

Annual Report
2022 Management Program
Westford Ponds
Westford, MA

Prepared by: SÖLitude Lake Management
590 Lake Street
Shrewsbury, MA 01545

Prepared for: Town of Westford
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Westford, MA 01886

Submitted on: November 16, 2022

Introduction

In accordance with the 2022 Aquatic Management Program contract between SÖLitude Lake Management and the Town of Westford for the Westford Ponds (Nabnasset Lake & Long Sought for Pond) the following document serves to provide this year's treatment and monitoring results, as well as recommendations for the 2023 management season. As proposed, TRC (formerly ESS Group) conducted all monitoring work.

All management activities were conducted in compliance with the current Orders of Conditions issued by the Westford Conservation Commission and the Licenses to Apply Chemicals (# WM04-0000988 – Long Sought For Pond, WM04-0000977 - Nabnasset Lake) issued by the MA DEP Office of Watershed Management.

This year's program was limited to Long Sought for Pond and Nabnasset Lake, although an algaecide treatment of Keyes Pond was also requested later in the summer. Pre & Post treatment vegetation surveys and water quality sampling was conducted at both Long Sought for Pond and Nabnasset Lake. Active management consisted of treating nuisance pondweeds at Long Sought for Pond, treatment of curlyleaf pondweed, milfoil and nuisance algae at Nabnasset Lake and an algaecide treatment at Keyes Pond.

Pre-Treatment Surveys

The pre-treatment surveys for Nabnasset Lake and Long Sought For Pond were conducted by TRC on June 3rd. Curlyleaf pondweed (*Potamogeton crispus*) and thinleaf pondweed (*Potamogeton spp.*) were noted at nuisance levels and recommended for treatment. In Nabnasset Lake, a significant amount of curlyleaf pondweed and a couple isolated



occurrences of variable watermilfoil (*Myriophyllum heterophyllum*) were observed and recommended for treatment. Water celery (*Vallisneria americana*) was noted at low density in the lake and was not slated for treatment. The complete pre-treatment report, including water quality sampling results, from TRC is attached.

Herbicide Treatments

Treatment of Long Sought For Pond and Nabnasset Lake was performed on June 15th to control respective aquatic invasive species growth around select areas of the shoreline. Prior to both treatment events, notification was posted on the Town's website and Facebook page, as well as water-use restriction signs that were posted along the shoreline of each pond.

Both ponds were treated utilizing diquat herbicide; approximately 50 acres in Long Sought For, and 40 acres in Nabnasset were treated. Copper sulfate treatments were performed at Nabnasset Lake on July 18th and August 18th to address cyanobacteria blooms later in the summer. At the request of the Town, a half-pond copper sulfate algacide treatment was conducted at Keyes Pond on September 29th.

Post-Treatment Assessment

The final post-treatment plant mapping and WQ sampling at Long Sought For Pond and Nabnasset Lake was conducted by TRC on September 15th.

Overall, the herbicide treatments at Long Sought for Pond and Nabnasset Lake worked well to control the target species. Long Sought for Pond exhibited only small, localized areas of curlyleaf pondweed and thin leaf pondweed growth. Similarly, Nabnasset Lake had only one small area of sparse curlyleaf pondweed growth present at the time of the survey and only a small amount of variable milfoil and brittle naiad (*Najas minor*) in mouth of Shipley Swamp. The detailed results of the sampling and late season mapping work are included in the attached report by TRC.

Ongoing Management Recommendations

Consistent with prior years, we recommend continuing annual monitoring and treatment, if warranted, at not only Long Sought For Pond and Nabnasset Lake, but also the other managed ponds in Westford in 2023. We strongly recommend initiating monitoring and management of all ponds in early spring to sufficiently allow for scheduling and appropriate treatment timing for the various target species. More information on the recommendations from TRC (with input from SOLitude) is included in their attached reports. One final thing of note is that elevated phosphorus levels were observed in both Long Sought For Pond and Nabnasset Lake this year, which is of concern especially considering that cyanobacteria bloom occurred and were treated twice this year at Nabnasset Lake. Additional study and discussion of this issue is warranted.



June 21, 2022

Dominic Meringolo
SOLitude Lake Management
590 Lake Street
Shrewsbury, Massachusetts 01545

**Re: Aquatic Plant and Water Quality Monitoring and Reporting, Pre-treatment – 2022
Westford, Massachusetts
ESS Project No. 495629.0000.0000**

Dear Mr. Meringolo,

ESS Group, LLC (ESS), A TRC Company, was contracted by SOLitude Lake Management (SOLitude) to complete a pre-treatment monitoring program at Long Sought-for Pond and Nabnasset Lake located within the Town of Westford (Town).

Pre-treatment Monitoring

Pre-treatment monitoring consisted of aquatic vegetation mapping and water quality sampling and was completed at on June 3, 2022.

Aquatic Vegetation Monitoring

Aquatic plants were surveyed using comparable methods to 2021. Plant rakes were used to help assess aquatic invasive plant densities. Data was collected using a combination of field notes and a Trimble Geo7x DGPS receiver capable of sub-meter accuracy. Aquatic plants observed during the pre-treatment monitoring are presented in Table 1.

Additional details on the results of the aquatic plant surveys are presented, by pond, in the following sections.

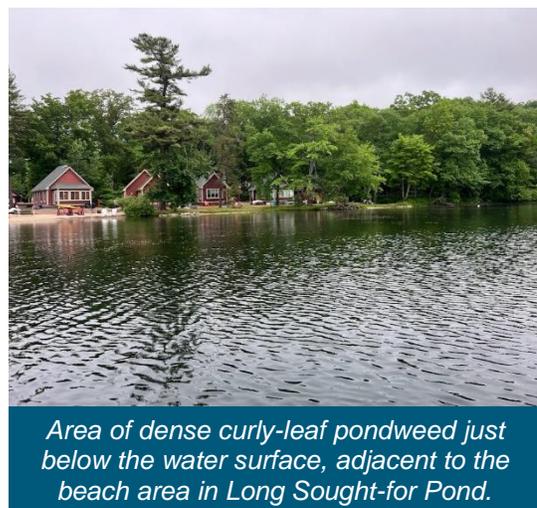
Long Sought-for Pond

Seven species of aquatic plant and one species of macroalgae were observed at Long Sought-for Pond during the pre-treatment survey (Table 1).

Aquatic invasive curly-leaf pondweed (*Potamogeton crispus*) covered approximately 30 acres during the 2022 pre-treatment survey (Figure 1). Unlike previous years, beds were generally of moderate most areas where observed.

Additionally, a native thinleaf pondweed species (*Potamogeton spp.*) covered approximately 11 acres of the pond in light to moderate growth, with one small areas of denser beds along the southwestern shoreline (Figure 2).

Eurasian milfoil (*Myriophyllum spicatum*), which has been observed in the recent past, was not observed at Long Sought-for Pond during 2022 pre-treatment monitoring.



Area of dense curly-leaf pondweed just below the water surface, adjacent to the beach area in Long Sought-for Pond.



Nabnasset Lake

Ten species of aquatic plants and one species of macroalgae were observed at Nabnasset Lake during the pre-treatment survey (Table 1).

Most notably, aquatic invasive curly-leaf pondweed was documented at high densities in Nabnasset Lake and covered approximately 23 acres during the 2022 pre-treatment survey (Figure 3). This species was widespread and found at high densities along the northern shoreline and eastern coves of Nabnasset Lake.

Water chestnut (*Trapa natans*) had been observed during the 2021 survey; however it was not observed at Nabnasset Lake during the 2022 pre-treatment survey.

Water celery (*Vallisneria americana*), although not an exotic species, has been observed to grow at nuisance densities in past surveys; however, it was not observed to be widespread at Nabnasset Lake during the time of the 2022 pre-treatment survey (Figure 4). Water celery was generally present at low densities at only a handful of locations.

Variable-leaf milfoil was observed at a single location in one of the northeast coves of Nabnasset Lake during 2022 pre-treatment monitoring. Variable-leaf milfoil was also observed adjacent to the lake in the outlet of Shipley Swamp.



Area of dense curly-leaf pondweed growth in the northeast cove of Nabnasset Lake.

Table 1. Aquatic Plants Observed at Westford Ponds during 2022 Pre-treatment Surveys.

Common Name	Scientific Name	Native or Exotic	Long Sought-for Pond	Nabnasset Lake
Bigleaf Pondweed	<i>Potamogeton amplifolius</i>	Native		X
Bushy Naiad	<i>Najas flexilis</i>	Native	X	X
Common Bladderwort	<i>Utricularia macrorhiza</i>	Native		X
Curly-leaf Pondweed	<i>Potamogeton crispus</i>	Exotic	X	X
Muskgrass	<i>Chara sp.</i>	Native	X	
Spikerush	<i>Eleocharis sp.</i>	Native	X	
Stonewort	<i>Nitella sp.</i>	Native	X	X
Thinleaf Pondweed	<i>Potamogeton spp.</i>	Native	X	X
Variable-leaf Milfoil	<i>Myriophyllum heterophyllum</i>	Exotic		X
Water Celery (Tapegrass)	<i>Vallisneria americana</i>	Native	X	X
Watershield	<i>Brasenia schreberi</i>	Native		X
White Water Lily	<i>Nymphaea odorata</i>	Native	X	X
Yellow Water Lily	<i>Nuphar lutea variegata</i>	Native		X
Total			8	11

Water Quality Monitoring

ESS conducted water quality sampling at three stations within each waterbody, including one location in the deepest portion of each waterbody. ESS measured the following parameters in the field: dissolved oxygen, temperature, turbidity, pH, and water clarity (Secchi disk).

ESS collected water samples for laboratory analysis of the following analytes: hardness, nitrate nitrogen, alkalinity, total phosphorus, total Kjeldahl nitrogen, and ammonia nitrogen. Water samples were analyzed by a Massachusetts-certified analytical laboratory. Notable water quality results are summarized in the following sections.

Dissolved Oxygen

Each pond exhibited dissolved oxygen concentrations suitable for aquatic life near the surface. Long Sought-for Pond and Nabnasset Lake contained sufficient dissolved oxygen nearly to the bottom of the water column. However, Long Sought-for Pond also demonstrated supersaturated (i.e., >100%) dissolved oxygen in the mid water column. This could potentially be associated with bloom conditions, in which photosynthesis by phytoplankton removes carbonic acid (carbon dioxide) from the water and produces oxygen.

Turbidity

Turbidity was similar in both waterbodies. The “bottom” sample at Nabnasset Lake was slightly higher than what was recorded at Long Sought-for Pond but turbidity did not appear to be elevated in any of the locations sampled. Some variability was observed among sampling locations within a pond, with turbidity readings ranging twice as high at some locations as others.

Secchi Depth (Transparency)

Secchi depth is a measure of water transparency and may be reduced by suspended sediments, algal growth, or the presence of other organic matter in the water column. Reduced Secchi depths are typically associated with nutrient-enriched ponds.

In this study, Secchi depth was similar for both water bodies (Table 4), however the transparency at Long Sought-for Pond was slightly higher than what was recorded at Nabnasset Lake. Although transparency was not excellent, it also did not appear to be severely limited.

pH, Hardness, and Alkalinity

The pH of both water bodies was circumneutral (i.e., pH near 7.0).

Hardness was higher at Nabnasset Lake but alkalinity was similar between the two ponds. These results are consistent with the results of pre-treatment water quality sampling conducted in prior years.

Greater hardness suggest higher levels of dissolved metals. Increased alkalinity suggests greater buffering capacity of the water (i.e., resistance to pH change). Ponds with low buffering capacity may be susceptible to more abrupt swings in pH than those with higher alkalinity.

Phosphorus and Nitrogen

Phosphorus and nitrogen are both major nutrients fueling plant and algal growth. Of the two, phosphorus tends to be limiting nutrient in most New England freshwater systems. However, nitrogen levels can also impact the overall productivity of the system and type of algal growth favored, and may even influence the production of toxins in some cyanobacteria. In general, high water column nutrient levels can contribute to algal blooms and excessive aquatic plant growth, especially floating plants.

Total phosphorus concentrations were elevated in both Nabnasset and Long-Sought-for than compared to past sampling events. Total phosphorus concentrations were highest at the inlet location (LSF-C) in Long-Sought-for Pond. Concentrations in excess of 0.050 mg/L were recorded at both the inlet and surface of Long-Sought-for Pond. At Nabnasset Lake, the total phosphorus concentrations were recorded in excess

of 0.050 mg/L at all sampling locations and the highest total phosphorus concentration was recorded at the outlet location (NAB-C) in Nabnasset Lake.

Overall nitrogen levels were highest Nabnasset Lake, where nitrate contributed similar concentrations of nitrogen as total Kjeldahl nitrogen (TKN). This is consistent with prior years, which indicate elevated concentrations of nitrate nitrogen in Nabnasset Lake. Ammonia nitrogen, which is a component of TKN, was low at all locations.

Table 2. Dissolved Oxygen Profiles at Deep Hole Locations During 2022 Pre-treatment Monitoring

Depth	Long-Sought-for Pond		Nabnasset Lake	
	m	%	mg/L	mg/L
0.5	96.6	8.27	96.4	8.39
1.0	92.8	8.15	97.3	8.53
2.0	94.8	8.25	97.8	8.58
3.0	94.4	8.23	98.3	8.62
4.0	104.7	9.39	92.7	8.66
5.0	105.9	10.17	84.1	8.35
6.0	96.9	9.71	60.5	6.17
7.0	70.4	7.12	36.7	3.83
8.0	45.0	4.62	9.5	1.06
9.0	10.2	1.3	-	-

Table 3. Temperature (°C) Profiles at Deep Hole Locations During 2022 Pre-treatment Monitoring

Depth (m)	Long-Sought-for Pond	Nabnasset Lake
0.5	21.5	21.3
1.0	21.5	21.3
2.0	21.5	21.2
3.0	21.5	21.1
4.0	20.0	20.7
5.0	16.7	15.7
6.0	15.1	14.2
7.0	14.2	13.6
8.0	13.2	13.0
9.0	12.4	-

Table 4. Water Quality Parameters Collected During 2022 Pre-treatment Monitoring

Parameter	Units	Long Sought-for Pond			Nabnasset Lake		
		LSF-A	LSF-B	LSF-C	NAB-A	NAB-B	NAB-C
		Deep Hole		Inlet	Deep Hole		Outlet
		Surface	Bottom		Surface	Bottom	
Total depth	m	9.0		0.5	8.0		2.0
Sample depth	m	surface	8	surface	surface	7	surface
Temperature	C	21.5	13.2	21.2	21.3	13.6	20.8
Dissolved oxygen	%	96.6	45	89.0	96.4	36.7	92.3
	mg/L	8.27	4.61	7.70	8.39	3.83	8.46
Turbidity	NTU	1.63	1.71	0.7	1.02	2.36	0.3
pH	SU	7.89	7.65	7.82	7.67	7.55	7.77
Secchi Depth	m	5.5		0.5 (bottom)	3.25		2.0 (bottom)
Hardness	mg/L	37.0	38.0	37.7	49.9	49.3	49.4
Alkalinity	mg/L	30.4	33.2	29.4	31.4	32.3	32.3
Total phosphorus	mg/L	0.066	0.034	0.054	0.058	0.055	0.076
Nitrate nitrogen	mg/L	0.03	0.05	0.03	0.69	0.58	0.64
Total Kjeldahl nitrogen	mg/L	0.47	0.53	0.43	0.50	0.58	0.92
Ammonia nitrogen	mg/L	0.07	0.12	<0.05	0.06	0.13	0.10

Monitoring

Fall season/post-treatment water quality and aquatic vegetation monitoring is recommended for Nabnasset Lake and Long Sought-for Pond, as well as the other five ponds that are typically monitored on a biannual basis. This will allow for the development of next year’s monitoring and management plan using data that are up-to-date and accurately reflect the current condition of each water body. For consistency, post-treatment monitoring protocols should be the same as the pre-treatment monitoring conducted as part of this study. ESS recommends completing the monitoring program in September or early October to maximize comparability of the results to prior years.



Dominic Meringolo
June 21, 2022

We appreciate the opportunity to work with you on this project. Please contact James Treacy at (781) 419-7742 if you have any questions.

Sincerely,

ESS GROUP, LLC

A handwritten signature in cursive script that reads "James Treacy".

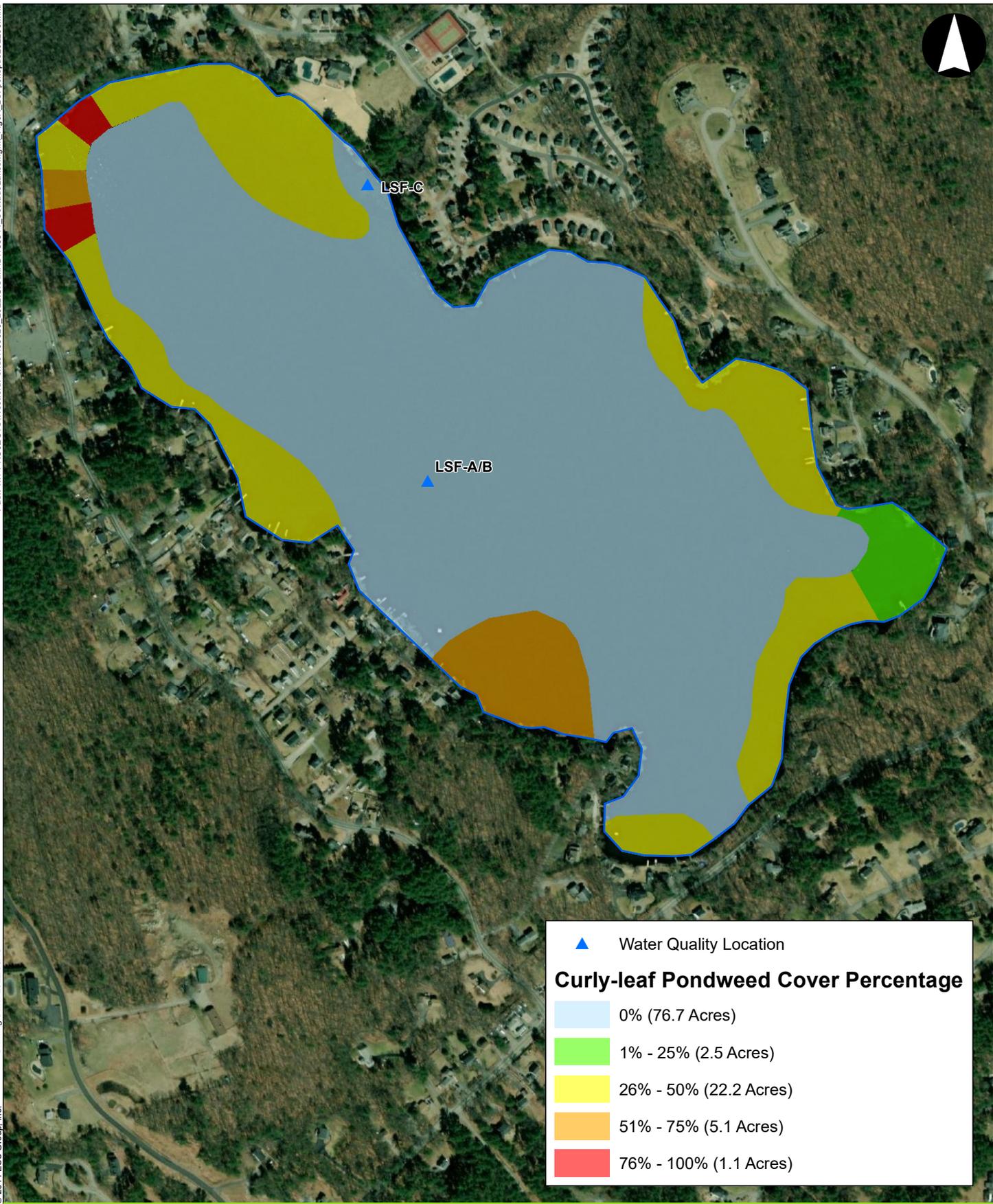
James Treacy
Staff Scientist

Attachments: Figures

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Drawing Date: 2022/06/15

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▲ Water Quality Location

Curly-leaf Pondweed Cover Percentage

Light Blue	0% (76.7 Acres)
Green	1% - 25% (2.5 Acres)
Yellow	26% - 50% (22.2 Acres)
Orange	51% - 75% (5.1 Acres)
Red	76% - 100% (1.1 Acres)



Solitude Lake Management LLC
Westford, Massachusetts

Long Sought For Pond
Curly-leaf Pondweed (June 2022)

Source: 1) ESRI, World Imagery, 2019
2) ESS, GPS Data, June 2022

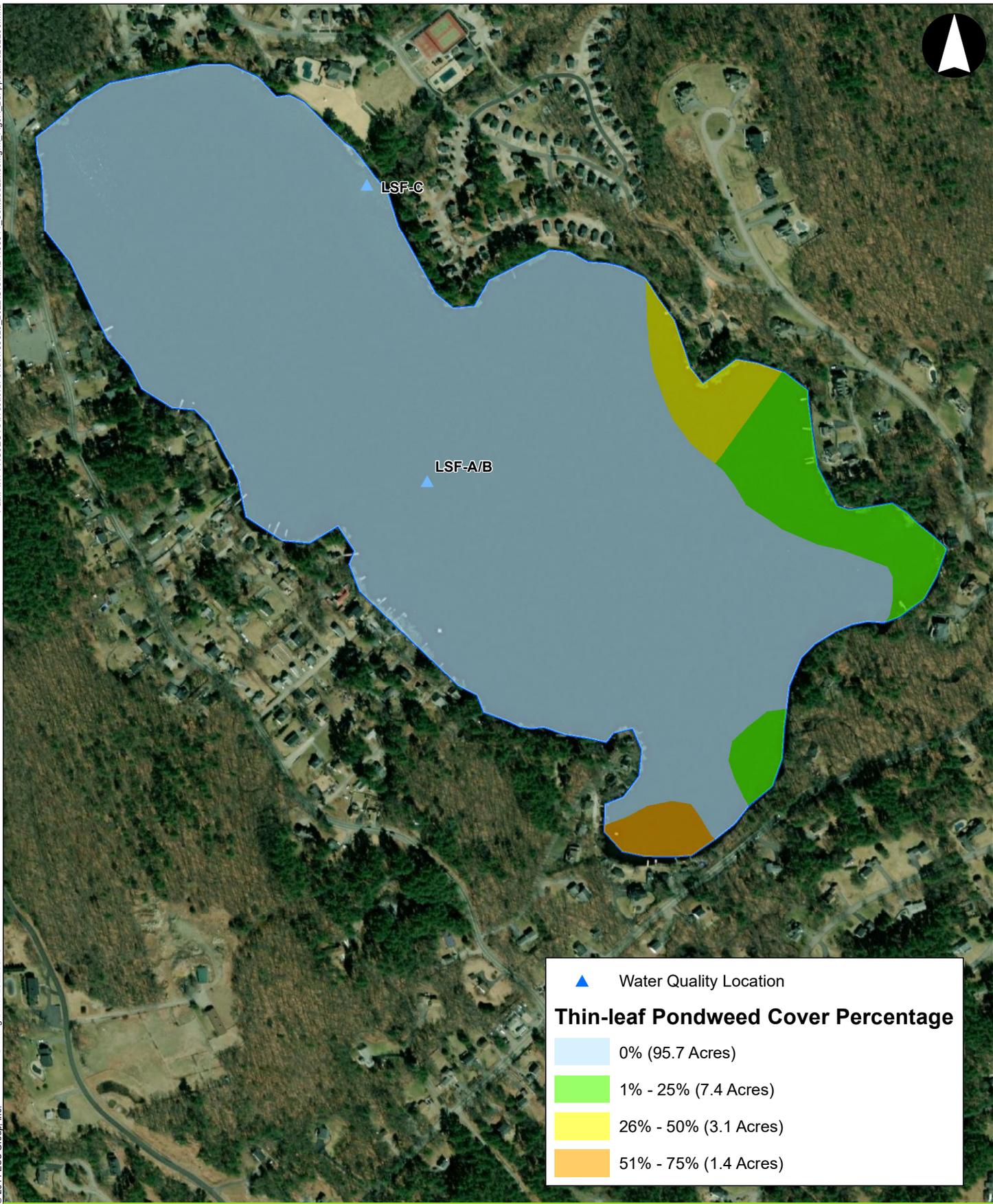


Figure 1

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Drawing Date: 2022/06/15

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▲ Water Quality Location

Thin-leaf Pondweed Cover Percentage

Light Blue	0% (95.7 Acres)
Green	1% - 25% (7.4 Acres)
Yellow	26% - 50% (3.1 Acres)
Orange	51% - 75% (1.4 Acres)



Solitude Lake Management LLC
Westford, Massachusetts

Long Sought For Pond
Thin-leaf Pondweed (June 2022)

Source: 1) ESRI, World Imagery, 2019
2) ESS, GPS Data, June 2022

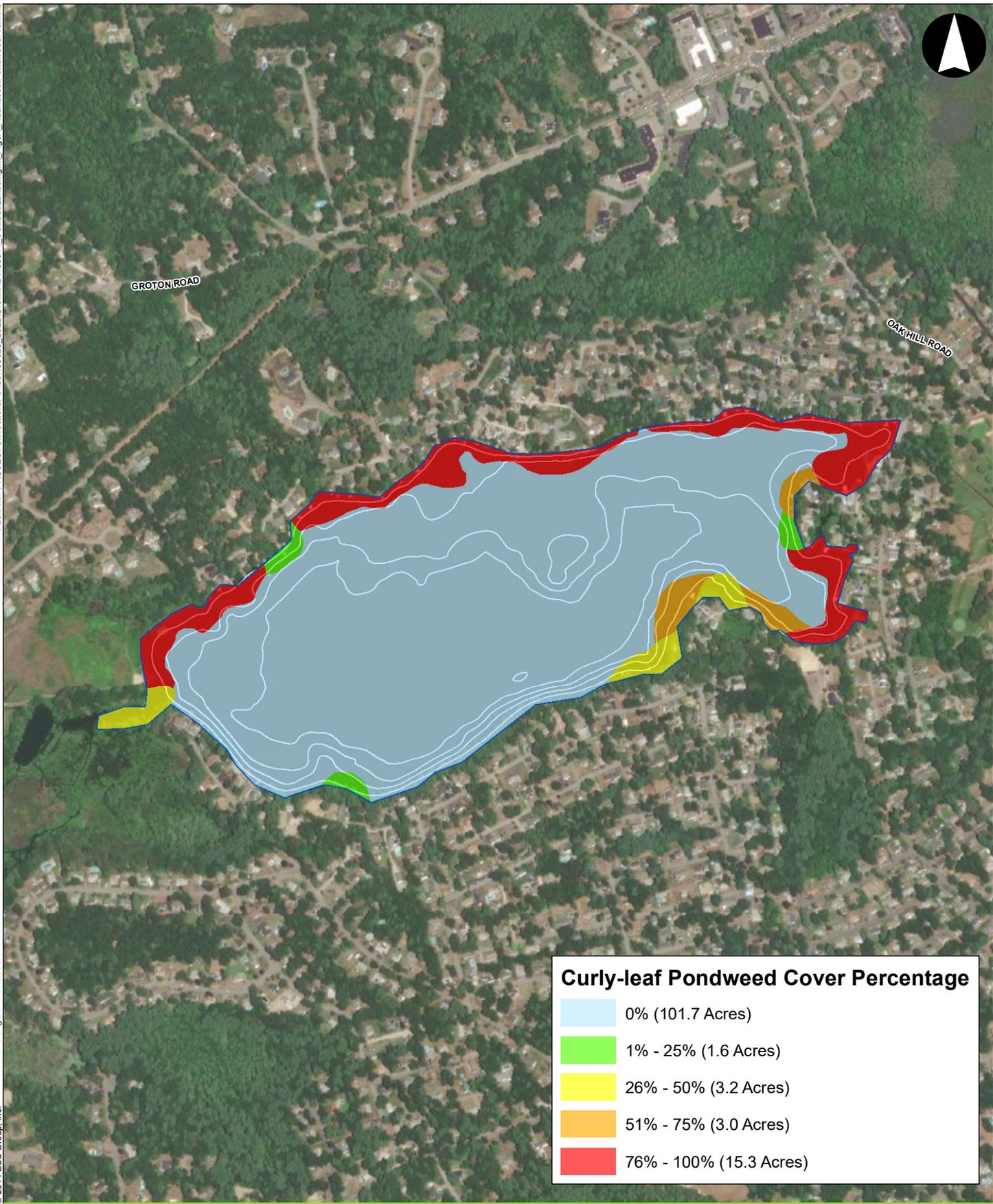


Figure 2

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Drawing Date: 2022/06/14

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Solitude Lake Management LLC
Westford, Massachusetts

Nabnasset Pond
Curly-leaf Pondweed Cover
Pre-Treatment (June 2022)

Source: 1) ESRI, World Imagery, 2020
2) ESS, GPS Data, June 2022

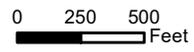
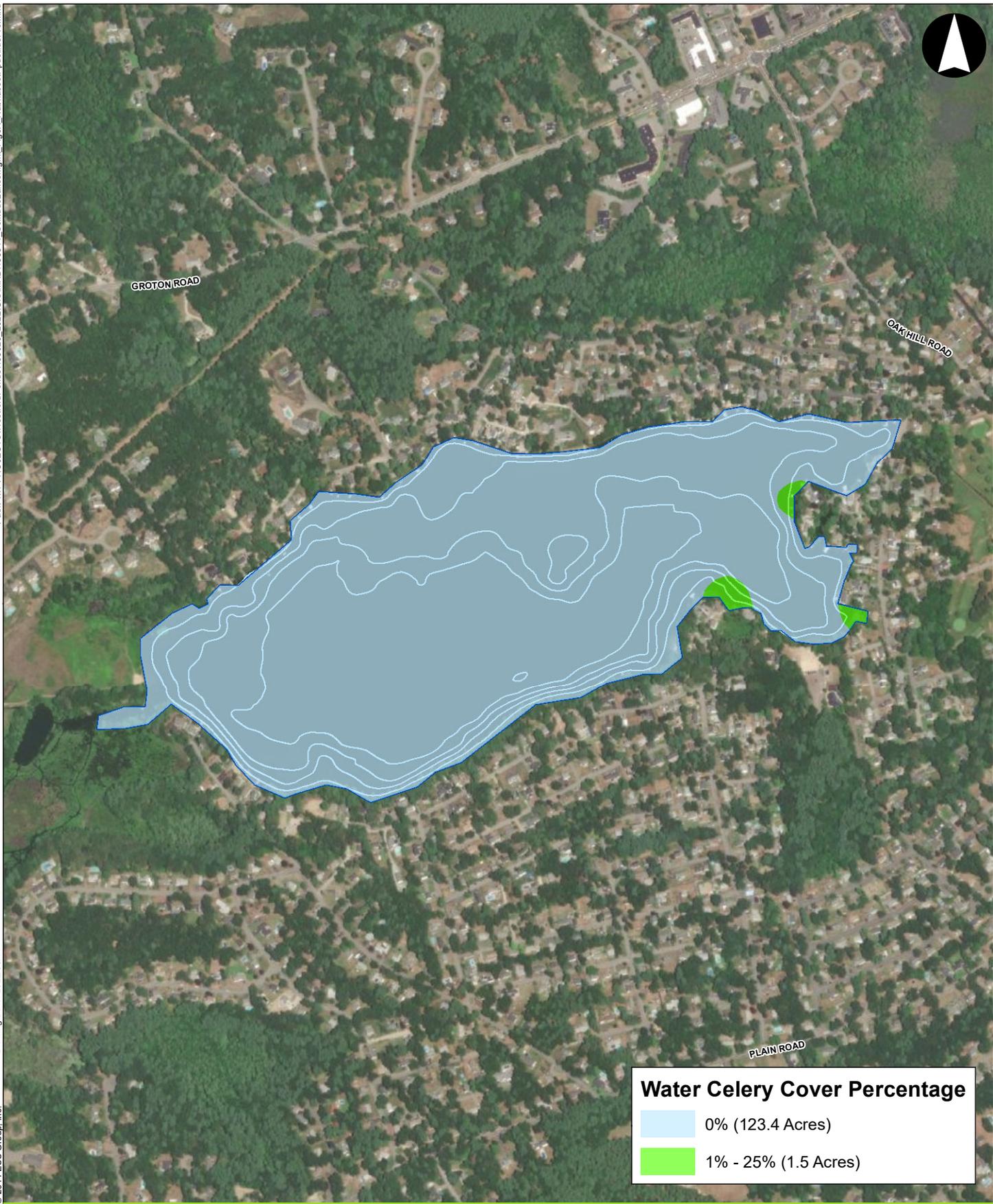


Figure 3

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Drawing Date: 2022/06/14

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Water Celery Cover Percentage

	0% (123.4 Acres)
	1% - 25% (1.5 Acres)



Solitude Lake Management LLC
Westford, Massachusetts

Nabnasset Pond
Water Celery Cover
Pre-Treatment (June 2022)

Source: 1) ESRI, World Imagery, 2020
2) ESS, GPS Data, June 2022

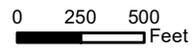


Figure 4

October 20, 2022

Dominic Meringolo
SOLitude Lake Management
590 Lake Street
Shrewsbury, Massachusetts 01545

**Re: Aquatic Plant and Water Quality Monitoring and Reporting, Post-treatment – 2022
Westford, Massachusetts
TRC Project No. 495629.0000.0000**

Dear Mr. Meringolo,

TRC Companies, Inc (TRC), was contracted by SOLitude Lake Management (SOLitude) to complete a post-treatment monitoring program at Long Sought-for Pond and Nabnasset Lake located within the Town of Westford (Town).

Post-treatment Monitoring

Post-treatment monitoring consisted of aquatic vegetation mapping and water quality sampling and was completed at on September 15, 2022.

Aquatic Vegetation Monitoring

Aquatic plants were surveyed using comparable methods to 2021 (ESS 2021). Plant rakes were used to help assess aquatic invasive plant densities. Data was collected using a combination of field notes and a Trimble Geo7x DGPS receiver capable of sub-meter accuracy.

Overall, the aquatic plant communities at Long Sought-for Pond and Nabnasset Lake have been relatively consistent with previous years. Additional details on the results of the aquatic plant surveys are presented, by pond, in the following sections.

Long Sought-for Pond

Seven species of aquatic plants were observed at Long Sought-for Pond during the post-treatment survey (Table 1).

Aquatic invasive curly-leaf pondweed (*Potamogeton crispus*) covered less than 1 acre during the 2022 post-treatment survey (Figure 1). Although this is significantly less than what had been observed during the 2022 pre-treatment survey, the post-treatment survey was completed outside the growing season for curly-leaf pondweed.

Additionally, a native thinleaf pondweed species (*Potamogeton spp.*) covered approximately 2 acres of the pond in light to moderate growth (Figure 2). Although a native, this has been a target species which has been documented at nuisance levels in past years surveys at Long Sought-for Pond.

Eurasian milfoil (*Myriophyllum spicatum*) which has not been observed since 2018, was not observed at Long Sought-for Pond during 2022 post-treatment monitoring.



Long Sought-for Pond during the post-treatment survey on September 15, 2022.

Nabnasset Lake

Ten species of aquatic plants were observed at Nabnasset Lake during the post-treatment survey (Table 1).

Aquatic invasive curly-leaf pondweed was documented at high densities in Nabnasset Lake during the 2022 pre-treatment survey. During the 2022 post-treatment survey, this species was found at low densities at only a few locations on the northern shoreline of Nabnasset Lake (Figure 3). The post-treatment survey at Nabnasset Lake was completed outside the maximum growing season for curly-leaf pondweed.

Water celery (*Vallisneria americana*), although not an exotic species, has been observed to grow at nuisance densities in past surveys; however, it was not observed to be widespread at Nabnasset Lake during the time of the 2022 post-treatment survey (Figure 4). Water celery was generally present at low densities.

Variable-leaf milfoil (*Myriophyllum heterophyllum*) and brittle naiad (*Najas minor*) were observed at a single location, adjacent to the lake in the outlet of Shipley Swamp (Figure 3).

Water chestnut (*Trapa natans*) had been observed during the 2021 survey; however, it was not observed at Nabnasset Lake during the 2022 post-treatment survey.



Table 1. Aquatic Plants Observed at Westford Ponds during 2022 Post-treatment Surveys.

Common Name	Scientific Name	Native or Exotic	Long Sought-for Pond	Nabnasset Lake
Brittle Naiad	<i>Najas minor</i>	Exotic		X
Curly-leaf Pondweed	<i>Potamogeton crispus</i>	Exotic	X	X
Humped Bladderwort	<i>Utricularia gibba</i>	Native	X	
Purple Bladderwort	<i>Utricularia purpurea</i>	Native	X	X
Southern Naiad	<i>Najas guadalupensis</i>	Native	X	X
Thinleaf Pondweed	<i>Potamogeton spp.</i>	Native	X	X
Variable-leaf Milfoil	<i>Myriophyllum heterophyllum</i>	Exotic		X
Water Celery (Tapegrass)	<i>Vallisneria americana</i>	Native	X	X
Watershield	<i>Brasenia schreberi</i>	Native		X
White Water Lily	<i>Nymphaea odorata</i>	Native	X	X
Yellow Water Lily	<i>Nuphar variegata</i>	Native		X
Total			7	10

Water Quality Monitoring

TRC conducted water quality sampling at three stations within each waterbody, including one location in the deepest portion of each waterbody. TRC measured the following parameters in the field: dissolved oxygen, temperature, turbidity, pH, and water clarity (Secchi disk).

TRC collected water samples for laboratory analysis of the following analytes: hardness, nitrate nitrogen, alkalinity, total phosphorus, total Kjeldahl nitrogen, and ammonia nitrogen. Water samples were analyzed by a

Massachusetts-certified analytical laboratory. Notable water quality results are summarized in the following sections.

Dissolved Oxygen

Each pond exhibited dissolved oxygen concentrations suitable for aquatic life near the surface. Long Sought-for Pond contained sufficient dissolved oxygen in the upper and middle portions of the water column and Nabnasset Lake contained sufficient dissolved oxygen to the bottom of the water column (Table 2).

Turbidity

Turbidity was similar in both waterbodies. The “bottom” sample at Nabnasset Lake was slightly higher than what was recorded at Long Sought-for Pond but turbidity did not appear to be elevated in any of the locations sampled (Table 4).

Secchi Depth (Transparency)

Secchi depth is a measure of water transparency and may be reduced by suspended sediments, algal growth, or the presence of other organic matter in the water column. Reduced Secchi depths are typically associated with nutrient-enriched ponds.

In this study, Secchi depth was similar for both water bodies (Table 4), however the transparency Nabnasset Lake was slightly higher than what was recorded at Long Sought-for Pond. Although transparency was not excellent, it also did not appear to be severely limited.

pH, Hardness, and Alkalinity

The pH of both water bodies was circumneutral (i.e., pH near 7.0).

Hardness was higher at Nabnasset Lake but alkalinity was similar between the two ponds. These results are consistent with the results of post-treatment water quality sampling conducted in prior years.

Greater hardness suggests higher levels of dissolved metals. Increased alkalinity suggests greater buffering capacity of the water (i.e., resistance to pH change). Ponds with low buffering capacity may be susceptible to more abrupt swings in pH than those with higher alkalinity.

Phosphorus and Nitrogen

Phosphorus and nitrogen are both major nutrients fueling plant and algal growth. Of the two, phosphorus tends to be limiting nutrient in most New England freshwater systems. However, nitrogen levels can also impact the overall productivity of the system and type of algal growth favored, and may even influence the production of toxins in some cyanobacteria. In general, high water column nutrient levels can contribute to algal blooms and excessive aquatic plant growth, especially floating plants.

In the 2022 pre-treatment survey, concentrations in excess of 0.050 mg/L were recorded at both Long-Sought-for Pond and Nabnasset Lake. However, in the 2022 post-treatment survey total phosphorus concentrations returned to levels that they had been recorded at in previous years. During the 2022 post treatment surveys total phosphorus concentrations were highest at the bottom location (NAB-B) in Nabnasset Lake (Table 4).

In the 2022 post-treatment survey, Long Sought-for Pond and Nabnasset Lake had overall nitrogen levels that were similar to the 2022 pre-treatment survey and were highest in Nabnasset Lake, particularly the bottom location (NAB-B). This is consistent with prior years. Ammonia nitrogen, which is a component of TKN, was also highest in the bottom location (NAB-B) at Nabnasset Lake (Table 4).

Table 2. Dissolved Oxygen Profiles at Deep Hole Locations During 2022 Post-treatment Monitoring

Depth	Long-Sought-for Pond		Nabnasset Lake	
	m	%	mg/L	mg/L
0.5	103.8	8.91	95.2	8.18
1.0	101.3	8.68	94.8	8.19
2.0	99.2	8.53	95.6	8.22
3.0	99.0	8.57	95.1	8.20
4.0	97.8	8.41	85.0	7.36
5.0	84.3	7.37	64.8	5.77
6.0	50.5	4.49	63.8	5.65
7.0	20.1	1.85	-	-

Table 3. Temperature (°C) Profiles at Deep Hole Locations During 2022 Post-treatment Monitoring

Depth (m)	Long-Sought-for Pond	Nabnasset Lake
0.5	22.6	22.7
1.0	22.6	22.7
2.0	22.6	22.7
3.0	22.6	22.7
4.0	22.4	22.4
5.0	21.6	21.3
6.0	21.4	21.3
7.0	21.3	-

Table 4. Water Quality Parameters Collected During 2022 Post-treatment Monitoring

Parameter	Units	Long Sought-for Pond			Nabnasset Lake		
		LSF-A	LSF-B	LSF-C	NAB-A	NAB-B	NAB-C
		Deep Hole		Inlet	Deep Hole		Outlet
		Surface	Bottom		Surface	Bottom	
Total depth	m	8.0		0.5	6.5		2.0
Sample depth	m	surface	7	surface	surface	6	surface
Temperature	C	22.6	19.1	22.3	22.7	21.3	22.9
Dissolved oxygen	%	103.8	20.1	96.5	95.2	63.8	92.3
	mg/L	8.91	1.85	8.20	8.18	5.65	7.93
Turbidity	NTU	2.44	2.15	1.93	1.93	2.60	1.49
pH	SU	7.22	6.63	7.10	7.10	6.80	7.20
Secchi Depth	m	2.5		0.5 (bottom)	3.0		2.0 (bottom)
Hardness	mg/L	30.9	40.0	31.7	47.3	55.1	55.2
Alkalinity	mg/L	20.5	34.7	20.8	26.7	35.0	27.3
Total phosphorus	mg/L	0.024	0.035	0.017	0.020	0.047	0.018
Nitrate nitrogen	mg/L	0.01	0.01	0.01	0.03	0.01	0.03
Total Kjeldahl nitrogen	mg/L	0.48	0.63	0.52	0.53	0.99	0.44
Ammonia nitrogen	mg/L	0.025	0.22	0.025	0.08	0.45	0.09

Monitoring

Biannual water quality and aquatic vegetation monitoring is recommended for Nabnasset Lake and Long Sought-for Pond. This will allow for the refinement of next year’s monitoring and management program using data that are up-to-date and accurately reflect the current condition of each water body. TRC recommends completing the monitoring program in September or early October to maximize comparability of the results to prior years.

References

ESS Group, Inc. [ESS]. 2021. Autumn 2021 Westford Ponds Report, 2021. Prepared for the Town of Westford, Massachusetts.

We appreciate the opportunity to work with you on this project. Please contact James Treacy at (781) 419-7742 if you have any questions.

Sincerely,

TRC Companies, Inc



James Treacy
Staff Scientist

COORDINATE SYSTEM: WGS 1984 WEB MERCATOR AUXILIARY SPHERE; MAP ROTATION: 0
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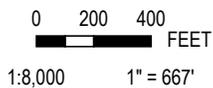


Curly-leaf Pondweed Cover Percentage

- 0% (106.8 acres)
- 1% - 25% (0.8 acres)

PROJECT: SOLitude Lake Management 590 Lake Street Shrewsbury, Massachusetts	
TITLE: Long Sought For Pond Curly-leaf Pondweed Post-Treatment (September 2022)	
DRAWN BY: K. BACHAND	PROJ. NO.: 495629.0000.0000
CHECKED BY: S. DEHAINAUT	FIGURE 1
APPROVED BY: J. TREACY	
DATE: SEPTEMBER 2022	

BASE MAP: ESRI, WORLD IMAGERY, 2019
 DATA SOURCES:
 TRC, GPS LOCATIONS, 2022



404 WYMAN STREET
 SUITE 375
 WALTHAM, MA 02451
 PHONE: 781.419.7696

FILE: 495629_NABNASSETLSF

COORDINATE SYSTEM: WGS 1984 WEB MERCATOR AUXILIARY SPHERE; MAP ROTATION: 0
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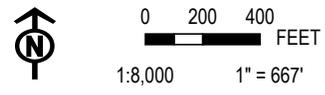


Thinleaf Pondweed Cover Percentage

- 0% (105.6 acres)
- 1% - 25% (2.0 acres)

PROJECT: SOLitude Lake Management 590 Lake Street Shrewsbury, Massachusetts	
TITLE: Long Sought For Pond Thinleaf Pondweed Post-Treatment (September 2022)	
DRAWN BY: K. BACHAND	PROJ. NO.: 495629.0000.0000
CHECKED BY: S. DEHAINAUT	FIGURE 2
APPROVED BY: J. TREACY	
DATE: SEPTEMBER 2022	

BASE MAP: ESRI, WORLD IMAGERY, 2019
 DATA SOURCES:
 TRC, GPS LOCATIONS, 2022



404 WYMAN STREET
 SUITE 375
 WALTHAM, MA 02451
 PHONE: 781.419.7696

FILE: 495629_NABNASSETLSF

COORDINATE SYSTEM: WGS 1984 WEB MERCATOR AUXILIARY SPHERE; MAP ROTATION: 0
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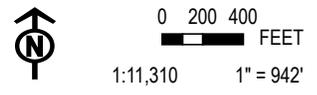
Both Brittle Naiad and Variable-leaf Milfoil common in Shipley Swamp.

Curly-leaf Pondweed Cover Percentage

	0% (124.0 acres)
	1% - 50% (0.4 acres)
	26% - 50% (0.4 acres)

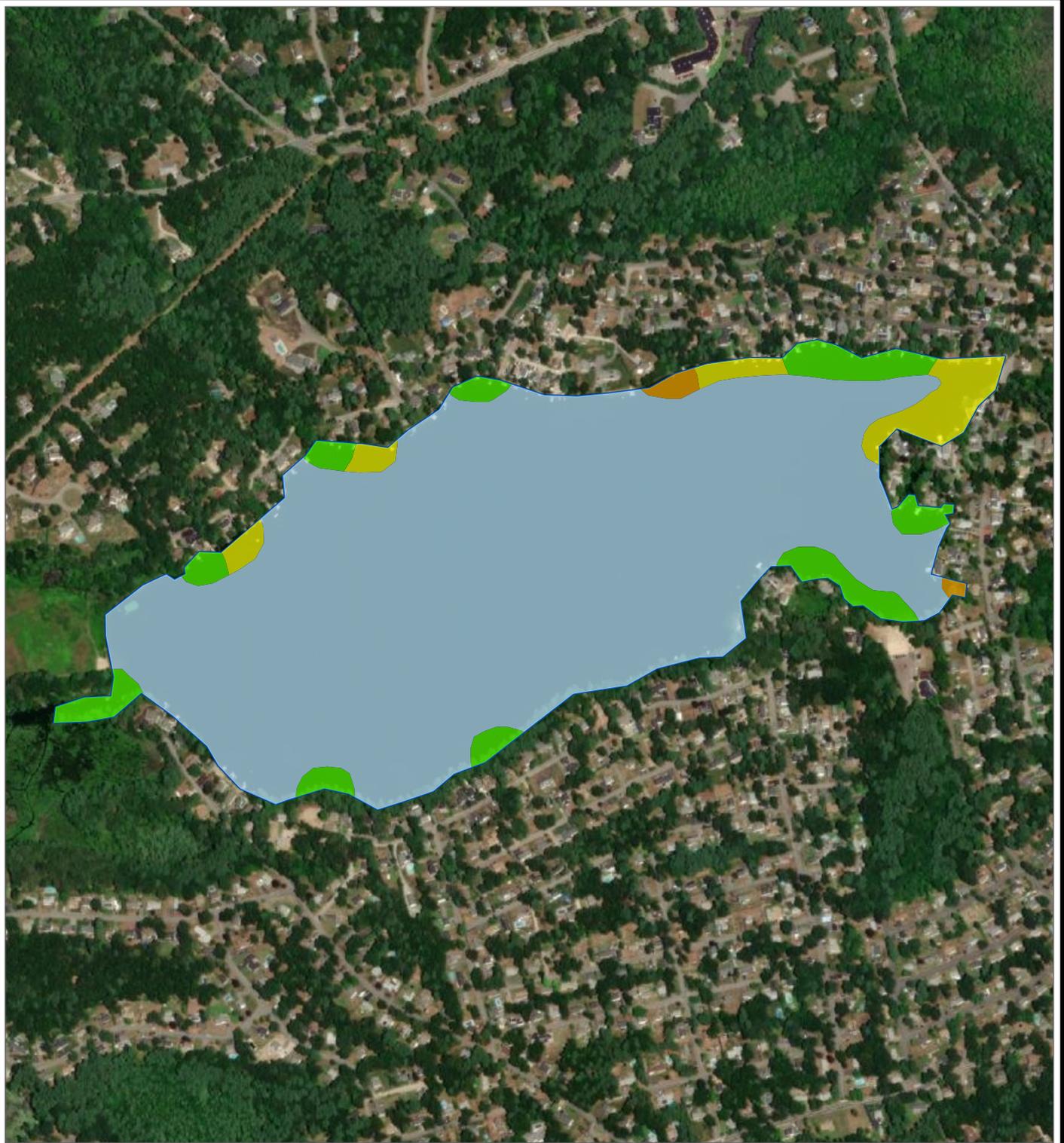
PROJECT: SOLitude Lake Management 590 Lake Street Shrewsbury, Massachusetts	
TITLE: Nabnasset Pond Curly-leaf Pondweed Post-Treatment (September 2022)	
DRAWN BY: K. BACHAND	PROJ. NO.: 495629.0000.0000
CHECKED BY: S. DEHAINAUT	FIGURE 3
APPROVED BY: J. TREACY	
DATE: SEPTEMBER 2022	

BASE MAP: ESRI, WORLD IMAGERY, 2019
 DATA SOURCES:
 TRC, GPS LOCATIONS, 2022



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	FILE: 495629_NABNASSETLSF

COORDINATE SYSTEM: WGS 1984 WEB MERCATOR AUXILIARY SPHERE; MAP ROTATION: 0
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Water Celery Cover Percentage

- 0% (109.7 acres)
- 1% - 25% (9.0 acres)
- 26% - 50% (5.5 acres)
- 51% - 75% (0.7 acres)

BASE MAP: ESRI, WORLD IMAGERY, 2019
 DATA SOURCES:
 TRC, GPS LOCATIONS, 2022



0 200 400
 FEET
 1:11,310 1" = 942'

PROJECT: SOLitude Lake Management	
590 Lake Street Shrewsbury, Massachusetts	
TITLE: Nabnasset Pond Water Celery Post-Treatment (September 2022)	
DRAWN BY: K. BACHAND	PROJ. NO.: 495629.0000.0000
CHECKED BY: S. DEHAINAUT	FIGURE 4
APPROVED BY: J. TREACY	
DATE: SEPTEMBER 2022	
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FILE: 495629_NABNASSETLSF	