Lake Warner Aquatic Plant Assessment Report

FEBRUARY 2024

PREPARED FOR

The Friends of Lake Warner and the Mill River

PREPARED BY

SWCA Environmental Consultants

LAKE WARNER AQUATIC PLANT ASSESSMENT REPORT

Prepared for

The Friends of Lake Warner and the Mill River
P.O. Box 11
Hadley, Massachusetts 01035
Attn: Brian Pearson

Prepared by

Naomi Valentine, M.S., CERP

Principal Investigators

Steve Johnson, Ph.D.
Joel Harris

SWCA Environmental Consultants
15 Research Drive
Amherst, Massachusetts 01002
(413) 256-0202
www.swca.com

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1 INTRODUCTION

The Friends of Lake Warner and the Mill River (The Friends) are dedicated to the study, maintenance, and improvement of water quality and habitat value of Lake Warner and the Mill River Watershed. The Friends secured Community Preservation Act funding to develop an aquatic plant survey and conduct standard water quality testing in order to determine short- and long-term management practices that might increase habitat value within Lake Warner. SWCA conducted a detailed aquatic plant survey on September 6, 7, and 15, 2023, and conducted water and surface sediment sampling on September 28, 2023.

In the development of this report, SWCA reviewed historic data provided by The Friends in order to determine a baseline of conditions within the lake and also to understand its past uses and impairments. While this document review is important, only the relevant aspects of the historic conditions of Lake Warner are included in this report.

The purpose of this report and associated recommendations is to describe pre-management conditions of aquatic vegetation in Lake Warner and integrate them into a Lake Management Plan.

1.1 Lake Description and Uses

Lake Warner is a 70-acre warm water reservoir located in North Hadley, Massachusetts, within the Connecticut River watershed (MassWildlife, 2018). The lake has a mean water depth of 4 feet with a maximum depth of 12 feet (MassWildlife, 2018). The lake predominantly consists of a muck bottom, has a mostly weed-covered surface, and has approximately 3.4 miles of predominately undeveloped shoreline (MassWildlife, 2018). The land surrounding Lake Warner is home to highly valued historical sites, unique geological features, several day-use trails for the community to access, and a significant amount of valuable forested land and water resources that provide habitat for an array of wildlife and plant species.

1.1.1 Historic Land Use

This area of the Northeast has been the homeland of the Abenaki and Pocumtuck people since time immemorial (Boehmer et al. 2011). Both groups were historically closely allied and made use of the Connecticut River Valley without sharply divided territories. Mt. Warner's location surrounded by fields and adjacent to the Connecticut River made it a very desirable place to hunt, fish, and camp. The Native tribes sold the valuable farmland to English settlers in 1658, making sure they retained their hunting and fishing rights, and they still remain in the area (Boehmer et al. 2011). Several sites have been located immediately bordering the mountain, and a collection of artifacts have been found on surrounding farmland. The collection represents a range of time periods and consists of mostly quartz or chert projectile points used for hunting (Boehmer et al. 2011). Various signs of colonial use over the past 200 years have been observed on and around Mt. Warner, including two distinct water holes, an old brick well, a sizeable rock formation surrounding a spring, and scattered barbed wire suggesting the presence of livestock (Boehmer et al. 2011). Current land use consists of predominantly residential/agriculture.

In recent history, Lake Warner has been used for recreation and acts as a large local catchment for the Amherst-Hadley area. The main public access point is a small, paved ramp off Mt. Warner Road in Hadley, Massachusetts.

1.1.2 Water Resources

Mt. Warner is considered an aquifer recharge area for the town of Hadley (Boehmer et al. 2011). There are two backup water wells and two storage tanks located on the south slope of the mountain (Boehmer et al. 2011). Lake Warner sits on the north side of the mountain and is fed by several seasonal streams, springs, wetlands and vernal pools that exist surrounding the lake. The main water source to Lake Warner is the Mill River. The Mill River is a tributary to the Connecticut River, draining into Lake Warner just before the confluence (University of Massachusetts and Geosyntec Consultants, Inc., 2019). The Mill River watershed has a drainage area of approximately 19,500 acres (30 square miles), encompassing portions of Amherst, Leverett, Shutesbury, and Sunderland (University of Massachusetts and Geosyntec Consultants, Inc., 2019).

1.1.3 Wildlife Habitat

Much of Lake Warner is surrounded by well-aged mixed forest consisting of species including hemlock (*Tsuga* spp.), black birch (*Betula lenta*), red maple (*Acer rubrum*), red oak (*Quercus rubra*), white oak (*Quercus alba*), white pine (*Pinus strobus*), hickory (*Carya* spp.), and sugar maple (*Acer saccharum*) (Boehmer et al. 2011). Downed timber and large old pines provide important wildlife habitat. The lake itself, along with various surrounding wetlands and vernal pools, also provides a great deal of wildlife habitat (Boehmer et al. 2011). Mt. Warner has been designated as part of a wildlife corridor that runs from the agricultural farmlands of the University of Massachusetts Amherst, through protected areas of the Kestrel Land Trust and farm fields, to Mt. Warner, Lake Warner, and onto the shores of the Connecticut River (Boehmer et al. 2011). Species observed near Lake Warner include many species of frogs, ducks, salamanders, snakes, woodpeckers, owls, crows, bears, rabbits, squirrels, coyotes, turkeys, deer, and moose (MassWildlife 2018).

Fish noted in the Lake by the Massachusetts Division of Fisheries and Wildlife Largemouth bass (*Micropterus salmoides*), chain pickerel (*Esox niger*), black crappie (*Pomoxis nigromaculatus*), yellow perch (*Perca flavescens*), white perch (*Morone americana*), pumpkinseed (*Lepomis gibbosus*), bluegill (*Lepomis macrochirus*), brown bullhead (*Ameiurus nebulosus*), yellow bullhead (*Ameiurus natalis*), common carp (*Cyprinus carpio*), white sucker (*Catostomus commersonii*), and golden shiner (*Notemigonus crysoleucas*). (MassWildlife 2018).

1.2 Studies by The Friends

The health of the lake began being questioned in the 1970s with reports produced for the Massachusetts Water Resources Commission, which highlighted its observed phosphorus loading and lake sedimentation (Johnson, 2019). Lake Warner was placed on the Federal Clean Water Act Section 303(d) list of impaired water bodies in 2002, 2007, 2012, 2014, and 2016 due to nutrients (total phosphorus), excess algal growth, organic enrichment, low dissolved oxygen, turbidity, and noxious aquatic plants (Johnson, 2019). The Mill River above the inlet to the lake was also placed on the 303d list of impaired water bodies for excessive E. coli bacterial pollution in 2006, 2011, 2014, and 2016 (Johnson, 2019). Various studies were conducted from 2002 to 2015 to identify potential nonpoint pollution sources and nutrient pathways into the lake, characterize the extent and type of aquatic plant growth, and attempt to comprehensively measure the physical and biological parameters of the lake (Johnson, 2019).

In 2016, The Friends recognized that the lake suffered from a variety of problems and additional water quality information would be useful in developing strategies to protect and restore the health of the lake and its watershed. To accomplish this, The Friends conducted an official monitoring program on Lake Warner and its tributaries from 2016 to 2019. The intent of this study was to assess the general health of

the lake and identify and assess potential nutrient sources within the watershed (Johnson, 2019). This study established baseline and trend data of water quality in the lake, assessed sources of nutrients and bacteria, and identified dominant vegetation species and their location in the lake (Johnson, 2019). The research showed that portions of Lake Warner were under extreme seasonal stress due to oxygen depletion, which is fueled by abundance of aquatic plants and algae (Johnson, 2019). They determined that management of this aquatic vegetation would be key to improving the health of the lake and improving recreational experiences in the short term (Johnson, 2019). The study suggested that monitoring should continue to measure changes within the ecosystem and evaluate management techniques (Johnson, 2019).

2 2023 AQUATIC PLANT ASSESSMENT

SWCA conducted a detailed aquatic plant survey of Lake Warner on September 6, 7, and 15, 2023. SWCA identified over 30 species of aquatic and emergent wetland vegetation. The vast majority of these plants were native; only two invasive submerged aquatic plants were observed, curly-leaf pondweed (*Potamogeton crispus*) and water chestnut (*Trapa natans*). Three additional invasive emergent/wetland plants were identified on the banks and shallow waters surrounding the lake. The remaining 26 plant species identified throughout the 85 survey quadrats, which encompass the entirety of the lake, were native.

2.1 2023 Aquatic Plant Survey Methods

SWCA developed a quadrat sampling method for the aquatic plant survey of Lake Warner. Each quadrat is 200 feet by 200 feet in size (40,000 square feet) and a total of 85 quadrats were defined to encompass the entirety of the lake. Because the quadrats divide the lake in a regular grid pattern, the quadrats that overlap the bank of the lake are irregularly shaped and often less than 40,000 square feet. See an overview of the survey area and quadrats in Figure 1 (Appendix A).

The survey team systematically visited each quadrat and conducted a combination of visual and rake-toss surveys to document all aquatic plants observed within each quadrat. Each plant identified was also assigned a percent cover, recorded in cover classes, within each quadrat. Data was collected using Esri Field Maps along with a Geode antenna, to ensure accuracy of the mapping effort. Photographs were taken and mapped in Field Maps (see Figure 1, Appendix A, for Photo Point locations) to document the overall conditions of Lake Warner at the time of the survey.

2.2 2023 Aquatic Plant Survey Results

SWCA observed aquatic plants in all 85 of the quadrats within Lake Warner. As seen in Table 1, Brazilian watermeal (*Wolffia brasiliensis*) was noted in 82 of the quadrats, coontail (*Ceratophyllum demersum*) was noted in 81 of the quadrats, and duckweed (*Lemna minor*) was noted in 80 of the 85 quadrats. Coontail has been observed at high densities in past years and according to observations by the Friends it has become denser in dry years. Although not noted across as many quadrats as watermeal, coontail was noted at the highest average percent cover of all other observed species, at 26-50% cover over its 81 quadrats.

The dominant submerged or floating aquatic plants (identified in 55 (65%) or more of the quadrats) include Brazilian watermeal, coontail, duckweed, white waterlily (*Nymphaea odorata*), water chestnut (*Trapa natans*), false water-pepper smartweed (*Persicaria hydropiperoides*), big-leaved pondweed (*Potamogeton amplifolius*), yellow pond lily (*Nuphar* variegata), and humped bladderwort (*Utricularia*

gibba). The two emergent plant species noted in 55 or more of the quadrants are American bur-reed (*Sparganium americanum) and* pickerelweed (*Pontederia cordata*).

Overall, Lake Warner was very densely populated with submerged and floating aquatic plant species at the time of the survey. Table 2 shows the distribution of quadrats across the five cover classes. The majority of the lake was observed at 50% vegetation cover or more, with only 28% of the lake observed at 25% cover or less.

This density of plants has been the historic condition within Lake Warner for many years. However, none of the documents SWCA reviewed discussed the high diversity of aquatic plant material noted during this survey. Achieving this density and diversity of aquatic plants with largely native plants (only two species of aquatic submerged or floating invasive plants were found) is not common in the Northeast.

Table 1. Lake Warner Vegetation Survey Results Sorted by Highest Prevalence

Scientific Name	Common Name	Status†	Quadrats	Average % Cover per Quadrat	Quadrat Number(s)
Wolffia brasiliensis	Brazilian watermeal	Native, apparently secure	82	6–25%	1–82
Ceratophyllum demersum	Coontail	Native, secure	81	26–50%	1- 66, 70–84
Lemna minor	Duckweed	Native, secure	80	< 5%	1–16, 18–30, 32–82
Nymphaea odorata	White waterlily	Native, secure	75	6–25%	1–5, 9–14, 16–20, 22–32, 34–59, 61–65, 67, 68, 70–77, 79–84
Pontederia cordata	Pickerelweed	Native, secure	65	< 5%	1–5, 9–13, 17–22, 25–33, 37, 42–45, 47–62, 65–82, 85
Trapa natans	Water chestnut	Introduced, invasive	65	6–25%	2, 3, 5, 6, 9–12, 17–21, 25, 27–32, 34–56, 58–78, 84
Persicaria hydropiperoides	False water-pepper smartweed	Native, secure	63	< 5%	1–5, 9–12, 17–23, 25–35, 38, 42–45, 47–49, 51–55, 57–62, 65–76, 78–82
Potamogeton amplifolius	Big-leaved pondweed	Native, secure	60	6–25%	1–3, 5, 9–11, 16, 17, 19, 20–25, 27, 29, 31, 32, 35–37, 39, 40–42, 45–47, 49, 50–56, 59–70, 72–77, 79, 80, 82, 83
Sparganium americanum	American bur-reed	Native, secure	59	6–25%	1–4, 9–13, 17–20, 23, 25, 27, 28, 30–32, 34, 37, 42–45, 47–53, 55, 58–63, 65–71, 74–85
Nuphar variegata	Yellow pond lily	Native, secure	56	6–25%	2, 3, 5, 10–12, 14, 17–21, 23, 26–32, 34–36, 38, 40, 41, 43–57, 59, 60, 62, 63, 66, 67, 70–75, 80, 81, 83
Utricularia gibba	Humped bladderwort	*(unknown), secure	56	< 5%	1–6, 9–12, 14, 15, 17–20, 23–33, 35, 37, 40–60, 62, 63, 71–74
Decodon verticillatus	Swamp loosestrife	Native, secure	39	6–25%	1, 3, 10–13, 18, 21–23, 26–28, 30, 31, 33, 34, 38, 43–45, 48, 49, 51, 55, 57, 58, 65, 68, 69, 72, 73, 75, 76, 79, 80, 82–84
Potamogeton pusillus	Small Pondweed	*(unknown), apparently secure	20	< 5%	1–5, 14, 16, 17, 21, 23, 35, 36, 39, 40, 41, 42, 45–47, 73
Potamogeton epihydrus	Ribbon-leaved pondweed	Native, secure	16	< 5%	1, 2, 5, 9, 17, 25, 32, 37, 42, 49, 51, 60, 65, 66, 84, 85
Bidens connata	Purple-stem beggar-ticks	Native, secure	14	< 5%	21, 23, 26, 30, 31, 34, 38, 55, 57, 58, 66, 69, 75, 85
Elodea nuttalii	Nuttall's waterweed	Native, secure	13	< 5%	2, 3, 4, 10, 18, 26, 27, 50, 53, 54, 57, 63, 71
Lythrum salicaria	Purple loosestrife	Introduced, invasive	12	< 5%	21, 23, 30, 31, 33, 48, 57, 65, 69, 74, 82, 85
Typha latifolia	Common cattail	Native, secure	9	6–25%	18, 26, 27, 57, 58, 72, 74, 78, 81
Callitriche palustris	Vernal water-starwort	Native, apparently secure	7	< 5%	49, 51, 65, 66, 70, 78, 80
Utricularia vulgaris	Greater bladderwort	Native, secure	7	< 5%	6, 10, 12, 18, 19, 29, 32

Scientific Name	Common Name	Status†	Quadrats	Average % Cover per Quadrat	Quadrat Number(s)
Potamogeton crispus	Curly leaf pondweed	Introduced, invasive	6	< 5%	5, 25, 32, 42, 49, 51
Cephalanthus occidentalis	Buttonbush	Native, secure	5	< 5%	33, 69, 81, 84, 85
Sagittaria latifolia	Common arrowhead	Native, secure	5	< 5%	1, 17, 32, 42, 60
Spirodela polyrrhiza	Common duck-meal	Native, secure	5	< 5%	9, 28, 29, 30, 33
Brasenia schreberi	Water-shield	Native, secure	4	< 5%	9, 19, 26, 27
Elodea canadensis	Common waterweed	Native, secure	2	< 5%	84, 85
Impatiens capensis	Jewelweed	Native, secure	2	< 5%	81, 85
*Myriophyllum sibricum***	Northern watermilfoil	Native, critically imperiled/imperiled (watch list)	2	6–25%	1, 2
Phalaris arundinacea	Reed canarygrass	Introduced, secure, invasive	2	< 5%	84, 85
Iris pseudacorus	Yellow iris	Introduced, invasive	1	< 5%	33
Potamogeton robbinsii	Robbins' pondweed	Native, secure	1	< 5%	9

† Status as defined by Cullina, 2011 (native, introduced; endangered, threatened, special concern, watch list, historic; secure = common/widespread, apparently secure = uncommon but not rare, * = Status in Hampshire County is not documented)

** Tentative identification (no fruits or flowers visible). If management efforts may potentially impact this portion of the lake, the Friends will need to positively identify these plants. Additional Massachusetts Endangered Species Act (MEPA) permitting will be required if these plants are confirmed to be northern watermilfoil. Specific avoidance measures may be needed if it is positively identified as such.

Table 2. Total Percent Cover of Vegetation within Quadrats by Percent Cover Groupings

Total % Cover	Percent of Quadrats	Quadrat Numbers
< 5%	9%	4, 6, 7, 8, 13, 15, 16, 69
6-25%	19%	1, 2, 3, 5, 9, 12, 14, 17, 22, 24, 32, 49, 52, 68, 76, 85
26-50%	26%	23, 25, 31, 34, 35, 36, 41, 42, 46, 51, 56, 60, 61, 63, 64, 65, 67, 70, 75, 77, 80, 84
51-75%	18%	28, 37, 40, 47, 50, 55, 57, 58, 66, 73, 74, 78, 79, 82, 83
76-100%	28%	10, 11, 18, 19, 20, 21, 26, 27, 29, 30, 33, 38, 39, 43, 44, 45, 48, 53, 54, 59, 62, 71, 72, 81

Note: Total percent cover has been estimated based on the absolute percent cover of each identified plant species.

3 WATER AND SEDIMENT SAMPLING AND ANALYSIS PROGRAM

SWCA conducted a water and sediment sampling and analysis program at Lake Warner on September 28, 2023, in order to better understand the current status of the pond in terms of water quality, sediment composition, nutrient levels, and overall health. A description of the sampling and analysis program, laboratory results, and conclusions are presented below in Sections 3.1 and 3.2.

3.1 Water Quality Sampling and Analysis Results

SWCA collected two sets of surface water and deepwater samples from Lake Warner (SW01/DW01 and SW02/DW02). The first set (SW01/DW01) was collected from the eastern end of Lake Warner near the inflow of the Mill River and a smaller tributary. The second set (SW02/DW02) was collected from the western end of the lake near the boat ramp. Figure 2 (Attachment B) shows the location of each of the water sampling locations.

The surface water samples were collected from the top of the water column at each location. The deepwater samples were collected within 1 foot of the bottom of the water column using clean tubing and a battery pump.

The water samples were collected and placed in pre-cleaned laboratory containers and submitted under chain of custody to Alpha Analytical, Inc., of Westborough, Massachusetts. The samples were analyzed for Total Hardness (SM 2340B), Turbidity (SM 2130), Total Alkalinity (SM 2320), Specific Conductance (EPA 9050), pH (EPA 9040), Ammonia Nitrogen (SM 4500), Nitrite Nitrogen (SM 4500), Nitrate Nitrogen (SM 4500), Total Kjeldahl Nitrogen (SM 4500), Dissolved Oxygen (SM 4500), Total Phosphorus (SM 4500), and Chlorophyll A (SM 10200H). Laboratory analytical results are summarized in Table 3 and laboratory analytical reports are provided in Attachment C.

Table 3. Water Quality Laboratory Results

Analyte	SW01	DW01	SW02	DW02	Notes
Hardness (mg/L)	36.0	35.3	33.5	35.1	Soft (0–60)
Turbidity (NTU)	2.3	2.2	1.8	180.0	Drinking water standard (<10); potential impact to aquatic life (>50)

Analyte	SW01	DW01	SW02	DW02	Notes
Alkalinity, Total (mg CaCO3/L)	26.8	28.2	28.0	27.2	Low buffered (</= 50)
Specific Conductance @ 25C (µmhos/cm)	190.0	190.0	180.0	180.0	Relatively low (< 5000 µmhos/cm)
pH	7.53	7.36	7.40	6.78	Standard for typical freshwaters
Nitrogen, Ammonia (mg/L)	ND	ND	ND	0.108	See Nitrate/Nitrate
Nitrogen, Nitrite (mg/L)	ND	ND	ND	ND	Typical freshwaters (<1)
Nitrogen, Nitrate (mg/L)	0.625	0.635	0.495	0.503	Typical freshwaters (<1)
Nitrogen, Total Kjeldahl (mg/L)	0.381	0.367	0.526	3.0	See Nitrate/Nitrate
Dissolved Oxygen (mg/L)	9.0	9.0	10.0	8.2	Typical for freshwater (>8.0)
Phosphorus, Total (mg/L)	0.026	0.026	0.037	0.889	Eutrophic (0.025–0.096); hypereutrophic (>0.096)
Chlorophyll A (mg/m3)	ND	2.46	3.82	955.0	Oligotrophic (<2.6); Mesotrophic (2.7–20) Hypereutrophic (>56)

ND = Not detected at the reporting limit for the sample.

As was noted in previous studies of the pond, the 2023 water sampling results show that the pond is eutrophic to hypereutrophic based on phosphorus concentrations in all four samples. The surface water and deepwater samples from the upstream end of the lake (SW01/DW01) display a eutrophic state, while the downstream samples (SW02/DW02) display a hypereutrophic state. As Lake Warner receives a lot of water and, therefore, the flow of water from up to downstream is strong (especially during large storm events), it is logical to assume that sediments deposit toward the downstream end, ahead of the dam. The lake has been assessed as impaired for high phosphorus concentrations, excess algal growth, and organic enrichment. No nutrient management has been conducted within the lake and it is likely that a steady flow of nutrient-laden sediment will continue to enter the lake. Therefore, this result is not surprising and will not change without significant intervention.

Lake Warner also appears to be low buffered, which means that the lake is more at risk to fluctuations in pH, which could negatively affect aquatic wildlife. All nitrogen levels, pH, turbidity, and dissolved oxygen were observed as either good or within normal levels for freshwater ponds. However, SWCA notes that there have been impairments noted for dissolved oxygen in past years. This difference could be attributed to cooler temperatures at the time of the survey, or other environmental factors. Whatever the cause, this is a surprising result considering the amount of aquatic vegetation present within the pond. It is very likely that, if sampled a few weeks later (early to mid-October), dissolved oxygen levels would have been much lower due to the rapid decomposition of the aquatic vegetation within the lake.

3.2 Sediment Sampling and Analysis Results

SWCA collected two composite surficial sediment samples from the bottom of Lake Warner (SS01 and SS02). Composite sediment sample SS01 was collected from the eastern end of the lake near the inflow of the Mill River and a smaller tributary. Composite sediment sample SS02 was collected at the western end of the lake near the boat ramp. Figure 2 (Attachment B) shows the location of each of the sediment sampling locations.

The two composite samples each consisted of three sub-samples collected from the top 1 foot of the sediment column and thoroughly mixed together in a stainless-steel bowl. The sediment samples were collected using a Wildco grab dredge sediment sampler.

The purpose of this surficial sediment sampling is to identify the accumulated sediment type and to determine whether there is a high content of phosphorus in the accumulated sediment in the lake. Each composite sediment sample ID, number of sub-samples, date of collection, and a description of the sediment are included in Table 4.

Table 4. Lake Warner Composite Sediment Sample Descriptions

Sediment Sample ID	Collection Date	Number of Sub-samples	Sediment Description
SS01	September 28, 2023	3	Dark brown silt and sand, organics.
SS02	September 28, 2023	3	Dark brown silt, trace sand and organics.

The sediment samples were collected, composited, and placed in pre-cleaned laboratory containers and submitted under chain of custody to Alpha Analytical, Inc., of Westborough, Massachusetts. The samples were analyzed for Total Phosphorous (EPA/APHA/SW-846 Method SM 21-22 4500 P E Modified), Total Solids (%) (EPA/APHA/SW-846 Method SM 2540G), and Total Organic Matter (%) (ASTM D2974). Laboratory analytical results are summarized in Table 5 and laboratory analytical reports are provided in Attachment C.

Table 5. Lake Warner Sediment Sample Analytical Results

Analyte	SS01	SS02
Total Solids (%)	96.7	98.1
Total Phosphorus (mg/kg)	380	360
Total Organic Matter (%)	2.2	3.3

As shown in Table 5, the analytical results indicate that elevated concentrations of total phosphorus were detected in the surficial sediments at both ends of Lake Warner. The total phosphorus concentrations were similar at both ends of the lake, ranging from 380 milligrams/kilogram (parts per million [ppm]) in composite sample SS01 to 360 ppm in composite sample SS02. The average total phosphorus loading in surficial sediments is 370 ppm.

The elevated concentrations of total phosphorus in Lake Warner may be due to influent sources of phosphorous from groundwater, existing geology, or historic uses of the pond and nearby land including the agricultural farms and residential development that surround the lake. However, historic use of the lake suggests that the primary contribution of phosphorus and nutrient-laden sediments is likely from the Mill River which is the main influent source for Lake Warner at the eastern end. The Mill River watershed includes stormwater runoff from the town of Amherst, the University of Massachusetts campus, and the Town of Amherst Wastewater Treatment Plant.

4 CONCLUSIONS AND RECOMMENDATIONS

Lake Warner contains an extremely diverse range of submerged and aquatic plant species, with the majority of those plants being native to Hampshire County, Massachusetts. While this is valuable, and not often the case within freshwater lakes and ponds of Massachusetts, the plants are also very dense throughout the lake. This density results in a number of water quality and habitat quality issues. Firstly, with almost no open water areas, there is not a very high diversity of wildlife habitat within the water column.

Secondly, the very dense populations of submerged and floating aquatic plant species result in a cycle of high nutrient loading on an annual basis and may also result in low dissolved oxygen levels during plant decomposition seasonally. While dissolved oxygen would be fairly high during peak photosynthesis, the decomposition of dense vegetation at the end of the field season could dramatically reduce dissolved oxygen to the point that it could be harmful to wildlife in the lake. The dense vegetation could also affect the ability for water to circulate between the lower and upper portions of the water column. Increasing circulation of water can help process nutrients within the water column and improve or maintain lower levels of nutrients. Thirdly, the density of vegetation throughout much of the waterbody diminishes the recreational value of the waterbody. Improving the recreational value of the waterbody is a high priority for the Friends. Lake Warner is an important historic feature in the landscape of the Amherst-Hadley area, and managing the dense vegetation within the lake could result in gains to the aesthetic and recreational benefits it provides.

SWCA understands that the Friends are looking for recommendations to improve overall habitat value and water quality within Lake Warner. Some high-impact measures to achieve these goals are managing invasive plant species, thinning submerged and floating aquatic vegetation in portions of the waterbody, and attempting to reduce nutrient loading within the lake. Table 6 includes a full summary of the relevant management options for the vegetative and nutrient-loading issues within Lake Warner.

The Friends have conducted hand-pulling of water chestnut in recent years and have managed some water shield and water lilies during these activities. However, these have been small-scale efforts and the Friends are currently looking for broader and larger management efforts to improve habitat value within the lake. Due to the high diversity of vegetation within the lake, there are not many chemical management options that would work well and also be selective enough to reduce non-target impacts. However, the chemical options included in Table 6 were chosen for their ability to be more selective. Both of these herbicide options are proposed primarily to target water chestnut, but would also work fairly well on some lily and watershield species.

ProcellaCOR is one of the most environmentally sensitive herbicides on the market. ProcellaCOR's very low impact allowed it to qualify for a special expedited approval process, which means that the results of rigorous testing were so conclusive that the approval process was able to be shortened at the federal level. ProcellaCOR is a systemic aquatic herbicide that is selective to milfoil species and select other aquatic vegetation (*Azolla* sp., *Eichhornia* sp., *Alternanthera philoxeroides*, *Nelumbo lutea*, *Nyphoides* sp., *Hydrocotyle umbellata*, *Ludwigia* sp., *Brasenia schreberi*, *Bacopa* sp., *Ceratophyllum demersum*, *Hydrilla verticillata*, and *Trapa* sp.). The other herbicide, Clearcast, is selective as well, but could impact a broader range of non-target species. Clearcast would be effective for water chestnut management. However, it is usually applied as a foliar application to vegetation above the water's surface and works best when directly applied to the leaf surface of target plants without water washing over the top and diluting the herbicide's effect.

The best recommendation for broadscale management of dense vegetation within Lake Warner includes a combination of methods detailed in Table 6. SWCA recommends testing out pilot management programs in high-priority sections of the Lake. For instance, hydroraking could be applied in specific open water corridors within portions of the lake. SWCA recommends focusing on the deeper portions of the lake, as much of the lake is shallow and nuisance vegetation will quickly and easily fill back in those managed sections. Along with hydroraking, the Friends may consider conducting further manual removal of invasive plant species to prevent their spread into the newly-open areas throughout the lake. These two methods could be paired with very selective herbicide applications to promote more long-term effects, while ensuring that non-target impacts are minimized as much as possible.

Finally, SWCA recommends that the Friends consider alum dosing to capture any nutrients locked in the water column. This would also provide a barrier on the base of the lake to prevent the recirculation of these nutrients. However, it should be noted that other measures for reducing the inflow of nutrients from upstream would need to be implemented for this to be a long-term solution.

Table 6. Lake Warner Management Options Matrix

Management Strategy	Type	Efficacy	Cost	Timing	Permitting*	Notes
DASH	Mechanical	WC ↑↓ CLP ↓	Medium	Growing Season	Basic permitting (see note)	• High efficacy for non-fragmenting species (water chestnut) but not efficient on curly leaf pondweed • Fairly expensive for all controlled species compared to other mechanical methods • No human health effects or non-target species impacts
Hand Pulling	Mechanical	WC: ↑ CPL: ↓	Medium	Growing Season	Basic permitting (see note)	• High efficacy for water chestnut but not efficient • Very low efficacy for curly-leaf pondweed • Fairly expensive if professionally done, but volunteers can help • No human health effects or non-target species impacts
Harvester	Mechanical	WC: ↑ CPL: ↓	Medium	Growing Season	Basic permitting (see note)	• Fair efficacy water chestnut, but not commonly done • Low efficacy for curly-leaf pondweed • Fairly inexpensive comparative to other mechanical methods • No human health effects but not much selectivity
Hydroraking	Mechanical	WC: ↑ CPL: ↓ Nutrients: ↓	Medium	Growing Season	Potential other state permits (Chapter 91, e.g.) depending on volume removed	• Low efficacy for curly-leaf pondweed (fragmentation/spread) • High efficacy for water chestnut • Mid-cost mechanical management option • No human health effects but not much selectivity
Aeration	Mechanical	WC: ↓ CPL: ↓ Nutrients: **Mid**	Low	Growing Season	No permitting required unless aeration anchors impact resource areas	• Increases dissolved oxygen, improves fish habitat and water quality. • Higher efficacy usually only occurs when paired with other actions and requires a full bathymetric survey before install. • Life expectancy 5-7 years on aeration systems. Need to consider replacement and maintenance costs.
Dredging	Mechanical	WC: ↑ CPL: ↑ Nutrients: ↑	High	Autumn or During Low Water	Potential other state permits (Chapter 91, e.g.) depending on volume removed	• While this can be effective for nutrients as well as both invasive plants, nutrients will likely continue to enter the lake and curly-leaf pondweed may spread through fragmentation. • Extremely expensive ○ Extra fees for permitting, planning, and engineering • Decrease lake diversity in dredged locations • No human health effects
Alum	Chemical	WC: none CPL: none Nutrients: ↑	High for nutrient loading	Early Spring and Repeated as Needed	Basic permitting (see note) License to Apply Chemicals to Waters of the Commonwealth Required	• Can easily be added to a treatment plan and not require additional permitting. • Can be very effective in reduction of nutrient loading, but will not continuously capture nutrients that continue to enter the lake.

Management Strategy	Type	Efficacy	Cost	Timing	Permitting*	Notes
Clearcast	Chemical	WC: ↑↓ CLP: ↓	Low	Early Growing Season	Basic permitting (see note) License to Apply Chemicals to Waters of the Commonwealth Required	• Apply with methylated seed oil (MSO) to emergent part of plant or as spot treatment using 2-5% Clearcast per spray volume. • Not selective. Use when potential for drift is minimal.
ProcellaCOR	Chemical	WC: ↑ CLP: none	Medium (~$8k/acre)	Growing Season	Basic permitting (see note) License to Apply Chemicals to Waters of the Commonwealth Required	• Long-lasting results (does not require multiple follow ups). • Selective, does not impact many native plant species • Non-toxic to humans • Can cause oxygen depletion if treating large areas.
PhosClear	Chemical	WC & CLP: ↓ Nutrients: ↑	Low ($130/acre)	Early Spring and/or Early Fall	Basic permitting (see note) License to Apply Chemicals to Waters of the Commonwealth Required	• Several applications may be needed each growing season • Safe for fish and native plants

Notes: WC = water chestnut; CLP = curly-leaf pondweed; * All of these potential management strategies would require the submission of a Notice of Intent through the local Conservation Commission and MassDEP. Depending on what portion of the Lake will be receiving treatment, NEHSP may need to be contact to see if this project would require MESA permitting as well. A portion of the northern section of the lake is in Priority Habitats of Rare Species.

5 LITERATURE CITED

Boehmer et al. 2011. Mount Warner Resource Inventory & Stewardship Plan. On file, University of Massachusetts, Amherst, Massachusetts.

Cullina et al. 2011. The Vascular Plants of Massachusetts: A County Checklist (First Revision). Massachusetts Natural Heritage & Endangered Species Program and Massachusetts Division of Fisheries and Wildlife.

Johnson, 2011. State of the Lake Report 2019. Prepared for the Town of Hadley, Massachusetts. Hadley, Massachusetts: Friends of Lake Warner.

MassWildlife. 2018. Lake Warner North Hadley. On file, Belchertown, Massachusetts.

University of Massachusetts and Geosyntec Consultants, Inc. 2019. Watershed-Based Plan: Mill River Watershed within the Towns of Hadley, Amherst, Sunderland, Leverett and Shutesbury. Prepared for MassDEP. Massachusetts.

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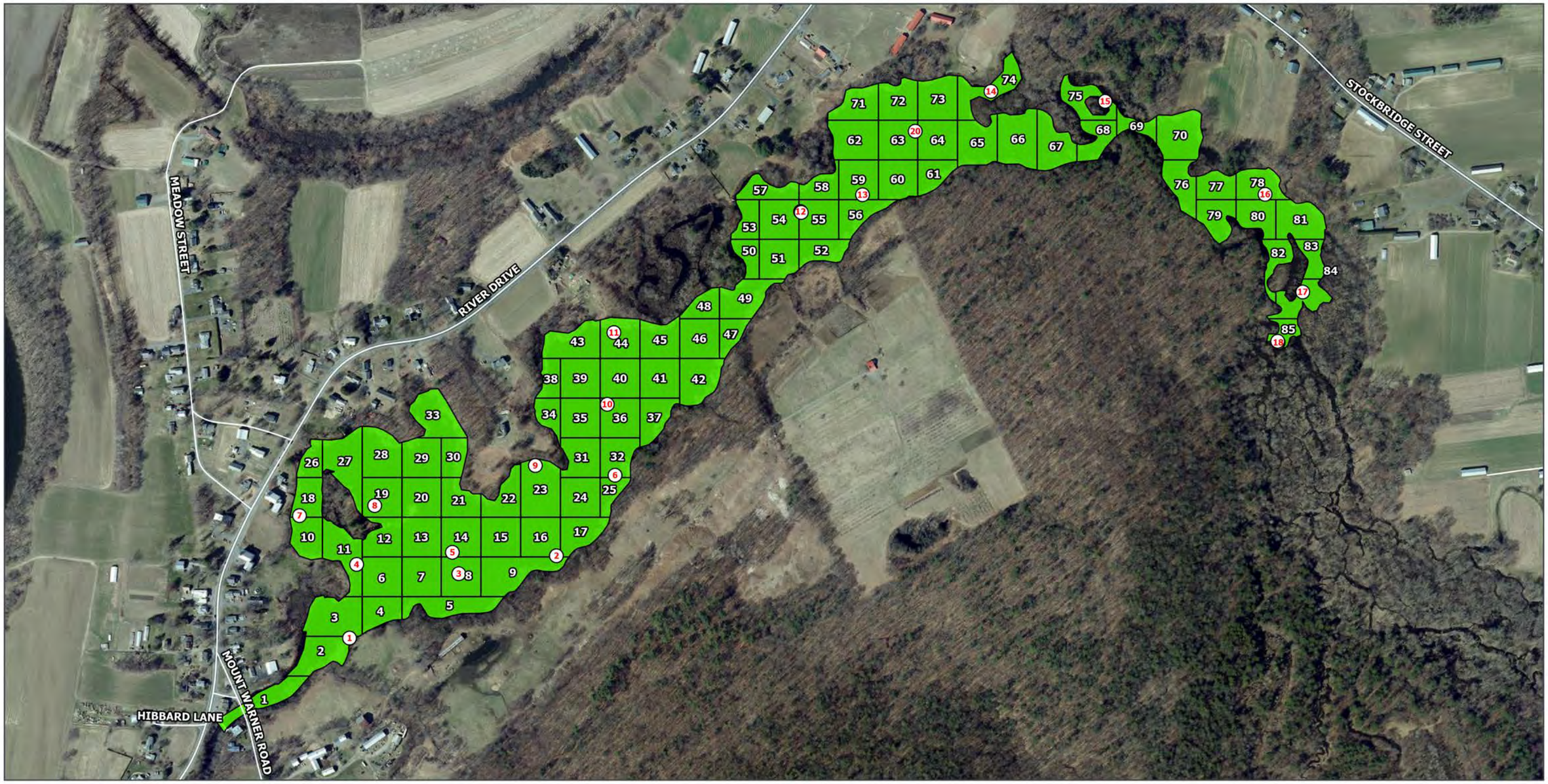
APPENDIX A

Quadrat Overview



LAKE WARNER WATERBODY ASSESSMENT

Figure 1. Plant Survey Index

Hadley, MA
NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
42.3903°N 72.5713°W

0 250 500 Feet
0 50 100 Meters

N

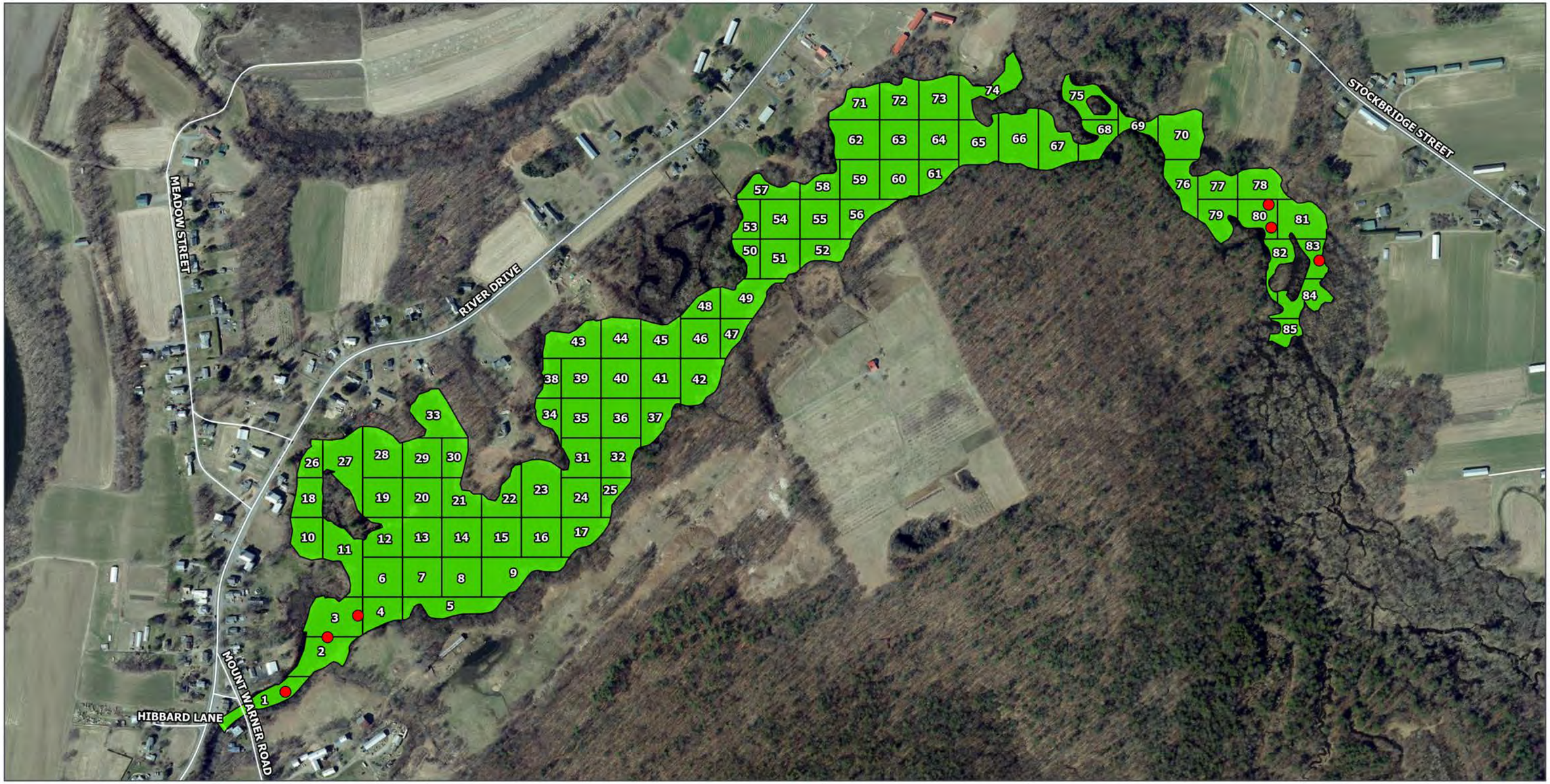
1:6,000

Base Map: Esri ArcGIS Online, accessed November 2023
Updated: 11/20/2023
Project No. 81887
Layout: 81887 Lake Warner 2023 Results Aprx: 887_lakeWarnerWaterbodyAssessment

SWCA ENVIRONMENTAL CONSULTANTS

APPENDIX B

Water and Soil Sampling Locations



LAKE WARNER WATERBODY ASSESSMENT

Figure 2. Sampling Locations

- Sampling Location
- Plant Survey Index

Hadley, MA
NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet
42.3903°N 72.5713°W

0 250 500 Feet
0 50 100 Meters

N

1:6,000

Base Map: Esri ArcGIS Online, accessed November 2023
Updated: 11/30/2023
Project No. 81887
Layout: 81887 Lake Warner 2023 Samples Aprx: 887_lakeWarnerWaterbodyAssessment

SWCA ENVIRONMENTAL CONSULTANTS

APPENDIX C

Sampling Analysis Results

ANALYTICAL REPORT

Lab Number:	L2357258
Client:	SWCA Environmental Consultants 15 Research Drive Amherst, MA 01002
ATTN:	Joel Harris
Phone:	(413) 256-0202
Project Name:	LAKE WARNER
Project Number:	81887
Report Date:	10/09/23

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0826), IL (200077), IN (C-MA-03), KY (KY98045), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), OH (CL108), OR (MA-1316), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #525-23-122-91930).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: LAKE WARNER
Project Number: 81887

Lab Number: L2357258
Report Date: 10/09/23

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2357258-01	SW01	WATER	HADLEY, MA	09/28/23 10:00	09/28/23
L2357258-02	DW01	WATER	HADLEY, MA	09/28/23 10:30	09/28/23
L2357258-03	SW02	WATER	HADLEY, MA	09/28/23 11:15	09/28/23
L2357258-04	DW02	WATER	HADLEY, MA	09/28/23 11:26	09/28/23
L2357258-05	SS01	SOIL	HADLEY, MA	09/28/23 10:15	09/28/23
L2357258-06	SS02	SOIL	HADLEY, MA	09/28/23 11:35	09/28/23

Project Name:	LAKE WARNER	**Lab Number:**	L2357258
Project Number:	81887	**Report Date:**	10/09/23

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name:	LAKE WARNER	**Lab Number:**	L2357258
Project Number:	81887	**Report Date:**	10/09/23

Case Narrative (continued)

Dissolved Oxygen

L2357258-01 through -04: The sample was analyzed with the method required holding time exceeded.

Chlorophyll A

The WG1833434-2 Laboratory Duplicate RPD for chlorophyll a (49%), performed on L2357258-03, is above the acceptance criteria; however, the sample and duplicate results are less than five times the reporting limit. Therefore, the RPD is valid.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Caitlin Walukevich

Caitlin Walukevich

Title: Technical Director/Representative Date: 10/09/23

METALS

Project Name: LAKE WARNER
Lab Number: L2357258
Project Number: 81887
Report Date: 10/09/23

SAMPLE RESULTS

Lab ID: L2357258-01
Client ID: SW01
Sample Location: HADLEY, MA
Date Collected: 09/28/23 10:00
Date Received: 09/28/23
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	36.0		mg/l	0.660	NA	1	10/03/23 15:01	10/03/23 21:21	EPA 3005A	1,6010D	TAA

Project Name: LAKE WARNER
Lab Number: L2357258
Project Number: 81887
Report Date: 10/09/23

SAMPLE RESULTS

Lab ID: L2357258-02
Client ID: DW01
Sample Location: HADLEY, MA
Date Collected: 09/28/23 10:30
Date Received: 09/28/23
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	35.3		mg/l	0.660	NA	1	10/03/23 15:01	10/03/23 21:24	EPA 3005A	1,6010D	TAA

Project Name: LAKE WARNER
Project Number: 81887
Lab Number: L2357258
Report Date: 10/09/23

SAMPLE RESULTS

Lab ID: L2357258-03
Client ID: SW02
Sample Location: HADLEY, MA
Sample Depth:
Matrix: Water

Date Collected: 09/28/23 11:15
Date Received: 09/28/23
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	33.5		mg/l	0.660	NA	1	10/03/23 15:01	10/03/23 21:27	EPA 3005A	1,6010D	TAA

Project Name: LAKE WARNER
Lab Number: L2357258
Project Number: 81887
Report Date: 10/09/23

SAMPLE RESULTS

Lab ID: L2357258-04
Client ID: DW02
Sample Location: HADLEY, MA
Date Collected: 09/28/23 11:26
Date Received: 09/28/23
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Prep Method	Analytical Method	Analyst
Total Hardness by SM 2340B - Mansfield Lab											
Hardness	35.1		mg/l	0.660	NA	1	10/03/23 15:01	10/03/23 21:30	EPA 3005A	1,6010D	TAA

Project Name: LAKE WARNER
Project Number: 81887
Lab Number: L2357258
Report Date: 10/09/23

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
Total Hardness by SM 2340B - Mansfield Lab for sample(s): 01-04 Batch: WG1834934-1										
Hardness	ND		mg/l	0.660	NA	1	10/03/23 15:01	10/03/23 20:41	1,6010D	TAA

Prep Information

Digestion Method: EPA 3005A

Lab Control Sample Analysis

Batch Quality Control

Project Name: LAKE WARNER
Project Number: 81887

Lab Number: L2357258
Report Date: 10/09/23

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Total Hardness by SM 2340B - Mansfield Lab	Associated sample(s): 01-04		Batch: WG1834934-2					
Hardness	105		-		80-120	-		

Matrix Spike Analysis
Batch Quality Control

Project Name: LAKE WARNER
Project Number: 81887

Lab Number: L2357258
Report Date: 10/09/23

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
Total Hardness by SM 2340B - Mansfield Lab Associated sample(s): 01-04 QC Batch ID: WG1834934-3 QC Sample: L2357133-01 Client ID: MS Sample												
Hardness	42.5	66.2	113	106		-	-		75-125	-		20

INORGANICS
&
MISCELLANEOUS

Project Name: LAKE WARNER
Project Number: 81887

Lab Number: L2357258
Report Date: 10/09/23

SAMPLE RESULTS

Lab ID: L2357258-01
Client ID: SW01
Sample Location: HADLEY, MA

Date Collected: 09/28/23 10:00
Date Received: 09/28/23
Field Prep: Not Specified

Sample Depth:
Matrix: Water

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	2.3		NTU	0.20	--	1	-	09/29/23 20:47	121,2130B	AAS
Alkalinity, Total	26.8		mg CaCO3/L	2.00	NA	1	-	10/07/23 13:39	121,2320B	MRM
Specific Conductance @ 25 C	190		umhos/cm	10	--	1	-	09/29/23 19:00	1,9050A	AAS
pH (H)	7.53		SU	-	NA	1	-	10/05/23 21:07	1,9040C	AAS
Nitrogen, Ammonia	ND		mg/l	0.075	--	1	10/08/23 23:30	10/09/23 14:59	121,4500NH3-BH	AVT
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	09/29/23 06:31	121,4500NO3-F	KAF
Nitrogen, Nitrate	0.625		mg/l	0.100	--	1	-	09/29/23 06:31	121,4500NO3-F	KAF
Nitrogen, Total Kjeldahl	0.381		mg/l	0.300	--	1	10/06/23 20:00	10/08/23 12:28	121,4500NH3-H	AVT
Dissolved Oxygen	9.0		mg/l	0.10	--	1	-	09/28/23 19:55	121,4500O-C	PLB
Phosphorus, Total	0.026		mg/l	0.010	--	1	10/03/23 19:32	10/03/23 21:05	121,4500P-E	MEF
Chlorophyll A	ND		mg/m3	2.00	NA	1	09/28/23 21:24	09/29/23 17:31	121,10200H	JAI

Project Name: LAKE WARNER
Project Number: 81887
Lab Number: L2357258
Report Date: 10/09/23

SAMPLE RESULTS

Lab ID: L2357258-02
Client ID: DW01
Sample Location: HADLEY, MA
Sample Depth:
Matrix: Water

Date Collected: 09/28/23 10:30
Date Received: 09/28/23
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	2.2		NTU	0.20	--	1	-	09/29/23 20:47	121,2130B	AAS
Alkalinity, Total	28.2		mg CaCO3/L	2.00	NA	1	-	10/07/23 13:41	121,2320B	MRM
Specific Conductance @ 25 C	190		umhos/cm	10	--	1	-	09/29/23 19:00	1,9050A	AAS
pH (H)	7.36		SU	-	NA	1	-	10/05/23 21:07	1,9040C	AAS
Nitrogen, Ammonia	ND		mg/l	0.075	--	1	10/08/23 23:30	10/09/23 15:00	121,4500NH3-BH	AVT
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	09/29/23 06:42	121,4500NO3-F	KAF
Nitrogen, Nitrate	0.635		mg/l	0.100	--	1	-	09/29/23 06:42	121,4500NO3-F	KAF
Nitrogen, Total Kjeldahl	0.367		mg/l	0.300	--	1	10/06/23 20:00	10/08/23 12:29	121,4500NH3-H	AVT
Dissolved Oxygen	9.0		mg/l	0.10	--	1	-	09/28/23 19:55	121,4500O-C	PLB
Phosphorus, Total	0.026		mg/l	0.010	--	1	10/03/23 19:32	10/03/23 21:06	121,4500P-E	MEF
Chlorophyll A	2.46		mg/m3	2.00	NA	1	09/28/23 21:24	09/29/23 17:31	121,10200H	JAI

Project Name: LAKE WARNER
Project Number: 81887
Lab Number: L2357258
Report Date: 10/09/23

SAMPLE RESULTS

Lab ID: L2357258-03
Client ID: SW02
Sample Location: HADLEY, MA
Sample Depth:
Matrix: Water

Date Collected: 09/28/23 11:15
Date Received: 09/28/23
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	1.8		NTU	0.20	--	1	-	09/29/23 20:47	121,2130B	AAS
Alkalinity, Total	28.0		mg CaCO3/L	2.00	NA	1	-	10/07/23 13:43	121,2320B	MRM
Specific Conductance @ 25 C	180		umhos/cm	10	--	1	-	09/29/23 19:00	1,9050A	AAS
pH (H)	7.40		SU	-	NA	1	-	10/05/23 21:07	1,9040C	AAS
Nitrogen, Ammonia	ND		mg/l	0.075	--	1	10/08/23 23:30	10/09/23 15:01	121,4500NH3-BH	AVT
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	09/29/23 06:43	121,4500NO3-F	KAF
Nitrogen, Nitrate	0.495		mg/l	0.100	--	1	-	09/29/23 06:43	121,4500NO3-F	KAF
Nitrogen, Total Kjeldahl	0.526		mg/l	0.300	--	1	10/06/23 20:00	10/08/23 12:30	121,4500NH3-H	AVT
Dissolved Oxygen	10.		mg/l	0.10	--	1	-	09/28/23 19:55	121,4500O-C	PLB
Phosphorus, Total	0.037		mg/l	0.010	--	1	10/03/23 19:32	10/03/23 21:06	121,4500P-E	MEF
Chlorophyll A	3.82		mg/m3	2.00	NA	1	09/28/23 21:24	09/29/23 17:31	121,10200H	JAI

Project Name: LAKE WARNER
Project Number: 81887
Lab Number: L2357258
Report Date: 10/09/23

SAMPLE RESULTS

Lab ID: L2357258-04
Client ID: DW02
Sample Location: HADLEY, MA
Sample Depth:
Matrix: Water

Date Collected: 09/28/23 11:26
Date Received: 09/28/23
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Turbidity	180		NTU	1.0	--	5	-	09/29/23 20:47	121,2130B	AAS
Alkalinity, Total	27.2		mg CaCO3/L	2.00	NA	1	-	10/07/23 13:45	121,2320B	MRM
Specific Conductance @ 25 C	180		umhos/cm	10	--	1	-	09/29/23 19:00	1,9050A	AAS
pH (H)	6.78		SU	-	NA	1	-	10/05/23 21:07	1,9040C	AAS
Nitrogen, Ammonia	0.108		mg/l	0.075	--	1	10/08/23 23:30	10/09/23 15:05	121,4500NH3-BH	AVT
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	09/29/23 06:44	121,4500NO3-F	KAF
Nitrogen, Nitrate	0.503		mg/l	0.100	--	1	-	09/29/23 06:44	121,4500NO3-F	KAF
Nitrogen, Total Kjeldahl	3.00		mg/l	0.300	--	1	10/06/23 20:00	10/08/23 12:31	121,4500NH3-H	AVT
Dissolved Oxygen	8.2		mg/l	0.10	--	1	-	09/28/23 19:55	121,4500O-C	PLB
Phosphorus, Total	0.889		mg/l	0.050	--	5	10/03/23 19:32	10/03/23 21:07	121,4500P-E	MEF
Chlorophyll A	955		mg/m3	2.00	NA	1	09/28/23 21:24	09/29/23 17:31	121,10200H	JAI

Project Name: LAKE WARNER
Project Number: 81887

Lab Number: L2357258
Report Date: 10/09/23

SAMPLE RESULTS

Lab ID: L2357258-05
Client ID: SS01
Sample Location: HADLEY, MA

Date Collected: 09/28/23 10:15
Date Received: 09/28/23
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	96.7		%	0.100	NA	1	-	09/29/23 08:25	121,2540G	ROI
Phosphorus, Total	380		mg/kg	30	--	5.8	-	10/01/23 17:40	121,4500P-E	MEF
Organic Matter, Total	2.2		%	0.10	--	1	-	10/05/23 06:35	12,D2974	DEW

Project Name: LAKE WARNER
Project Number: 81887

Lab Number: L2357258
Report Date: 10/09/23

SAMPLE RESULTS

Lab ID: L2357258-06
Client ID: SS02
Sample Location: HADLEY, MA

Date Collected: 09/28/23 11:35
Date Received: 09/28/23
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	98.1		%	0.100	NA	1	-	09/29/23 08:25	121,2540G	ROI
Phosphorus, Total	360		mg/kg	24	--	4.7	-	10/01/23 17:40	121,4500P-E	MEF
Organic Matter, Total	3.3		%	0.10	--	1	-	10/05/23 06:35	12,D2974	DEW

Project Name: LAKE WARNER
Project Number: 81887
Lab Number: L2357258
Report Date: 10/09/23

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG1833434-1										
Chlorophyll A	ND		mg/m3	2.00	NA	1	09/28/23 21:24	09/29/23 17:31	121,10200H	JAI
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG1833476-1										
Nitrogen, Nitrite	ND		mg/l	0.050	--	1	-	09/29/23 03:13	121,4500NO3-F	KAF
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG1833483-1										
Nitrogen, Nitrate	ND		mg/l	0.100	--	1	-	09/29/23 03:28	121,4500NO3-F	KAF
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG1833920-1										
Turbidity	ND		NTU	0.20	--	1	-	09/29/23 20:47	121,2130B	AAS
General Chemistry - Westborough Lab for sample(s): 05-06 Batch: WG1834330-1										
Phosphorus, Total	ND		mg/kg	5.0	--	1	-	10/01/23 17:40	121,4500P-E	MEF
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG1835176-1										
Phosphorus, Total	ND		mg/l	0.010	--	1	10/03/23 19:32	10/03/23 20:39	121,4500P-E	MEF
General Chemistry - Westborough Lab for sample(s): 05-06 Batch: WG1835771-1										
Organic Matter, Total	ND		%	0.10	--	1	-	10/05/23 06:35	12,D2974	DEW
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG1836680-1										
Nitrogen, Total Kjeldahl	ND		mg/l	0.300	--	1	10/06/23 20:00	10/08/23 12:06	121,4500NH3-H	AVT
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG1836849-1										
Alkalinity, Total	ND		mg CaCO3/L	2.00	NA	1	-	10/07/23 12:15	121,2320B	MRM
General Chemistry - Westborough Lab for sample(s): 01-04 Batch: WG1837076-1										
Nitrogen, Ammonia	ND		mg/l	0.075	--	1	10/08/23 23:30	10/09/23 14:32	121,4500NH3-BH	AVT

Lab Control Sample Analysis

Batch Quality Control

Project Name: LAKE WARNER
Project Number: 81887

Lab Number: L2357258
Report Date: 10/09/23

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG1833476-2								
Nitrogen, Nitrite	103		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG1833483-2								
Nitrogen, Nitrate	104		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG1833885-1								
Specific Conductance	99		-		99-101	-		
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG1833920-2								
Turbidity	109		-		90-110	-		
General Chemistry - Westborough Lab Associated sample(s): 05-06 Batch: WG1834330-2								
Phosphorus, Total	93		-		52-148	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG1835176-2								
Phosphorus, Total	103		-		80-120	-		
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG1836212-1								
pH	101		-		99-101	-		5

Lab Control Sample Analysis

Batch Quality Control

Project Name: LAKE WARNER

Project Number: 81887

Lab Number: L2357258

Report Date: 10/09/23

Parameter	LCS %Recovery	LCSD %Recovery	%Recovery Limits	RPD	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG1836680-2					
Nitrogen, Total Kjeldahl	92	-	78-122	-	
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG1836849-2					
Alkalinity, Total	104	-	90-110	-	10
General Chemistry - Westborough Lab Associated sample(s): 01-04 Batch: WG1837076-2					
Nitrogen, Ammonia	100	-	80-120	-	20

Matrix Spike Analysis
Batch Quality Control

Project Name: LAKE WARNER
Project Number: 81887

Lab Number: L2357258
Report Date: 10/09/23

Parameter	Native Sample	MS Added	MS Found	MS %Recovery	Qual	MSD Found	MSD %Recovery	Qual	Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1833476-4 QC Sample: L2357258-01 Client ID: SW01												
Nitrogen, Nitrite	ND	4	3.95	99		-	-		80-120	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1833483-4 QC Sample: L2357258-01 Client ID: SW01												
Nitrogen, Nitrate	0.625	4	4.50	97		-	-		83-113	-		17
General Chemistry - Westborough Lab Associated sample(s): 05-06 QC Batch ID: WG1834330-4 QC Sample: L2356825-01 Client ID: MS Sample												
Phosphorus, Total	8800	805	8300	**0**	Q	-	-		75-125	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1835176-4 QC Sample: L2357192-01 Client ID: MS Sample												
Phosphorus, Total	0.030	0.5	0.523	99		-	-		75-125	-		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1836680-4 QC Sample: L2357205-07 Client ID: MS Sample												
Nitrogen, Total Kjeldahl	ND	8	7.65	96		-	-		77-111	-		24
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1836849-4 QC Sample: L2356537-03 Client ID: MS Sample												
Alkalinity, Total	43.6	100	139	96		-	-		86-116	-		10
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1837076-4 QC Sample: L2357146-01 Client ID: MS Sample												
Nitrogen, Ammonia	74.8	4	87.4	**315**	Q	-	-		80-120	-		20

Lab Duplicate Analysis
Batch Quality Control

Project Name: LAKE WARNER
Project Number: 81887

Lab Number: L2357258
Report Date: 10/09/23

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1833401-1 QC Sample: L2357258-04 Client ID: DW02						
Dissolved Oxygen	8.2	6.9	mg/l	17		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1833434-2 QC Sample: L2357258-03 Client ID: SW02						
Chlorophyll A	3.82	6.28	mg/m3	**49**	Q	35
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1833476-3 QC Sample: L2357258-01 Client ID: SW01						
Nitrogen, Nitrite	ND	ND	mg/l	NC		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1833483-3 QC Sample: L2357258-01 Client ID: SW01						
Nitrogen, Nitrate	0.625	0.596	mg/l	5		17
General Chemistry - Westborough Lab Associated sample(s): 05-06 QC Batch ID: WG1833558-1 QC Sample: L2357036-01 Client ID: DUP Sample						
Solids, Total	95.3	95.7	%	0		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1833885-2 QC Sample: L2356730-01 Client ID: DUP Sample						
Specific Conductance	390	400	umhos/cm	3		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1833920-3 QC Sample: L2357396-01 Client ID: DUP Sample						
Turbidity	1.5	1.5	NTU	0		13
General Chemistry - Westborough Lab Associated sample(s): 05-06 QC Batch ID: WG1834330-3 QC Sample: L2356825-01 Client ID: DUP Sample						
Phosphorus, Total	8800	9800	mg/kg	11		20
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1835176-3 QC Sample: L2357192-01 Client ID: DUP Sample						
Phosphorus, Total	0.030	0.030	mg/l	0		20

Lab Duplicate Analysis

Batch Quality Control

Project Name: LAKE WARNER
Project Number: 81887

Lab Number: L2357258
Report Date: 10/09/23

Parameter	Native Sample	Duplicate Sample	Units	RPD	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 05-06 QC Batch ID: WG1835771-2 QC Sample: L2357258-05 Client ID: SS01					
Organic Matter, Total	2.2	2.1	%	5	
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1836212-2 QC Sample: L2355809-01 Client ID: DUP Sample					
pH	7.44	7.48	SU	1	5
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1836680-3 QC Sample: L2357205-07 Client ID: DUP Sample					
Nitrogen, Total Kjeldahl	ND	0.359	mg/l	NC	24
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1836849-3 QC Sample: L2356537-03 Client ID: DUP Sample					
Alkalinity, Total	43.6	44.8	mg CaCO3/L	3	10
General Chemistry - Westborough Lab Associated sample(s): 01-04 QC Batch ID: WG1837076-3 QC Sample: L2357146-01 Client ID: DUP Sample					
Nitrogen, Ammonia	74.8	80.4	mg/l	7	20

Project Name: LAKE WARNER
Project Number: 81887

Lab Number: L2357258
Report Date: 10/09/23

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent
B	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2357258-01A	Plastic 250ml unpreserved/No Headspace	B	NA		5.0	Y	Absent		ALK-T-2320(14)
L2357258-01B	Plastic 250ml HNO3 preserved	B	<2	<2	5.0	Y	Absent		HARDT(180)
L2357258-01C	BOD bottle Powder Pillow preserved	B	NA		5.0	Y	Absent		DO-4500(.3)
L2357258-01D	BOD bottle Powder Pillow preserved	B	NA		5.0	Y	Absent		DO-4500(.3)
L2357258-01E	Plastic 500ml unpreserved	B	7	7	5.0	Y	Absent		TURB-2130(2),PH-9040(1),NO3-4500(2),NO2-4500NO3(2),COND-9050(28)
L2357258-01F	Plastic 950ml H2SO4 preserved	B	<2	<2	5.0	Y	Absent		TKN-4500(28),TPHOS-4500(28),NH3-4500(28)
L2357258-01G	Brown Plastic 1000ml unpreserved	B	NA		5.0	Y	Absent		CHLORO-A(1)
L2357258-01H	Brown Plastic 1000ml unpreserved	B	NA		5.0	Y	Absent		CHLORO-A(1)
L2357258-02A	Plastic 250ml unpreserved/No Headspace	B	NA		5.0	Y	Absent		ALK-T-2320(14)
L2357258-02B	Plastic 250ml HNO3 preserved	B	<2	<2	5.0	Y	Absent		HARDT(180)
L2357258-02C	BOD bottle Powder Pillow preserved	B	NA		5.0	Y	Absent		DO-4500(.3)
L2357258-02D	BOD bottle Powder Pillow preserved	B	NA		5.0	Y	Absent		DO-4500(.3)
L2357258-02E	Plastic 500ml unpreserved	B	7	7	5.0	Y	Absent		TURB-2130(2),PH-9040(1),NO3-4500(2),NO2-4500NO3(2),COND-9050(28)
L2357258-02F	Plastic 950ml H2SO4 preserved	B	<2	<2	5.0	Y	Absent		TKN-4500(28),TPHOS-4500(28),NH3-4500(28)
L2357258-02G	Brown Plastic 1000ml unpreserved	B	NA		5.0	Y	Absent		CHLORO-A(1)
L2357258-02H	Brown Plastic 1000ml unpreserved	B	NA		5.0	Y	Absent		CHLORO-A(1)
L2357258-03A	Plastic 250ml unpreserved/No Headspace	A	NA		4.9	Y	Absent		ALK-T-2320(14)
L2357258-03B	Plastic 250ml HNO3 preserved	A	<2	<2	4.9	Y	Absent		HARDT(180)
L2357258-03C	BOD bottle Powder Pillow preserved	A	NA		4.9	Y	Absent		DO-4500(.3)
L2357258-03D	BOD bottle Powder Pillow preserved	A	NA		4.9	Y	Absent		DO-4500(.3)
L2357258-03E	Plastic 500ml unpreserved	A	7	7	4.9	Y	Absent		TURB-2130(2),PH-9040(1),NO3-4500(2),NO2-4500NO3(2),COND-9050(28)

*Values in parentheses indicate holding time in days

Project Name: LAKE WARNER
Project Number: 81887

Lab Number: L2357258
Report Date: 10/09/23

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2357258-03F	Plastic 950ml H2SO4 preserved	A	<2	<2	4.9	Y	Absent		TKN-4500(28),TPHOS-4500(28),NH3-4500(28)
L2357258-03G	Brown Plastic 1000ml unpreserved	A	NA		4.9	Y	Absent		CHLORO-A(1)
L2357258-03H	Brown Plastic 1000ml unpreserved	A	NA		4.9	Y	Absent		CHLORO-A(1)
L2357258-04A	Plastic 250ml unpreserved/No Headspace	A	NA		4.9	Y	Absent		ALK-T-2320(14)
L2357258-04B	Plastic 250ml HNO3 preserved	A	<2	<2	4.9	Y	Absent		HARDT(180)
L2357258-04C	BOD bottle Powder Pillow preserved	A	NA		4.9	Y	Absent		DO-4500(.3)
L2357258-04D	BOD bottle Powder Pillow preserved	A	NA		4.9	Y	Absent		DO-4500(.3)
L2357258-04E	Plastic 500ml unpreserved	A	7	7	4.9	Y	Absent		TURB-2130(2),PH-9040(1),NO3-4500(2),NO2-4500NO3(2),COND-9050(28)
L2357258-04F	Plastic 950ml H2SO4 preserved	A	<2	<2	4.9	Y	Absent		TKN-4500(28),TPHOS-4500(28),NH3-4500(28)
L2357258-04G	Brown Plastic 1000ml unpreserved	A	NA		4.9	Y	Absent		CHLORO-A(1)
L2357258-04H	Brown Plastic 1000ml unpreserved	A	NA		4.9	Y	Absent		CHLORO-A(1)
L2357258-05A	Plastic 2oz unpreserved for TS	B	NA		5.0	Y	Absent		TS(7)
L2357258-05B	Glass 60mL/2oz unpreserved	B	NA		5.0	Y	Absent		TPHOS-4500(28),ORGMATTER(7)
L2357258-06A	Plastic 2oz unpreserved for TS	A	NA		4.9	Y	Absent		TS(7)
L2357258-06B	Glass 60mL/2oz unpreserved	A	NA		4.9	Y	Absent		TPHOS-4500(28),ORGMATTER(7)

*Values in parentheses indicate holding time in days

Project Name:	LAKE WARNER	**Lab Number:**	L2357258
Project Number:	81887	**Report Date:**	10/09/23

GLOSSARY

Acronyms

DL - Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

EDL - Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).

EMPC - Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.

EPA - Environmental Protection Agency.

LCS - Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LCSD - Laboratory Control Sample Duplicate: Refer to LCS.

LFB - Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.

LOD - Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

LOQ - Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)

MDL - Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

MS - Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.

MSD - Matrix Spike Sample Duplicate: Refer to MS.

NA - Not Applicable.

NC - Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.

NDPA/DPA - N-Nitrosodiphenylamine/Diphenylamine.

NI - Not Ignitable.

NP - Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.

NR - No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.

RL - Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.

RPD - Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.

SRM - Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.

STLP - Semi-dynamic Tank Leaching Procedure per EPA Method 1315.

TEF - Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.

TEQ - Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.

TIC - Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: Data Usability Report

Project Name:	LAKE WARNER	**Lab Number:**	L2357258
Project Number:	81887	**Report Date:**	10/09/23

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Chlordane: The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Gasoline Range Organics (GRO): Gasoline Range Organics (GRO) results include all chromatographic peaks eluting from Methyl tert butyl ether through Naphthalene, with the exception of GRO analysis in support of State of Ohio programs, which includes all chromatographic peaks eluting from Hexane through Dodecane.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

Report Format: Data Usability Report

Project Name:	LAKE WARNER	**Lab Number:**	L2357258
Project Number:	81887	**Report Date:**	10/09/23

Data Qualifiers

ND - Not detected at the reporting limit (RL) for the sample.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

V - The surrogate associated with this target analyte has a recovery outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Z - The batch matrix spike and/or duplicate associated with this target analyte has a recovery/RPD outside the QC acceptance limits. (Applicable to MassDEP DW Compliance samples only.)

Report Format: Data Usability Report

Project Name:	LAKE WARNER	**Lab Number:**	L2357258
Project Number:	81887	**Report Date:**	10/09/23

REFERENCES

1 Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. Third Edition. Updates I - VI, 2018.

12 Annual Book of ASTM Standards. (American Society for Testing and Materials) ASTM International.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625.1: alpha-Terpineol
EPA 8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 524.2: THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N**, SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables).
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb**,** As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 2

ALPHA ANALYTICAL

Westborough, MA
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA
TEL: 508-822-9300
FAX: 508-822-3288

Date Rec'd in Lab: 09/28/23

ALPHA Job #: L2357258

Project Information

Project Name: Lake Warner

Project Location: Hadley, MA

Project #: 81887

Project Manager: Joel Harris

ALPHA Quote #:

Client Information

Client: SWCA

Address: 15 Research Drive,

Amherst, MA

Phone: 413-530-7520

Fax:

Email: jaharris@swca.com

☐ These samples have been Previously analyzed by Alpha

Report Information Data Deliverables

☐ FAX ☒ EMAIL

☒ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info

PO #:

Regulatory Requirements/Report Limits

State/Fed Program

Criteria

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Other Project Specific Requirements/Comments/Detection Limits:

SAMPLE HANDLING
Filtration
☐ Done
☐ Not Needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ANALYSIS

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Total Alkalinity	Ammonia Nitrogen	Nitrate Nitrogen	Total Kjeldahl Nitrogen	Total Phosphorous	Chlorophyll A	Specific Conductance	Dissolved Oxygen	Turbidity	pH-Hydrogen Ion Concentration	Total Hardness		Sample Specific Comments
57258-01	SW01	9/28/23	10am	SW	JAH	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☐	9 of Top bottles
-02	DW01	9/28/23	10:30am	SW	JAH	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☐	
-03	SW02	9/28/23	11:15am	SW	JAH	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☐	
-04	DW02	9/28/23	11:26am	SW	JAH	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☐	
						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
				Container Type		-	-	-	-	-	-	-	-	-	-	-	-	
				Preservative		-	-	-	-	-	-	-	-	-	-	-	-	

Relinquished By:	Date/Time	Received By:	Date/Time
J Harris	9/28/23 3pm	[signature]	9/28/23 1631
[signature]	9/28/23 1812	[signature]	9/28/23 1812

Please print clearly, le and completely. Sam not be logged in and turnaround time clock start until any ambigui resolved. All samples submitted are subject Alpha's Payment Term

FORM NO: 01-01(I-HM) (rev. 5-JAN-12)

CHAIN OF CUSTODY

PAGE 2 OF 2

ALPHA ANALYTICAL

Westborough, MA TEL: 508-898-9220 FAX: 508-898-9193

Mansfield, MA TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab: 09/28/23

ALPHA Job #: L2357258

Project Information

Project Name: Lake Warner

Project Location: Hadley, MA

Project #: 81887

Project Manager: Joel Harris

ALPHA Quote #:

Client Information

Client: SWCA

Address: 15 Research Drive

Amherst, MA

Phone: 413-530-7520

Fax:

Email: jaharris@swca.com

☐ These samples have been Previously analyzed by Alpha

Turn-Around Time

☒ Standard ☐ Rush (ONLY IF PRE-APPROVED)

Due Date: Time:

Report Information Data Deliverables

☐ FAX ☒ EMAIL

☒ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed Program Criteria

Other Project Specific Requirements/Comments/Detection Limits:

ANALYSIS

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Total Phosphorous	Total Organic Matter	Total Solids										Sample Specific Comments
57258-05	SS01	9/28/23	10:15am	Sediment	JAH	☒	☒	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	
-06	SS02	9/28/23	11:35am	Sediment	JAH	☒	☒	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	
						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
Container Type						-	-	-	-	-	-	-	-	-	-	-	-	
Preservative						-	-	-	-	-	-	-	-	-	-	-	-	

SAMPLE HANDLING

Filtration

☐ Done

☐ Not Needed

☐ Lab to do

Preservation

☐ Lab to do

(Please specify below)

2 2 # of bottles

Relinquished By:	Date/Time	Received By:	Date/Time
JHarris	9/28/23 3pm	[signature]	9/28/23 1[illegible]
[signature]	9/28/23 1817	[signature]	9/28 1812

Please print clearly, le[gibly] and completely. Sam[ples can] not be logged in and turnaround time clock [will not] start until any ambigu[ities are] resolved. All samples submitted are subject [to] Alpha's Payment Term[s]

FORM NO: 01-01(I-NJ) (rev. 5-JAN-12)

APPENDIX D

Photograph Pages

Photo Point 1, Photo 1. Dense cover of emergent and floating vegetation. (9/6/2023)

Photo Point 1, Photo 2. Dense population of watermeal providing 100% cover. (9/6/2023)

Photo Point 2, Photo 1. Low density area with a population of bladderwort. (9/6/2023)

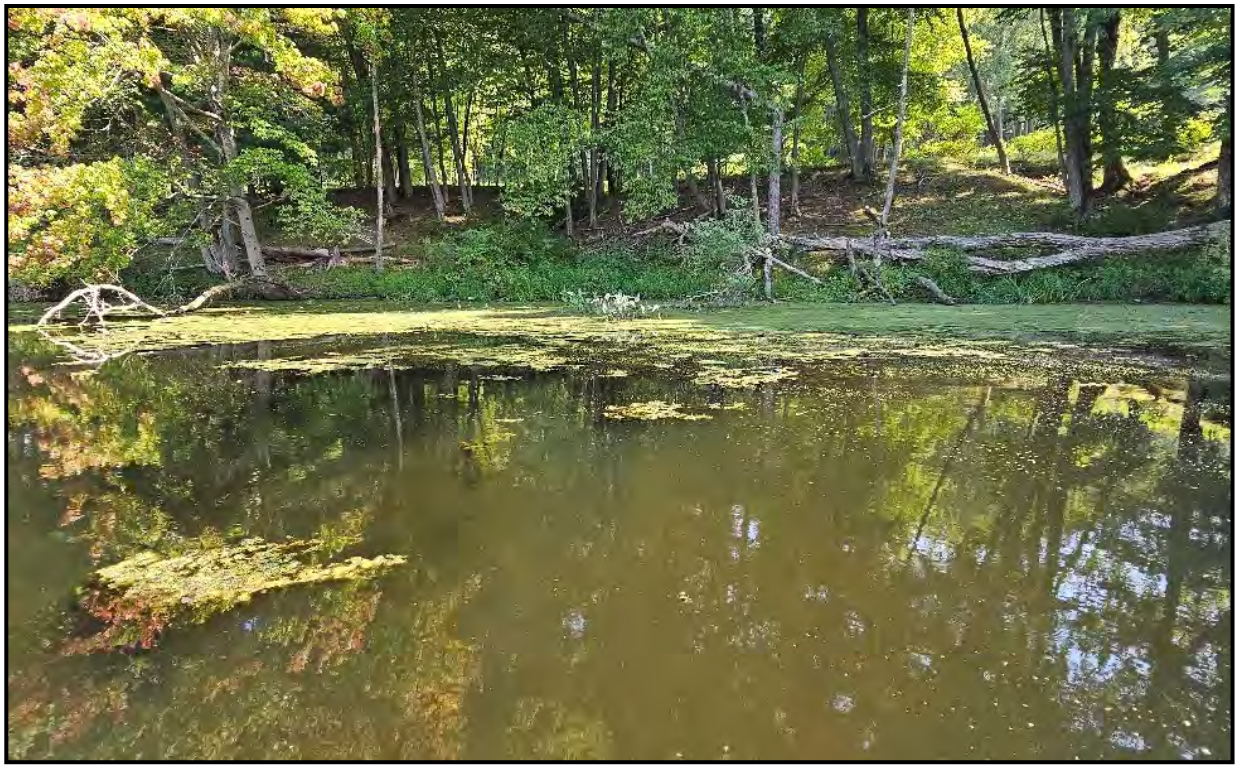


Photo Point 2, Photo 2. Low density are with duckweed, watermeal and bladderwort. (9/6/2023)

Photo Point 3, Photo 1. Low density area with bladderwort. (9/6/2023)

Photo Point 3, Photo 2. Very low density are with small populations of bladderwort. (9/6/2023)

Photo Point 4, Photo 1. Very high density area with bladderwort, watermeal and pond lily. (9/6/2023)

Photo Point 4, Photo 2. Very high density area of watermeal and pond lily. (9/6/2023)

Photo Point 4, Photo 3. Very high density area of watermeal and pond lily. (9/6/2023)

Photo Point 5, Photo 1. Low density area with bladderwort and watermeal in the background. (9/6/2023)

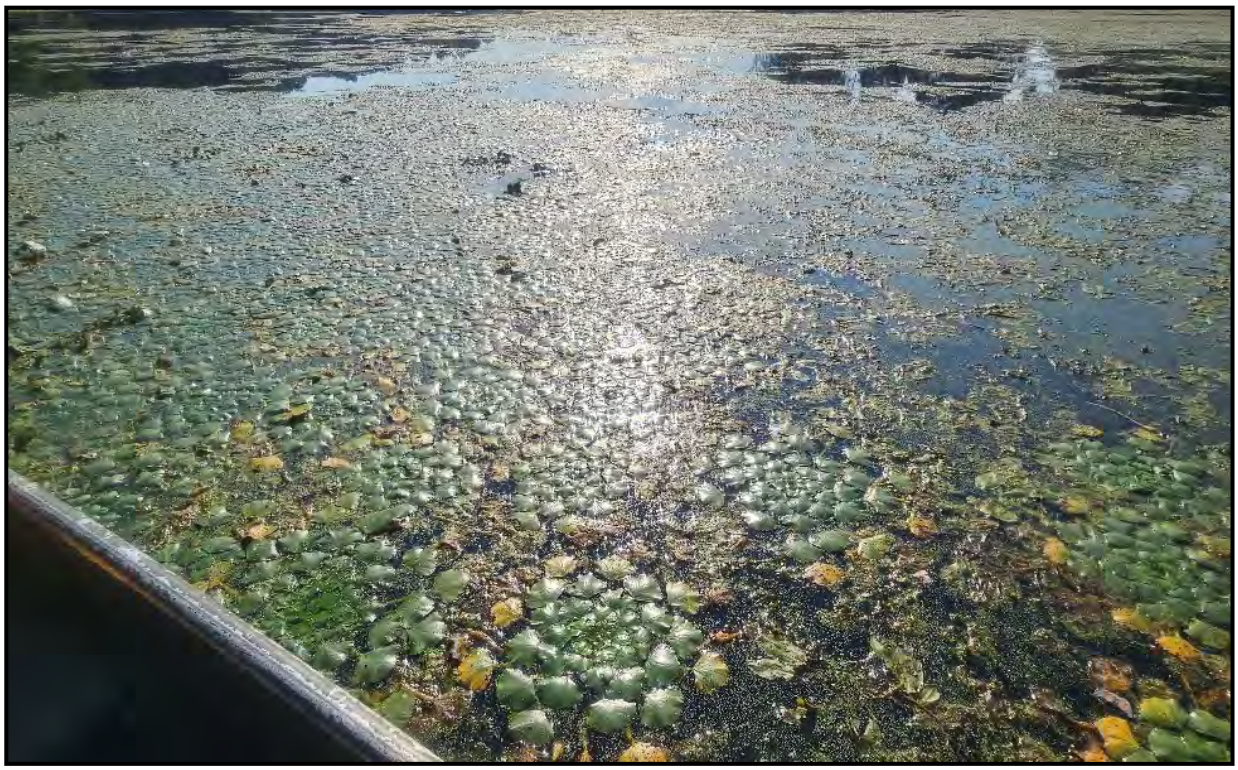


Photo Point 6, Photo 1. Population of invasive water chestnut. (9/6/2023)

Photo Point 6, Photo 2. High density area of bladderwort, watermeal and invasive water chestnut. (9/6/2023)

Photo Point 6, Photo 3. Very high density area of bladderwort, watermeal and invasive water chestnut. (9/6/2023)

Photo Point 7, Photo 1. Very high density area of watermeal and pond lily. (9/7/2023)

Photo Point 7, Photo 2. Very high density area of watermeal and pond lily. (9/7/2023)

Photo Point 7, Photo 3. Very high density area of watermeal between populations of pond lily. (9/7/2023)

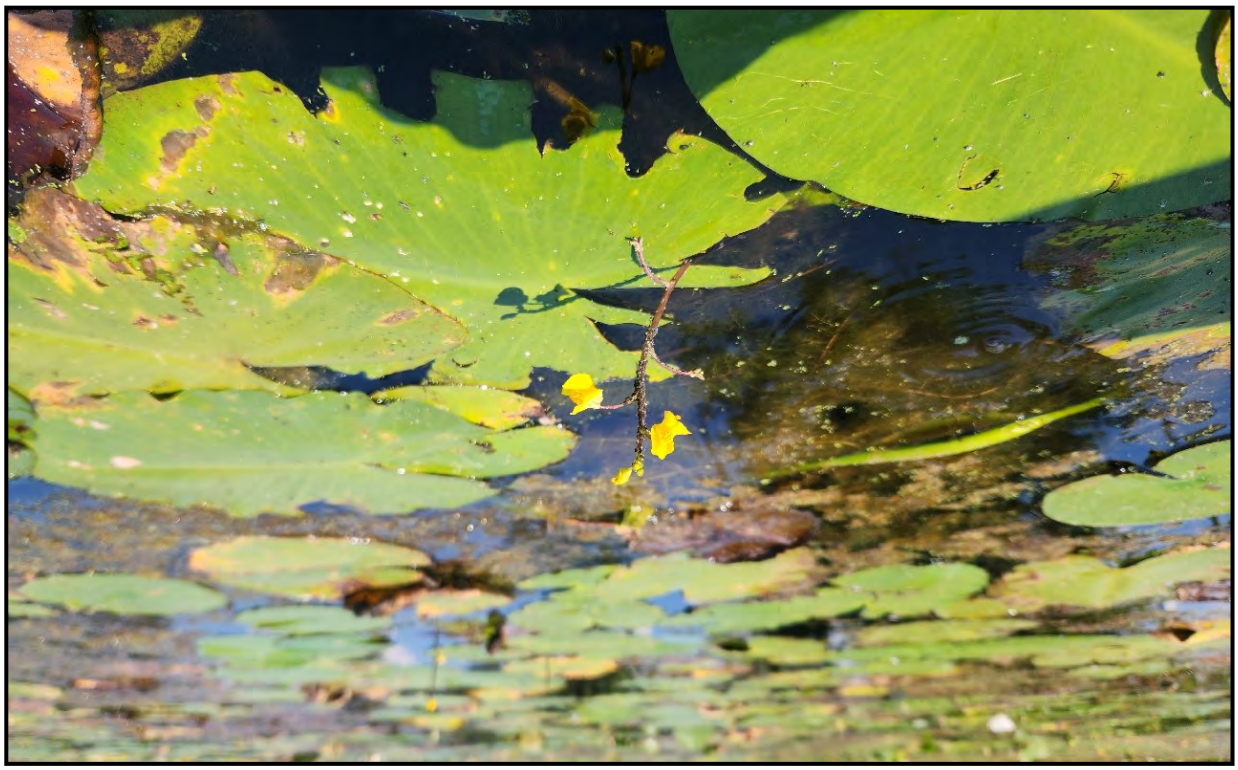


Photo Point 8, Photo 1. Bladderwort flower emerging among pond lily leaves. (9/7/2023)

Photo Point 9, Photo 1. Very high density area with water lily, watermeal, and invasive water chestnut. (9/7/2023)

Photo Point 9, Photo 2. Close up view of invasive water chestnut with watermeal interspersed. (9/7/2023)

Photo Point 10, Photo 1. High density area with bladderwort in the foreground and waterlily and water chestnut in the background. (9/7/2023)

Photo Point 10, Photo 2. Very high density area with bladerwort and invasive water chestnut. (9/7/2023)

Photo Point 10, Photo 3. Very high density area with bladderwort in the foreground and invasive water chestnut to the right. (9/7/2023)

Photo Point 11, Photo 1. Very high density area with watermeal and bladderwort. (9/15/2023)

Photo Point 11, Photo 2. Very high density area with bladderwort, watermeal and pond lily. (9/15/2023)

Photo Point 12, Photo 1. Medium density area with pond lily, watermeal, duckweed, and water chestnut in the foreground. (9/15/2023)

Photo Point 12, Photo 2. High density area with duckweed, watermeal, swamp loosestrife and water chestnut. (9/15/2023)

Photo Point 12, Photo 3. High density area with duckweed, water lily and bladderwort. High mounded vegetation is predominantly native swamp loosestrife. (9/15/2023)

Photo Point 13, Photo 1. High density area with watermeal, duckweed, bladderwort and broadleaf arrowhead (9/15/2023)

Photo Point 13, Photo 2. High density area with watermeal, pond lily, and bladderwort. Invasive water chestnut is seen in low concentration (9/15/2023)

Photo Point 14, Photo 1. High density area with duckweed, watermeal, pond lily and bladderwort. Bordered by native swamp loosestrife, water-pepper and cat tail. (9/15/2023)

Photo Point 14, Photo 2. High density area with duckweed, watermeal, pond lily and bladderwort. Bordered by native swamp loosestrife, water-pepper and cat tail. (9/15/2023)

Photo Point 15, Photo 1. High density area with duckweed, watermeal and bladderwort. Left bank is predominantly water-pepper and native swamp loosestrife. (9/15/2023)

Photo Point 15, Photo 2. High density area with duckweed, watermeal and pond lily. Banks are populated mostly by water-pepper and native swamp loosestrife. (9/15/2023)

Photo Point 16, Photo 1. Low density area with a dense patch of invasive water chestnut. (9/15/2023)

Photo Point 16, Photo 2. Low density area of open water with dense patches of bur-reed along edges . (9/15/2023)

Photo Point 16, Photo 3. Shallow, low density area with a dense patch of water chestnut to the right. Bank is mostly swamp loosestrife, broadleaf arrowhead, and bur-reed. (9/15/2023)

Photo Point 17, Photo 1. Low density area with an open water channel and densley vegetated banks consisting of bur-reed and reed canary grass. (9/15/2023)

Photo Point 17, Photo 2. Shallow, low density area with a sparsely vegetated open water channel in the center and densly vegetated banks dominated by bur-reed and button bush. (9/15/2023)

Photo Point 17, Photo 3. Shallow, low density area an open water channel and densely vegetated banks consisting primarily of native bur-reed. (9/15/2023)

Photo Point 18, Photo 1. Shallow, medium density area domninated by American bur-reed and ribbon-leaved pondweed. (9/15/2023)

Photo Point 19, Photo 1. High density area with water-pepper, water lily, and northern watermilfoil. (9/15/2023)

Photo Point 19, Photo 2. Very high density area with water lily, northern watermilfoil and invasive water chestnut. Mounded vegetation is predominantly water-pepper and swamp loosestrife. (9/15/2023)

Photo Point 19, Photo 3. High density area consisting of water lily and northern watermilfoil. (9/15/2023)

Photo Point 20, Photo 1. High density area dominated by water lily, coontail, and pondweed. (9/15/2023)

Photo Point 20, Photo 2. Shallow medium density area with somewhat sparse surface vegetation, but dense submerged vegetation consisting of pondweed and coontail. (9/15/2023)

Photo Point 21, Photo 1. Shallow, densely vegetated area at the furthest east portion of Lake Warner. (9/15/2023)

Photo Point 21, Photo 2. Shallow densely vegetated area dominated by bur-reed and ribbon-leaved pondweed. (9/15/2023)

Photo Point 21, Photo 3. Shallow, medium density area domninated by American bur-reed and ribbon-leaved pondweed. (9/15/2023)

Miscellaneous Photo 1 . A view of SWCA conducting sediment sampling. (9/28/2023)

Miscellaneous Photo 2. A view of SWCA conducting sediment sampling. (9/28/2023)