Lake Wickaboag
West Brookfield, Massachusetts
2023 Year-End Report

Prepared on: November 6, 2023

Prepared for: West Brookfield Board of Health – boh@wbrookfield.com
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In accordance with the aquatic plant management contract between SŌLitude Lake Management, the West Brookfield Board of Health and the Lake Wickaboag Preservation Association for Lake Wickaboag in West Brookfield, the following document serves to provide this year's treatment and survey results and management recommendations for next season.

All management activities were consistent with the Order of Conditions (DEP File #329-094), and the License to Apply Chemicals issued by the MA DEP – Office of Watershed Management (#WM04-0001118).

2023 Management Program Summary

- Early Season Survey 05/31/2023
- Herbicide Treatment 06/19/2023
- First Water Sampling Event 06/21/2023
- Post-Management Survey 08/11/2023
- Second Water Sampling Event 09/01/2023

Early Season Survey

The pre-treatment survey was conducted on May 31st by two SOLitude Biologists accompanied in another boat by David Brown and Barbara Portal of the Lake Wickaboag Preservation Association. The entire littoral zone was surveyed using a combination of visual

observation and throw rake sampling. **Figure 1** shows the locations of all vegetation species observed during the survey.

At the time of the early season survey, the target species, non-native variable watermilfoil (*Myriophyllum heterophyllum*), was observed as trace patches in the northernmost section of the Lake, with one other small area of trace growth occurring in the small cove along the eastern shoreline. Two new moderate to dense patches in the southeastern end of the lake were also observed at this time.

Native plant species observed include: large-leaf pondweed(*Potamogeton amplifolius)*, thin-leaf pondweed (*P. pusillus*), ribbon-leaf pondweed (*P. epihydrus*), muskgrass (*Chara sp.*), bladderwort (*Utricularia spp.*), waterweed (*Elodea canadensis*), waterlilies (*Nymphaea sp. & Nuphar sp.*), and watershield (*Brasenia schreberi*). Floating-leaf species were observed along parts of the shoreline in relatively small patches of trace to sparse abundances with the majority of the dense growth in the northern, shallow part of the waterbody. Benthic and floating filamentous algae was observed throughout the shoreline.

Herbicide Treatment

Based on conditions observed during the early season survey, treatment of Lake Wickaboag was scheduled and performed on June 19th. In accordance with the Order of Conditions for this project, written notification of the scheduled treatment date was sent to the West Brookfield Conservation Commission. Printed signs warning of the treatment and the associated temporary water-use restrictions were also sent to members of the Association for posting around the lake.

Treatment was performed using SOLitude's specially designed application boat. The herbicide is mixed with lake water in an onboard storage tank, it then travels through a pump system and out through a submersed boom behind the stern. Diquat (Tribune) or ProcellaCOR (florpyrauxifen-benzyl) herbicide was applied to specific areas of target growth within the lake for variable watermilfoil and common waterweed, while a combination of diquat and Aquathol K (endothall) were applied to target areas of large-leaf pondweed shown in **Figure 2**. The GPS tracks recorded during this treatment are also shown in **Figure 2**. A total of 60 gallons of Tribune, 26 gallons of Aquathol-K and 30 PDU of ProcellaCOR were applied.

Water Sampling Events

This season, a water sampling program was developed and conducted in conjunction with the SOLitude Biology team and the LWPA. Parameters sampled in the past were again sampled at two different events, and the bottles for which were ordered and delivered to the LWPA. A courier was scheduled to pick up the samples and bring them back to Alpha

Analytical for processing. The results for each sampling event are below, with an explanation of each parameter at the end of the section.

Table 1: Water sampling results from June 21, 2023 sampling event at Lake Wickaboag.

June 21			Results		
Parameter	**Units**	**Reporting Limit (RL)**	**Inlet**	**Mid-Lake**	**Dam**
Nitrogen, Ammonia	mg/L	0.075	ND	ND	ND
Nitrogen, Nitrite	mg/L	0.050	ND	ND	ND
Nitrogen, Nitrate	mg/L	0.100	ND	ND	ND
Nitrogen, Total Kjeldahl	mg/L	0.300	0.411	0.398	0.338
Phosphorus, Total	mg/L	0.010	0.024	0.016	0.019
Phosphorus, Soluble	mg/L	0.010	ND	0.018	ND
Chlorophyll A	mg/m3	2.000	4.40	4.29	3.75

Table 2: Water sampling results from September 1, 2023 sampling event at Lake Wickaboag.

September 1			Results		
Parameter	**Units**	**Reporting Limit (RL)**	**North Cove**	**Mid-Lake**	**Dam**
Nitrogen, Ammonia	mg/L	0.075	0.156	0.141	0.182
Nitrogen, Nitrite	mg/L	0.050	ND	ND	ND
Nitrogen, Nitrate	mg/L	0.100	ND	ND	ND
Nitrogen, Total Kjeldahl	mg/L	0.300	0.540	0.389	0.539
Phosphorus, Total	mg/L	0.010	0.039	0.035	0.035
Phosphorus, Soluble	mg/L	0.010	0.017	0.018	0.019
Chlorophyll A	mg/m3	2.00	17.2	16.0	18.2

Nitrogen, Ammonia: Ammonia is a product of microbiological activity, and is indicative of anoxic conditions. NH3, the un-ionized form as free ammonia, is toxic to fish (both freshwater and marine) at >0.03 mg/L (ppm). The ionized form, NH4+, or ammonium, is innocuous. Ammonia toxicity to aquatic life has been reported at levels between 0.53 and 22.8mg/L, and the toxicity is dependent on temperature, water source, pH and how the measurement is taken. ***Ammonia levels were not detected during the June sampling event at any sampling point, but it was detected at each of the sampling points during the***

September sampling event. The levels were: 0.156 at the North Cove, 0.141 at Mid-Lake, and 0.182 at the Dam.

Nitrogen, Nitrite - Nitrite has been shown to be very toxic to different types of fishes and other aquatic life, even at low concentrations. Allowable concentrations of nitrite increase with ambient concentrations of chloride. ***Nitrite levels at Lake Wickaboag were not detected at either sampling event at any of the sampling points.***

Nitrogen, Nitrate – Nitrate is another form of nitrogen found in bodies of water. Nitrate nitrogen is generally the most prevalent form of inorganic nitrogen in the water and from such things as natural aerobic bacterial activity and fertilizer use. It is also the form that is most readily available for plant and algae growth. Levels <0.3 mg/L are ideal. ***Nitrate levels at Lake Wickaboag were not detected at either sampling event at any of the sampling points.***

Total Kjeldahl Nitrogen (TKN) is defined as the total combination of organic forms of nitrogen and ammonia and ammonium. This measurement indicates the total present amount of nitrogen, much of which is missed by ammonia testing also done on a sample, hence it shows a more accurate representation of the water quality. Values are generally undetectable below 0.2 mg/L and desirable under 1.0m/L, but high TKN values can indicate manure or sewage inputs in the water body. ***The TKN values at Wickaboag varied between 0.338-0.411 during the June sampling event. During the September sampling event, the values were listed from 0.389 to 0.540, with the highest value collected at the North Cove site. This is generally due to natural decomposition of plants in the end stage of their life cycle and also following chemical treatments.***

Total/Soluble Phosphorus – Total Phosphorus measures both particulate and dissolved phosphorus, where particulate phosphorus is generally not biologically available for algae or plant growth. Generally, a total phosphorus concentration over 30 parts per billion (ppb, or 0.03 mg/L) is the threshold at which algae blooms or excessive plant growth can be stimulated. Aquatic systems at 12 ppb or below are considered nutrient-poor and oligotrophic; levels between 12-24 ppb contain a moderate amount of nutrients and mesotrophic; levels between 25-96 ppb are nutrient-rich and eutrophic; levels above 96 ppb contain excessive nutrients and are hypereutrophic. Particulate phosphorus is generally not biologically available, therefore dissolved phosphorus more readily supports plant and algae growth. While rooted plant growth generally obtains most of its nutrients from the sediment, phosphorus found in the water column has a more direct effect on algae growth. Dissolved phosphorus remains in the water column, while particulate phosphorus settles to the lake bottom. Dissolved phosphorus is biologically available and is used in aquatic processes such as plant and algae growth. ***Soluble phosphorus levels were only detected at the Mid-Lake sample site during June at 0.018mg/L, and from 0.017 to 0.019mg/L in September. The total phosphorus levels in Wickaboag Lake during the June sampling event ranged from 0.016-0.024, indicating a mesotrophic water body with***

moderate amounts of nutrients. The levels during September were listed as 0.035 and 0.039, indicating a eutrophic water body and high nutrient levels. This is likely due to the above-average rainfall this season, and not likely due to point sources of nutrient contamination, such as leaking septic tanks or particular areas of fertilizer runoff.

Chlorophyll A - Levels between 0-10 mg/m3 indicate no evident water quality problems and no water discoloration. Levels between 11-20 mg/m3 suggest that algal scums and some water discoloration are present. Levels between 21-30 mg/m3 indicate nuisance conditions and considerable water discoloration. Levels above 30 mg/m3 suggest severe discoloration and water quality issues. Chlorophyll A samples were collected at both sampling events, but due to lab closures for Labor Day, the samples taken in September were not tested until after the standard hold time. This affected the reliability of the samples, as the algae within the sample was able to multiply while the sample was waiting to be run. ***In June, chlorophyll A was detected at levels ranging from 3.75 to 4.40mg/m3, indicating no water discoloration or evident water quality problems. If considering the samples as they were reported, the September levels of 16.0 to 18.2mg/m3 could suggest water discoloration and algal scums.***

Copper Treatments

No copper sulfate treatments were needed this year as water clarity remained good for most of the summer and there was no visual evidence of major cyanobacteria blooms. During the early- and mid-season time periods, there were some visual observations of areas of cyanobacteria within coves and along shorelines below heavily-groomed lawns, but these areas dissipated quickly and without spreading.

Post-Treatment Survey

A post-treatment survey was conducted by a SŌLitude Biologist, accompanied by David Brown, on August 11th. The survey showed an overall reduction in the distribution and densities of target vegetation species variable watermilfoil and large-leaf pondweed within the treatment areas. At the time of the late-season survey, variable watermilfoil regrowth was only observed at trace densities in the shallow area of the northern portion of the lake. Also noted during the survey were beneficial vegetation such as tapegrass (*Vallisneria americana*), coontail (*Ceratophyllum demersum*), bladderwort (*Utricularia spp.),* and various pondweeds (*Potamogeton spp*.). These species help with water quality as they filter out some of the nutrients otherwise utilized by algae species, and are beneficial to the wildlife species who inhabit and utilize the water body. See **Figure 3** for the late season vegetation assemblages.

The final late-season survey was determined to be not necessary at this time, and was canceled for the season.

Ongoing Management Recommendations

Results of the vegetation monitoring show that the 2023 herbicide treatments for variable watermilfoil, large-leaf pondweed and common waterweed were largely successful in reducing distribution and density of these species. In 2024, we recommend continued treatment of invasive, non-native variable watermilfoil, as well as nuisance amounts of pondweed and floating-leaf species with aquatic herbicides.

This was the first year that ProcellaCOR herbicide was used to manage variable watermilfoil in the lake. Past treatments using diquat, especially in the shallow north end of the lake did not provide even seasonal control. Although more costly, ProcellaCOR is expected to provide longer term control because of its systemic properties. Some regrowth of watermilfoil was observed in the northern end of the lake during the post-treatment survey but the density was much less than is typical after treatment with diquat. We recommend continuing to utilize ProcellaCOR for variable watermilfoil management in the future as budgets allow.

For control of other species, like large-leaf pondweed, naiad and waterlilies, we recommend continuing with the use of diquat, endothall and glyphosate, as-needed based on monitoring. Copper sulfate algaecide treatments at Lake Wickaboag were not needed this year, but algae monitoring should be conducted as necessary so treatments can be performed if bloom conditions develop. Please keep in mind that algal growth is not consistent year to year and is dependent on many factors both within and outside the lake. Nutrient remediation could be considered if algae and phosphorus levels continue to rise, and this can certainly be discussed in more detail with your project manager if it becomes an issue.

Yearly monitoring during early- and late-season inspections will continue to help in determining when nuisance levels have been reached and further guide the management of Lake Wickaboag.

Thank you for your continued support this season, and we look forward to working again with you next season.

Figure 1: Pre-Management Survey - May 31, 2023

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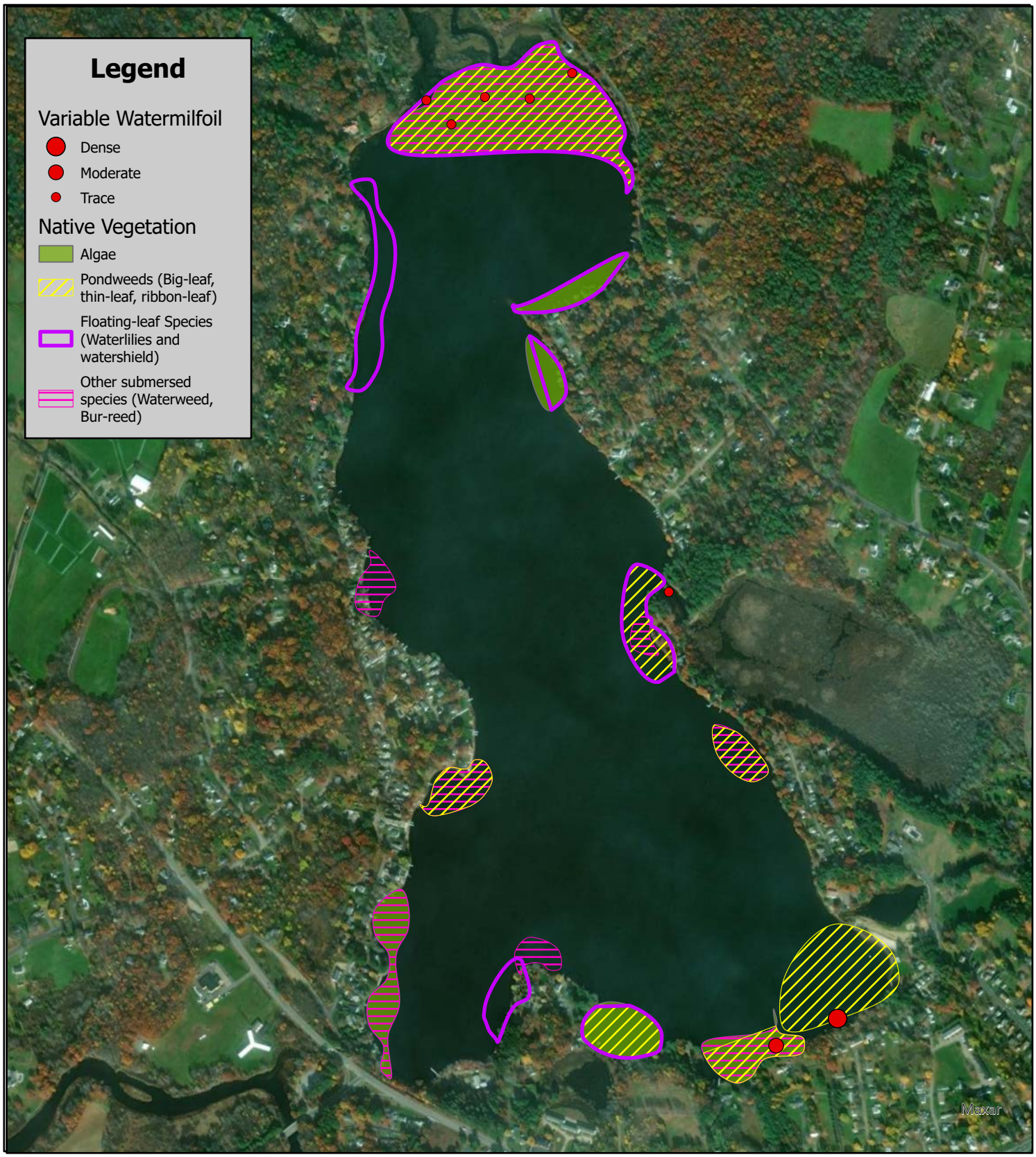
888.480.5253
solitudelakemanagement.com



Wickaboag Lake
West Brookfield, MA

Wickaboag Lake

0 360 720 1,440 Feet

N

1:304,225

Map Date: 06/16/2023
Survey Date: 05/31/2023
Prepared by: SB
Office: Shrewsbury, MA

Figure 2: Treatment Areas and Treatment Tracks (June 19, 2023)

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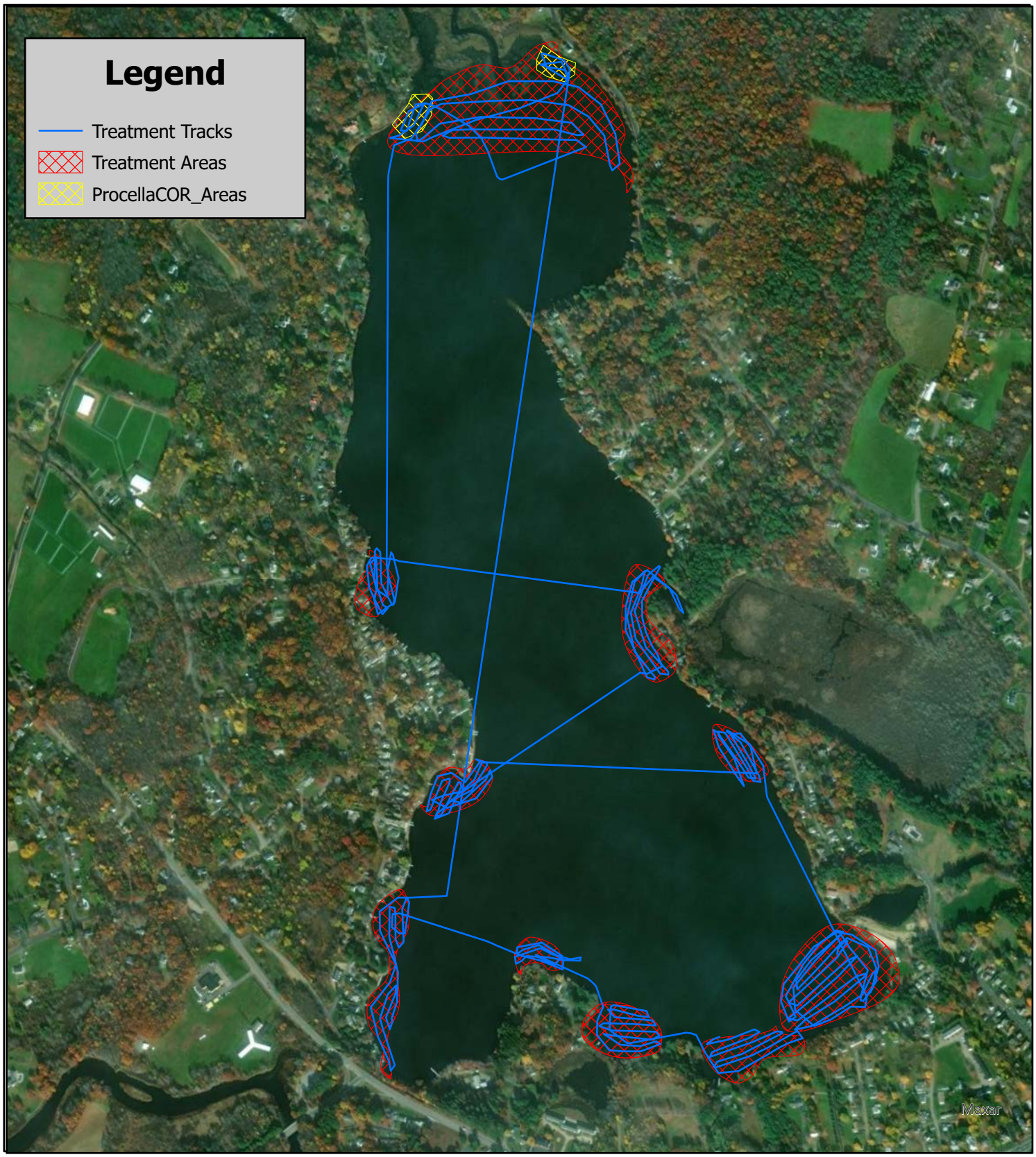

Wickaboag Lake
West Brookfield, MA

Wickaboag Lake

0 360 720 1,440 Feet

1:304,225

N

Map Date: 08/25/2023

Prepared by: DM
Office: Shrewsbury, MA

FIGURE 3: Post-Management Visual Survey
August 8, 2023

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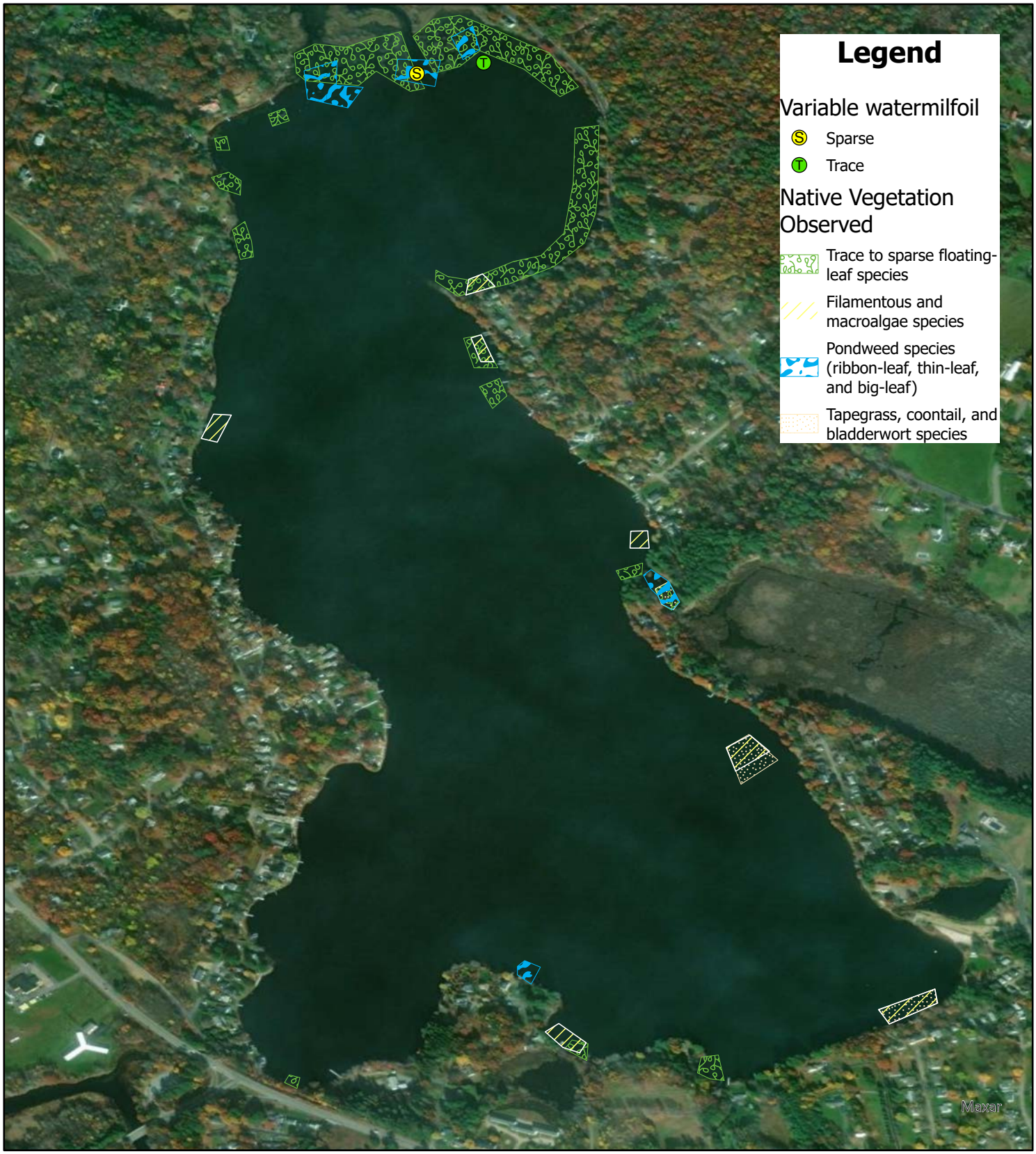

Lake Wickaboag
West Brookfield, MA

Lake Wickaboag

0 300 600 1,200 Feet

1:10,516

N

Map Date: 08/25/2023
Survey Date: 08/11/2023
Prepared by: KV
Office: SHREWSBURY, MA