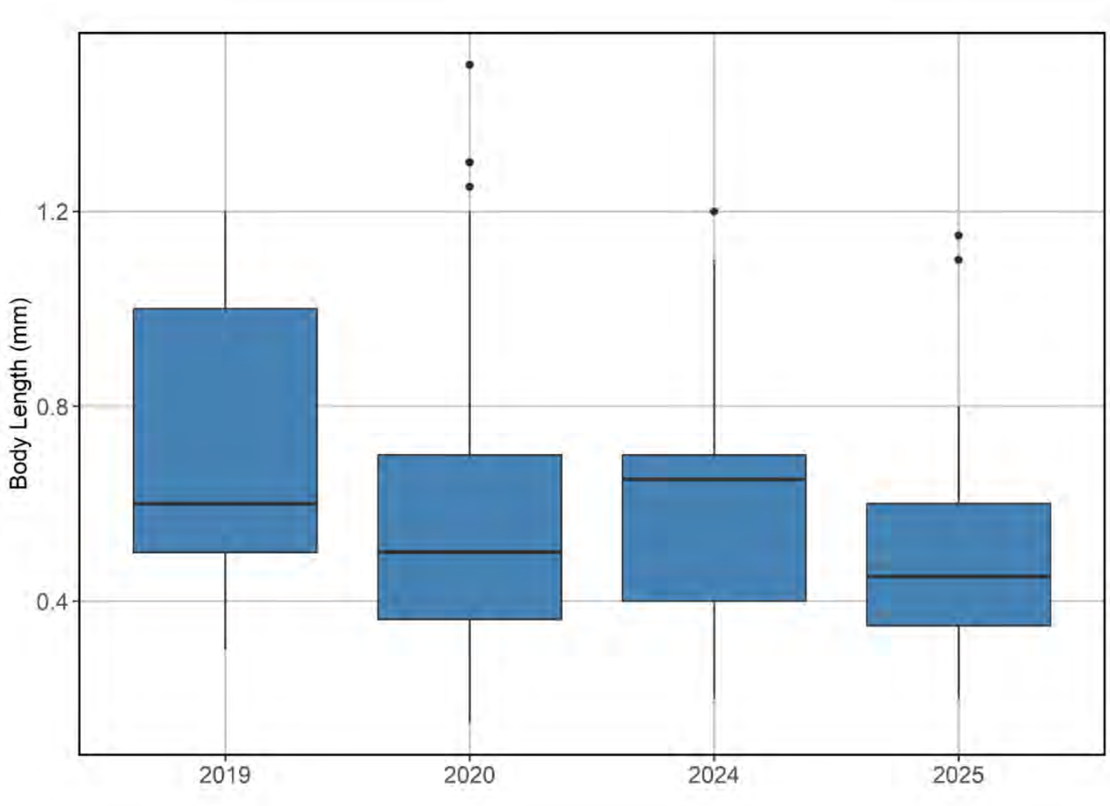


**Figure 12. Mean Body Length of Copepods and Cladocerans in Roaring Brook Lake in 2019, 2020, and 2024. The vertical dashed line indicates the threshold size for significant fish predation.**




## *Aquatic Plant Survey*

### Background

GEI staff visited Roaring Brook Lake on August 20, 22, and 26, 2025 to perform a full lake aquatic plant survey. The survey was designed to take a representative sample of all plants growing in the lake. Residents have started to notice increased aquatic plant growth and have expressed interest in management strategies to reduce growth. In 2011, the TOPV decided to stock 500 grass carp in Roaring Brook Lake to control excess vegetation. From 2011 to 2017, there were no aquatic plant surveys done to track and document declines in vegetation. Princeton Hydro did document plants within the lake in 2017, noting that while there appeared to be declines in vegetation as compared to a 2007 study (Note: GEI could not find the study Princeton Hydro was referencing), where vegetation biomass was moderate to dense around the shoreline. While the methodology between the different surveyors are not directly comparable, observations from the 2019 aquatic plant survey indicate that vegetation did decline from 2016, as observers did not document “moderate to dense” aquatic vegetation in areas around the shoreline.

## Methodology

Aquatic plant survey methods involved a point intercept style survey. Pre-determined waypoints from previous survey efforts were re-visited. A total of 203 waypoints were visited. At each waypoint, depth was recorded along with all species observable in a 10 X 10 ft quadrat alongside the boat.

Plant coverage was determined using a combination of three methods. The first method was at each waypoint, a 14-tine double-sided garden rake attached to a 10m rope was tossed or a long-handled garden rake was used to rake the lake bottom to collect specimens of all species at that point. This method involves stopping the boat and throwing the 10m tow line and rake head and/or raking the bottom with the long-handled rake through the plant bed. The second method is the visual density determination method which is based solely on what is visible from the surface. This method involves using a hypothetical quadrat. The surveyor visually estimates how much area is covered by the plant in question. Surveyors visualized a hypothetical quadrat approximately 10 ft X 10 ft around the boat, then estimated coverage accordingly. Visual estimates are made by a single person during the survey, but the entire team has input on the final estimate to ensure accuracy.

The final method used to estimate the percent coverage of vegetation is to use the down-imaging SONAR images from a Lowrance Hook Reveal of the plants as the boat passes above. In areas where plants cannot be seen from the surface, the SONAR images become extremely useful for percent coverage estimations, along with rake tosses. SONAR and visual estimates are corroborated by rake tosses. When possible, all three ways of estimating the percent cover are used at each waypoint, and the resulting estimate is recorded on the datasheet. Using those three measurements in conjunction achieves the most accurate estimate of plant coverage possible during surveying. In the field, plant survey data was entered into ESRI's Survey123 application and was later processed in R studio using tidyr and dplyr packages where quality control and data cleaning took place prior to analysis. A few different metrics were derived used to describe the aquatic plant community which are as follows:

**Growth Habit:** Describes the dominant habit of growth for the specific species. The three main growth habits are submersed, meaning the plants grow from the lake bottom and their leaves mostly occupy the water column (e.g. pondweeds), emergent, where the plant's growth habit is to grow from the sediments out of the water column and into the air (e.g. cattails) and floating, where the leaves are on top of the water's surface (e.g. lilies). There are some subclasses to each of these growth habits, such as floating plant (e.g. duckweed) and floating rooted (e.g. lilies) and algae (including cyanobacteria).

**Frequency of Occurrence:** Measure of the total amount of observations of a particular species divided by the total amount of points that were surveyed. It can also be represented as Percent Occurrence.

**Mean Water Depth:** Measure of the average water depth in which species observed during the survey.

**Growth Form:** Categorical measure of plant height in the water column. The rating scale is from 1 to 5. A species with a growth rating of 1 is growing right along the lake bottom, while a species with a growth rating of 5 is growing all the way to the water's surface or topping out and growing horizontally.

**Nuisance Index:** Metric that describes how problematic a particular species is at a particular location in terms of recreational and ecological impact. The index is calculated by multiplying the percent cover (as a proportion) by the growth form. The theoretical densest a patch of plants can be is if the plant occupies 100% of the lake bottom and grows all the way to the surface. This dense patch would have a nuisance index score of 5. Plants that both cover the bottom completely and grow to the surface negatively impact recreational and ecological uses. Plants that cover the bottom, but are low growing may crowd out native species, but will most likely have little impact on recreational uses. Conversely tall growing plants (such as curly leaf pondweed) may be unsightly if it grows to the surface, but if there are only a few stems in the area and percent cover is low, it would be expected that most ecological and recreational uses would be unaffected.

Analysis to determine frequency of occurrence, mean percent cover, mean water depth, and mean nuisance index was performed within R studio utilizing the tidyr and dplyr packages. Maps were made utilizing ArcGIS Pro. For ease of interpretation, percent cover values were binned into different density categories (Very Sparse ≤10%, Sparse 11-25%, Moderate 26-50%, Dense 51-75%, Very Dense 76-100%).

## Aquatic Plant Community

A total of 23 different aquatic taxa were documented at Roaring Brook Lake in 2025, with three of the taxa being algae (either macroalgae, filamentous algae and cyanobacteria), 15 being submersed species, one floating-leaved, and three non-rooted (Table 5). GEI staff implemented a new way of recording emergent species this year, where emergent species on the shorelines would be recorded if they were growing directly in the water, but not otherwise. Please note that this new strategy may affect the total species numbers, and species occurrences of emergent-growing plants. The most commonly occurring species was Eurasian watermilfoil which was observed at a total of 104 points or 51.2% of all survey points. The next most abundant species were stonewort, largeleaf pondweed, brittle naiad, and fanwort. When cross-analyzing frequency of occurrence with average percent cover at observations, Eurasian watermilfoil was the most impeding species of 2025. Its average observed growth was a 4.3 out of 5 meaning it grew high in the water column where it was observed also contributing to nuisance level.

**Table 5. Frequency of Occurrence for all Species Observed During the 2019, 2022, 2024, and 2025 Surveys**

| | | | 2019 | 2022 | 2024 | 2025 |
|---|---|---|---|---|---|---|
| **Scientific Name** | **Common Name** | **Growth Form** | **Frequency of Occurrence** | | | |
| ***Brasenia schreberi*** | Water Shield | Floating Leaved | 0 | 1 | 0.9 | 0 |
| ***Cabomba caroliniana*** | Fanwort | Submersed | 21.4 | 1 | 14.2 | 32.5 |
| ***Callitriche stagnalis*** | Pond Water-Starwort | Submersed | 21 | 12.4 | 9 | 0 |
| ***Ceratophyllum demersum*** | Hornwort | Non-Rooted | 5.7 | 1 | 14.2 | 23.6 |
| ***Chara sp.*** | Muskgrass | Algae | 0 | 0 | 9.9 | 17.7 |
| ***Elatine sp.*** | Waterwort | Submersed | 0 | 4.3 | 2.8 | 0.5 |
| ***Eleocharis acicularis*** | Least Spikerush | Submersed | 0 | 0.5 | 0 | 0 |
| ***Elodea nuttallii*** | Western Waterweed | Submersed | 0 | 0 | 0.9 | 3 |
| **Filamentous algae** | Filamentous algae | Algae | 4.8 | 1.4 | 12.7 | 12.8 |
| ***Isoetes sp.*** | Quillwort | Submersed | 0 | 0.5 | 0 | 0 |
| ***Fontinalis sp.*** | Water Moss | Submersed | 0 | 0 | 1.4 | 0 |
| ***Lemna minor*** | Common Duckweed | Non-Rooted | 0 | 0 | 0.5 | 0 |

| | | | **2019** | **2022** | **2024** | **2025** |
|---|---|---|---|---|---|---|
| ***Lyngbya wolleii*** | Horsehair Algae | Algae | 0.5 | 15.3 | 1.9 | 0 |
| ***Myriophyllum spicatum*** | Eurasian Watermilfoil | Submersed | 12.9 | 29.2 | 59.4 | 51.2 |
| ***Najas flexilis*** | Nodding Naiad | Submersed | 0 | 0.5 | 2.4 | 2 |
| ***Najas gracillima*** | Slender Naiad | Submersed | 0.5 | 2.9 | 16.5 | 3 |
| ***Najas guadalupensis*** | Southern Naiad | Submersed | 0 | 0 | 7.5 | 12.3 |
| ***Najas minor*** | Brittle Naiad | Submersed | 3.8 | 2.9 | 25 | 33 |
| ***Nitella sp.*** | Stonewort | Algae | 29.5 | 24.9 | 42.5 | 44.8 |
| **Nothing present** | | | 31 | 39.7 | 21.2 | 8.4 |
| ***Nymphaea odorata*** | White Water Lily | Floating Leaved | 0 | 0 | 0.9 | 0.5 |
| ***Phragmites australis*** | Common Reed | Emergent | 0.5 | 1.4 | 0.5 | 0 |
| ***Potamogeton amplifolius*** | Largeleaf Pondweed | Submersed | 4.3 | 10.5 | 18.4 | 44.3 |
| ***Potamogeton berchtoldii*** | Berchtold's Pondweed | Submersed | 0 | 0 | 0 | 1.5 |
| ***Potamogeton bicupulatus*** | Snail-Seed Pondweed | Submersed | 0 | 0 | 2.8 | 0 |
| ***Potamogeton epihydrus*** | Ribbon-Leaf Pondweed | Submersed | 0.5 | 0 | 2.4 | 2.5 |
| ***Potamogeton foliosus*** | Leafy Pondweed | Submersed | 0 | 0 | 0 | 0.5 |
| ***Potamogeton perfoliatus*** | Clasping-Leaf Pondweed | Submersed | 0 | 0 | 0.5 | 0.5 |
| ***Potamogeton pusillus*** | Small Pondweed | Submersed | 0.5 | 0 | 13.7 | 27.1 |
| ***Potamogeton spirillus*** | Northern Snail-Seed Pondweed | Submersed | 0 | 0 | 0.5 | 3.4 |
| ***Sparganium angustifolium*** | Narrow-Leaved Bur-Reed | Emergent/ Submersed | 0 | 0 | 0.9 | 0 |
| ***Spirodela polyrhiza*** | Greater Duckweed | Non-Rooted | 0 | 0 | 0.5 | 0 |
| ***Typha sp.*** | Cattail | Emergent | 0 | 0.5 | 0 | 0 |
| ***Utricularia geminiscapa*** | Hidden Fruit Bladderwort | Non-Rooted | 0 | 0 | 0.9 | 0.5 |
| ***Utricularia gibba*** | Humped Bladderwort | Non-Rooted | 1.9 | 0 | 0 | 0 |
| ***Utricularia inflata*** | Inflated Bladderwort | Non-Rooted | 46.7 | 23.4 | 32.5 | 26.1 |
| ***Vallesneria americana*** | Eel Grass | Submersed | 0 | 5.7 | 0 | 0 |

## Comparison Between Past Surveys

Species richness per waypoint increased each year from 2019 to 2025, but overall species richness has slightly decreased in 2025 (Table 6). The loss of a few species this year is partially due to the change in the way emergent species are recorded in 2025 (only recorded if they are growing directly in the water), which would make them less likely to be recorded. The other clear pattern in species that were not observed in 2025 compared to 2024, were species that were already at a very low detection rate. All but one species that were seen in 2024 but not in 2025 had a lower than 3% frequency of occurrence meaning it is likely that they were there but simply not detected. This indicates that the plant population may be stabilizing after the recent rapid recovery from grass carp stocking impacts. Because of the stabilization of the plant population and the differences in species richness, there were more balanced increases and decreases in frequency of occurrence from 2024-2025 (Table 7). There is still a clear favor of species increasing from the original 2019 survey to the 2025 survey, confirming the improvement from then.

**Table 6. Species Richness at Whole-Lake Scale and Mean Richness per Sampling Location**

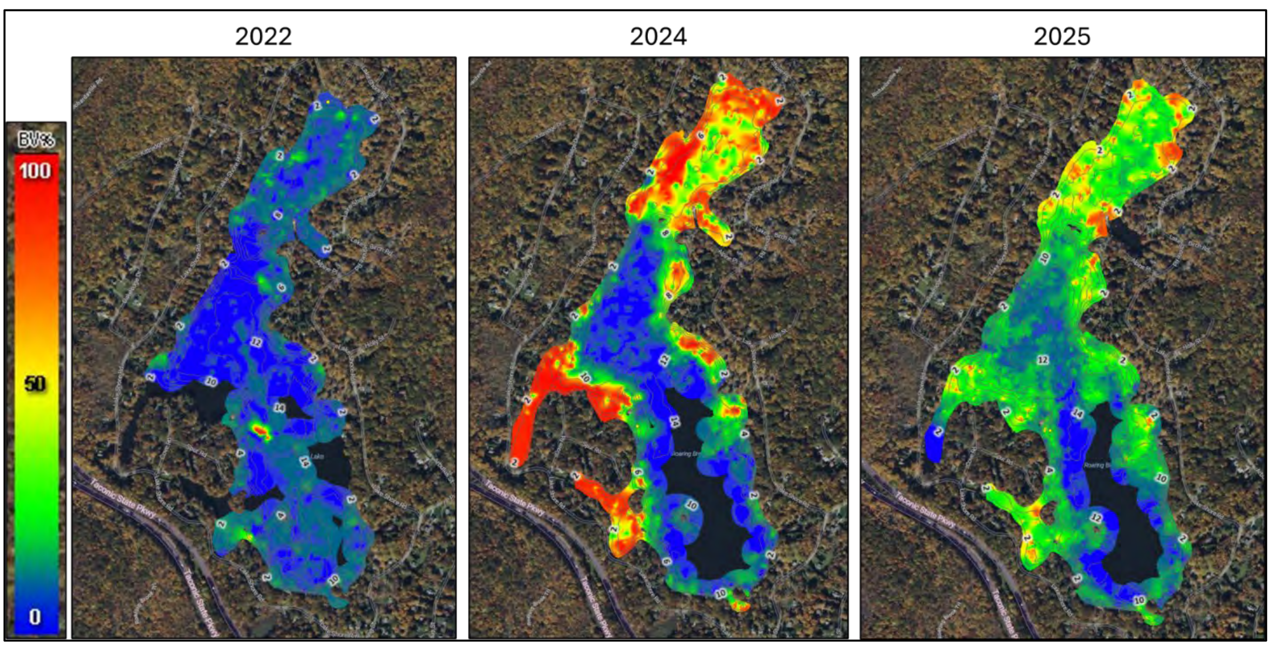
| | 2019 | 2022 | 2024 | 2025 |
|---|---|---|---|---|
| Species Richness | 16 | 20 | 30 | 23 |
| Richness per Waypoint | 0.9 | 0.8 | 2.2 | 2.5 |

**Table 7. Changes in the Number of Species that had Increased, Decreased or Remained the same in 2019, 2022, 2024, and 2025**

| Frequency of Occurrence Changes | 2019-2022 | 2022-2024 | 2019-2024 | 2019-2025 | 2024-2025 |
|---|---|---|---|---|---|
| Increased | 13 | 25 | 26 | 21 | 14 |
| Decreased | 11 | 11 | 6 | 6 | 17 |
| Remained the Same | 13 | 1 | 5 | 10 | 6 |

The total amount of area covered in vegetation has also increased in Roaring Brook Lake since 2019 and 2022. The frequency of waypoints with no aquatic vegetation decreased from 31 and 39.7 in 2019 and 2022 to 21.2 and 8.4 in 2024 and 2025 (Table 4). This indicates that aquatic vegetation is increasing in distribution. Examining the lake wide biovolume (plant height in water column; Figure 13) in 2022 to 2025, there is a clear increase across the lake.

**Figure 13. Plant Biovolume (height of plants in the water column) from 2022, 2024 and 2025**




Average percent cover increased each year from 2019 to 2025 in just over half of the species (hornwort, muskgrass, Eurasian watermilfoil, brittle naiad, stonewort, and leargeleaf pondweed) and for two other species the percent cover increased each year from 2019 to 2024 where it peaked and then declined in 2025 (filamentous algae, small pondweed; Figure 13). Average percent cover of inflated bladderwort declined each year from 2019 to 2025 and fanwort saw a reduction from 2019 to 2022, but it bounced back the years following. Mean growth form was variable among the three invasive species with

Eurasian water milfoil experiencing an increase in growth for each year, brittle naiad having a more up and down variable pattern, and fanwort remaining between a growth form of 2 and 3 among all the years (Figure 14). The mean nuisance index values of the invasive species in 2025, which accounts for both percent cover and growth form, were either the highest or tied with the highest values (Figure 15). Overall nuisance index values still show low overall lake impact of aquatic vegetation, as a nuisance index of 5 would indicate that all waypoints that a particular species occurred at had 100% coverage and were growing all the way to the lake surface (Figure 16). No invasives had a mean nuisance index value was above 1.

**Figure 14. Mean Percent Cover of Select Species (top ten frequency of occurrence) in Roaring Brook Lake from 2019, 2022, 2024, and 2025**

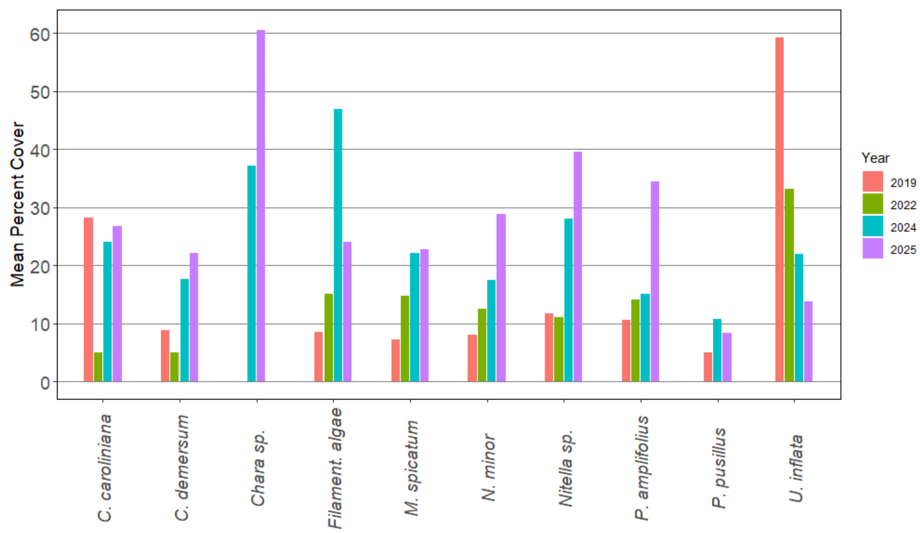



**Figure 15. Mean Growth Form of Select Species in Roaring Brook Lake from 2019, 2022, 2024, and 2025**

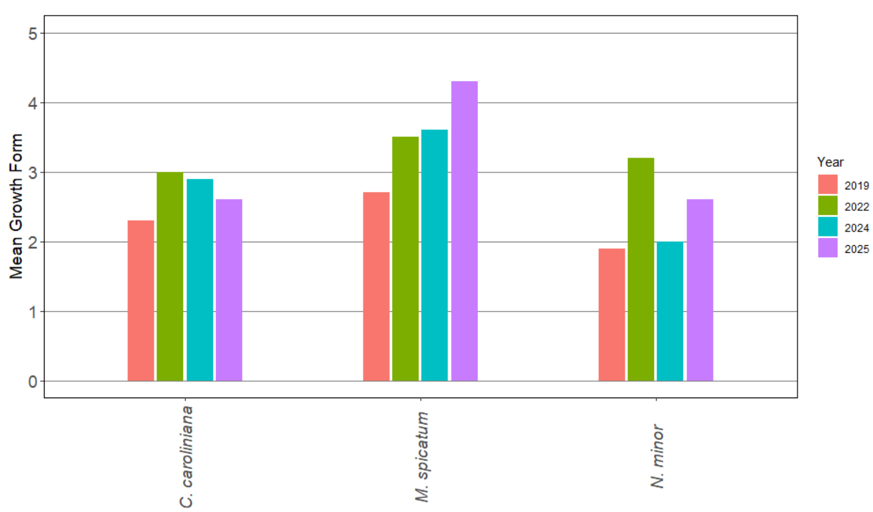
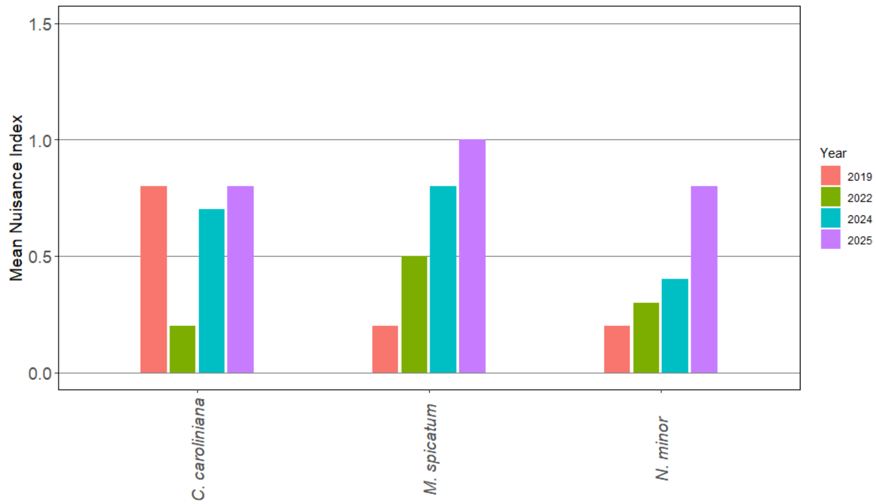


**Figure 16. Mean Nuisance Index of Select Species in Roaring Brook Lake from 2019, 2022, 2024, and 2025**




## Individual Species

Maps for individual species distributions in Roaring Brook Lake are present in Appendix A.

Eurasian watermilfoil had the highest frequency of occurrence in 2025 despite a slight decrease from 2024 (Table 5). Similarly to 2024, Eurasian watermilfoil was distributed throughout the lake, with particularly dense growth seen in the northern basin north of Park Beach (Appendix A, Map 1). Dense patches were also seen on the western shoreline and near Moon Beach and on the eastern shoreline between Park Beach and Shore Lane.

In 2025, fanwort had the second highest increase in frequency of occurrence with an 18.3% increase from 2024 to 2025 (Table 5). Fanwort has increased its range from 2024 to 2025 particularly in the northern basin north of Park Beach, along the eastern shoreline, and north of Spur Beach (Appendix A, Map 2). Dense growth was observed in the northern basin, especially in places where it was seen historically along the shorelines.

Similarly to 2024, brittle naiad was abundant in cove areas and the eastern shoreline of the northern basin (Appendix A, Map 3). Stonewort was abundant throughout the lake at most depths (Appendix A, Map 4). Largeleaf pondweed has expanded to areas nearby where past growth was seen notably along shorelines, in the north basin, and south of Moon Beach (Appendix A, Map 5). Inflated bladderwort, which was the bladderwort responsible for a severe recreation impediment in 2016 continued to decline in abundance and was mostly seen in low densities with no observation of nuisance floating mats (Appendix A, Map 6). Other dominate native plants such as coontail (Appendix A, Map 7) and small pondweed (Appendix A, Map 8) were well distributed throughout the lake, especially in the north basin and central part of the lake (North of Spur Beach).

## *Discussion and Recommendations*

Water quality in Roaring Brook Lake in 2025 was generally better than in 2024, with lower TP concentrations, greater Secchi disk values and lower chlorophyll a. There continued to be a lack of beach closures and HAB reports on the lake further support the notion of desirable water quality, despite the high TP data. Based on the DEC HAB archive page for 2025, Roaring Brook Lake had only four reported HABs from May 14$^{th}$ to June 5$^{th}$.

The continued good water quality in the lake is an excellent sign for lake recreational use. There are still underlying concerns, such as the loss of dissolved oxygen in the deep water which contributes phosphorus and nitrogen for algae to grow. This loss of dissolved oxygen, however, did not seem to lead to deleterious in-lake conditions. Secchi disk depths did get shallower (degraded) after September, but this was during the drawdown where most recreational activities were completed for 2025. Overall, the lake is in excellent condition water quality wise and fully supports recreational activities.

The most significant result of the 2025 aquatic plant monitoring is the continued increase in frequency of occurrence of certain species and increases in species richness per waypoint. Normally, increases in species richness in lakes is a good sign, as this shows ecological diversity which helps increase resilience to disturbances. However, of the species that showed market increases, they are either invasive (Eurasian watermilfoil, fanwort, brittle naiad) or a nuisance to recreation due to a tall growth habit (largeleaf pondweed). The recovery of species is to be expected to continue or be maintained because of the decline of grass carp numbers. It is possible that the lake is reaching a stable point in terms of species richness. Once the grass carp herbivory pressure is reduced enough to allow plant growth (~2023-2024 range), all plants in the seed bank are given a roughly equal chance of growing. However, as time goes on (2025), plant species that are better competitors become more dominant and crowd out other species. This may be what we are seeing in Roaring Brook Lake in 2025. Anecdotally, this was most evident in the coves, where Muskgrass (*Chara sp.*) a common macroalgae became dominant in 2025, in areas where there was greater diversity in 2024.

The recovery of the aquatic plant community does mean that the TOPV and the RBLPOA should continue think critically about and make decisions on management. Many areas of the lake, especially the northern cove and the area by Moon Beach have significant aquatic plant growth, particularly of Eurasian watermilfoil and fanwort. Based on the increase in nuisance plant populations, GEI is recommending the following actions take place.

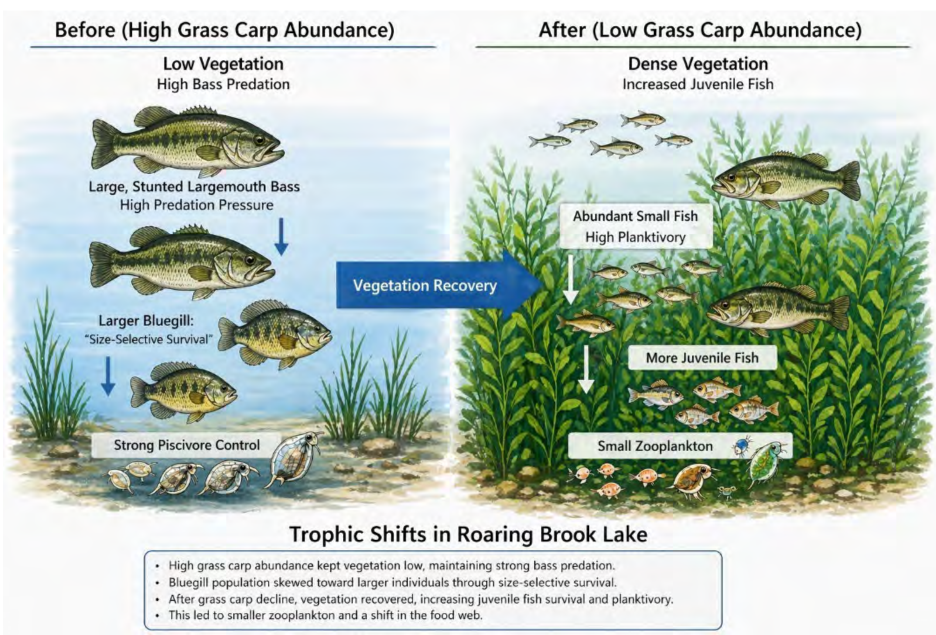
1. **Establish a Goal for Future Vegetation Management**: It is important to set a goal that the TOPV and the RBLPOA agree will reduce nuisance levels of vegetation, while also maintaining strong ecological function. A goal can be both narrative and quantitative such as “reduce vegetation to a point where recreation is not impeded, but ecological integrity is kept intact” or “reduce Eurasian watermilfoil frequency of occurrence by 70 percent,” for example. Any goal set should be clear and unambiguous which will allow for evaluations of success.
2. **Selection of Management Technique(s):** Based on the established goals, management techniques should be selected that best align with the vision for Roaring Brook Lake. There is no silver bullet for management of aquatic plants, therefore, multiple strategies may be needed. This is due to each technique having clear strengths and weaknesses. For example, drawdown

only affects the areas which have sufficient exposure to dry conditions during winter and certain herbicides have different selectivity and can be expensive per unit.

3. **Independent Monitoring of Management Action:** Monitoring the effectiveness of the chosen management strategy allows evaluation of successes and failures and sets the TPOV and the RBLPOA up for more scientifically sound management decisions moving forward. The monitoring should be done by an entity that is not the same as the entity implementing the management. Monitoring of the aquatic plant community should take place yearly at least within the management zones, but preferable within the entire lake to document large scale changes. Water quality is already being monitored through the CSLAP program and GEI's work.

A fisheries study should be conducted in 2026 that documents any changes in the fish populations as a result of the recovering aquatic plant community. The 2020 fish study showed that the largemouth bass population was stunted with most individuals between 11 and 13 inches. There was an absence of small fish as well. In 2024 and 2025 GEI staff observed small schools of fish in the cove areas and residents have mentioned that there are now larger bass present. A repeat of the 2020 fish study would be instrumental in understanding how the recovery of vegetation within Roaring Brook Lake has affected the fishery. There may also be effects of a different fisheries structure on zooplankton, which should be closely monitored. In 2026, the lowest zooplankton abundance and mean body length was observed. This may be due to the increased predation of small fish (called planktivory) which is a result of increased plant coverage. The general conceptual model for what the ecosystem change in Roaring Brook Lake may look like is presented in Figure 17.

**Figure 17. Conceptual Model of Trophic Shifts in Roaring Brook Lake Associated with Changes in Grass Carp Abundance and Aquatic Vegetation. Figure developed by the author with AI-assisted graphic generation.**




The potential ecosystem changes posited in Figure 17 have important implications for future management decisions and highlight the tradeoffs between having a lake with a dense and diverse aquatic plant community and a more sparse aquatic plant community. While the grass carp controlled vegetation for recreational uses, the fishery, specifically the largemouth bass fishery seemed to be negativity impacted. This impact and potential shift in the fish community should be considered when discussing possible management strategies for managing vegetation.

The only management strategy to take place in 2025 was an increased winter drawdown to a max drawdown depth of 7.2 feet, where typical drawdown years aim for 4 to 5 feet. Winter drawdowns can help to control aquatic plant populations via desiccation and freezing of plant tissues. While it is impossible to accurately predict what the impact on the aquatic plant population would be in 2026, it is a reasonable assumption that areas within the 0 to 4 foot range will have limited early season aquatic plant coverage. Deeper sections of the lake, such as 5 to 7 feet, may see decreased growth, however they are likely less affected by the drawdown. Deeper waters are the last areas to be exposed to freezing/drying conditions in the fall and the first areas to experience wet conditions during the spring re-fill. There are also plants that reproduce via seed (the naiads) which may have a competitive advantage in 2026.

Looking forward to 2026, it is important to track how this drawdown affects the aquatic plant community and to help plan for future management. It is possible that more plants will grow in the deeper lake areas beyond the drawdown zone, which may change what future management will look like.

## General Lake Management Recommendations for Homeowners

### *Rainfall Management*

For rainfall that hits the roof and runs off, it is important to have gutters installed and maintained correctly, as well as ensuring that once that water leaves the gutter, it does not flow onto an impervious surface. This can be done by either directing gutters into a natural wooded or vegetated area, installing a rain barrel to capture water and re-use for gardening/general irrigation, or install a rain garden and plant saturation-tolerant vegetation.

Driveways and roadways are one of the largest sources of impervious surface in the Roaring Brook Lake watershed. Residents should be encouraged to consult the RBLPOA on new driveway repair/construction to ensure that stormwater runoff is properly treated before entering the roadways and catch basins. This involves proper curbing and diversion of water into wooded areas and when possible, using sensible grading and/or drain placement.

### *Lawn Care*

For lawn care, using little to no fertilizer is suggested, especially in areas directly next to the road or the lake. Storms can flush the fertilizer into the drain system. If fertilizer is desired, use of slow-release nitrogen fertilizer is suggested, as this allows the vegetation to uptake nutrients in a fashion that minimizes wash off. Grass clippings and leaves should never be blown onto roads or into drainpipes. These clippings can decay in the lake and drain system, adding more organic material and nutrients. Only phosphorus-free fertilizers should be used.

### *Landscape Practices*

Reducing the number of short grasses and increasing shrubbery and mulch will also help keep nutrients on site. The idea of a beautiful landscape is not restricted to short grass extending directly to the shoreline. A mosaic of tall-growing grass, low growing native plants, mulched shrubbery, and trees can provide both an aesthetically pleasing view and protection against stormwater runoff.

### *Construction on Property*

New or ongoing construction should adhere to all proper protocols for stormwater prevention, especially the use of silt fences and other erosion control devices. If a new driveway or patio is being planned, using alternatives to impervious materials such as pavers or porous pavement will help reduce runoff. These materials infiltrate the rainwater into the ground instead, rather than allowing the water to run directly into the lake. It is also important to mention stormwater prevention and mitigation practices to the contractors prior to construction and before the design phase. It is much easier to build proper drainage and stormwater practices into the design of a project, than to adapt after the fact.

### *Septic System Maintenance*

All septic systems should be pumped out and inspected on a rotating 3-year basis. The TOPV already has a 5-year septic system pump-out regulation in effect for Roaring Brook Lake, which is a great starting point. GEI suggests that pump outs be conducted on a 3-year basis by homeowners, as more frequent inspections will assist in catching problems with the tank earlier on. It is also a good idea to ask the septic contractor to inspect the leach field for any signs of capacity issues or ponding of water. Most inspections only involve the integrity of the tank, which can only catch a portion of the issues.

## Literature Cited

Brooks, J. L., & Dodson, S. I. (1965). Predation, Body Size, and Composition of Plankton. *Science*, *150*(3692), 28–35. https://doi.org/10.1126/science.150.3692.28

Ecosystem Consulting Services. (1991). *Roaring Brook Lake Supplemental Diagnostic-Feasibility Study*.

Min, C., Johansson, L. S., Søndergaard, M., Lauridsen, T. L., Chen, F., Sh, T., & Jeppesen, E. (2021). Copepods as environmental indicator in lakes: Special focus on changes in the proportion of calanoids along nutrient and pH gradients. *Aquatic Ecology*, *55*(4), 1241–1252. https://doi.org/10.1007/s10452-021-09877-y

Northeast Aquatic Research. (2020). *Roaring Brook Lake Water Quality and Aquatic Plant Monitoring Report 2019*. Northeast Aquatic Research.

Northeast Aquatic Research. (2021). *Roaring Brook Lake 2020 Water Quality Monitoring & Fisheries Report*. Northeast Aquatic Research.

Northeast Aquatic Research. (2022). *Roaring Brook Lake 2021 Monitoring Report*. Northeast Aquatic Research.

Pearce NJT, Parsons CT, Pomfret SM, Yates AG. Periphyton Phosphorus Uptake in Response to Dynamic Concentrations in Streams: Assimilation and Changes to Intracellular Speciation. Environ Sci Technol. 2023 Mar 21;57(11):4643-4655. doi: 10.1021/acs.est.2c06285. Epub 2023 Mar 10. PMID: 36897624; PMCID: PMC10035032.

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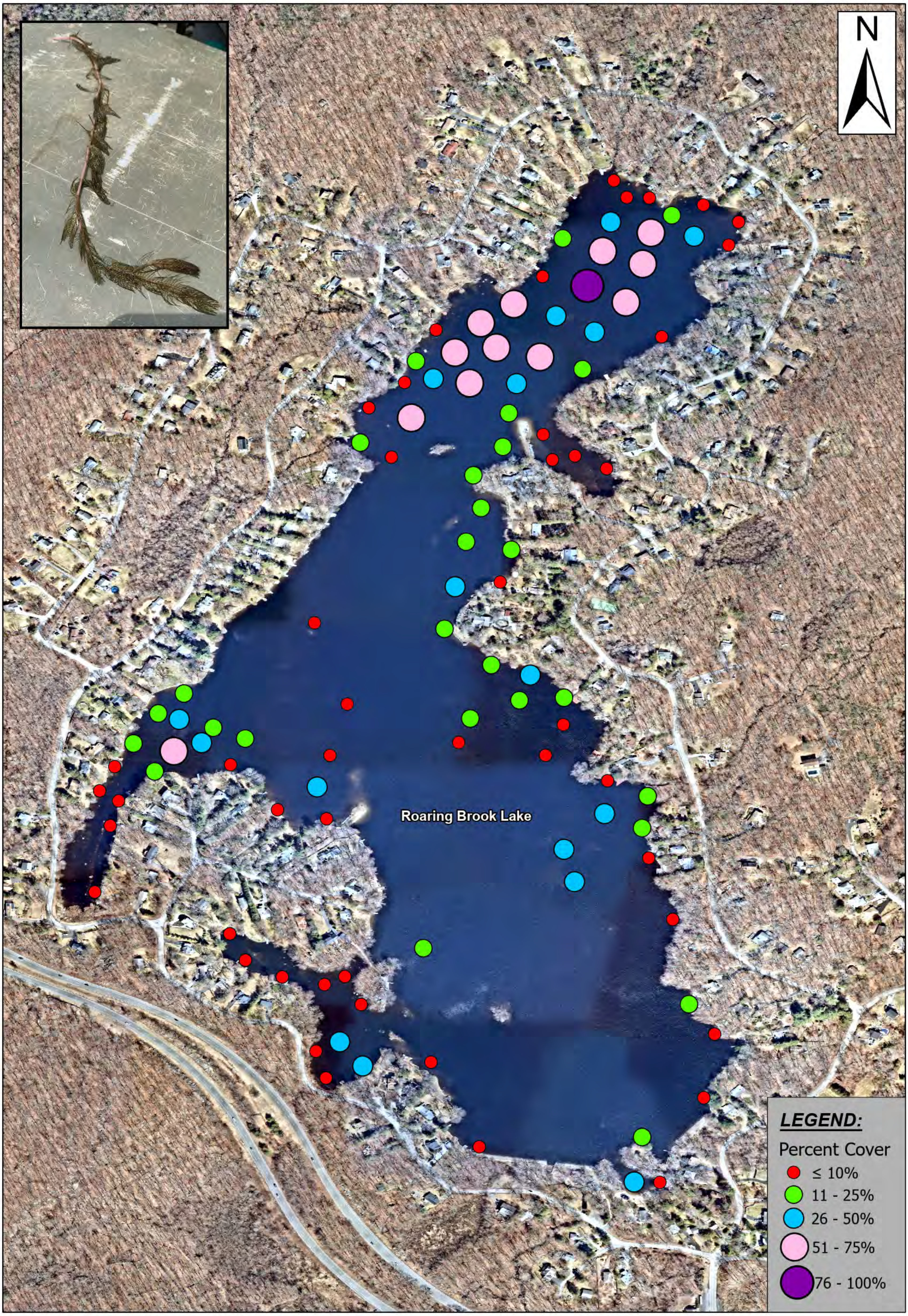
# Appendix A Maps




GEI Consultants

*Myriophyllum spicatum*

0 225 450 900
SCALE: 1" = 450'

Plant Distribution Map 2025
Roaring Brook Lake
Town of Putnam Valley, NY

Service Layer Credits: Aerial Imagery © Nearmap US Inc., March 23, 2025.

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GEI Consultants

*Cabomba carolinana*

0 225 450 900

SCALE: 1" = 450'

Plant Distribution Map 2025
Roaring Brook Lake
Town of Putnam Valley, NY



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| | | | |
|---|---|---|---|
| GEI Consultants | *Najas minor* | 0 225 450 900<br>SCALE: 1" = 450' | Plant Distribution Map 2025<br>Roaring Brook Lake<br>Town of Putnam Valley, NY |
| Service Layer Credits: Aerial Imagery © Nearmap US Inc., March 23, 2025. | | | Project 2502546 January 2026 |

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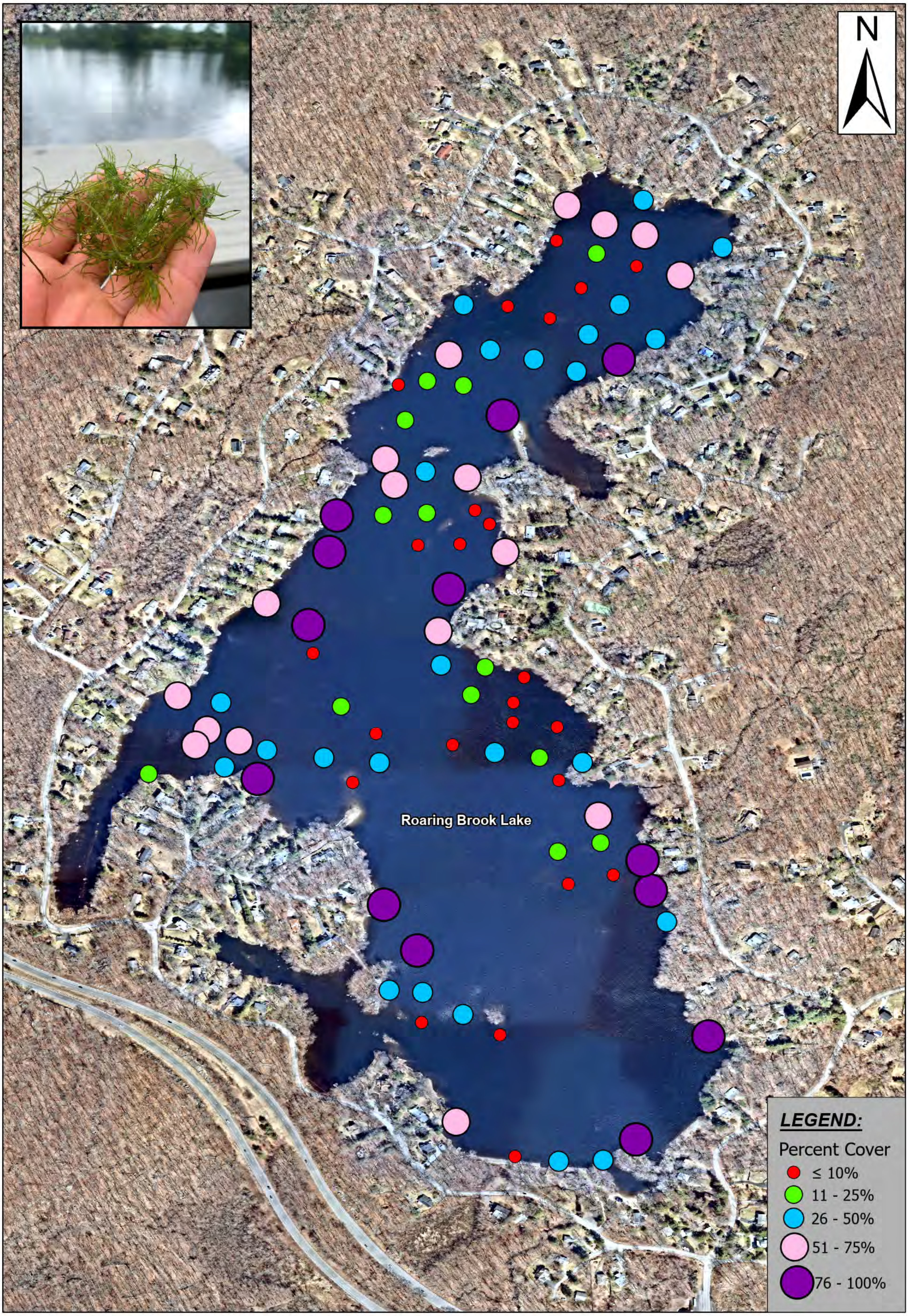


| | | | |
|---|---|---|---|
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| Service Layer Credits: Aerial Imagery © Nearmap US Inc., March 23, 2025. | | | Project 2502546 January 2026 |

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GEI Consultants

*Potamogeton amplifolius*

0 225 450 900

SCALE: 1" = 450'

Plant Distribution Map 2025
Roaring Brook Lake
Town of Putnam Valley, NY

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January 2026

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GEI Consultants

*Utricularia inflata*

0 225 450 900
SCALE: 1" = 450'

Plant Distribution Map 2025
Roaring Brook Lake
Town of Putnam Valley, NY

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Project 2502546 January 2026

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| | | | |
|---|---|---|---|
| GEI Consultants | *Ceratophyllum demersum* | 0 225 450 900<br>SCALE: 1" = 450' | Plant Distribution Map 2025<br>Roaring Brook Lake<br>Town of Putnam Valley, NY |
| Service Layer Credits: Aerial Imagery © Nearmap US Inc., March 23, 2025. | | | Project 2502546 January 2026 |

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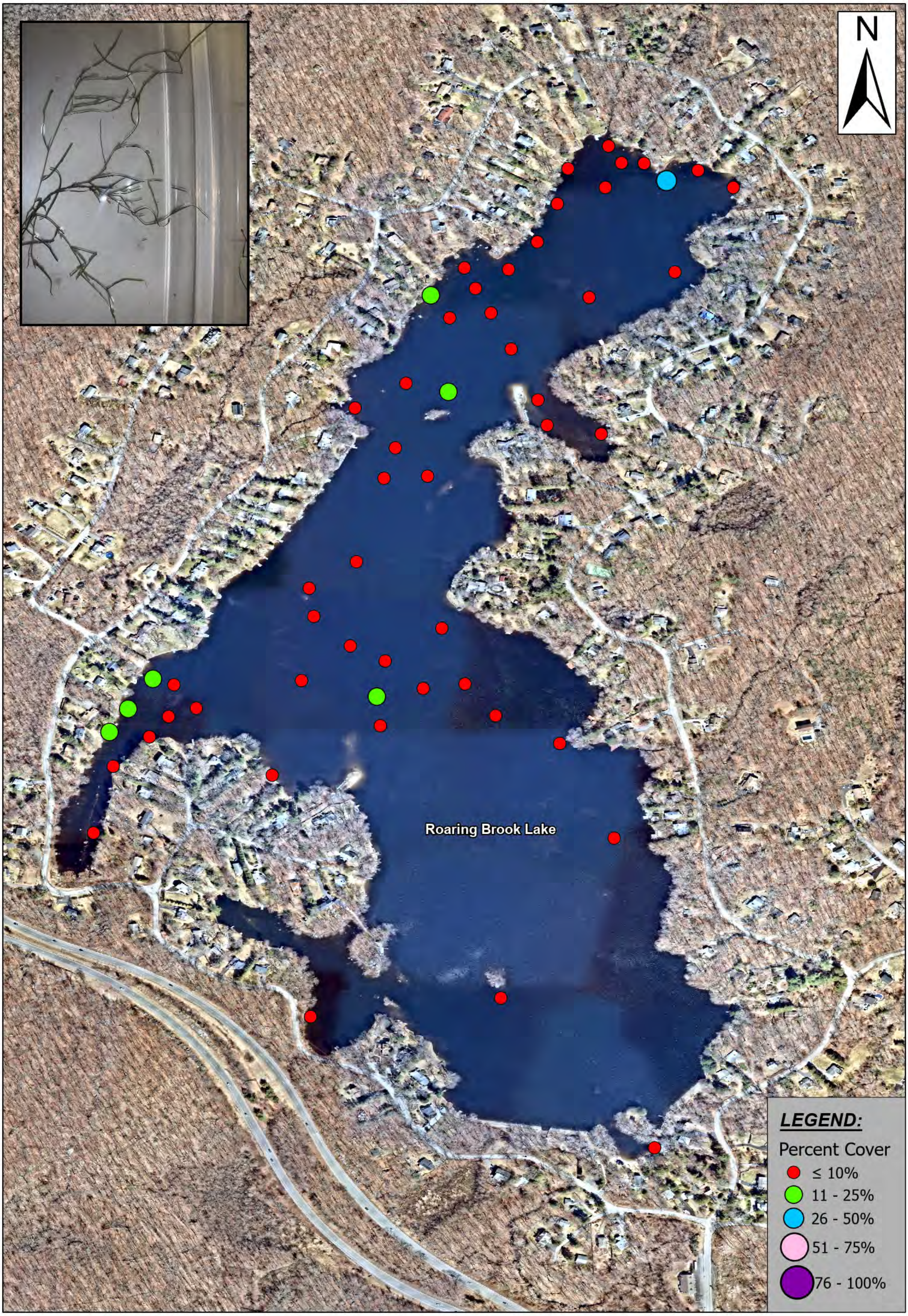


GEI Consultants

*Potamogeton pusillus*

0 225 450 900

SCALE: 1" = 450'

Plant Distribution Map 2025
Roaring Brook Lake
Town of Putnam Valley, NY

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January 2026

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