

**Northeast Aquatic Research**



# **Highland Lake 2024 Aquatic Plant Monitoring Report**

**Prepared for the Highland Lake Watershed Association & Town of  
Winchester, CT**



**December 18<sup>th</sup>, 2024**

## INTRODUCTION

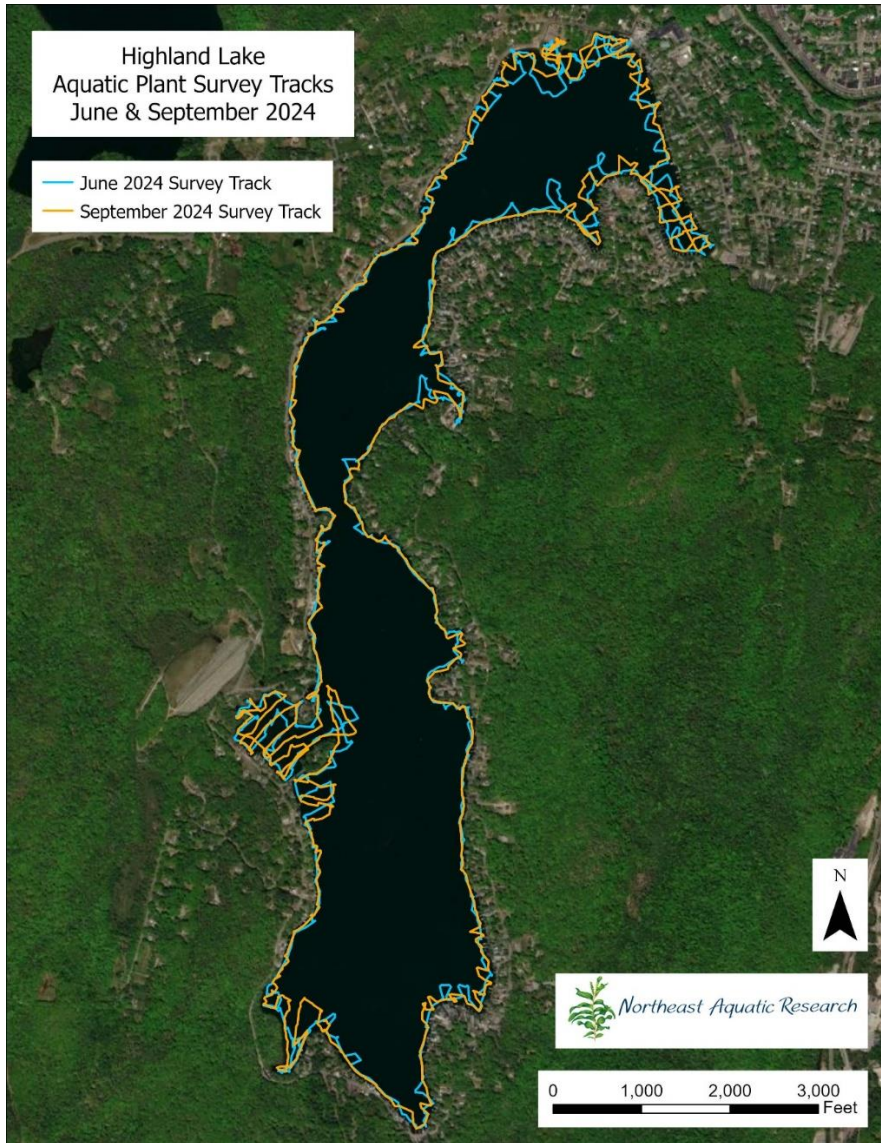
Northeast Aquatic Research (NEAR) has conducted annual surveys of the plants in Highland Lake since 2015 to monitor the management of the invasive Eurasian Milfoil (*Myriophyllum spicatum*) and Variable-Leaf Milfoil (*Myriophyllum heterophyllum*). In 2024, NEAR conducted pre- and post-treatment surveys of Highland Lake.

A full-lake pre-treatment aquatic plant survey was conducted on June 5<sup>th</sup>. The survey circumnavigated the entire littoral zone of the lake (**Map 1**). 330 waypoints were either newly created or revisited from previous surveys (**Map 2**).

AllHabitat Services, LLC conducted an 80-acre Tribune (Diquat) treatment and an 8-acre ProcellaCOR treatment on June 26<sup>th</sup>, 2024 (**Map 3**). Diquat was used to control native Southern Naiad (*Najas guadalupensis*) and Large-Leaf Pondweed (*Potamogeton amplifolius*). A ProcellaCOR treatment targeted Variable-Leaf Milfoil in Sucker Brook Cove.

NEAR conducted a full-lake post-treatment survey over two days, on September 12<sup>th</sup> and September 13<sup>th</sup>, 2024, to assess the impact of the herbicide treatments on the Variable-Leaf Milfoil, Southern Naiad, and Large-Leaf Pondweed. 389 new waypoints were made during the September survey. The June survey was conducted by two survey teams requiring only one day, the September survey was conducted by only one survey team, requiring two days to complete.

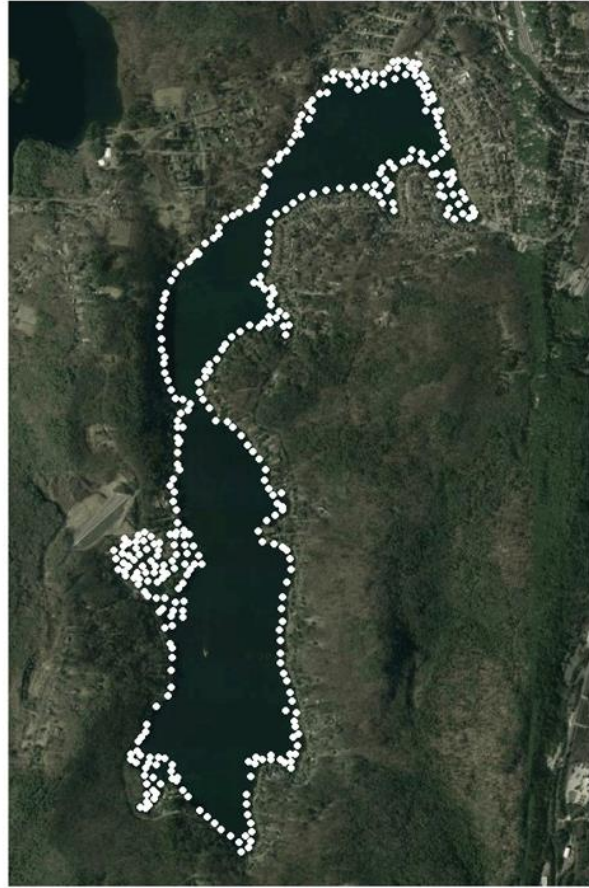
**Map 1. NEAR survey tracks in 2024.**



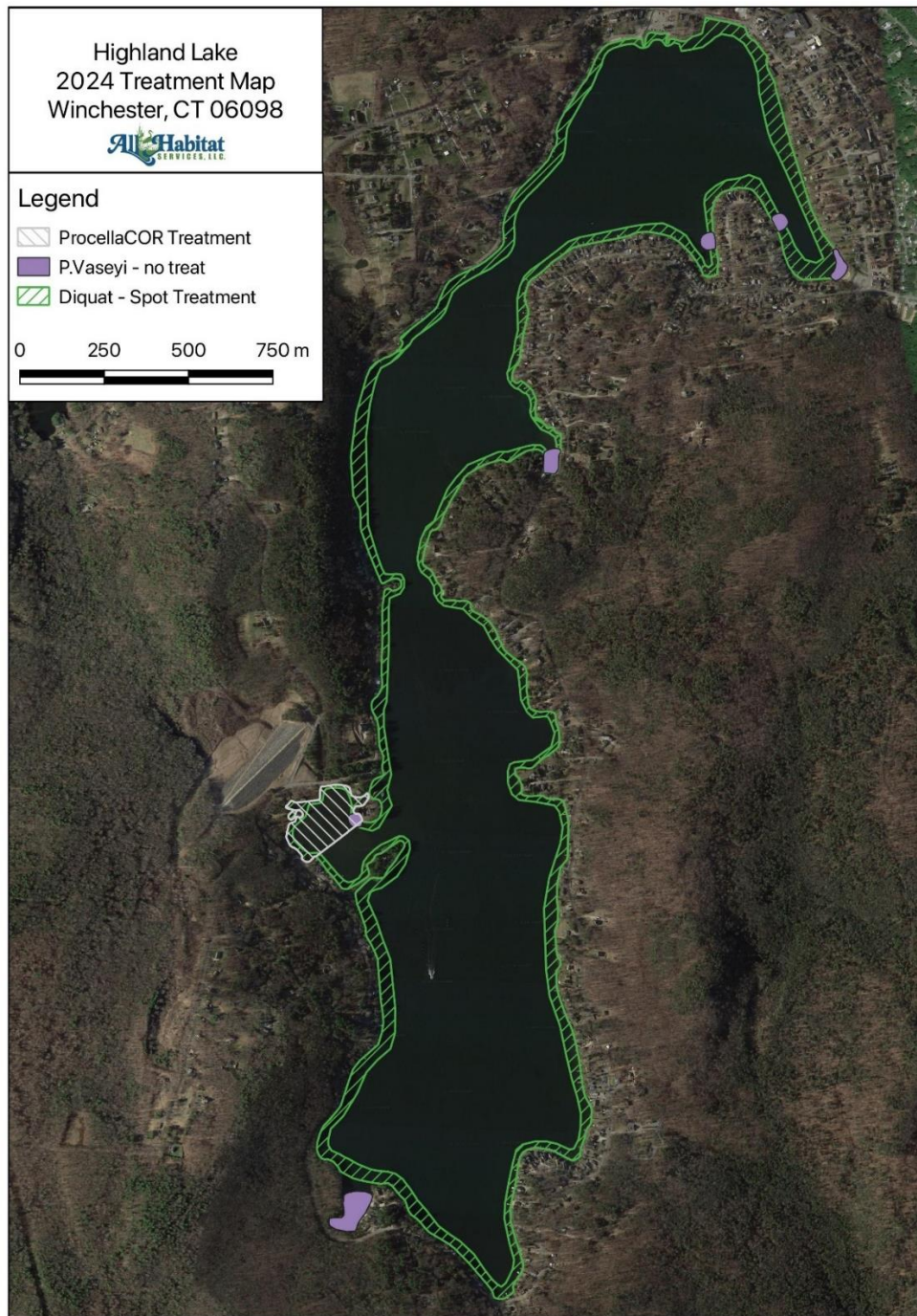
**Map 2.** Pre-treatment survey waypoints,

*June 5<sup>th</sup>, 2024*

*September 12<sup>th</sup>-13<sup>th</sup>, 2024*



**Map 3.** 2024 Highland Lake treatment areas from AllHabitat Services, LLC.



## MONITORING RESULTS

During the pre-treatment survey on June 5<sup>th</sup>, Variable-Leaf Milfoil was the only invasive species observed in the lake. Two very sparse patches were found at separate locations: one in Sucker Brook Cove at a depth of approximately 5.7 feet, and the other within the vicinity of *The Marina at Highland Lake*, just east of the State Boat launch, at a depth of around 3.1 feet. In 2023, Variable-Leaf Milfoil was found in multiple areas within the same Sucker Brook cove (**Map 4**). In addition to Variable-Leaf Milfoil, twenty-three aquatic plant species were present in the lake, along with Green Filamentous Algae and Benthic Cyanobacteria Mat (*Lyngbya sp.*) (**Table 1**). Southern Naiad, Large-Leaf Pondweed, and Floating Bladderwort (*Utricularia radiata*) were dominant, meaning they were present at greater than 20% of the survey points (**Maps 5, 6, 7**). All other species were present at less than 10% of the waypoints and half of all species were present less than 1% of the waypoints.

During the June survey, Vasey's Pondweed (*Potamogeton vaseyi*), a Connecticut state-listed threatened species, was found at seven locations, with an average density of 17% (**Map 8**). This indicates a slight decrease compared to 2023, when it was found at eight locations with an average density of 38%, and 2022, when it was present at fourteen locations with an average density of 46% (**Map 9**).

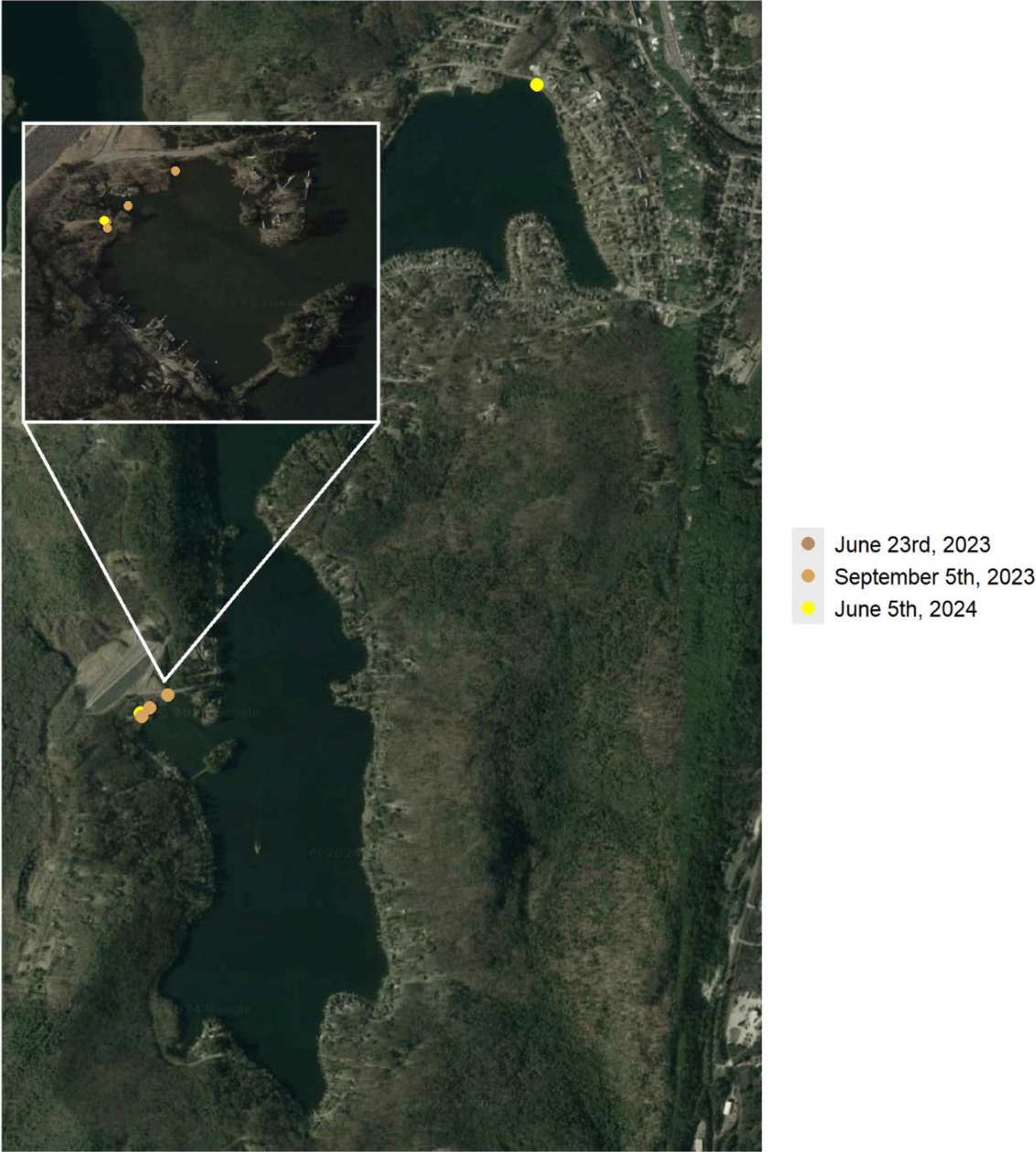
During the post-treatment survey on September 12<sup>th</sup> & 13<sup>th</sup>, 2024, twenty aquatic plant species were found, along with Filamentous Algae (**Table 1**). Variable-Leaf Milfoil was not found, even in areas where we found it in June. The survey found that the frequency of occurrence of the two dominant species, Southern Naiad and Large-Leaf Pondweed, remained nearly the same, while Floating Bladderwort declined significantly, from 35% to 3%.

Tapegrass (*Vallisneria americana*) increased dramatically during the summer, expanding from 14% occurrence in June to 64% occurrence in September. In September, Tapegrass was found growing densely throughout the majority of the lake (**Map 10**). Stonewort (*Nitella sp.*), a macroalgae species usually found along the bottom of the lake, was also dominant in September (**Map 11**).

The invasive species Brittle Naiad (*Najas minor*) and Eurasian Milfoil, both previously documented in the lake, were not found in 2024.

Maps of all dominant species (those present at 20% frequency and greater) from both the June and September surveys are included in this report, as well as maps of all invasive species, protected species, and those species targeted for treatment in 2024.

**Map 4.** Locations of Variable-Leaf Milfoil (*Myriophyllum heterophyllum*) in Highland Lake on June 23<sup>rd</sup>, 2023, September 5<sup>th</sup>, 2023, and June 5<sup>th</sup>, 2024.

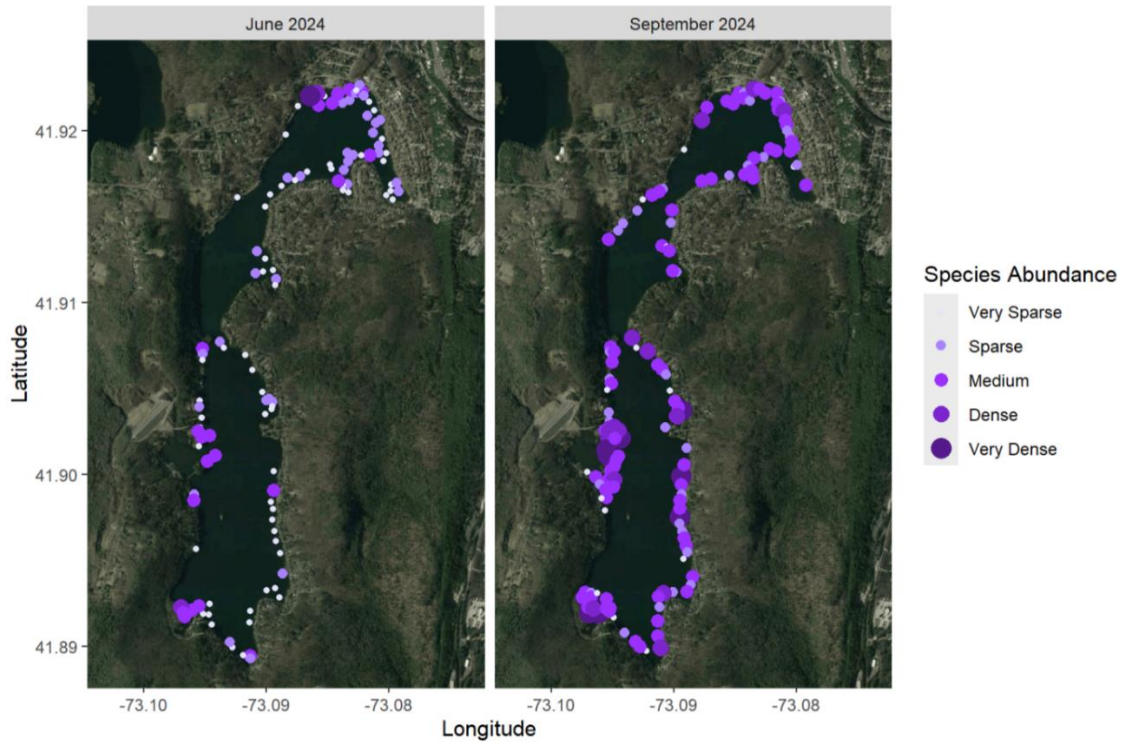


**Table 1.** Aquatic plant species in Highland Lake during June 5<sup>th</sup>, 2024 pre-treatment aquatic plant survey and September 12<sup>th</sup>-13<sup>th</sup>, 2024 post-treatment survey. Red lettering indicates invasive species. Blue lettering indicates protected species. NA=Not Available.

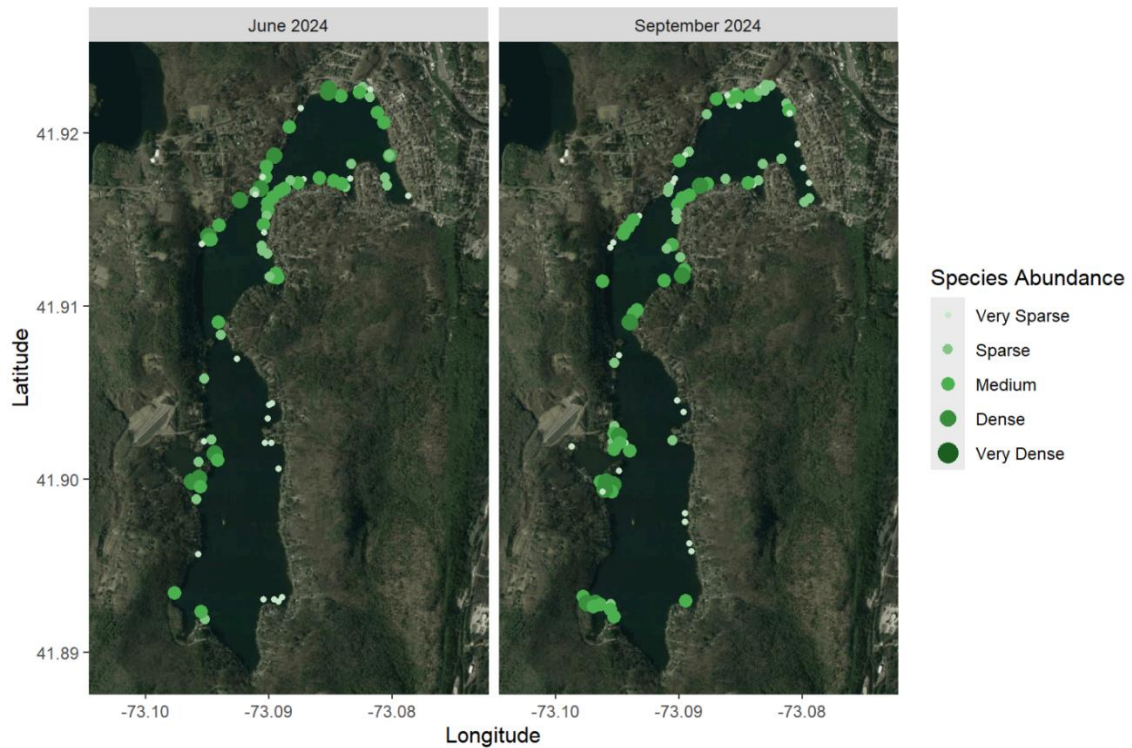
Scientific Name	Common Name	June 2024		Sept 2024	
		Frequency	Avg. Density	Frequency	Avg Density
<i>Najas guadalupensis</i>	Southern Naiad	36	12	38	32
<i>Utricularia radiata</i>	Floating Bladderwort	35	10	3	5
<i>Potamogeton amplifolius</i>	Large-Leaf Pondweed	27	28	24	23
<i>Vallisneria americana</i>	Tapegrass	14	8	63	19
<i>Potamogeton perfoliatus</i>	Clasping-Leaf Pondweed	11	24	9	10
<i>Spirogyra</i>	Filamentous Algae	10	30	10	29
<i>Nitella sp.</i>	Stonewort	8	27	42	32
<i>Elodea nuttallii</i>	Nuttall's Waterweed	8	29	<1	5
<i>Ceratophyllum demersum</i>	Coontail	4	9	4	10
<i>Sagittaria graminea</i>	Grassy Arrowhead	3	9	10	17
<i>Potamogeton vaseyi</i>	Vasey's Pondweed	2	16	0	NA
<i>Lyngbya sp.</i>	Benthic Cyanobacteria Mat	2	34	0	NA
<i>Najas flexilis</i>	Slender Naiad	2	13	0	NA
<i>Eleocharis acicularis</i>	Needle Spikerush	1	11	2	29
<i>Fontinalis sp.</i>	Aquatic Moss	1	20	<1	5
<i>Potamogeton bicupulatus</i>	Snail-Seed Pondweed	1	15	<1	25
<i>Potamogeton epihydrus</i>	Ribbon-Leaf Pondweed	1	19	13	25
<i>Utricularia minor</i>	Lesser Bladderwort	1	5	0	NA
<i>Utricularia gibba</i>	Humped Bladderwort	0	NA	<1	8
<i>Potamogeton robbinsii</i>	Robbins' Pondweed	1	5	<1	5
<i>Myriophyllum heterophyllum</i>	Variable-Leaf Milfoil	1	5	0	NA
<i>Potamogeton gramineus</i>	Grass-Leaved Pondweed	1	23	0	NA
<i>Utricularia purpurea</i>	Purple Bladderwort	0	NA	1	23
<i>Elodea canadensis</i>	Canadian Waterweed	<1	15	0	NA
<i>Chara sp.</i>	Muskgrass sp.	0	NA	1	13
<i>Typha sp.</i>	Cattail sp.	0	NA	1	NA
<i>Isoetes sp.</i>	Quillwort sp.	<1	5	0	NA
<i>Nuphar variegata</i>	Yellow Waterlily	<1	40	1	15
<i>Potamogeton pusillus</i>	Small Pondweed	<1	15	1	5
<i>Utricularia geminiscapa</i>	Hidden-Fruit Bladderwort	<1	5	0	NA



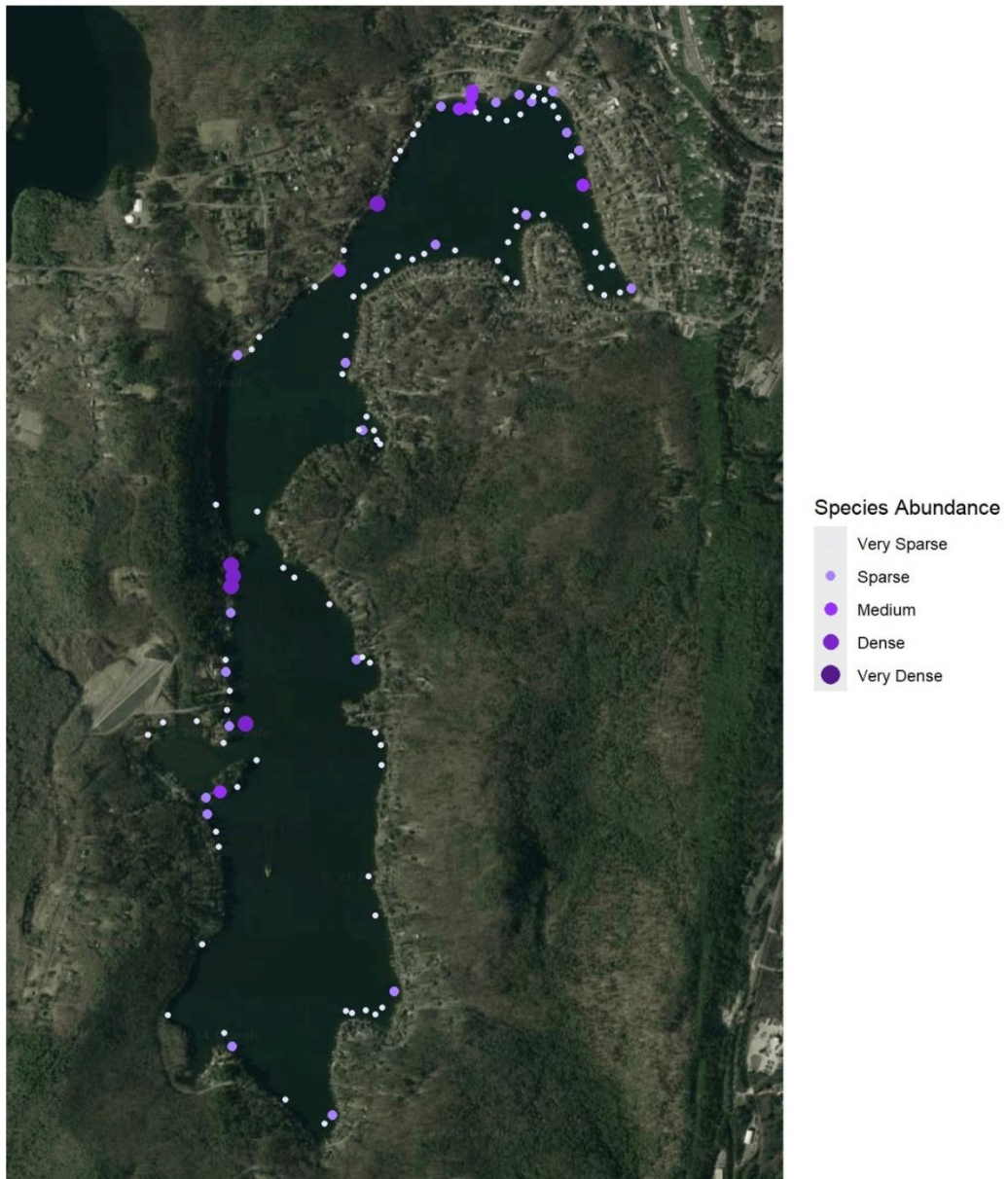
**Map 5.** Locations of Southern Naiad (*Najas guadalupensis*) in Highland Lake in June and September 2024.



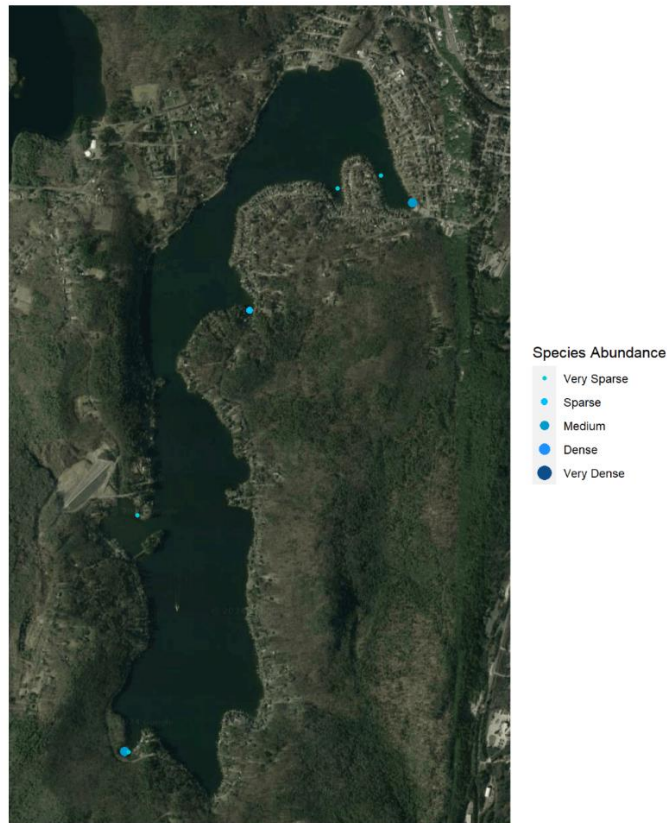
**Map 6.** Locations of Large-Leaf Pondweed (*Potamogeton amplifolius*) in Highland Lake in June and September 2024.



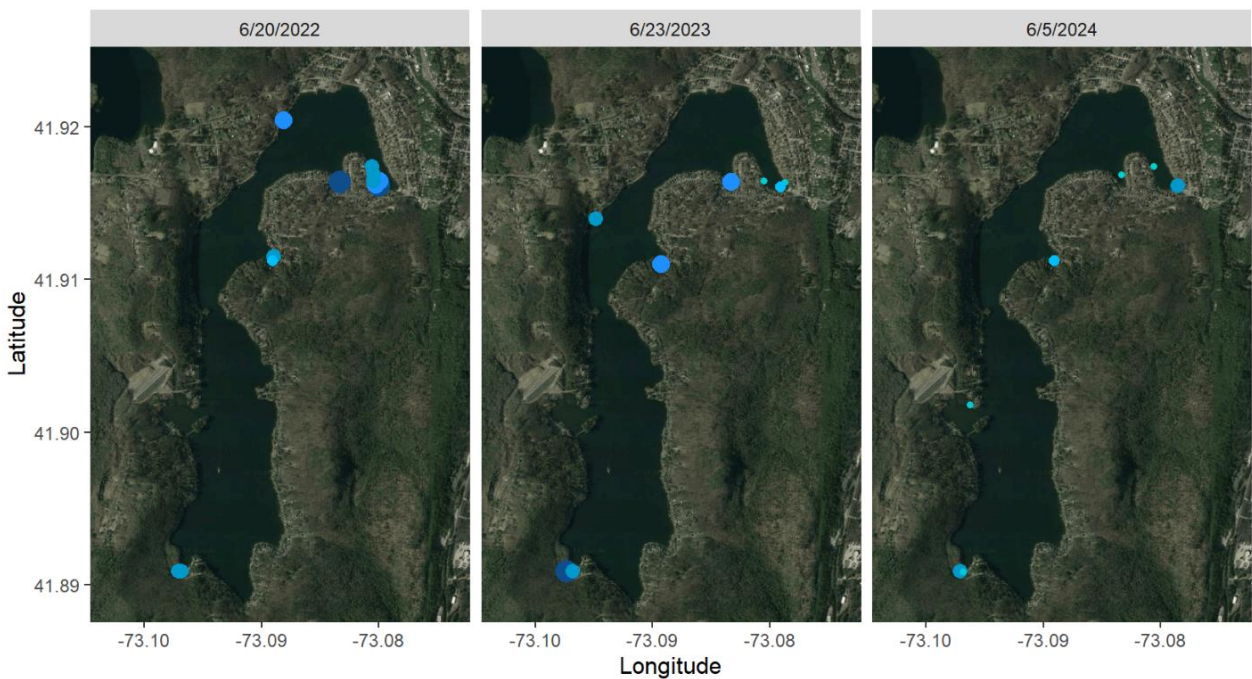
**Map 7.** Locations of Floating Bladderwort (*Utricularia radiata*) in Highland Lake on June 5<sup>th</sup>, 2024.



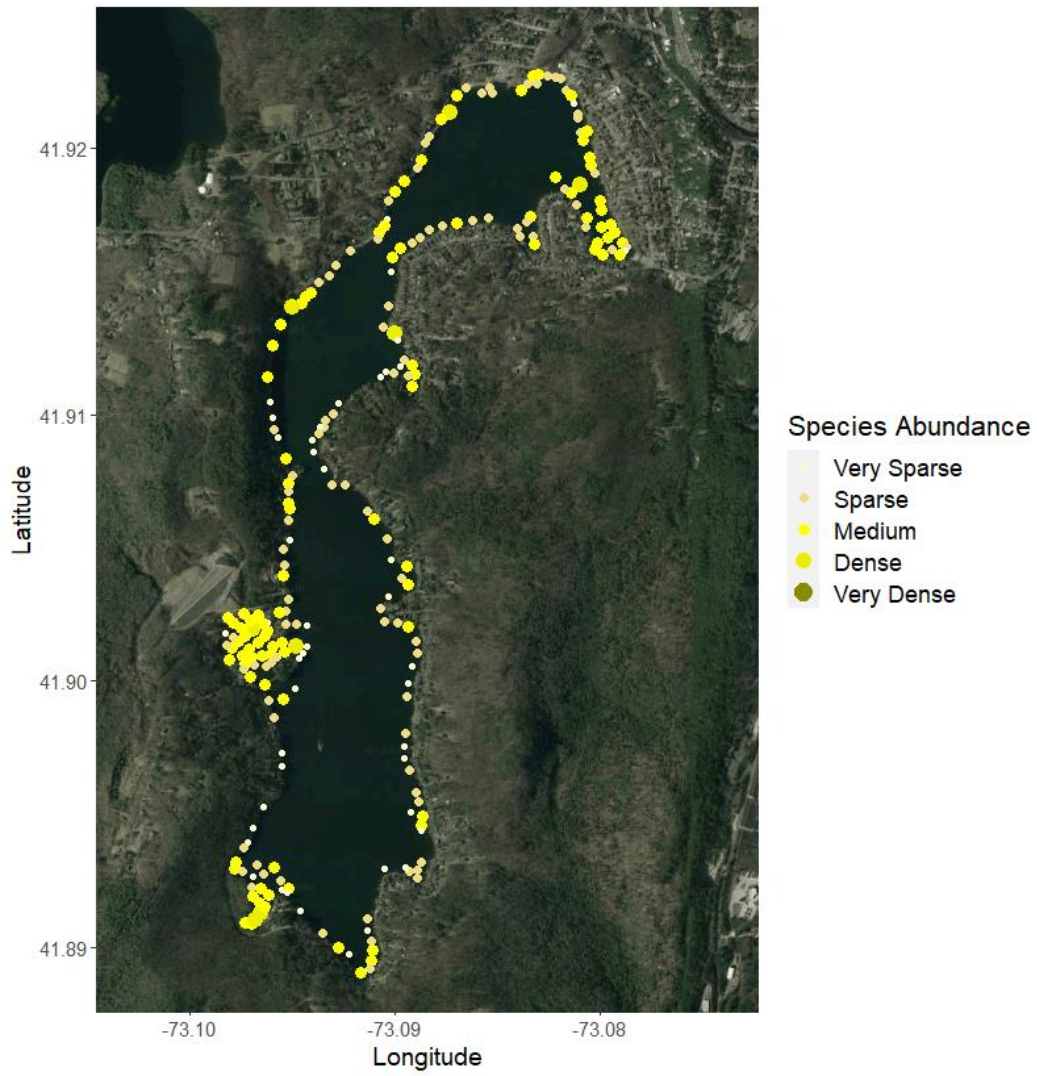
**Map 8.** Locations of Vasey's Pondweed (*Potamogeton vaseyi*) in Highland Lake on June 5<sup>th</sup>, 2024.



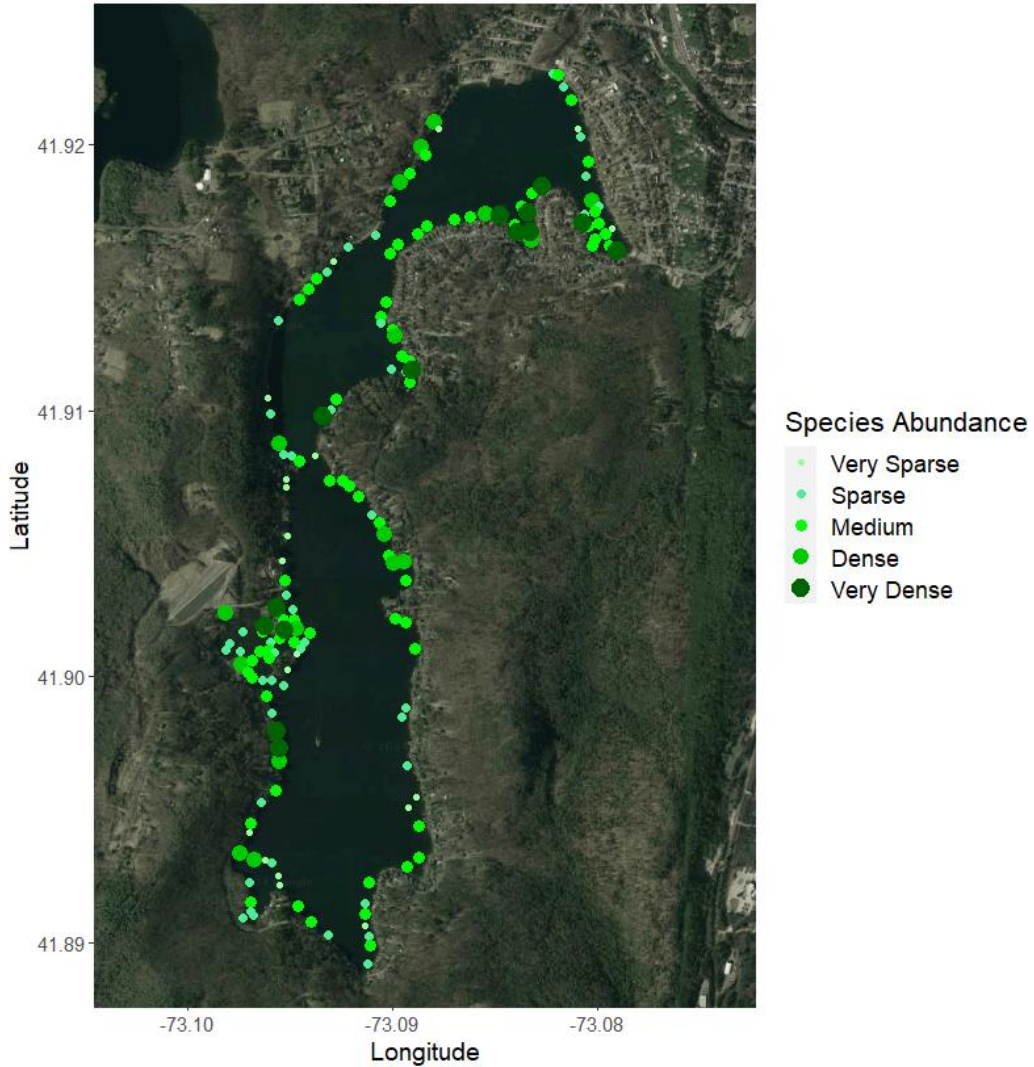
**Map 9.** Locations of state-protected Vasey's Pondweed (*Potamogeton vaseyi*) in Highland Lake on June 20<sup>th</sup>, 2022, June 23<sup>rd</sup>, 2023, and June 5<sup>th</sup>, 2024.



**Map 10.** Locations of Tapegrass (*Vallisneria americana*) in Highland Lake on September 12<sup>th</sup>-13<sup>th</sup>, 2024.



**Map 11.** Locations of Stonewort (*Nitella sp.*) in Highland Lake on September 12<sup>th</sup>-13<sup>th</sup>, 2024.



## Discussion of Historical Milfoil Growth

NEAR has conducted annual pre- and post-treatment aquatic plant surveys at Highland Lake since 2019, and annual pre-treatment surveys in 2009, 2010, and 2015 - 2018. The locations of Eurasian Milfoil and Variable-leaf Milfoil during each survey are shown in the maps below (**Maps 12-21**).

Table 2. Management history at Highland Lake since 2009, based on available NEAR records.

Year	Date(s)	Herbicide/Management	Target Species	Treatment	Contractor
2009	July 9 <sup>th</sup> , 2009	Diquat	Eurasian Milfoil Variable-Leaf Milfoil	30 acres	ACT
2018	July 18 <sup>th</sup> , 2018	Diquat	Eurasian Milfoil Variable-Leaf Milfoil	60 acres	Applicator?
2019	June 19 <sup>th</sup> , 2019	Diquat	Eurasian Milfoil Variable-Leaf Milfoil	10.9 acres	AllHabitat Services, LLC
2020	No herbicide treatment. DASH by New England Aquatic Services?				
2021	July 22 <sup>nd</sup> , 2021	Diquat ProcellaCOR	Eurasian Milfoil Variable-Leaf Milfoil	33.2 acres 16.1 acres	AllHabitat Services, LLC?
2022	July 11 <sup>th</sup> , 2022	Diquat	Variable-Leaf Milfoil Large-Leaf Pondweed Southern Naiad	35 acres	AllHabitat Services, LLC
2023	July 3 <sup>rd</sup> , 2023	NO treatment. DASH (Diver Assisted Suction Harvesting)	Variable-Leaf Milfoil	Sucker Brook Cove	New England Aquatic Services, LLC
2024	June 26 <sup>th</sup> , 2024	Diquat	Large-Leaf Pondweed Southern Naiad	80 acres	AllHabitat Services, LLC
		ProcellaCOR	Variable-Leaf Milfoil	8 acres	

## Variable-leaf Milfoil

In recent years, Variable-Leaf Milfoil has been found in and around Sucker Brook Cove. During the June 2024 pre-management survey, it was identified at two locations: one in Sucker Brook Cove and another in the northeastern part of the lake. No Variable-Leaf Milfoil plants were found during the September post-management survey.

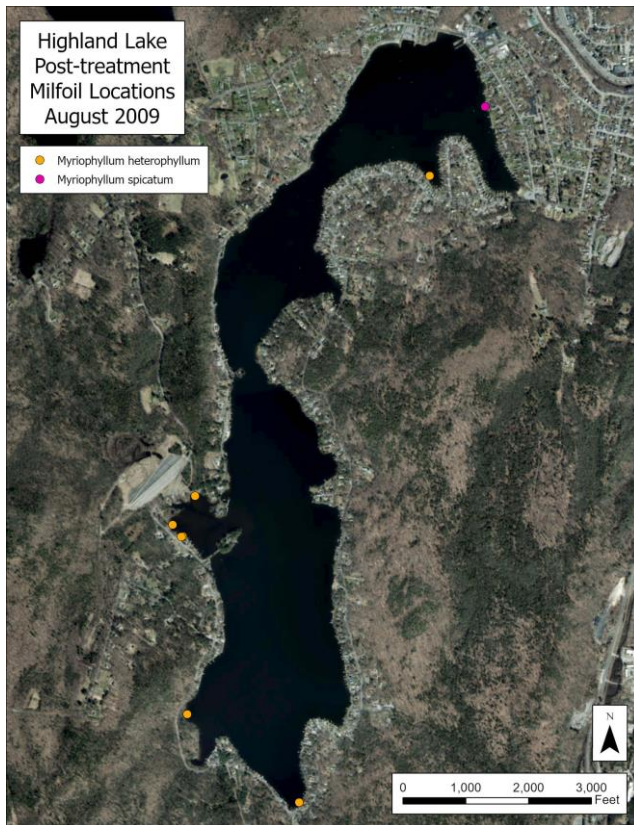
In 2009, Variable-Leaf Milfoil was found in Sucker Brook Cove, two locations in the southern end of the lake, and one location in the small cove in the northeast area of the lake. Over the next several surveys, with the exception of 2010, Variable-Leaf Milfoil spread throughout the lake.

Since August 2021, Variable-Leaf Milfoil has only been found in the very small cove under the bridge within the larger Sucker Brook Cove.

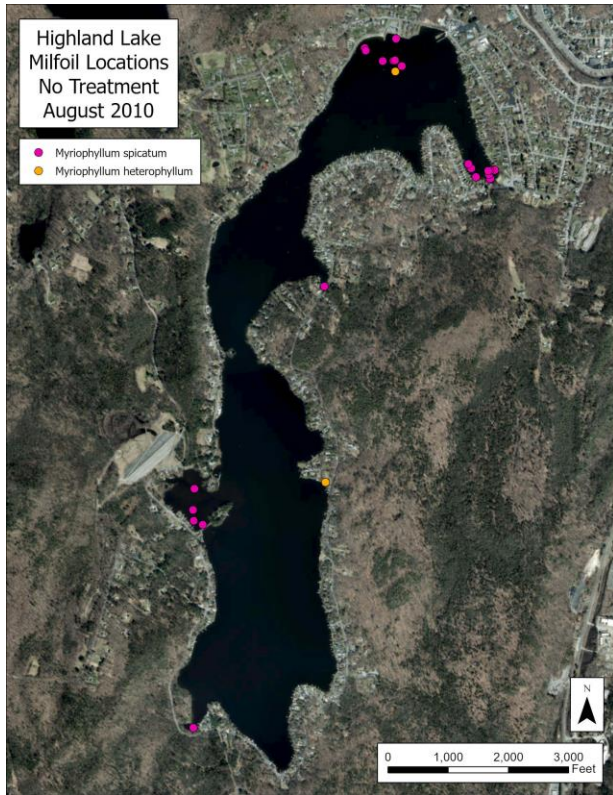
## Eurasian Milfoil

The distribution and density of Eurasian Milfoil varied considerably from 2009 to 2021. Following a large herbicide treatment in July 2021, no Eurasian Milfoil plants were found in August 2021. Since June 2021, Eurasian Milfoil was found during only one NEAR survey, on September 5<sup>th</sup>, 2023, where it was found at two locations in Sucker Brook Cove. Ideally, Eurasian Milfoil is expected to be minimal.

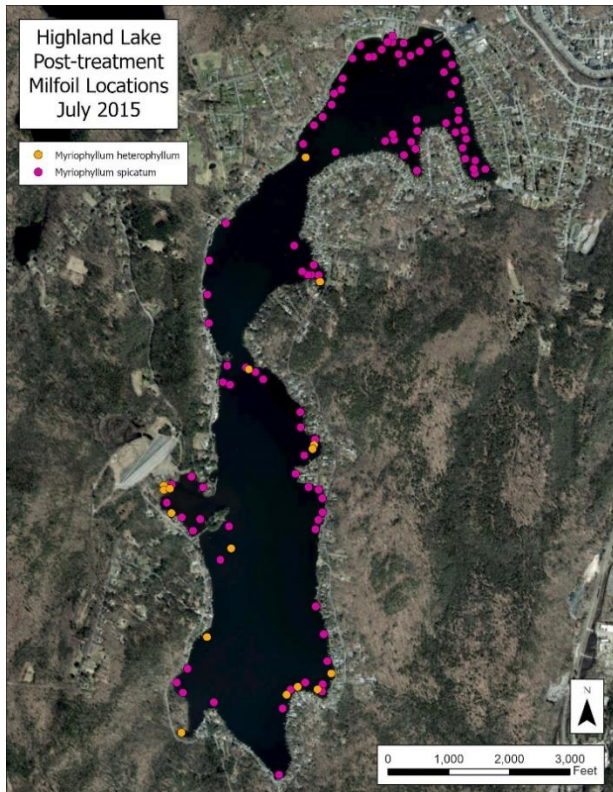
**Map 12.** Locations of Eurasian Milfoil and Variable-leaf Milfoil in 2009.



**Map 13.** Locations of Eurasian Milfoil and Variable-leaf Milfoil in 2010.

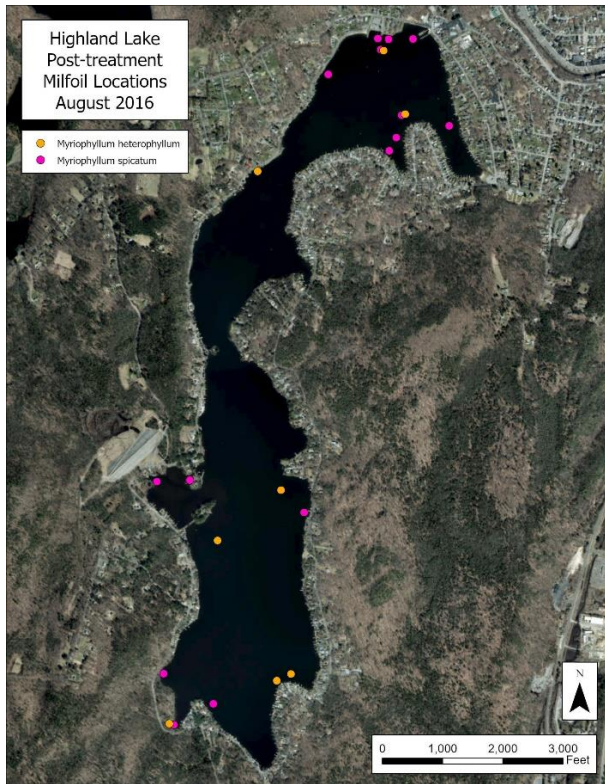


**Map 14.** Locations of Eurasian Milfoil and Variable-leaf Milfoil in 2015.

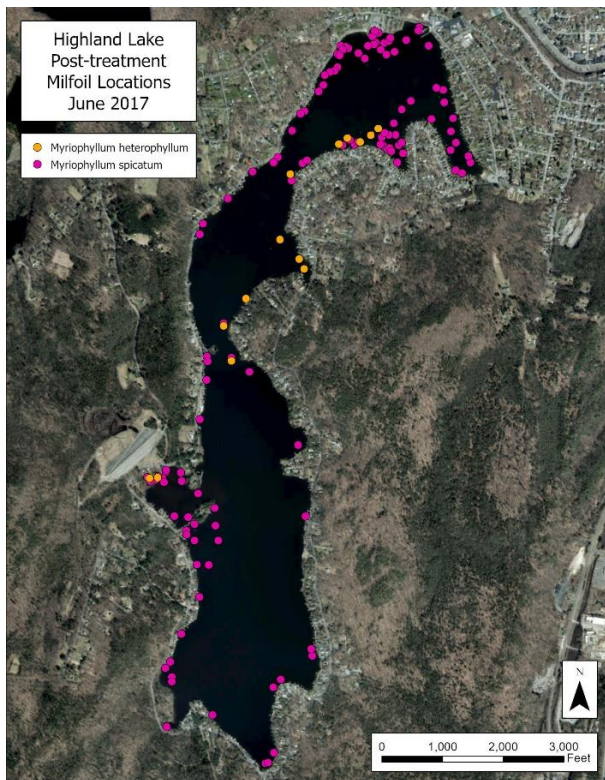




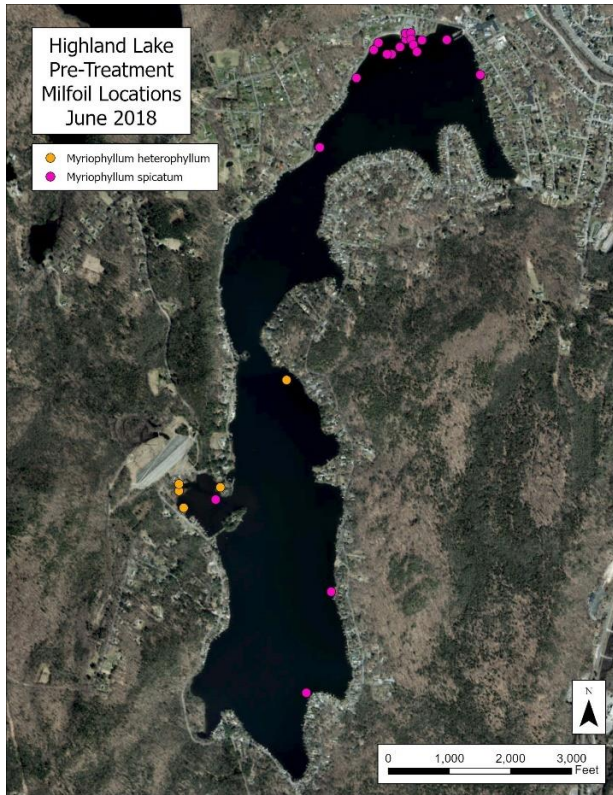
**Map 15.** Locations of Eurasian Milfoil and Variable-leaf Milfoil in 2016.



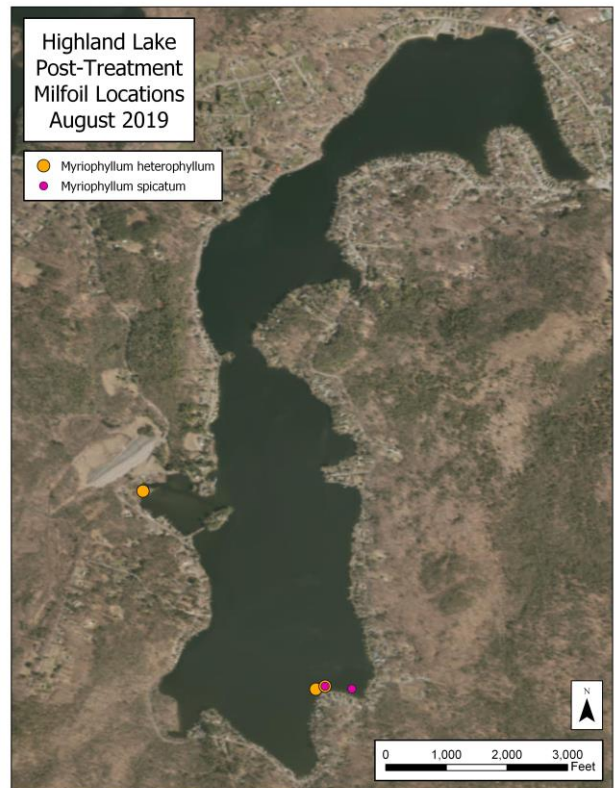
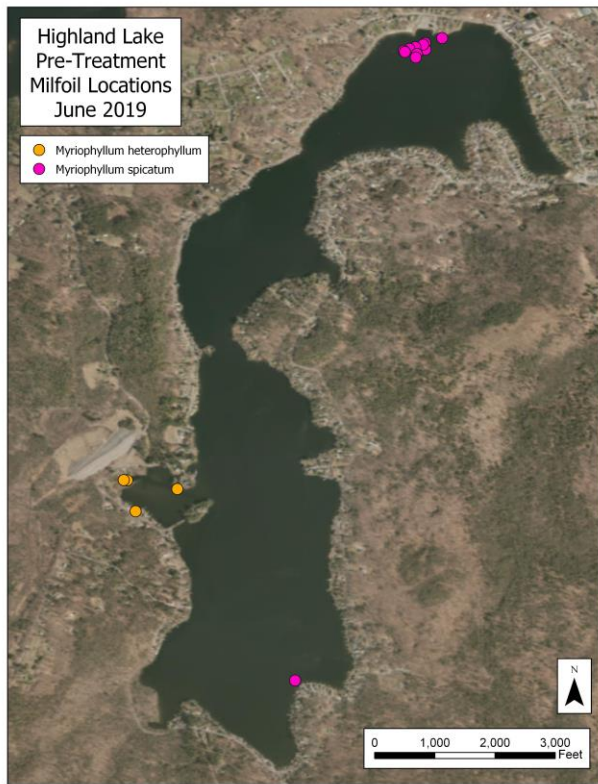
**Map 16.** Locations of Eurasian Milfoil and Variable-leaf Milfoil in 2017.



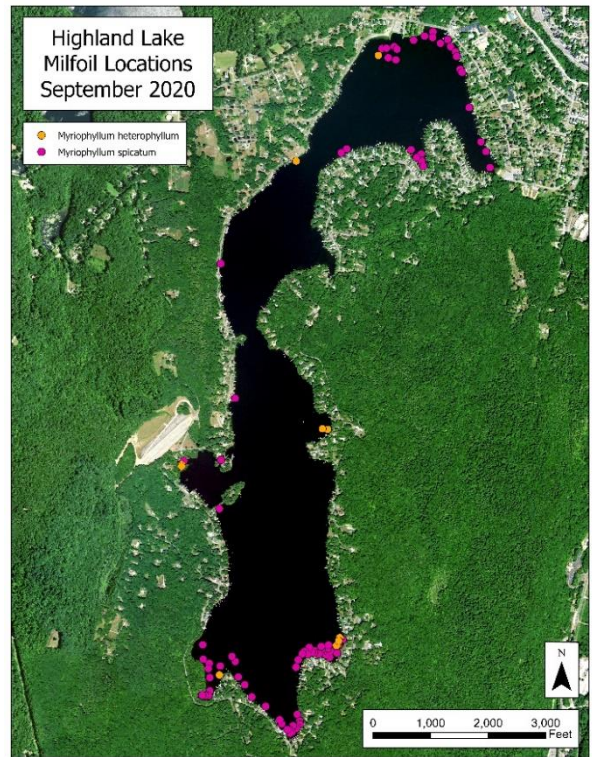
**Map 17.** Locations of Eurasian Milfoil and Variable-leaf Milfoil in 2018.



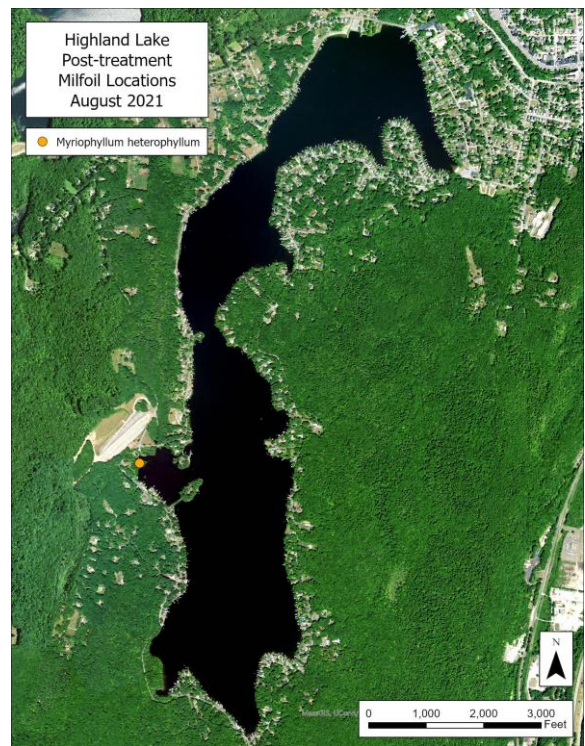
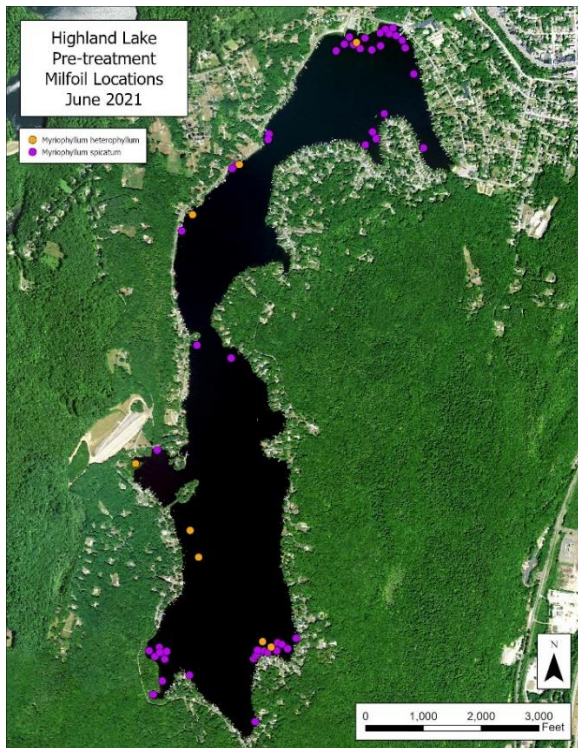
**Map 18.** Locations of Eurasian Milfoil and Variable-leaf Milfoil in 2019.



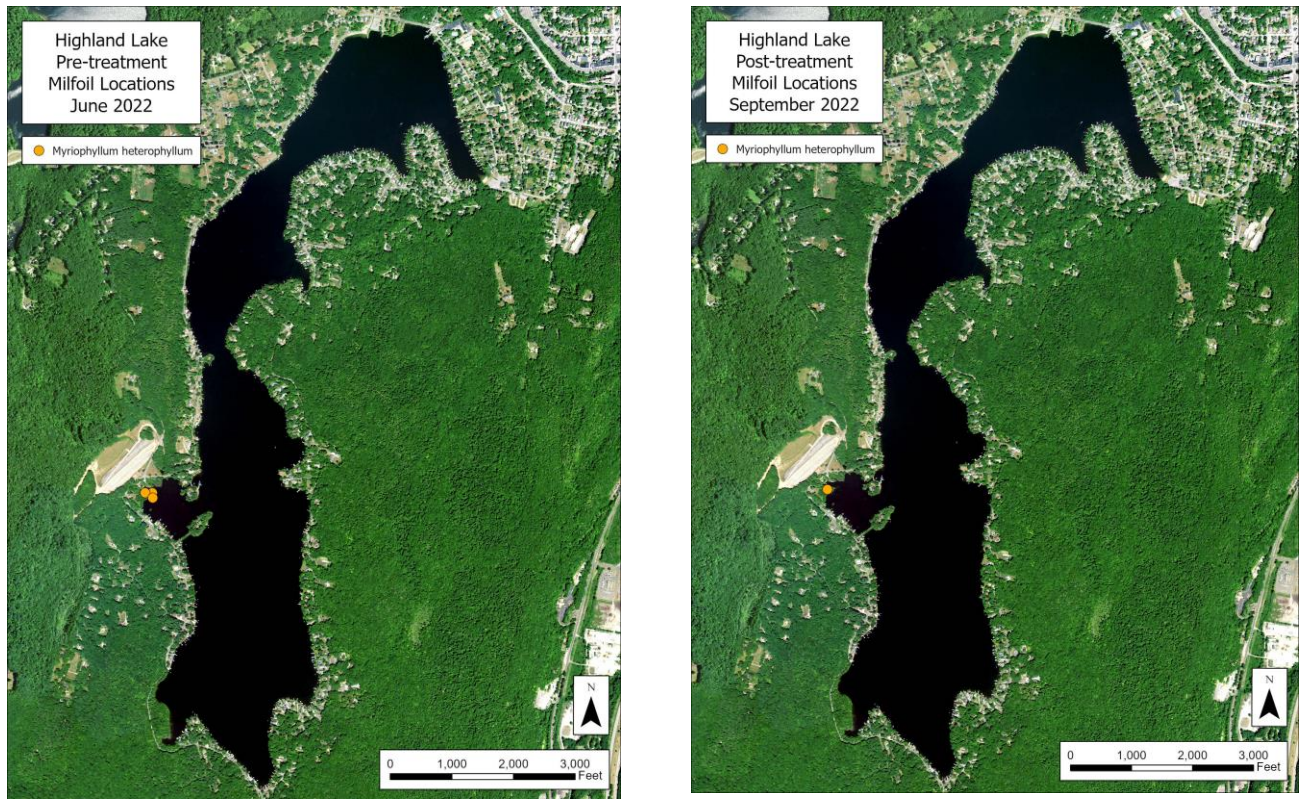
**Map 19.** Locations of Eurasian Milfoil and Variable-leaf Milfoil in 2020.



**Map 20.** Locations of Eurasian Milfoil and Variable-leaf Milfoil in 2021.



**Map 21.** Locations of Eurasian Milfoil and Variable-leaf Milfoil in 2022.



## Recommendations

- Conduct two full-lake aquatic surveys: one survey in early to mid-June, and the second in late August to early September 2025. The purpose of these surveys is to identify CT protected species and monitor for Eurasian Milfoil, Variable-Leaf Milfoil, or any other new invasive species, specifically Hydrilla (*Hydrilla verticillata*).
- Regrowth of Variable Milfoil in 2025 is not expected in Sucker Brook Cove. Variable Milfoil off *The Marina at Highland Lake* was not treated with ProcettaCOR, so regrowth might occur there in 2025. It is recommended that if the number of plants is few, they could be manageable via DASH (Diver Assisted Suction Harvesting). However, if many plants come back, herbicide treatment would be warranted.
- The Diquat treatment was not effective in controlling nuisance native Large-Leaf Pondweed or Southern Naiad, but it may have had a negative impact on the proliferation of the protected species *Potamogeton vaseyi*. Limit the use of a broad spectrum contact herbicide to control native pondweed and naiad to specific selected control areas.

# Resumes

The resume of Dr. George Knoecklein is included below because he is the principal Northeast Aquatic Research expert on state-listed aquatic plant identification. He personally conducted both the June and September surveys.

## Resume of Dr. George Knoecklein

### EDUCATION

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- Ph. D., 1997. UNIVERSITY OF CONNECTICUT**, Storrs, Connecticut. Major: Limnology. Thesis: *Anaerobic Respiration Dynamics of a Eutrophic Lake*.
- M.S., 1981. MICHIGAN STATE UNIVERSITY**, East Lansing, Michigan. Major: Limnology. Thesis: *The Vegetation and Hydrology of a Lakeside Wetland*.
- B.S., 1978. SOUTHERN CONNECTICUT STATE UNIVERSITY**, New Haven, Connecticut. Major: Biology.
- A.A.S., 1973. UNITY COLLEGE**, Unity, Maine, Major: Fisheries and Wildlife.
- C.L.M., 2013, 2023.** North American Lake Management Society.

### EMPLOYMENT

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#### 10/97 - Present Principal, Northeast Aquatic Research, LLC

Founder and principal investigator of ecological consulting and research company specializing in:

- ⊕ Lake diagnostic studies, continued monitoring programs, and aquatic plant management planning.
- ⊕ Aquatic plant surveys, including detection and mapping of invasive and protected species, and evaluation herbicide and other plant management projects.

Selected projects include:

- CT DEEP funded on-going diagnostic/feasibility study and weed management planning for Lower Bolton Lake, Bolton, CT, 2012-2017.
- Rapid response invasive species management program including intensive survey of Coventry Lake for the invasive *Hydrilla verticillata*, Coventry CT, 2015.
- Expert limnological witness for the defense in pond impact litigation, North Granby, CT.
- FirstLight GDF-Suez funded on-going monitoring of trophic status of Candlewood Lake, CT in 2013-2015.
- Planned and implemented intensive hydroraking project for pike fishery habitat remediation at Winchester Lake, Winchester, CT.
- Aquatic plant surveys of VT lakes; Lake Iroquois (2014), Lake Saint Catherine, and Lake Fairlee, 2015.
- Intensive investigation of nutrient budget and trophic status of Mirror Pond on the Storrs campus of University of Connecticut 2013-2014.
- Evaluation of impacts on the ecology of Candlewood Lake from 25 years of winter water level drawdown to control Eurasian milfoil. 2011.
- Intensive evaluations of highly eutrophic; Lake Pocotopaug (East Hampton CT).
- Full aquatic plant surveys in 2010 and 2012 of Johnson's Pond (Flat River Reservoir, Coventry, RI). Herbicide management plan in 2014-2016, for control of invasive non-native aquatic plants; variable milfoil (*Myriophyllum heterophyllum*), and fanwort (*Cabomba caroliniana*).
- Identification and management of invasive aquatic plants in all water bodies in the town of Vernon, CT, ongoing 2009-2017.
- CT DEP funded feasibility study of Hatch Pond with Water Resources Services 2013-2014.
- Diagnostic/feasibility study and weed management plan of Bantam Lake, Morris, CT.
- Organized multi-year (2006-2012) suction harvesting project in Bantam Lake, Morris, CT to remove invasive non-native aquatic plant fanwort (*Cabomba caroliniana*) from state protected aquatic plant beds. Developed herbicide treatment plan for Bantam River, first river treatment in CT, for control of invasive non-native aquatic plant fanwort (*Cabomba caroliniana*).

- Organized multi-year (2008-2010) suction harvesting project to remove invasive non-native aquatic plant variable milfoil (*Myriophyllum heterophyllum*) in state protected aquatic plant beds following DEP Funded Demonstration Project to Evaluate Suction Harvesting as weed removal technique Crystal Lake Ellington/Stafford, CT.
- Evaluation of impacts of proposed winter water level drawdown on MA protected aquatic plant species *Potamogeton ogdenii* in Onoda Lake, Pittsfield, MA.
- Evaluation of impacts of winter water level drawdown on ecology of Highland Lake, Winchester, CT 2008.
- EPA/DEP 319 funded diagnostic investigation of Lake Zoar in 2011.
- Steering Committee for Water Resource Foundation's Manual: Reservoir Operations and Maintenance Strategies (2010 - 2014).
- EPA/CT DEP 319 funded 5 year diagnostic investigation of Lake Lillinonah, CT, 2006–2010.
- CT DEP funded diagnostic/feasibility study of Hatch Pond, Kent, CT, 2004–2005. Follow-up EPA/DEP 319 funded trophic assessment and watershed loading evaluation 2010-2012.
- Detection/distribution mapping of CT protected aquatic plant species; *Potamogeton fresii* and *Myriophyllum sibiricum* in Lake Wononscoponuc, Salisbury, CT, 2004 and 2007.
- CT DEP funded aquatic plant management study of Pickerel Lake, Colchester, CT.
- Detailed CT DEP funded aquatic plant mapping of Pachaug Pond 2004/2005 repeated in 2009/2010, Griswold, CT.
- Detailed hydrological and nutrient budget for Doolittle Lake, Norfolk, CT.
- Review of proposed aeration on existing trophic characteristics of Lily Pond, Cohasset, MA.
- Intensive diagnostic evaluations of; Nantucket Harbor, Hummock Pond, Miacomet Pond, Long Pond, and Madaket Harbor, on the island of Nantucket, MA. 1998 – 2008.
- CT DEP funded diagnostic/feasibility studies of Lake Hayward (2001), Rogers (2003), Lillinonah (2002-2003), Bashan (2002), Crystal–Ellington/Stafford—(2004),
- Detection/distribution mapping of CT protected aquatic plant species *Potamogeton ogdenii* in Indian Lake, Sharon, CT.
- Detection/distribution mapping of CT protected aquatic plant species *Potamogeton ogdenii* in West Twin Lake, Salisbury. CT.
- Aquatic plant survey and CT protected aquatic plant species *Megalodonta beckii* mapping in Lake Quonnipaug, Guilford,
- Detection/distribution mapping of CT protected aquatic plant species *Megalodonta beckii* in West Twin Lakes, Salisbury. CT.
- Conducted water quality characterization of storm water discharges from Tilcon CT's Branford Quarry.
- Cooperative involvement in CT DEP funded lake diagnostic feasibility study of Lake Kenosia with ENSR, and ACT, Inc. Responsible for conducting field sampling and data analysis.
- Developed 'Resident Sampling Program' to enable lake residents to collect their own lake monitoring data (managing 10 lake groups as of 2015).

## PROFESSIONAL MEMBERSHIPS

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Connecticut Federation of Lakes, (President 1999 – 2007)

Northeast Aquatic Plant Management Society (Board of Director 2010 - 2013)

North American Lake Management Society (member since 1986)

New England Chapter of North American Lake Management Society, (Leadership Committee)

Last full revision 2017 ■

The resume of Kendra Kilson is included below as she was the primary contact for the project period and also conducted the June survey.

# Resume of Kendra Kilson

## Kendra Kilson

Contact: cell: (203) 312 -3941; email: kendra.k@ne-aquatic.com

### EDUCATION

**State University of New York College at Oneonta, Oneonta, NY & Biological Field Station, Cooperstown, NY**  
*Master of Science, Lake Management, December 2019*

**University of Connecticut, Storrs, CT**

*Bachelor of Science, Natural Resources, Concentration in Environmental Conservation, May 2016*

### PROFESSIONAL EXPERIENCE

**Northeast Aquatic Research, Mansfield, CT**

*Research Scientist, August 2019-present, Seasonal Intern, April 2017-November 2017*

- Client manager for ongoing lake and pond management projects.
  - Aid applicators and professional contractors in aquatic plant management planning to minimize ecological harm and maximize target plant species control.
- Perform aquatic plant surveys to identify native and invasive species presence and abundance.
  - Highly competent in taxonomic identification of aquatic plants in New England.
- Lake and pond water quality monitoring for management purposes.
  - Experience with measuring dissolved oxygen, temperature, conductivity, pH and Secchi transparency.
  - Perform algae and zooplankton collection, and limited experience in microscopic identification.
- Sample stormwater discharge in a timely manner to analyze nutrient runoff in the watershed.
  - Improve knowledge in Low Impact Development (LID) and innovative stormwater infiltration systems.

**SOLitude Lake Management, Washington, NJ and Shrewsbury, MA**

*Seasonal Aquatic Biologist, May 2019-August 2019*

- Performed aquatic plant surveys to identify native and invasive species presence and abundance.
  - Further developed skills in taxonomic identification of aquatic plants in New England.
- Monitored water quality on lakes, ponds, and rivers for management purposes.

**CT Department of Energy and Environmental Protection, Hartford, CT**

**Water Permitting and Enforcement Division, Stormwater Section**

*Intern, May 2015-August 2015*

- Implemented stormwater compliance evaluations by inputting data to be utilized by the companies and DEEP.
- Drafted inspection reports for EPA by compiling organizational observations to assess stormwater quality.

**The Mayflower Inn and Spa, Washington, CT**

*Waiter's Assistant/Server, October 2011-August 2014*

- Assisted fellow employees to ensure maximum efficiency and customer satisfaction in a time-oriented environment.
- Prioritized and assessed workload to meet demands in a well-organized manner to provide optimal assistance.

### VOLUNTEER EXPERIENCE

**Friends of the Lake: Lake Lillinonah, Bridgewater, CT**

*Volunteer, April 2014-present*

- Collect water quality data from a research buoy to better understand the health and conditions of the lake.
- Participate in annual Save-the-Lake Day by picking up trash and hand-pulling invasive aquatic plants.

**CT Department of Energy and Environmental Protection (DEEP): Riffle Bioassessment by Volunteers Program (RBV)**

*RBV Volunteer/Trainer, September 2014-present*

- Discover pollution-sensitive macroinvertebrates to be studied by DEEP in order to identify streams with excellent water quality.

### SKILLS ACQUIRED TO DATE

- Professional Association of Diving Instructors (PADI) Open Water Diver Certified No. 19070H2801
- Lake Management Associate (LMA), North American Lake Management Society (NALMS)
- Certificate of Personal Watercraft Operation (Connecticut)
- Experience in trailer and small powerboat operation
- Computer:
  - Microsoft Office: Word; PowerPoint; Excel; Outlook
  - ArcGIS, ArcMap; Developmental Tools: RStudio