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Lake Quassapaug 2017 Management Report

December 11, 2017

Water Quality Summary

Not all water quality results have been analyzed at this time as volunteers still need to send in data sheets and late season water-samples.

Secchi Disk Transparency and In-Lake Nutrient Results

Volunteers provided only two Secchi disk transparency numbers for 2017 prior to the date this report was written. Additional data can be added if more sampling dates occurred in 2017.

Only three dates of Total Phosphorus (TP) testing results are displayed below. In general, all Top and Upper-Mid TP levels were below 10ppb, which is low and very good. The respective excellent water clarity Secchi readings in June and August are a direct results of the low phosphorus. Internal phosphorus release occurred at the bottom and was transported to at least 14m on September 17th. It is unknown how much transfer of nutrients to the surface occurs during fall lake-turnover in late October or November.

Table 1: Lake Quassapaug 2017 Secchi Disk Depth (m) and Total Phosphorus (TP - ppb)

	Date	6/8/2017	8/30/2017	9/17/2017
	Depth (m)	TP (ppb)	TP (ppb)	TP (ppb)
Top	1	9	1	4
Upper-Mid	5		ND	6
Upper-Mid	6	6		
Lower-Mid	12	5		
Lower-Mid	14		6	34
Bottom	18	6		
Bottom	19		62	23
	Secchi (m)	7.4	7.2	?

Temperature and Dissolved Oxygen

Only two dates of water profile data were provided by volunteers: June 8th and August 30th, 2017.

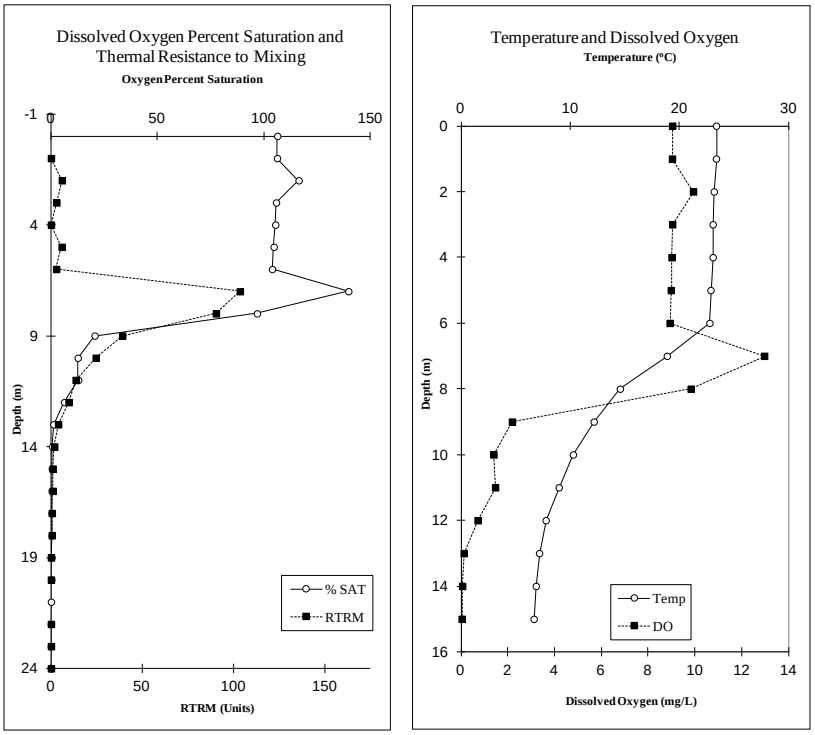

Figure 1: June 8, 2017 Lake Quassapaug Profile Data

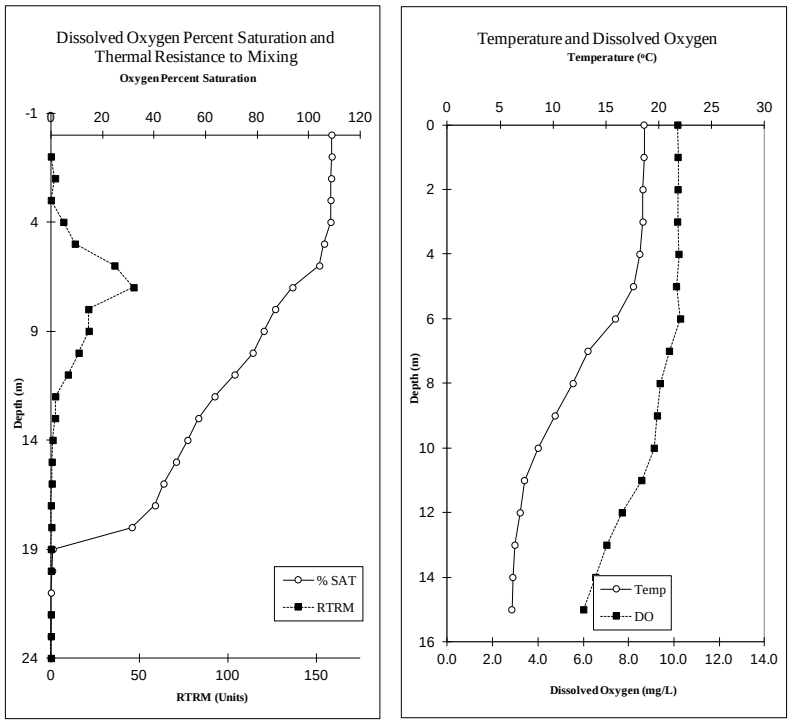

Figure 2: August 30, 2017 Lake Quassapaug Profile Data

Inlets and Storm-water Results

The inlet and storm-water sampling has been entirely conducted by volunteers of the Lake Quassapaug Association. Nutrient results are shown below in Table 2. The volunteers provided a hand-drawn map of where samples were taken in 2017, but some of the earlier sampling locations are less clear. To better organize sampling locations in the future, volunteers should set up distinct names for each location and stick to those names in the labeling process. A descriptive name is good, such as the "End of Tyler Cove Inflow" site. It is also recommended that volunteers document/name if the sampling location is storm drain discharge directly from a roadway culvert, or if it is considered a stream sample.

Table 2: Volunteer Stormwater Sampling Results 2015-2017 (NA=not analyzed)

Inlet Sampling Location Name	Year	Date	NH3_ug/L	TN_ug/L	TP_ug/L
Quassapaug Top of Tyler Cove Road	2017	5/6/2017	980	1602	48
Quassapaug Midway Down Tyler Cove Road	2017	5/6/2017	1410	2168	121
Quassapaug Outflow to Lake from Tyler Cove Road	2017	5/6/2017	1690	2406	162
Quassapaug Big Cove Inflow	2017	5/6/2017	ND	351	7
Quassapaug End of Tyler Cove Inflow	2017	5/6/2017	8	88	4
Quassapaug Rte. 64 pipe under road	2017	5/6/2017	391	764	115
Quassapaug End of Tyler Cove Inflow	2016	5/3/2016	NA	NA	2
Quassapaug Tyler's Cove Road	2016	5/3/2016	NA	NA	435
Quassapaug North end of Big Cove	2016	5/3/2016	NA	NA	14
Quassapaug Sandy Beach	2015	3/11/2015	NA	NA	17

In prior years, storm-water samples were analyzed for Total Phosphorus (TP), but ammonium (NH_3) and Total Nitrogen (TN) were added to the list of parameters for 2017.

Though nutrient concentrations will vary based on the amount of rainfall and local conditions, three locations were sampled in both 2016 and 2017. TP data is compared below. Concentrations below 25ug/L are considered low, concentrations below 15ug/L are considered very low.

1. End of Tyler Cove Inflow - 2016: 2ug/L, 2017: 4ug/L

    - Very low TP, very good overall water quality

2. Big Cove Inflow (aka North end of Big Cove) - 2016: 14ug/L, 2017: 7ug/L

    - Low and very low TP, good overall water quality

3. Tyler Cove Road (aka Outflow to Lake from Tyler Cove Road) - 2016: 435ug/L, 2017: 165ug/L

    - Very high TP, both years bad storm-water runoff quality

Aquatic Plants

Invasive Species Survey Results

In an effort to control the rapidly expanding populations of the invasive aquatic Variable and Eurasian milfoil species, the Lake Quassapaug Association began a Diver Assisted Suction Harvesting (DASH) program. An integral part of this program is the annual aquatic plant survey that locates new areas of both species and identifies problem areas where divers should focus efforts in the next season. The secondary goal of annual aquatic plant surveys is to evaluate the ongoing progress of the Variable milfoil (*Myriophyllum heterophyllum*) and Eurasian milfoil (*Myriophyllum spicatum*) control measures.

The 2017 aquatic plant survey was conducted on September 25. Table 3 documents the five-year progression of Variable milfoil abundance. The surveys conducted in 2015-2017 all use the same GPS waypoints for statistical comparison of Variable milfoil distribution.

Table 3: Variable milfoil survey statistics 2013-2017

Variable milfoil (*Myriophyllum heterophyllum*)				
2013	**2014**	**2015**	**2016**	**2017**
%occur	%occur	%occur	%occur	%occur
38	39	34	31	29
AVG%	AVG%	AVG%	AVG%	AVG%
	59	68	56	66
Overall%	Overall%	Overall%	Overall%	Overall%
	23	23	17	19
		*Boxed uses same waypoints		

From the overall statistical data (Table 3) it seems as though the Variable milfoil has had a steadily decreasing % occurrence, meaning that fewer of the original waypoints (from 2016 and 2015) had Variable milfoil in 2017. It also seems as though the average % cover (AVG%) has not changed much over the five year period. At each waypoint the Variable milfoil is assigned an estimate of density on a scale of 0-100%, which are then factored into the annual AVG%. The annual AVG% values indicate that despite a slightly lower frequency of Variable milfoil as the year's progress, the areas where it was found still had very dense growth, on average 50-60% cover. The decrease to 15% Overall% in 2017 can be attributed to a lesser % occurrence. It should be noted, however, that statistical measures are just one way of measuring success and should be used in concert with site notes and mapping.

Figure 3 below is a map of all Variable and Eurasian milfoil coverage in the lake in 2017.

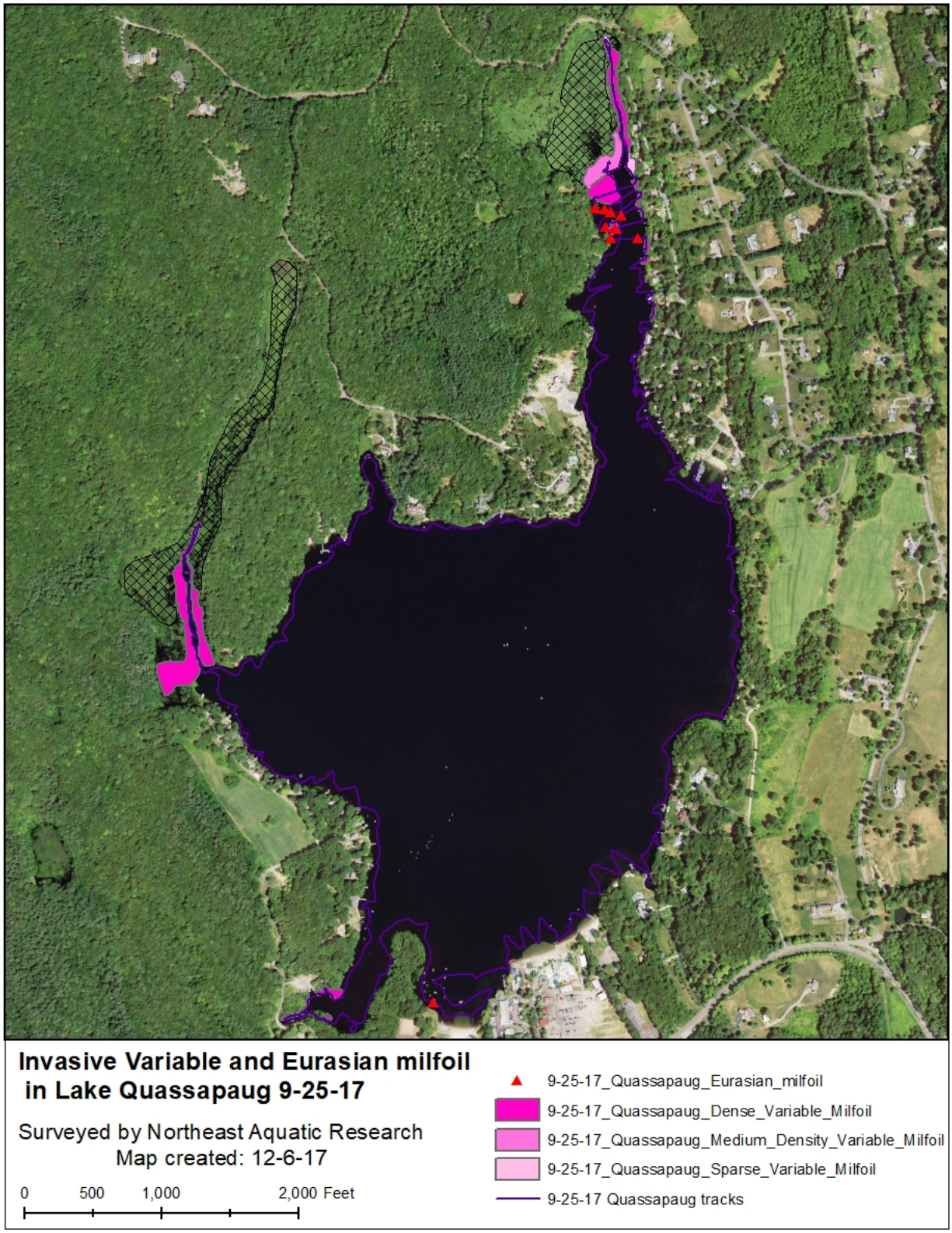

Figure 3: Lake Quassapaug 2017 Variable and Eurasian milfoil

Results for Eurasian milfoil are shown below in Table 4. However, because total Eurasian milfoil abundance in the lake is so low, coverage statistics for this species were estimated using a combination of new and old waypoints, as well as other notes made during the surveys.

Table 4: Eurasian milfoil lake-wide estimated statistics

Eurasian milfoil (*Myriophyllum spicatum*)				
2013	**2014**	**2015**	**2016**	**2017**
%occur	%occur	%occur	%occur	%occur
4	6	2	3	7
AVG%	AVG%	AVG%	AVG%	AVG%
	10	2 plants	10	13
Overall%	Overall%	Overall%	Overall%	Overall%
	0.6	0.03	0.3	0.95

Eurasian milfoil has historically been found at low densities in multiple coves, but in 2016 it was only found in the Tyler Cove arm. In 2016, there were only three locations with Eurasian milfoil plants in this area, but in 2017 there were 8 waypoints where plants were documented in the Tyler Cove arm (Figure 4).

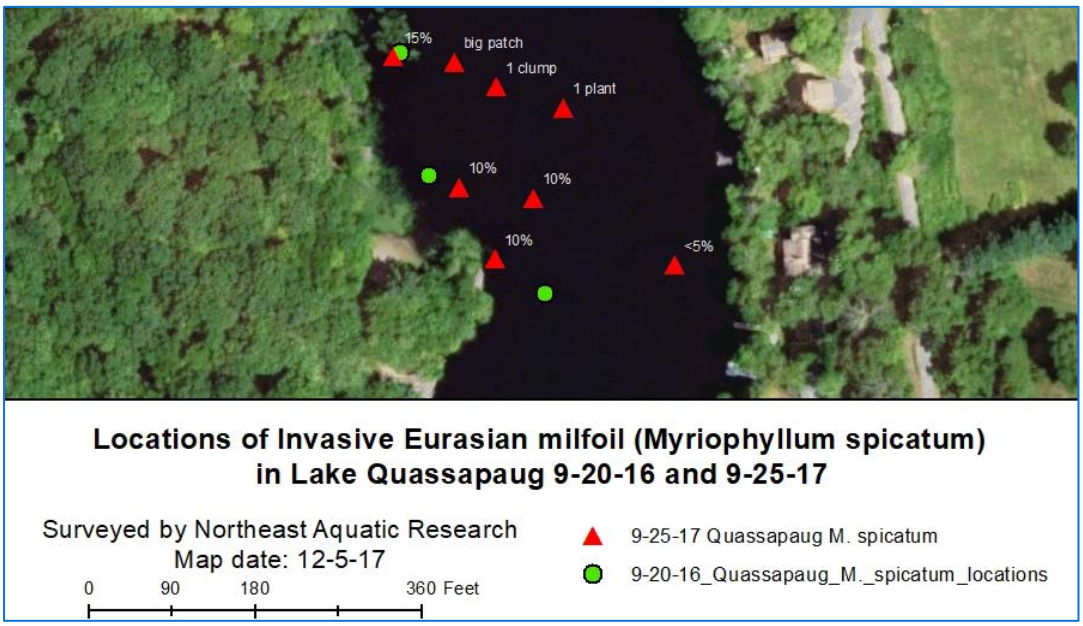

Figure 4: Eurasian milfoil 2017 in Tyler Cove

Referring to Figure 4, the Eurasian milfoil sites listed as 10%, indicate that there were several individual plants and small plant clusters with an estimated 10% cover overall in about a 10x10ft area. The <5% label indicates a few scattered plants. The waypoint labeled "big patch" was enough to be estimated at approximately 80% total cover in a 10x10ft area. The depths at which Eurasian milfoil plants were found in Tyler Cove ranged from 2.3 to 7.8ft.

Only one Eurasian milfoil plant was found outside of Tyler Cove. The individual plant (*M. spicatum*) was found to the left of the large southern beach area as shown in Figure 5. NEAR staff attempted to pull the plant from out of the water, but the roots are likely still in-tact and the plant will re-grow in 2018 if not addressed. This area should be a top priority for divers in 2018, but due to the lack of invasive species in this general area of the lake, extreme caution should be taken not to accidentally transport any Variable or Eurasian milfoil fragments from the suction harvesting boat that could subsequently become established in this area. Removing this individual plant should not require the entire suction harvesting apparatus and could be done by hand to avoid bringing the suction pontoon into this cove.

The 2017 Variable and Eurasian milfoil in the southern part of the Lake is displayed in the map below (Figure 6). To highlight the Eurasian milfoil point, it is surrounded by a yellow-dashed box near the southern beach area. To also highlight a small Variable milfoil patch along the western shore, it is boxed with a yellow dotted line.

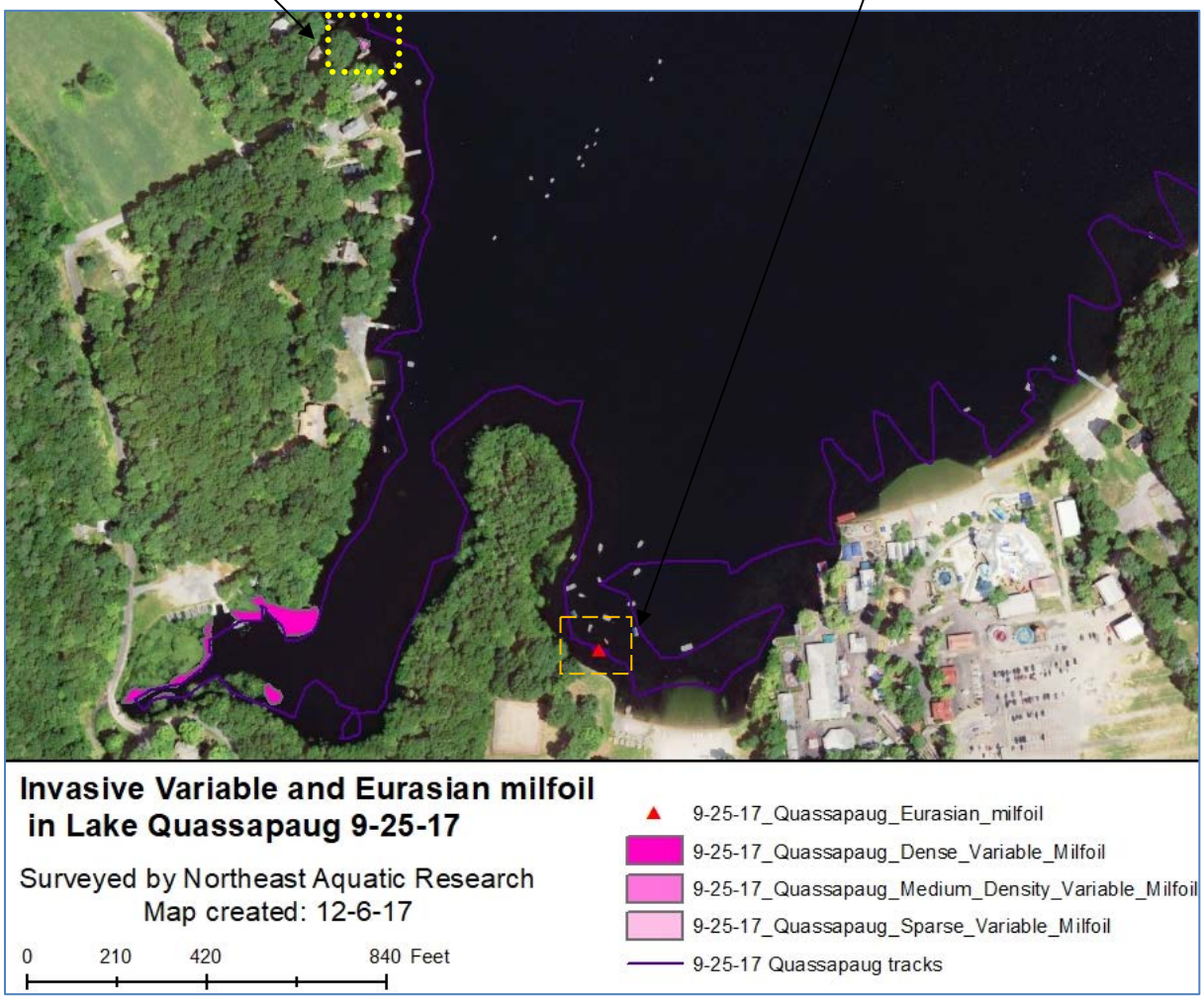

Figure 1: Variable and Eurasian milfoil 2017 (southern Lake Quassapaug)

During the course of the survey, the presence of native species was also recorded at each waypoint. A total of 27 aquatic plant species were recorded in 2017. The species list shown in Table 5, lists both the scientific and common names of these plants. The invasive species are highlighted in red. *Phragmites* is also invasive, but it is a shoreline wetland species that will not actively take over the lake area.

Table 5: 2017 Lake Quassapaug Aquatic Plant Species List

Aquatic Plant Species List 2017		
Scientific Name	**Common Name**	
Potamogeton epihydrus	Ribbon-leaf pondweed	
Brasenia schreberi	Watershield	
Sagittaria graminea	Grassy arrowhead	
Eleocharis acicularis	Needle spikerush	
Nymphaea odorata	White water lily	
Pontederia cordata	Pickerelweed	
Myriophyllum heterophyllum	Variable milfoil	invasive
Potamogeton bicupulatis	Snailseed pondweed	
Utricularia macrorhiza	Common bladderwort	
Fontinalis sp.	Aquatic moss	
Nuphar variegata	Yellow water lily	
Utricularia radiata	Little floating bladderwort	
Typha	Cattails	
Potamogeton natans	Floating pondweed	
Emergent sparganium	Bur-reed	
Ceratophyllum demersum	Coontail	
Mryiophyllum spicatum	Eurasian milfoil	invasive
Sparganium fluctuans	Floating bur-reed	
Utricularia pupurea	Purple bladderwort	
Isoetes	Quillwort	
Phragmites australis	Common reed	invasive
Najas guadalupensis	Southern naiad	
Nitella sp.	Stonewort	
Najas gracillima	Slender naiad	
Elodea nuttallii	Slender waterweed	
Eriocaulon aquaticum	Pipewort	

Management Discussion & Recommendations

In general, the DASH efforts to remove Variable milfoil were very apparent. The Tyler Cove arm had a widened and extended channel that was largely free of milfoil, when prior to 2017, the very northern part of this cove was entirely topped out with the invasive species. Though there were still large areas with re-growing milfoil shoots in 2017, there were also many new large areas of open sediment that will hopefully remain milfoil free with continued maintenance. Long Cove had a very similar new channel and the survey boat was able to reach about 500ft farther into the cove in 2017 than in 2016.

Divers should be able to maintain these channels and slowly work outwards clearing more Variable milfoil as they go, but efforts should also be put into the outer edges of the Variable milfoil beds to prevent extension further into the main part of the Lake. The photos below show the definite channel from Long Cove.

Photo 1

Photo 2

In terms of Eurasian milfoil, it is concerning that despite diver efforts new plants seem to be colonizing the Tyler Cove area and that there was at least one new plant in an entirely new area of the lake. The "big patch" in Tyler Cove (Figure 2) is concerning because it is larger than any other Eurasian milfoil patches that have been seen thus far in the lake. Divers should focus time in this area in 2018 to eradicate the Eurasian milfoil as it is still at a manageable density level and relatively confined. Monitoring of other coves should continue on at least an annual basis.

One of the biggest concerns about both aquatic invasive species is spreading to new areas in the lake. The very clear water of Lake Quassapaug could potentially allow both species to colonize very deep water (up to ~20ft deep) because the plants will still have adequate light at those depths. The floating orange boom that was installed across Long Cove during suction harvesting appeared to be trapping many fragments that are produced during suction harvesting. We did not find any Variable milfoil fragments below (lake ward) the Long Cove boom. We did, however, find at least three locations with multiple Variable milfoil fragments below the Tyler Cove arm, which did not have a boom on the day the survey was conducted. During the survey, we collected at least ten fragments on the eastern shoreline of Tyler Cove, below- south- of the area colonized with milfoil. Each fragment had roots and could potentially spread the milfoil and create new patches.