

Lake Hayward

2021 Aquatic Plant Management Final Report



SOLITUDE
LAKE MANAGEMENT

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1.0 INTRODUCTION

The Property Owners Association of Lake Hayward hired SOLitude Lake Management to perform an aquatic plant management program for the summer of 2021. For over a decade, Lake Hayward has managed the non-native, invasive species, fanwort (*Cabomba caroliniana*). In addition, Lake Hayward has experienced growth of variable watermilfoil (*Myriophyllum heterophyllum*) and cyanobacteria/filamentous algal blooms.

The report below details the results of the 2021 early- and late-season point-intercept surveys, algal sample analysis, dissolved oxygen and temperature profiles, and clarity readings. 2019 was the first year the point-intercept technique was instituted in the Lake Hayward management program. From 2003-2018, a transect survey was performed pre-and post-management to determine the density and distribution of invasive species, as well as the native plant assemblage. Due to improved techniques, it was agreed upon by Solitude Lake Management and the Property Owners Association of Lake Hayward that a point-intercept survey would be more appropriate to determine the complete distribution of submersed aquatic vegetation, with special regard to invasive species. 2021 marks the third year of point-intercept data collection. The report below outlines those results.

2.0 HERBICIDE APPLICATION

Multiple areas of the lake were treated with the herbicide Clipper (flumioxazin). Treatment was completed on June 29th by SOLitude Lake Management's licensed applicators. The treatment proceeded smoothly and with no observed adverse effects or difficulties.

Overall, the treatment worked well within the treatment areas and only a few areas of late growth were observed. However, permit restrictions prohibited treatment in the northeast cove due to the presence of state protected species where fanwort continues to flourish. Fanwort was also observed on the north-western shoreline; however, a single site on the south-western shoreline displayed the presence of trace fanwort.

3.0 POINT-INTERCEPT SURVEYS

The pre-management point-intercept survey was conducted on June 8th and the post-management point-intercept survey was conducted on August 18th by a SOLitude biologist. These surveys were conducted by a 14-ft skiff along the established series of data points created in 2019. Refer to for point-intercept survey result maps. The raw data table (Appendix A) provides the actual data collected from each point.

A. Survey Methodology

Point Intercept Method

Solitude Lake Management's biologists surveyed the water body using the aforementioned survey points uploaded to a GPS unit. Please refer to **Figure 1** for locations of data points. The following data will be collected at each of the survey points:

Species Identification

The rake toss method, based on protocols developed by Cornell University, was used to retrieve submersed aquatic vegetation from either side of the survey vessel. Two rake tosses will be carried out at each point; one on either side of the survey vessel. Each species found on the rake will be identified and recorded. Plant species observed in the immediate area, but not found on either rake toss, were also recorded. Any species not readily identified *in situ* was placed into a plastic bag labeled with the data point number and preserved for



further analysis. Once all species were recorded, the most prevalent species was noted as dominant for later use in presence/absence maps.

Water Depth	Species Present
Relative Abundance of each species	Total Percent Cover of All Species
Biovolume Index	Total Percent Cover of Target Species

Relative Abundance

The abundance scale, developed by the US Army Corps of Engineers and modified by Cornell, was used to categorize total growth.

Notation	Description
Z	Zero: no plants on rake
T	Trace: fingerful on rake
S	Sparse: handful on rake
M	Moderate: more than a handful on rake
D	Dense: difficult to bring into boat

Percent Cover

Percent cover was defined as the percent of bottom sediments obscured by vegetation. In general, an area in which no sediments are visible was classified at 100% cover; at times, bottom sediments are not visible due to water clarity, regardless of vegetative growth. These points will be given a null (Ø) designation, for data recording purposes.

Notation	Description
0%	No plant growth observed
1-25%	Little to no plant growth obscuring bottom layer
25-50%	Sparse patches of bottom cover
50-75%	Much of the bottom obscured by plant growth
75-100%	Little to no bottom coverage visibly

Percentage of Target Species

The immediate area around the boat was observed for growth of *C. caroliniana* and *M. heterophyllum*, and any other target species that potentially could be present. Each point will be assigned the appropriate percentage as seen in the list above.

Biovolume Index

The biovolume for each data point indicates the approximate height that plants are present in the water column. Each plant species is recorded on a scale from zero to four:

0	No biovolume	No plants
1	Low biovolume	Very low growth
2	Moderate biovolume	Growth extending up and into water column
3	High biovolume	Growth in water column and possibly to surface, may be considered a recreational or habitat nuisance
4	Very high biovolume	Growth filling the water column and covering the surface



B. Early-season Survey Results

The early-season survey was performed on June 8th. A total of twenty-three (23) aquatic species were collected during the early-season survey, including two invasive aquatic submersed species (fanwort and inflated bladderwort) and a single macro-alga (*Nitella spp.*) (Table 1). Eighty-two (82) of the 107 survey points had vegetation present, which account for 76% of survey points. Stonewort (*Nitella spp.*) was the most common species, present at 60% of the survey points, followed by fanwort (*Cabomba caroliniana*, 21%) and inflated bladderwort (*Utricularia inflata*, 20.5%). Spikerush (*Eleocharis spp.*) was present at 15% of survey points. All other species occurred at less than 10% of the survey points. Aquatic plant growth was still minimal at the time of the survey indicated by the low average biomass (1.3) and overall percent cover of all species (28.7%). Overall cover of invasive species was also very low (4%).

Fanwort was primarily observed in trace abundances in historic areas of the lake, such as the northern and southern end. Fanwort was also observed in trace abundances on the western shoreline. Moderate fanwort was identified in the area of the boat launch.

C. Late-season Survey Results

The late-season survey was performed on August 18th. At this time, a total of thirteen (13) aquatic species were identified during the post-survey (Table 1). Both fanwort and inflated bladderwort were present during this survey. Stonewort was once again the most common species at this time, observed at 52% of survey points. Fanwort and inflated bladderwort were observed at 28% and 8% of survey points, respectively. Fanwort displayed an increase of 7 points from the June survey, which is to be expected due to fanwort's growth habits. Fanwort also displayed an increase of 15 points over the 2020 late-season results; inflated bladderwort did not display an increase. Two new species, watershield (*Brasenia schreberi*) and low watermilfoil (*Myriophyllum humile*) were observed in 2021.



Table 1: Submersed aquatic vegetation found in Lake Hayward

COMMON NAME	SCIENTIFIC NAME	2019		2020		2021	
		Pre (%)	Post (%)	Pre (%)	Post (%)	Pre (%)	Post (%)
Watershield	<i>Brasenia schreberi</i>	0	0	0	0	3	1
Fanwort	<i>Cabomba caroliniana</i>	19	22	21	14	21	28
Water Starwort	<i>Callitriche spp.</i>	3	1	1	0	1	0
Spikerush	<i>Eleocharis sp.</i>	16	15	15	19	15	14
Pipewort spp.	<i>Eriocaulon spp.</i>	0	3	3	2	3	4
Quillwort	<i>Isoetes sp.</i>	22	0	0	0	0	0
Whorled Watermilfoil	<i>Myriophyllum verticillatum</i>	0	2	0	0	0	0
Low Watermilfoil	<i>Myriophyllum humile</i>	0	0	0	0	2	0
Southern Naiad	<i>Najas guadalupensis</i>	0	8	0	0	0	0
Stonewort	<i>Nitella sp.</i>	49	62	60	35	60	52
Yellow water-lily	<i>Nuphar variegata</i>	2	3	3	3	3	1
White water-lily	<i>Nymphaea odorata</i>	2	6	6	1	6	3
Little Floating Heart	<i>Nymphoides cordata</i>	0	3	3	1	3	4
Large-leaf Pondweed	<i>Potamogeton amplifolius</i>	0	1	1	0	1	1
Snail-seed Pondweed	<i>Potamogeton bicipulatus</i>	0	4	4	0	4	0
Ribbon-leaf Pondweed	<i>Potamogeton epihydrus</i>	0	2	2	0	2	3
Leafy Pondweed	<i>Potamogeton foliosus</i>	4	5	4	1	4	3
Thin-leaf Pondweed	<i>Potamogeton pusillus</i>	0	0	0	0	0	0
Spiral-fruited Pondweed	<i>Potamogeton spirillus</i>	0	8	8	0	0	0
Marsh Mermaid-weed	<i>Proserpinaca palustris</i>	0	1	1	0	1	0
Arrowhead	<i>Sagittaria sp.</i>	5	4	4	4	4	5
Floating Bur-reed	<i>Sparganium fluctuans</i>	0	7	6	0	7	0
Humped Bladderwort	<i>Utricularia gibba</i>	10	3	3	1	3	0
Inflated Bladderwort	<i>Utricularia inflata</i>	0	21	21	8	21	8
Purple Bladderwort	<i>Utricularia purpurea</i>	21	0	0	0	0	0
Common bladderwort	<i>Utricularia vulgaris</i>	0	3	3	3	3	0
Filamentous Alga		37	6	6	1	0	0

*n=107; Red indicates invasive species

3.0 WATER QUALITY

During the May and August surveys, secchi disk transparency readings, dissolved oxygen, temperature readings, and phytoplankton (algae) samples were taken in two locations (Site #1 – South End & Site #2 – North End) on the lake. Tables 2 & 3, split into sample locations, present this data.

Dissolved oxygen and temperature readings for May and August are average for this region of Connecticut. The June dissolved oxygen levels were desirable and remained above 4.0 mg/L at both the northern and southern end. Dissolved oxygen declined at the thermocline in the southern end during the August sampling (4m), but



was at desirable levels in the northern end. Secchi clarity at more than 4 feet in depth is desirable; any less than 4 feet may indicate an algae bloom. Both locations displayed desirable clarity during both visits.

Table 2: Water quality data for the south end of Lake Hayward

South						
Depth (Meters)	Dissolved Oxygen (mg/L)		Temperature (°C)		Water Clarity (Feet)	
	06/08	08/18	06/08	08/18	06/08	08/18
SW	8.45	7.75	26.7	27.1	13.0	7.0
1	8.81	7.77	25.2	27.0		
2	9.08	7.31	23.7	26.5		
3	9.48	5.43	21.2	25.6		
4	9.40	2.01	19.4	24.1	pH	
5	9.10	1.07	18.4	23.5	6.6	7.2
6	7.81	0.62	17.3	22.2		
7	6.82	0.46	17.0	19.5		
8	5.46	0.38	15.9	17.7		
9	4.37	0.34	15.4	16.3		
10	2.30	0.31	14.8	15.4		
11	10.98		14.5			

Table 3: Water quality data for the north end of Lake Hayward

North						
Depth (Meters)	Dissolved Oxygen (mg/L)		Temperature (°C)		Water Clarity (Feet)	
	06/08	08/18	06/08	08/18	06/08	08/18
SW	8.20	8.07	28.1	26.9	12.0	7.0
1	8.59	8.08	26.9	26.9		
2	8.68	7.87	25.2	26.7	pH	
3	9.60	7.09	21.7	26.2	6.8	7.2
4	10.23	6.02	19.2	25.9		

The chart below outlines the secchi depth (feet) clarity between 2004 and 2021. At no point in this 16-year period has the secchi clarity dropped below 5.0 feet in both the south and the north end of the lake. This indicates that Lake Hayward has maintained desirable clarity for over a decade of time.

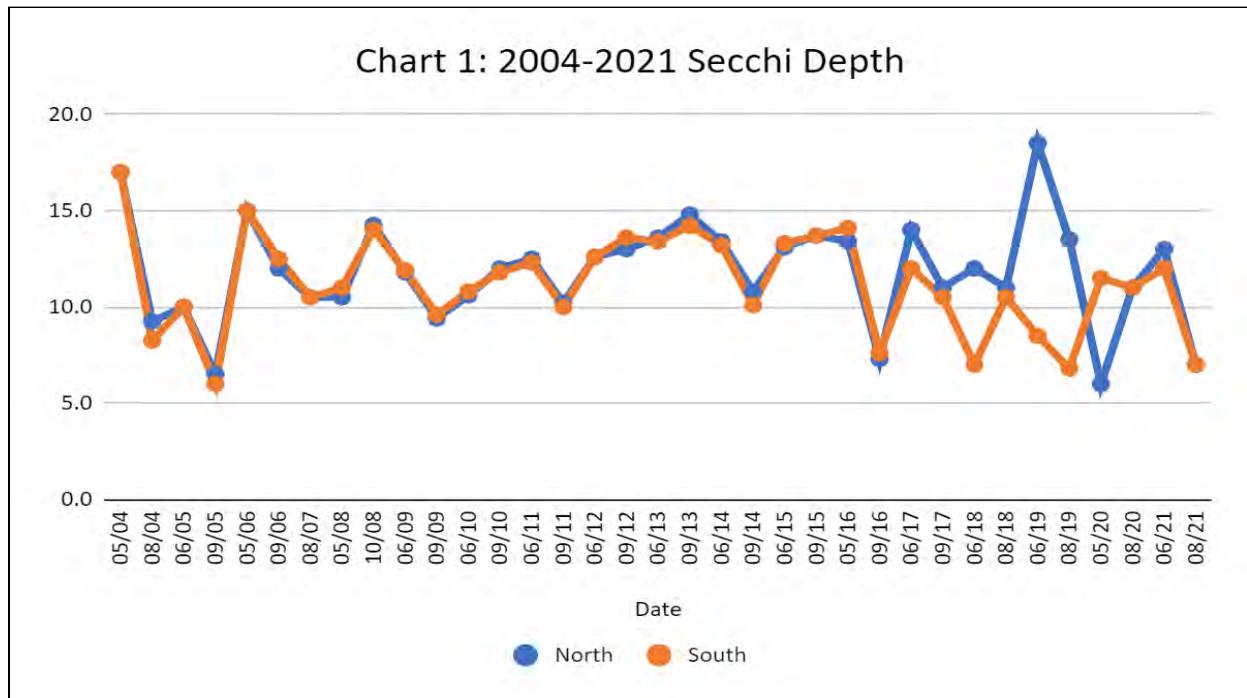


Table 4: Phytoplankton counts in Lake Hayward

Phytoplankton Counts (cells/mL)				
Family	South		North	
	06/08	08/18	06/08	08/18
Diatoms	57	-	48	-
Biraphid Pennate	0	-	0	-
Chlorophytes	10	-	-	-
Desmids	10	-	10	-
Cyanophyta	4,000	-	3,500	1,150
Filamentous Non-Nitrogen Fixers	380	430	340	0
Total Blue-green cell count	4,380	430	3,840	1,150

Cyanobacteria naturally occur in aquatic systems; thus, its presence in a lake system does not indicate poor water quality. The World Health Organization (WHO) determined that 70,000 cells/mL is the suggested threshold at which human health is at risk. A negligible amount of cyanobacteria was observed during the June and August sample collections. The algal sample results indicate that cyanobacteria was present during the June and August sample events. Depending on conditions observed in the lake by both Solitude Lake Management and Property Owners Association of Lake Hayward, algicide applications will be determined when necessary.



4.0 MANAGEMENT RECOMMENDATIONS

A similar monitoring program is recommended for 2022. This will include detailed, point-intercept pre- & post-treatment vegetation surveys and three rounds of water clarity measurement and algae sampling (one to be collected by the Association).

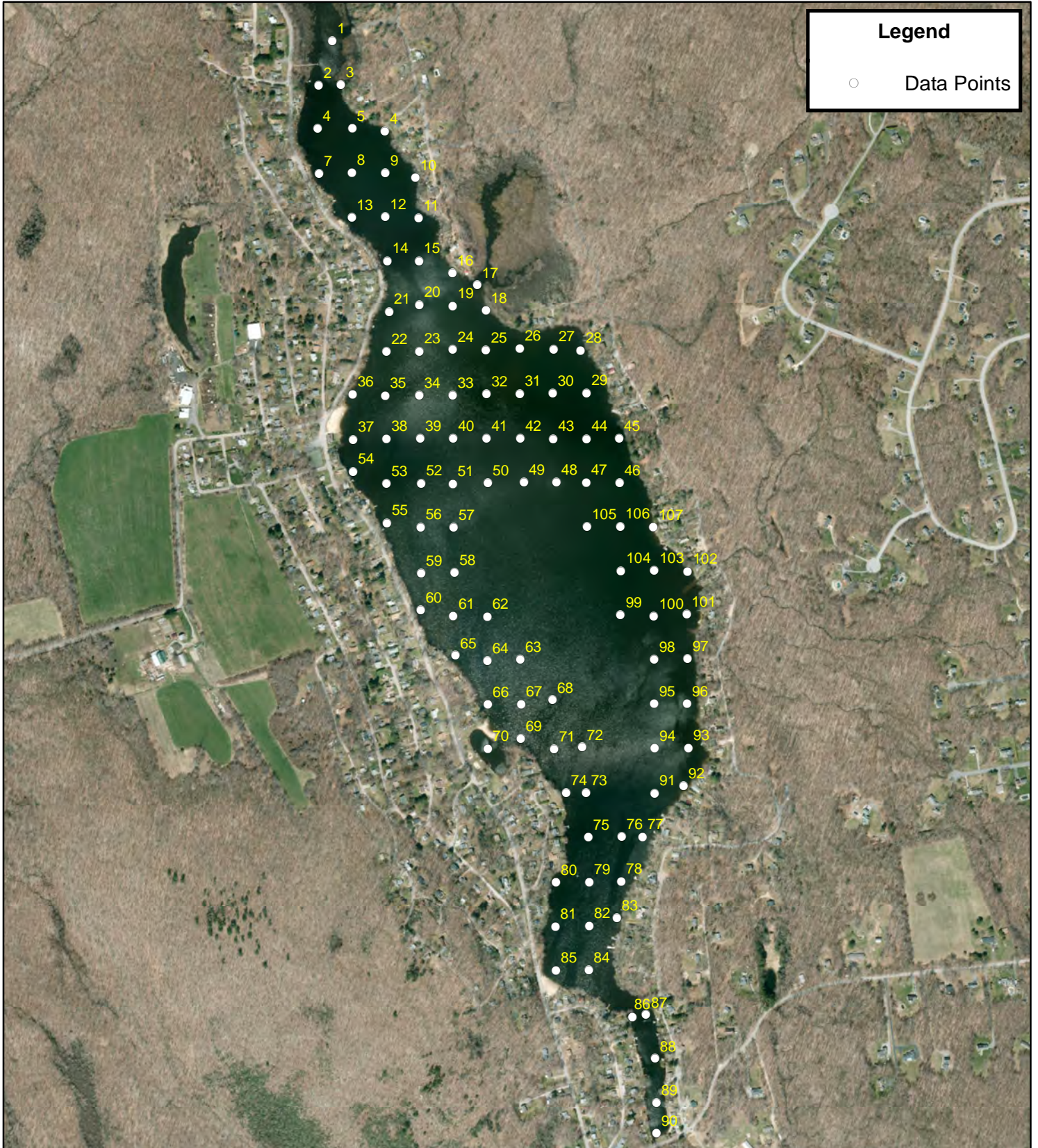
Given the increased coverage and density of the fanwort, we recommend implementing an early season low-dose application of the herbicide Sonar Genesis or Sonar One (active ingredient fluridone). A full-lake, systemic herbicide Sonar treatment would be the most effective method towards reduction of the non-native species. Fluridone is a systemic herbicide which disrupts the target plant species ability to photosynthesize, starving the plants. Sonar Genesis is a fast-acting liquid concentrate of the herbicide, while Sonar One is a slow-releasing pellet formulation. An early season Sonar application allows for us to control the growth of these plants using lower herbicide dosages while achieving the same, if not better, control. Follow up treatment may be necessary later in the year to maintain a lethal concentration of the herbicide within the waterbody. This allows the target concentration of active ingredients to remain in the water over a longer period that is often required when using systemic products. There is a minimum 30-day irrigation restriction associated with Sonar treatments.

Should algaecide treatments for filamentous or microscopic algae be required or requested, we would recommend treatment with the Cutrine Plus algaecide. Algae have been intermittently problematic in some areas of the lake and we would defer to the Association to decide if and where treatment is needed.

We trust this report provides information to guide your future management decisions at Lake Hayward. If you have any questions, please feel free to give us a call. It has been a pleasure working with you this year and we look forward to continuing work with you and the Association in the future. With your permission, we'll forward a copy of this report to the appropriate parties at CT DEEP.

APPENDIX A

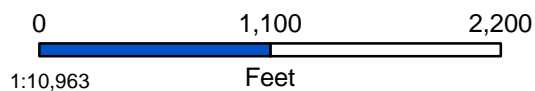
Abundance Maps



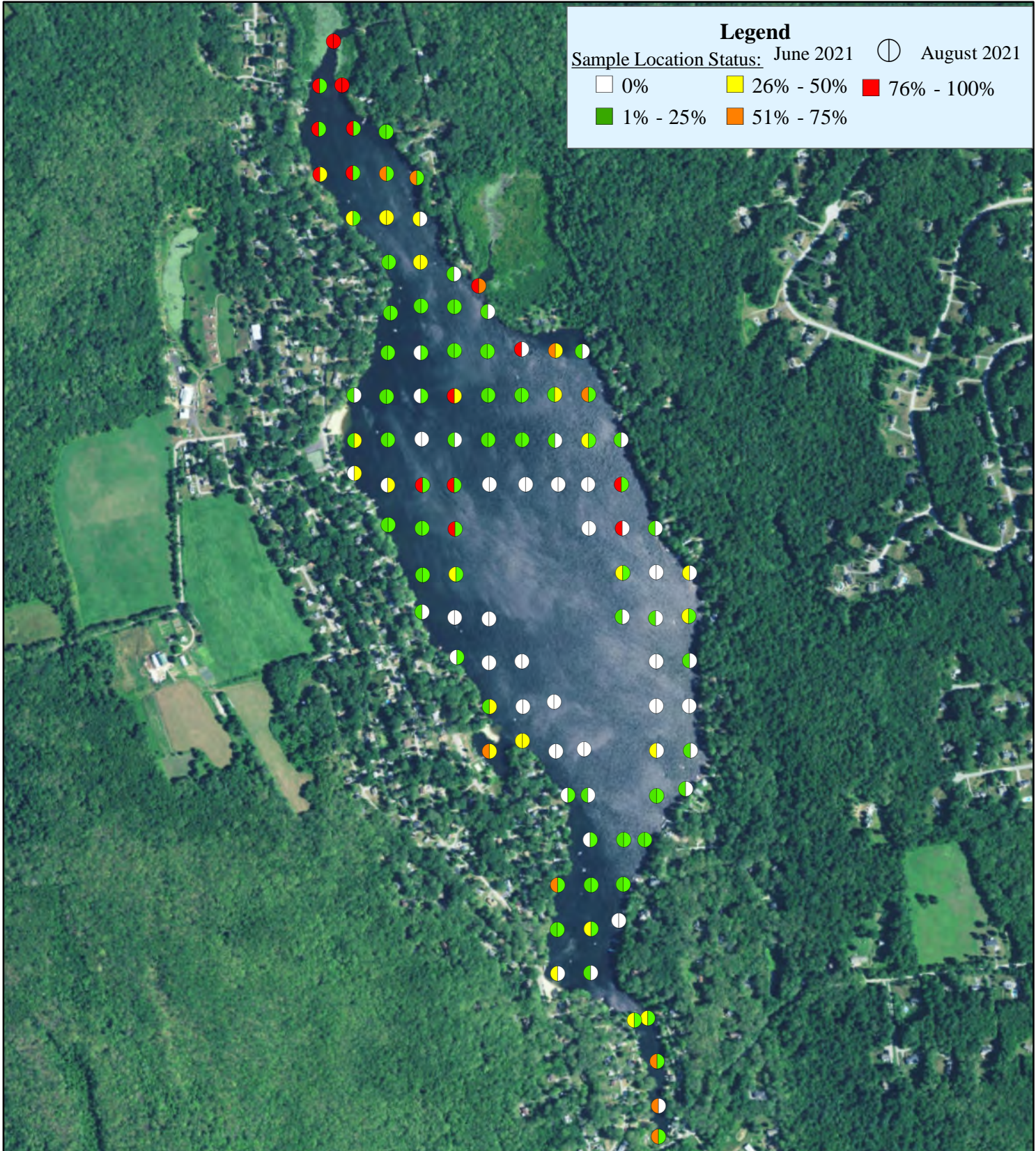
Lake Hayward
East Haddam, CT



Lake Hayward



Map Date: 12-08-21
Prepared by: AM
Office: SHREWSBURY, MA



Legend
 Sample Location Status: June 2021 (circle with horizontal line) August 2021 (circle with vertical line)

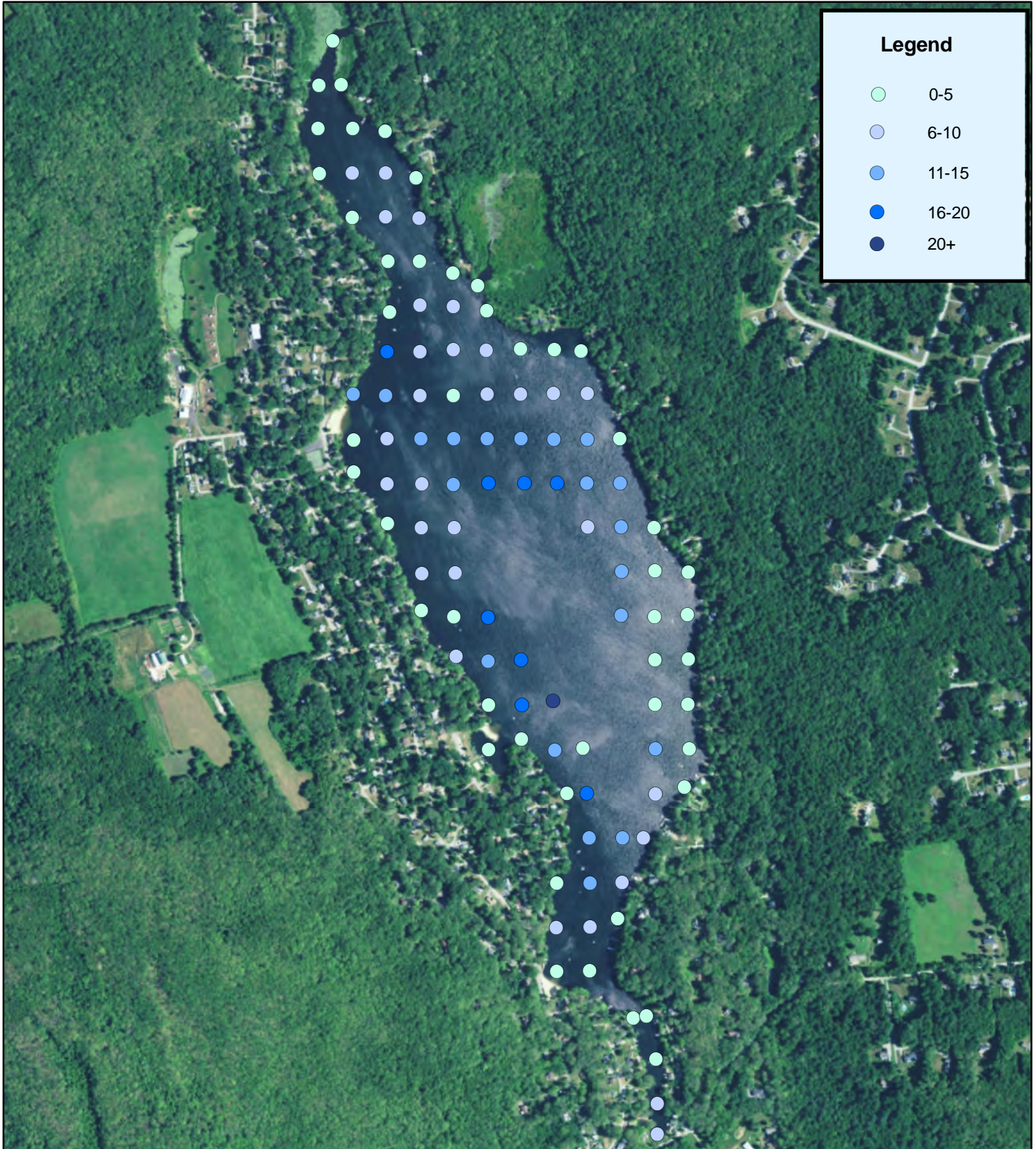
0%	26% - 50%	76% - 100%
1% - 25%	51% - 75%	

Lake Hayward
 East Haddam, CT

Lake Hayward

0 1,100 2,200
 1:10,963 Feet

Map Date: 12-08-21
 Prepared by: KV
 Office: SHREWSBURY, MA



Legend

- 0-5
- 6-10
- 11-15
- 16-20
- 20+

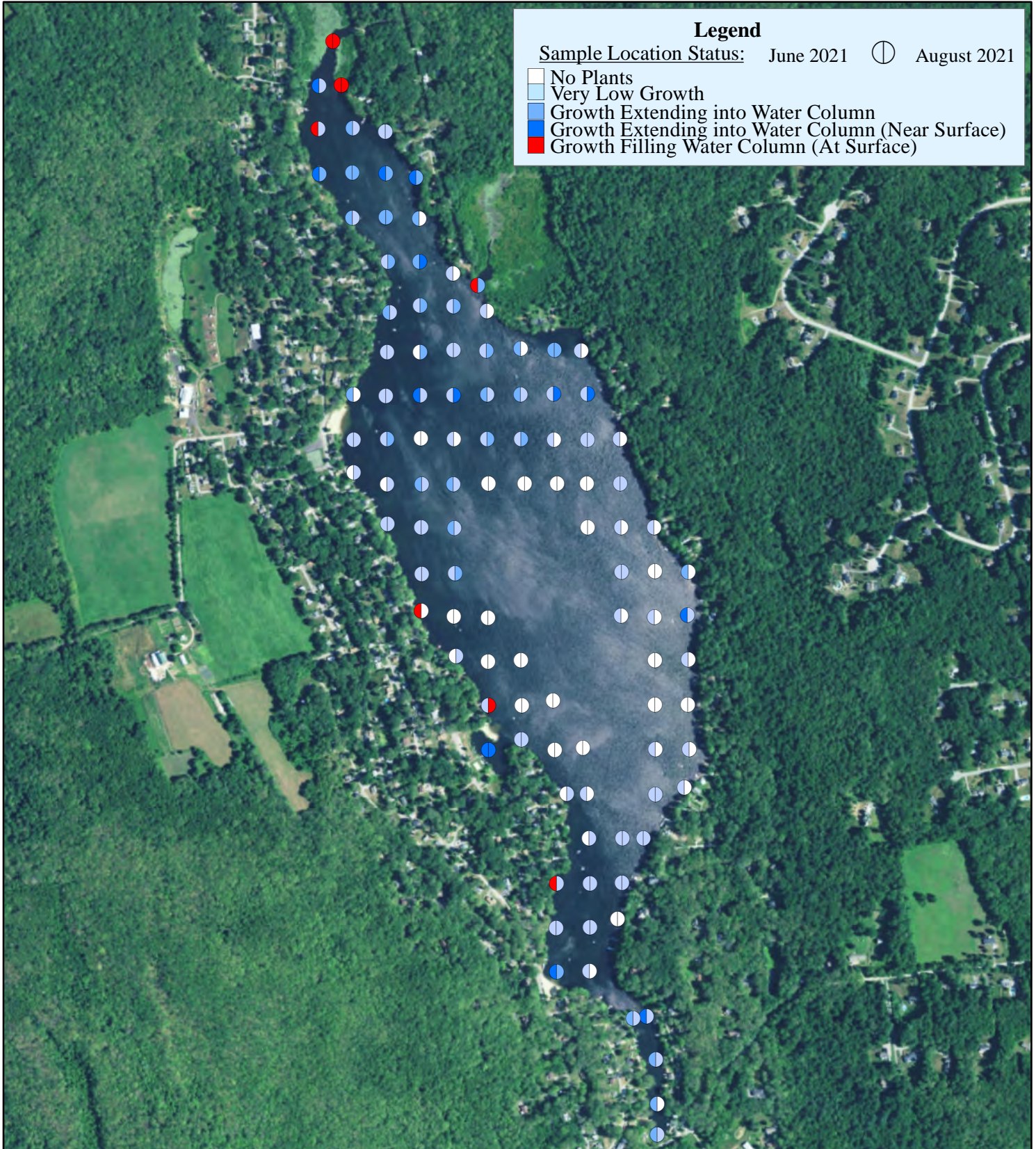
Lake Hayward
East Haddam, CT

Lake Hayward

0 1,100 2,200

1:10,963 Feet

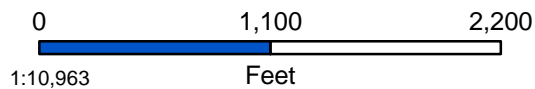
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East Haddam, CT

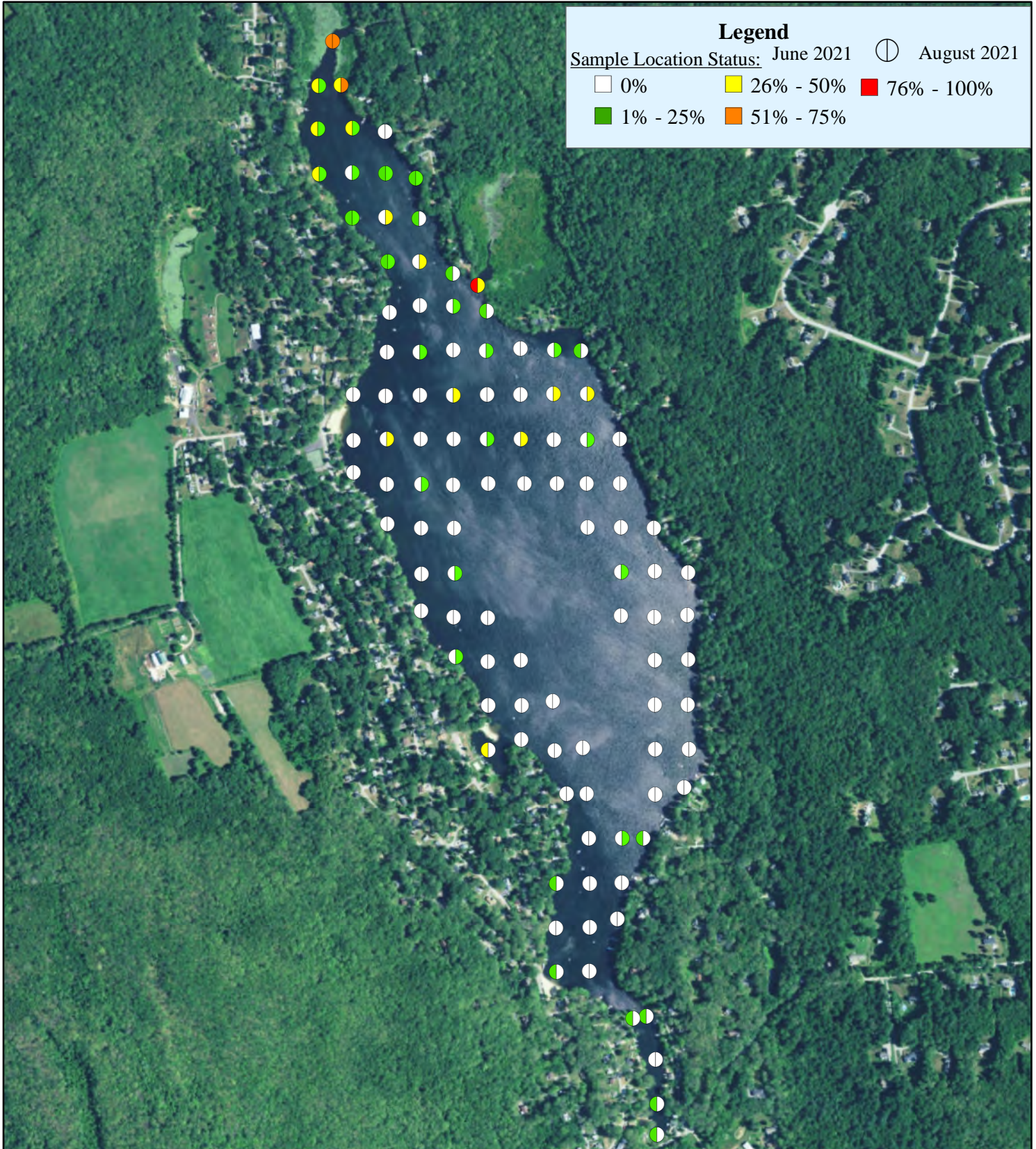


Lake Hayward

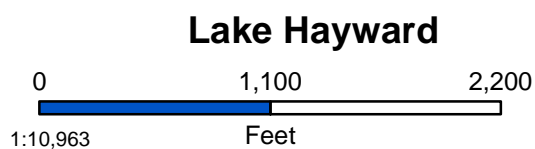


Map Date: 12-08-21
Prepared by: KV
Office: SHREWSBURY, MA

Pre- and Post-Management Density of Fanwort (*C. caroliniana*)

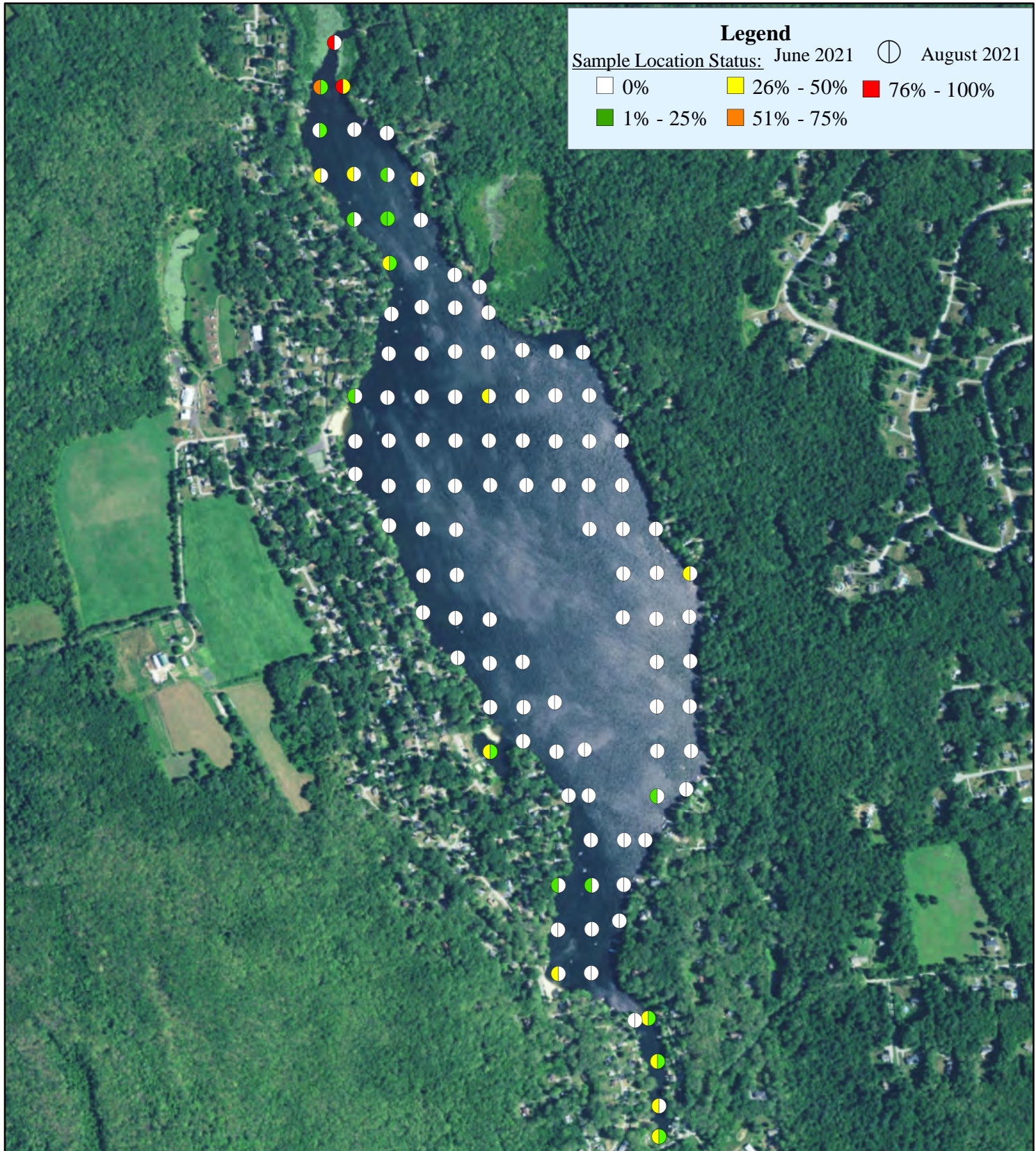


Lake Hayward
East Haddam, CT



Map Date: 12-08-21
Prepared by: KV
Office: SHREWSBURY, MA

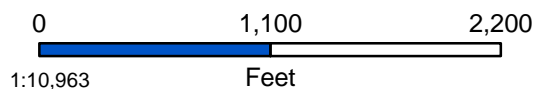
Pre- and Post-Management Density of Inflated Bladderwort (*U. inflata*)



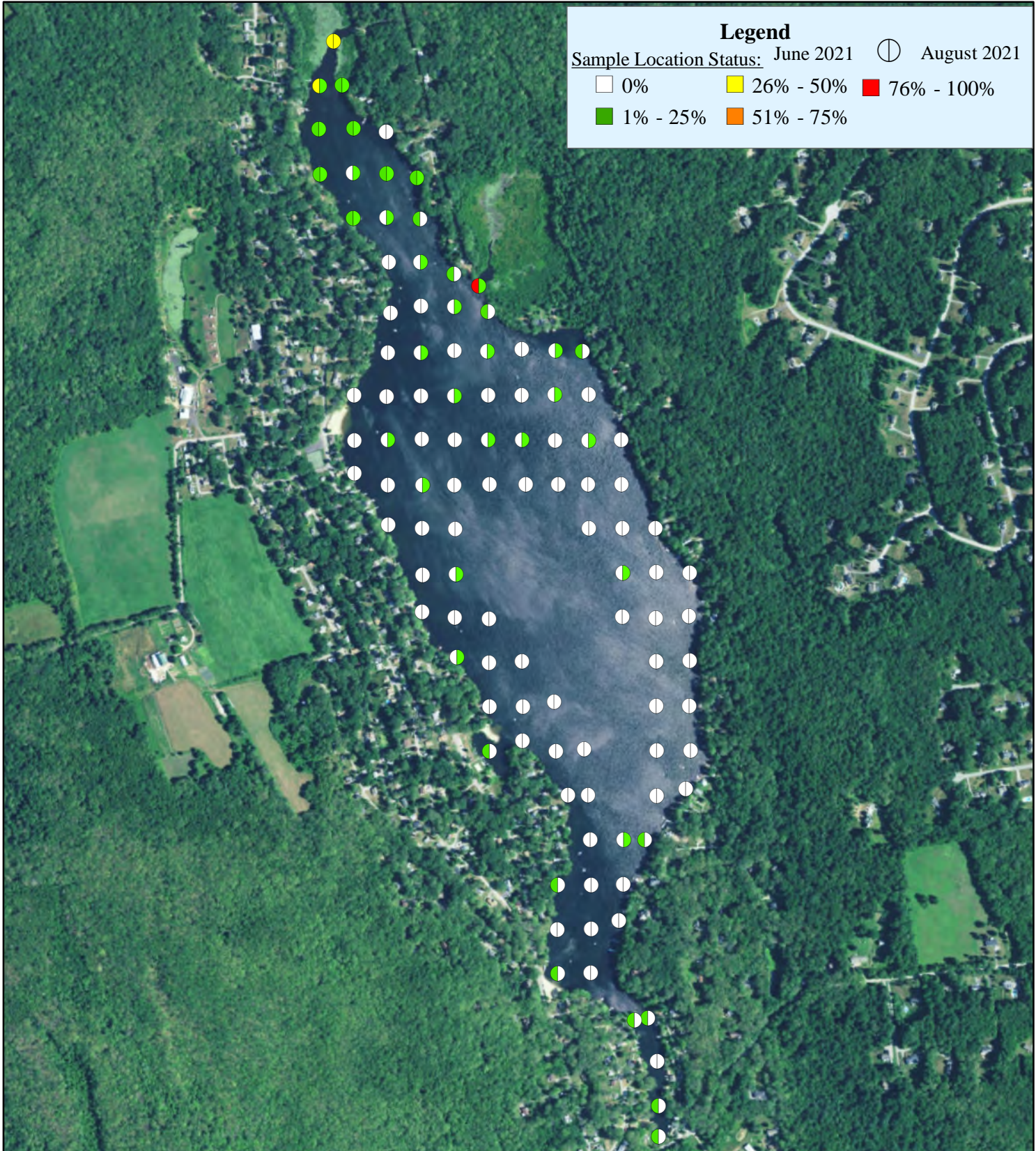
Lake Hayward
East Haddam, CT



Lake Hayward



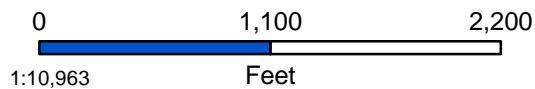
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Office: SHREWSBURY, MA



Lake Hayward
East Haddam, CT

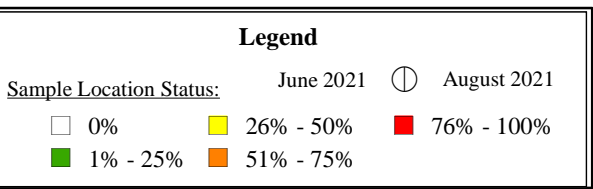
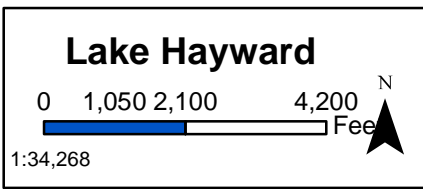
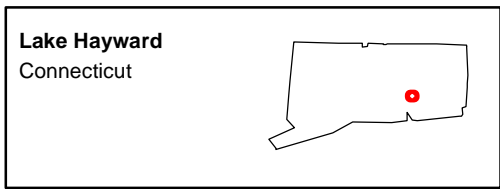
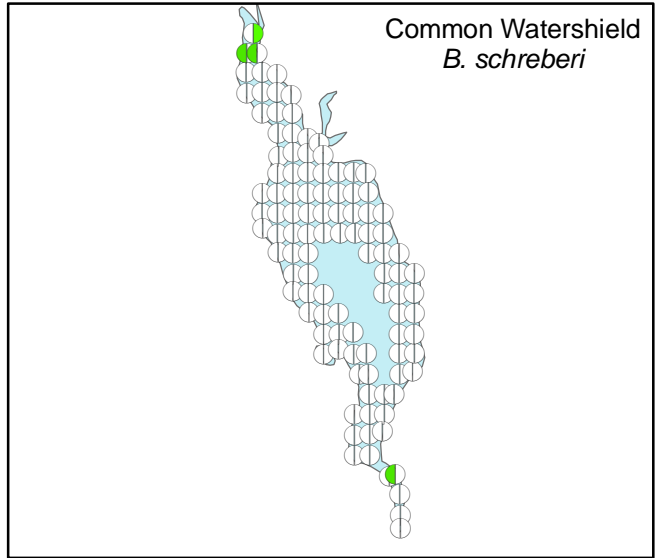
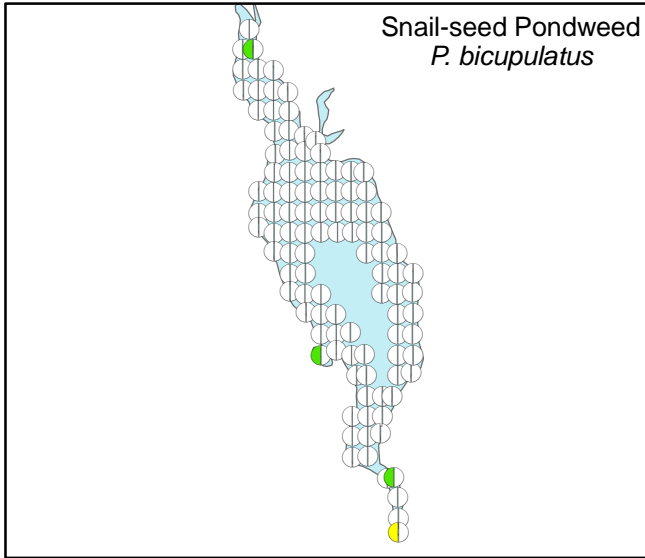
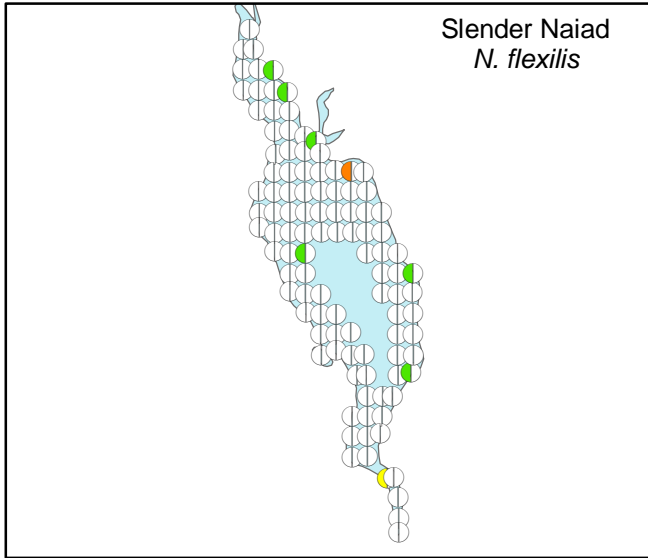
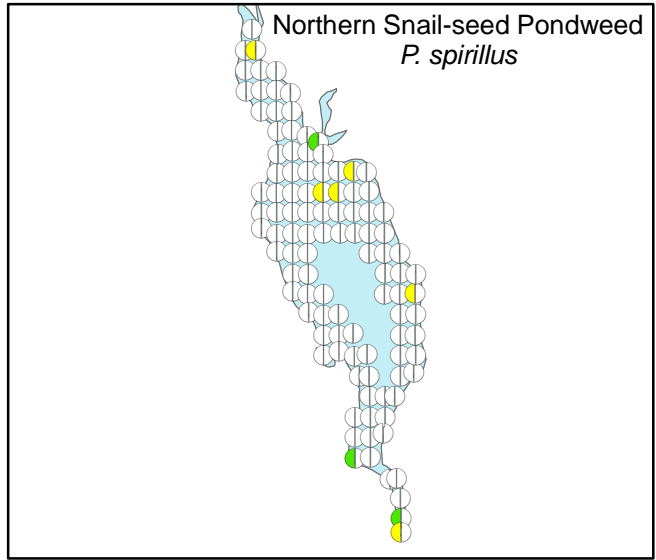
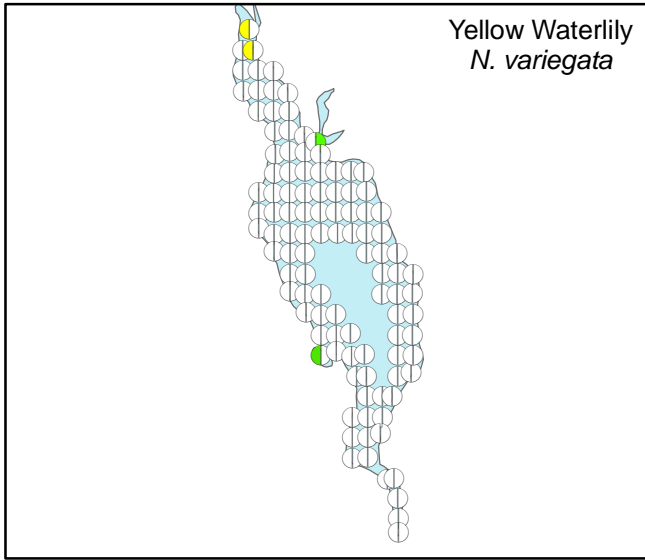
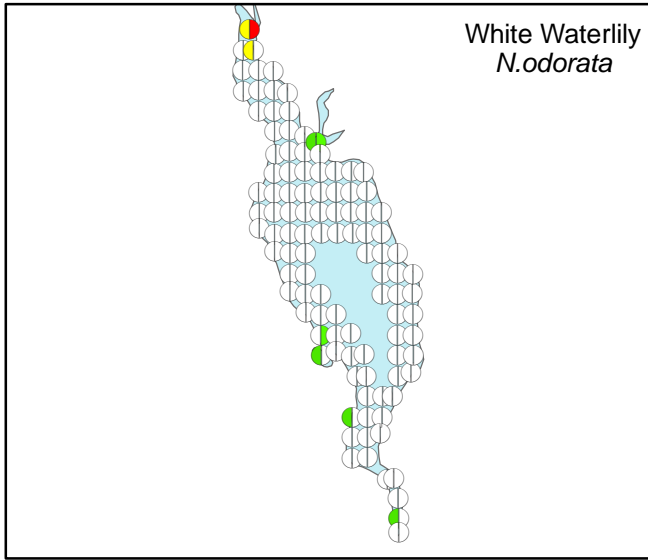


Lake Hayward



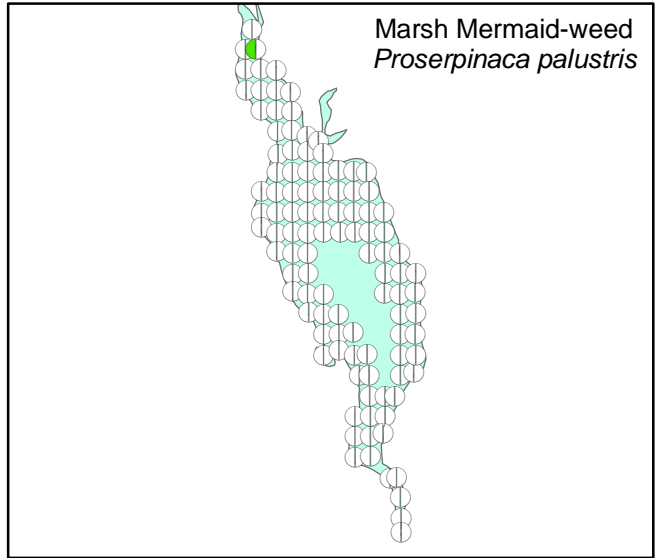
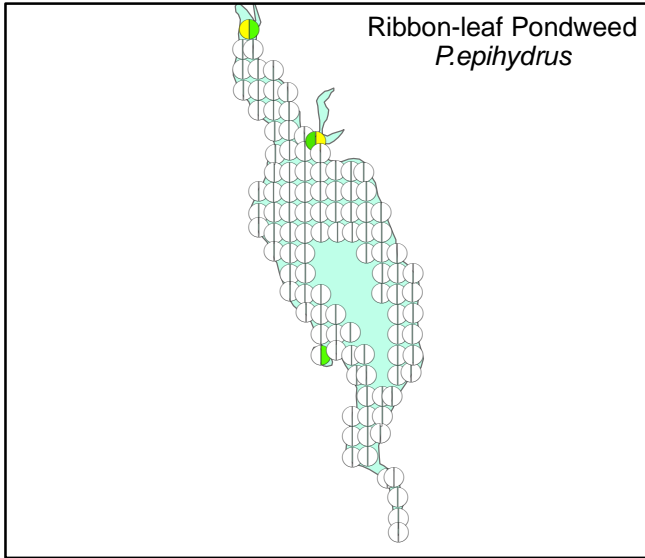
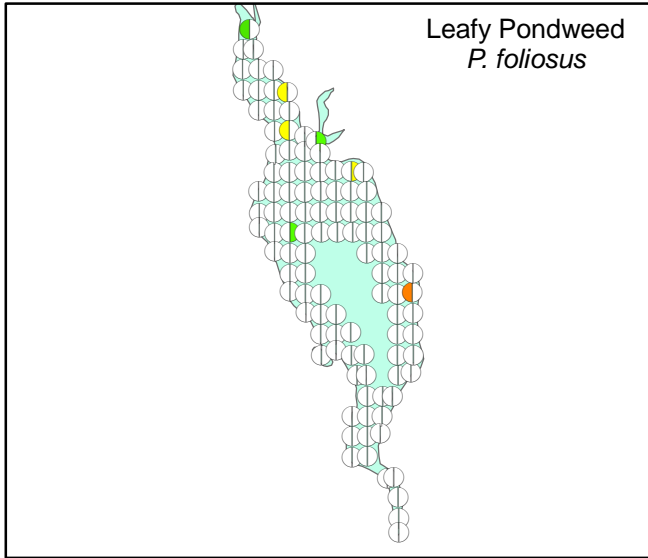
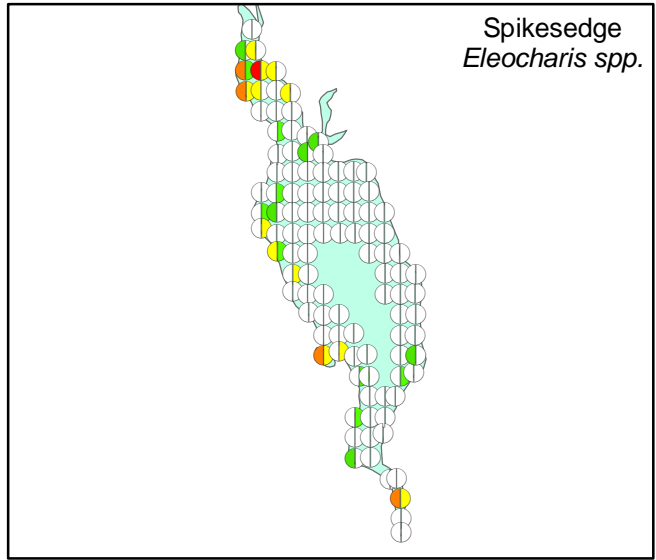
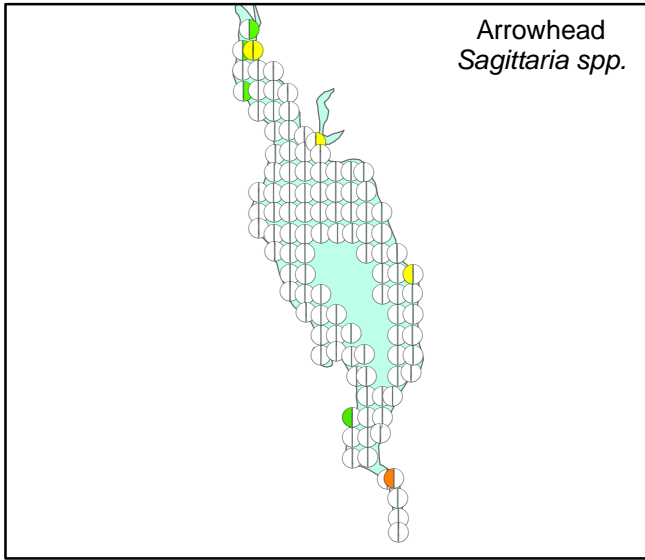
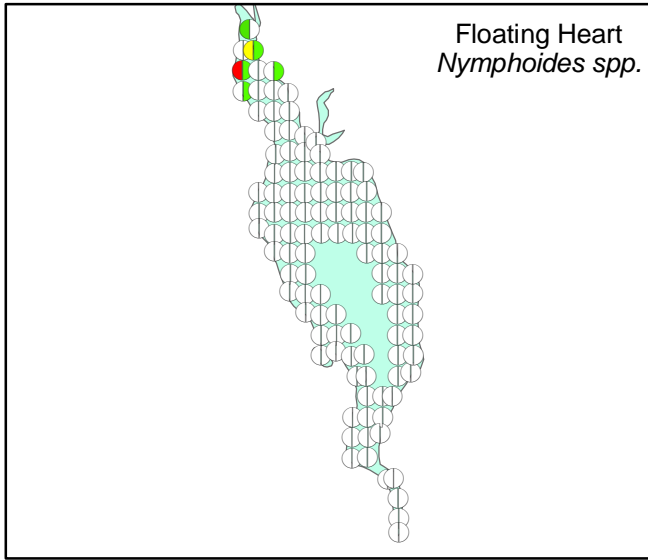
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Prepared by: KV
Office: SHREWSBURY, MA

Relative Abundance of Submersed Aquatic Vegetation



Map Date: 12/20/2021
Prepared by: KV
Office: Shrewsbury, MA

Relative Abundance of Submersed Aquatic Vegetation



Lake Hayward
Connecticut

Lake Hayward

0 900 1,800 3,600
Feet

1:34,268

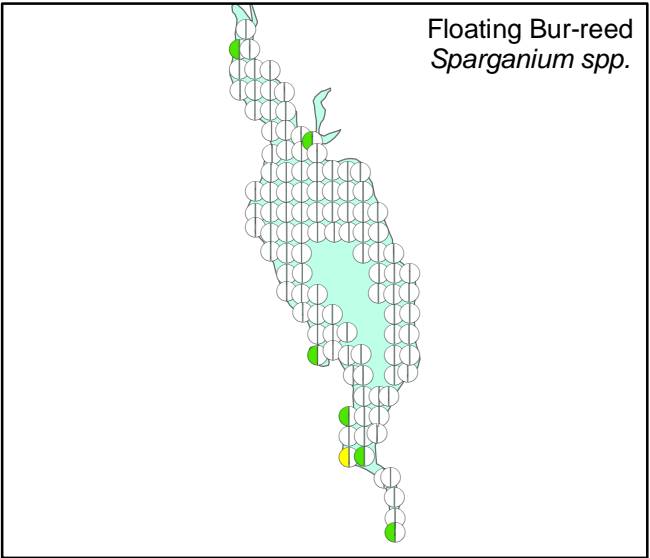
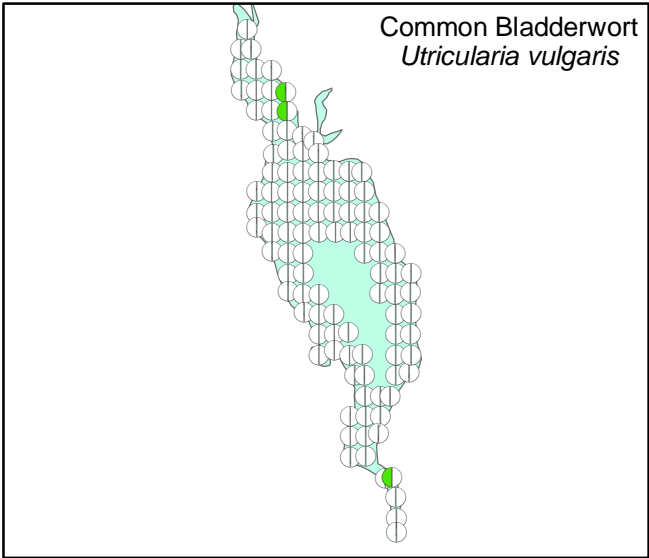
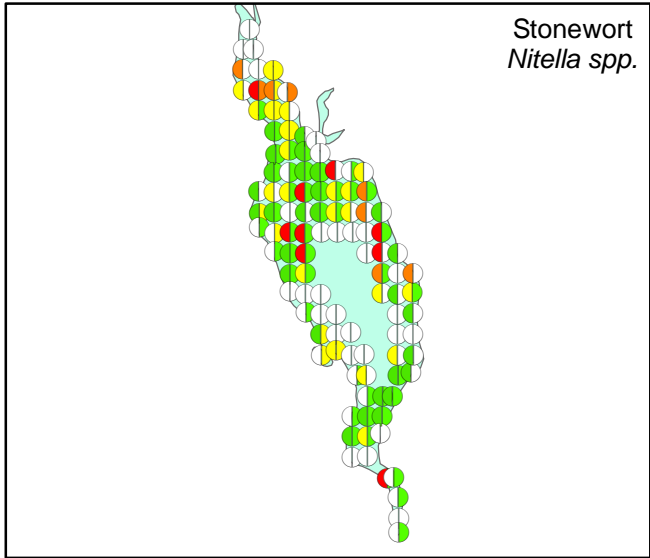
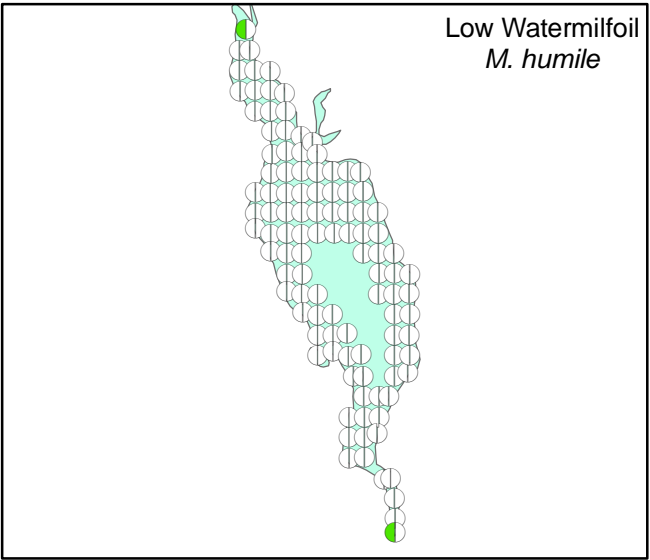
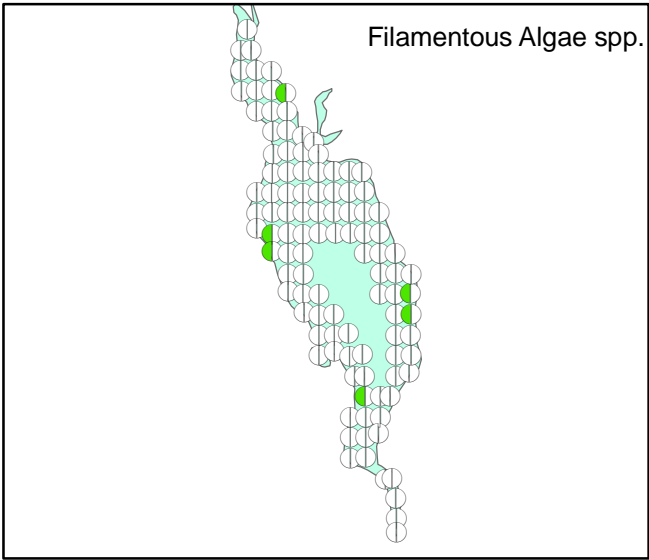
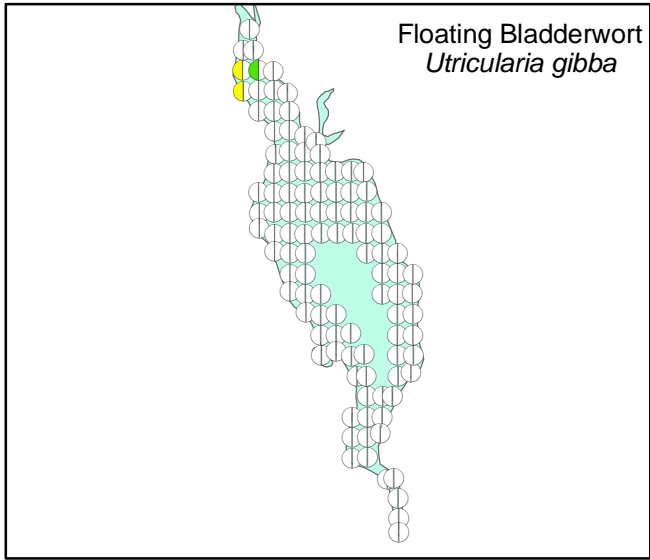
Legend

Sample Location Status: June 2021 (circle with dot) August 2021 (circle with ring)

White	Yellow	Red
0%	26% - 50%	76% - 100%
Green	Orange	
1% - 25%	51% - 75%	

Map Date: 12/20/2021
Prepared by: KV
Office: Shrewsbury, MA

Relative Abundance of Submersed Aquatic Vegetation



Lake Hayward
Connecticut

Lake Hayward

0 1,000 2,000 4,000 Feet

1:34,268

Legend

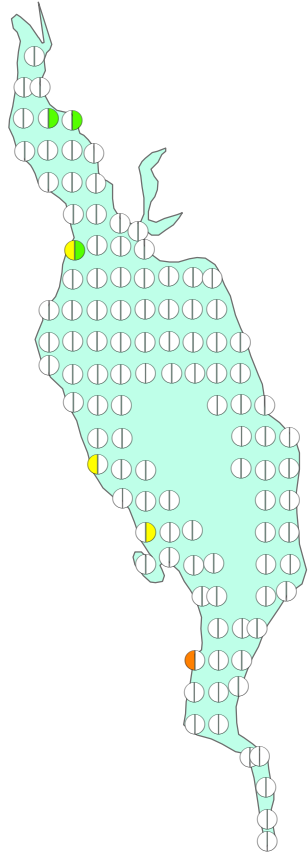
Sample Location Status: June 2021 August 2021

0%	26% - 50%	76% - 100%
1% - 25%	51% - 75%	

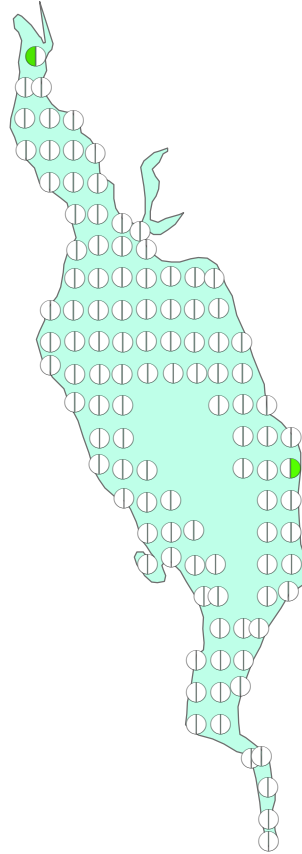
Map Date: 12/20/2021
Prepared by: KV
Office: Shrewsbury, MA

Relative Abundance of Submersed Aquatic Vegetation

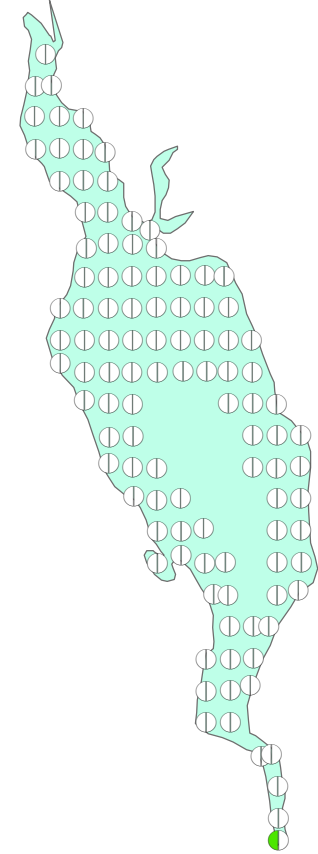
Pipewort
Eriochaulon spp.



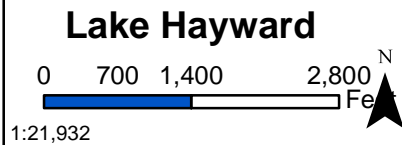
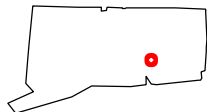
Big-leaf Pondweed
P. amplifolius



Water Starwort
Callitriche spp.



Lake Hayward
Connecticut



Legend

Sample Location Status: June 2021 ⊕ August 2021

□ 0%	■ 26% - 50%	■ 76% - 100%
■ 1% - 25%	■ 51% - 75%	

Map Date: 12/20/2021
Prepared by: KV
Office: Shrewsbury, MA

APPENDIX B

Northeast Laboratory Algae Reports

Raw Data

Data Point	Latitude	Longitude	Depth (Feet)	Biovolume	% Cover All	% Cover INV	Fanwort	Inflated Bladderwort	White Waterlily	Yellow Waterlily	Spiral Pondweed	Slender Naiad	Snail-seed Pondweed	Watershield	Little Floating-heart	Arrowhead	Spikerush	Low Watermilfoil	Leafy Pondweed	Ribbon-leaf Pondweed	Mermaid weed	Humped Bladderwort	Filamentous Alga	Stonewort	Common Bladderwort	Burreed	Pipewort	Water Starwort	Big-leaf Pondweed
1	41.5300	-72.3338	2	4	100	45	M	D	S	S					T			T	T	S									T
2	41.5291	-72.3342	2	3	80	35	S	M						T			T									T			
3	41.5292	-72.3336	3	4	100	20	S	D	S	S	S		T	T	S	S	S				T								
4	41.5283	-72.3325	2	1	20	0						T					S							S					
5	41.5283	-72.3333	3	2	100	15	S										D								T				
6	41.5283	-72.3342	3	4	100	25	S								D		M								S	M			
7	41.5275	-72.3342	3	3	85	20	S	S									M								S	S			
8	41.5275	-72.3333	7	2	85	0		S									S									D			
9	41.5275	-72.3325	7	3	70	15	T	T																	M				
10	41.5274	-72.3317	4	3	65	25	T	S				T					S		S					P		T			
11	41.5266	-72.3317	6	2	35	5	T																		S	T			
12	41.5267	-72.3325	9	2	30	0		T																	S				
13	41.5267	-72.3333	4	2	35	10	T	T																	S				
14	41.5258	-72.3325	5	1	25	0	T	S																	T				
15	41.5258	-72.3317	2	2	35	0													S						S				
16	41.5256	-72.3308	3	1	15	10	T																		T				
17	41.5254	-72.3302	2	4	90	80	D		T		T	T					T			T						T			
18	41.5249	-72.3300	4	1	5	5	T																						
19	41.5250	-72.3308	9	1	10	0											T								T				
20	41.5250	-72.3317	10	1	25	0																			S				
21	41.5249	-72.3324	3	2	20	0																			T		S		
22	41.5241	-72.3325	20	1	10	0																			T				
23	41.5233	-72.3333	10	2	10	0		T																	T				
24	41.5242	-72.3308	10	1	10	0																			T				
25	41.5242	-72.3300	10	1	5	0																			T				
26	41.5233	-72.3308	4	1	80	0																			D				
27	41.5233	-72.3300	4	2	25	0		S			S														T				
28	41.5233	-72.3292	4	2	25	0					S														S				
29	41.5233	-72.3283	9	1	25	0																			S				

Notation	Description
Z	Zero: no plants on rake
T	Trace: fingerful on rake
S	Sparse: handful on rake
M	Moderate: more than a handful on rake
D	Dense: difficult to bring into boat

Data Point	Latitude	Longitude	Depth (Feet)	Biovolume	% Cover All	% Cover INV	Fanwort	Inflated Bladderwort	White Waterlily	Yellow Waterlily	Spiral Pondweed	Slender Naiad	Snail-seed Pondweed	Watershield	Little Floating-heart	Arrowhead	Spikerush	Low Watermilfoil	Leafy Pondweed	Ribbon-leaf Pondweed	Mermaid weed	Humped Bladderwort	Filamentous Alga	Stonewort	Common Bladderwort	Burreed	Pipewort	Water Starwort	Big-leaf Pondweed	
30	41.5233	-72.3275	8	1	60	0																		M						
31	41.5225	-72.3267	7	1	10	0																			T					
32	41.5225	-72.3275	6	1	45	0																			M					
33	41.5225	-72.3283	4	1	25	0																			S					
34	41.5225	-72.3292	10	1	20	0																			S					
35	41.5225	-72.3300	14	1	10	0																			T					
36	41.5225	-72.3308	11	1	10	0																			T					
37	41.5225	-72.3317	2	0	0	0																								
38	41.5225	-72.3325	10	1	15	0											T									T				
39	41.5225	-72.3333	14	1	5	0																			T					
40	41.5219	-72.3333	15	0	0	0																								
41	41.5217	-72.3325	12	0	0	0																		P						
42	41.5217	-72.3316	13	2	80	0																			D					
43	41.5216	-72.3309	14	2	80	0																			D					
44	41.5208	-72.3308	11	2	80	0						T													D					
45	41.5208	-72.3317	4	1	5	0																			T					
46	41.5209	-72.3325	12	1	25	0											S							P						
47	41.5200	-72.3317	14	1	10	0																			T					
48	41.5200	-72.3308	18	1	30	0																			S					
49	41.5191	-72.3300	20	0	0	0																								
50	41.5192	-72.3309	17	0	0	0																								
51	41.5193	-72.3317	11	4	20	0																					S			
52	41.5184	-72.3308	8	0	0	0																								
53	41.5183	-72.3300	6	0	0	0																								
54	41.5175	-72.3292	3	0	0	0																								
55	41.5175	-72.3300	4	1	5	0																			T					
56	41.5169	-72.3292	8	1	45	0																			S					
57	41.5167	-72.3300	8	3	75	25	S	S	T	T			T				M										T			
58	41.5166	-72.3284	10	0	0	0																								

Notation	Description
Z	Zero: no plants on rake
T	Trace: fingerful on rake
S	Sparse: handful on rake
M	Moderate: more than a handful on rake
D	Dense: difficult to bring into boat

Data Point	Latitude	Longitude	Depth (Feet)	Biovolume	% Cover All	% Cover INV	Fanwort	Inflated Bladderwort	White Waterlily	Yellow Waterlily	Spiral Pondweed	Slender Naiad	Snail-seed Pondweed	Watershield	Little Floating-heart	Arrowhead	Spikerush	Low Watermilfoil	Leafy Pondweed	Ribbon-leaf Pondweed	Mermaid weed	Humped Bladderwort	Filamentous Alga	Stonewort	Common Bladderwort	Burreed	Pipewort	Water Starwort	Big-leaf Pondweed
59	41.5158	-72.3281	7	0	0	0																							
60	41.5150	-72.3275	4	0	0	0																	P						
61	41.5150	-72.3267	5	1	15	0																		T					
62	41.5150	-72.3261	17	1	10	5	T																	T					
63	41.5142	-72.3267	20	1	5	0																		T					
64	41.5141	-72.3275	14	1	10	0		T																T					
65	41.5141	-72.3283	10	4	55	10	T	T	T							T										T	M		
66	41.5133	-72.3283	4	1	5	0																		T					
67	41.5133	-72.3275	17	1	30	0																		S					
68	41.5135	-72.3268	30	0	0	0																							
69	41.5125	-72.3275	5	1	5	0																				T			
70	41.5116	-72.3264	3	2	30	5	T					S												D					
71	41.5116	-72.3261	15	3	50	15	T	S					T	T		M									T				
72	41.5108	-72.3259	4	2	60	0		S									M												
73	41.5100	-72.3258	17	2	70	10	T	S	T		T																		
74	41.5094	-72.3258	4	2	75	20	T	S			S		S					T								T		T	
75	41.5159	-72.3251	11	1	15	0						T												T					
76	41.5158	-72.3258	13	1	15	0		T																T					
77	41.5167	-72.3258	6	1	30	0																		S					
78	41.5167	-72.3250	9	1	10	0										T								T					
79	41.5175	-72.3250	12	0	0	0																							
80	41.5175	-72.3258	2	0	0	0																							
81	41.5183	-72.3258	7	0	0	0																							
82	41.5183	-72.3250	8	1	5	0																		P	T				
83	41.5192	-72.3250	4	3	45	0					S								M				P	S					
84	41.5191	-72.3258	4	1	10	0																		T					
85	41.5192	-72.3267	2	1	25	0																		S					
86	41.5200	-72.3267	2	1	50	0																		M					
87	41.5200	-72.3258	4	0	0	0																							

Notation	Description
Z	Zero: no plants on rake
T	Trace: fingerful on rake
S	Sparse: handful on rake
M	Moderate: more than a handful on rake
D	Dense: difficult to bring into boat

Data Point	Latitude	Longitude	Depth (Feet)	Biovolume	% Cover All	% Cover INV	Fanwort	Inflated Bladderwort	White Waterlily	Yellow Waterlily	Spiral Pondweed	Slender Naiad	Snail-seed Pondweed	Watershield	Little Floating-heart	Arrowhead	Spikerush	Low Watermilfoil	Leafy Pondweed	Ribbon-leaf Pondweed	Mermaid weed	Humped Bladderwort	Filamentous Alga	Stonewort	Common Bladderwort	Burreed	Pipewort	Water Starwort	Big-leaf Pondweed
88	41.5200	-72.3250	4	2	50	0		S				T				S								M					
89	41.5208	-72.3258	7	1	10	0																		T					
90	41.5208	-72.3267	6	1	80	0																		D					
91	41.5208	-72.3275	10	0	0	0																							
92	41.5217	-72.3300	4	0	0	0																							
93	41.5217	-72.3291	4	0	0	0																							
94	41.5217	-72.3283	14	0	0	0																							
95	41.5217	-72.3275	5	0	0	0																							
96	41.5216	-72.3267	4	1	80	0																			D				
97	41.5183	-72.3292	2	0	0	0																							
98	41.5176	-72.3284	4	0	0	0																							
99	41.5158	-72.3276	12	1	25	0																		S					
100	41.5167	-72.3277	5	0	0	0																							
101	41.5125	-72.3283	2	3	35	10	T	S			T					T										S			
102	41.5242	-72.3292	2	2	80	0																		D					
103	41.5233	-72.3317	5	3	0	0																		S					
104	41.5233	-72.3325	12	1	25	0																		S					
105	41.5241	-72.3317	10	0	0	0																							
106	41.5242	-72.3283	12	2	60	0					S	M																	
107	41.5241	-72.3276	4	1	25	10	T																	S					

Notation	Description
Z	Zero: no plants on rake
T	Trace: fingerful on rake
S	Sparse: handful on rake
M	Moderate: more than a handful on rake
D	Dense: difficult to bring into boat

Data Point	Latitude	Longitude	Depth (Feet)	Biovolume	% Cover All	% Cover INV	Fanwort	Inflated Bladderwort	White Waterlily	Yellow Waterlily	Spiral Pondweed	Slender Naiad	Snail-seed Pondweed	Watershield	Little Floating-heart	Arrowhead	Spikerush	Low Watermilfoil	Leafy Pondweed	Ribbon-leaf Pondweed	Mermaid Weed	Humped Bladderwort	Filamentous Alga	Stonewort	Common Bladderwort	Burreed	Pipewort	Water Starwort	Big-leaf Pondweed
1	41.5300	-72.3338	2	4	80	50	M		D					T		T				T									
2	41.5291	-72.3342	2	1	15	5	T	T						T		T													
3	41.5292	-72.3336	3	4	80	15	M	S							T	S													
4	41.5283	-72.3325	2	1	20	0									T									S			T		
5	41.5283	-72.3333	3	1	20	10	T										S										T		
6	41.5283	-72.3342	3	1	15	5	T	T							T		T												
7	41.5275	-72.3342	3	2	30	5	T								T	T	S												
8	41.5275	-72.3333	7	2	20	5	T																	M					
9	41.5275	-72.3325	7	2	20	10	T																	S					
10	41.5274	-72.3317	4	2	20	10	T																	M					
11	41.5266	-72.3317	6	0	0	0																							
12	41.5267	-72.3325	9	2	45	25	S	T																S					
13	41.5267	-72.3333	4	1	20	10	T																	T					
14	41.5258	-72.3325	5	2	25	0	T	T									T							T					
15	41.5258	-72.3317	2	3	35	25	S																	S					
16	41.5256	-72.3308	3	0	0	0																							
17	41.5254	-72.3302	2	2	55	20	S		T	T						S			T	S									
18	41.5249	-72.3300	4	0	0	0																							
19	41.5250	-72.3308	9	2	20	15	T																	T					
20	41.5250	-72.3317	10	2	10	0																		T					
21	41.5249	-72.3324	3	1	10	0																		T			T		
22	41.5241	-72.3325	20	1	10	0																		T					
23	41.5241	-72.3317	10	2	15	10	T																	T					
24	41.5242	-72.3308	10	1	10	0																		T					
25	41.5242	-72.3300	10	2	20	15	T																	T					
26	41.5242	-72.3292	4	0	0	0																							
27	41.5242	-72.3283	4	2	30	10	T												S					T					
28	41.5241	-72.3276	4	0	0	0																							
29	41.5233	-72.3275	9	3	25	0	S																	T					
30	41.5233	-72.3283	8	3	30	25	S																	T					

Notation	Description
Z	Zero: no plants on rake
T	Trace: fingerful on rake
S	Sparse: handful on rake
M	Moderate: more than a handful on rake
D	Dense: difficult to bring into boat

Data Point	Latitude	Longitude	Depth (Feet)	Biovolume	% Cover All	% Cover INV	Fanwort	Inflated Bladderwort	White Waterlily	Yellow Waterlily	Spiral Pondweed	Slender Naiad	Snail-seed Pondweed	Watershield	Little Floating-heart	Arrowhead	Spikerush	Low Watermilfoil	Leafy Pondweed	Ribbon-leaf Pondweed	Mermaid Weed	Humped Bladderwort	Filamentous Alga	Stonewort	Common Bladderwort	Burreed	Pipewort	Water Starwort	Big-leaf Pondweed
31	41.5233	-72.3292	7	1	15	0																		T					
32	41.5233	-72.3300	6	1	10	0																		T					
33	41.5233	-72.3308	4	3	30	25	S																	T					
34	41.5233	-72.3317	10	1	5	0																		T					
35	41.5233	-72.3325	14	1	15	0											T												
36	41.5233	-72.3333	11	0	0	0																							
37	41.5225	-72.3333	2	1	30	0											T								S				
38	41.5225	-72.3325	10	2	25	20	S																	T					
39	41.5225	-72.3317	14	0	0	0																							
40	41.5225	-72.3308	15	0	0	0																							
41	41.5225	-72.3300	12	2	15	10	T																	T					
42	41.5225	-72.3292	13	2	25	20	S																	T					
43	41.5225	-72.3283	14	0	0	0																							
44	41.5225	-72.3275	11	1	15	15	T																						
45	41.5225	-72.3267	4	0	0	0																							
46	41.5216	-72.3267	12	1	10	0																		T					
47	41.5217	-72.3275	14	0	0	0																							
48	41.5217	-72.3283	18	0	0	0																							
49	41.5217	-72.3291	20	0	0	0																							
50	41.5217	-72.3300	17	0	0	0																							
51	41.5216	-72.3309	11	1	10	0																		T					
52	41.5217	-72.3316	8	1	20	10	T											T						T					
53	41.5217	-72.3325	6	1	30	0																		S					
54	41.5219	-72.3333	3	1	30	0											S							T					
55	41.5209	-72.3325	4	1	20	0											T							T					
56	41.5208	-72.3317	8	1	15	0																		T					
57	41.5208	-72.3308	8	1	10	0																		T					
58	41.5200	-72.3308	10	2	15	10	T																	T					
59	41.5200	-72.3317	7	1	25	0											S							T					
60	41.5193	-72.3317	4	0	0	0																							

Notation	Description
Z	Zero: no plants on rake
T	Trace: fingerful on rake
S	Sparse: handful on rake
M	Moderate: more than a handful on rake
D	Dense: difficult to bring into boat

Data Point	Latitude	Longitude	Depth (Feet)	Biovolume	% Cover All	% Cover INV	Fanwort	Inflated Bladderwort	White Waterlily	Yellow Waterlily	Spiral Pondweed	Slender Naiad	Snail-seed Pondweed	Watershield	Little Floating-heart	Arrowhead	Spikerush	Low Watermilfoil	Leafy Pondweed	Ribbon-leaf Pondweed	Mermaid Weed	Humped Bladderwort	Filamentous Alga	Stonewort	Common Bladderwort	Burreed	Pipewort	Water Starwort	Big-leaf Pondweed	
61	41.5192	-72.3309	5	0	0	0																								
62	41.5191	-72.3300	17	0	0	0																								
63	41.5183	-72.3292	20	0	0	0																								
64	41.5183	-72.3300	14	0	0	0																								
65	41.5184	-72.3308	10	1	20	15	T																	T						
66	41.5175	-72.3300	4	4	30	0			T															S			S			
67	41.5175	-72.3292	17	0	0	0																								
68	41.5176	-72.3284	30	0	0	0																								
69	41.5169	-72.3292	5	1	30	0											S							S						
70	41.5167	-72.3300	3	3	45	0		T									S			T				S						
71	41.5166	-72.3284	15	0	0	0																								
72	41.5167	-72.3277	4	0	0	0																								
73	41.5158	-72.3276	17	0	0	0																								
74	41.5158	-72.3281	4	1	10	0											T								T					
75	41.5150	-72.3275	11	1	10	0																			T					
76	41.5150	-72.3267	13	1	15	10	T																		T					
77	41.5150	-72.3261	6	1	15	0																			T					
78	41.5142	-72.3267	9	1	10	0																			T					
79	41.5141	-72.3275	12	1	20	0																			T					
80	41.5141	-72.3283	2	1	15	0											T								T					
81	41.5133	-72.3283	7	1	10	0																			T					
82	41.5133	-72.3275	8	1	10	0																			T					
83	41.5135	-72.3268	4	0	0	0																								
84	41.5125	-72.3275	4	0	0	0																								
85	41.5125	-72.3283	2	2	0	0																								
86	41.5116	-72.3264	2	1	10	0																			T					
87	41.5116	-72.3261	4	1	10	0		T																	T					
88	41.5108	-72.3259	4	1	25	0		T								S									T					
89	41.5100	-72.3258	7	0	0	0																								
90	41.5094	-72.3258	6	1	10	0		T																	T					

Notation	Description
Z	Zero: no plants on rake
T	Trace: fingerful on rake
S	Sparse: handful on rake
M	Moderate: more than a handful on rake
D	Dense: difficult to bring into boat

Data Point	Latitude	Longitude	Depth (Feet)	Biovolume	% Cover All	% Cover INV	Fanwort	Inflated Bladderwort	White Waterlily	Yellow Waterlily	Spiral Pondweed	Slender Naiad	Snail-seed Pondweed	Watershield	Little Floating-heart	Arrowhead	Spikerush	Low Watermilfoil	Leafy Pondweed	Ribbon-leaf Pondweed	Mermaid Weed	Humped Bladderwort	Filamentous Alga	Stonewort	Common Bladderwort	Burreed	Pipewort	Water Starwort	Big-leaf Pondweed
91	41.5158	-72.3258	10	1	10	0											T							T					
92	41.5159	-72.3251	4	0	0	0																							
93	41.5167	-72.3250	4	0	0	0																							
94	41.5167	-72.3258	14	0	0	0																							
95	41.5175	-72.3258	5	0	0	0																							
96	41.5175	-72.3250	4	0	0	0																							
97	41.5183	-72.3250	2	0	0	0																							
98	41.5183	-72.3258	4	0	0	0																							
99	41.5192	-72.3267	12	0	0	0																							
100	41.5191	-72.3258	5	0	0	0																							
101	41.5192	-72.3250	2	1	25	0																			T				T
102	41.5200	-72.3250	2	0	0	0																							
103	41.5200	-72.3258	5	0	0	0																							
104	41.5200	-72.3267	12	1	10	10	T																						
105	41.5208	-72.3275	10	0	0	0																							
106	41.5208	-72.3267	12	0	0	0																							
107	41.5208	-72.3258	4	0	0	0																							

Notation	Description
Z	Zero: no plants on rake
T	Trace: fingerful on rake
S	Sparse: handful on rake
M	Moderate: more than a handful on rake
D	Dense: difficult to bring into boat



SOLitude Lake Management
590 Lake Street
Shrewsbury, MA 01545

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Table with 2 columns and 3 rows containing report metadata: Report Date (8/30/2021), Laboratory ID# (N2185077-01), Date Sampled (8/18/2021), Date Received (8/19/2021), Date Tested (8/26/2021). Includes a summary row for Sample Site: SURFACE WATER LAKE HAYWARD, SOUTH - EAST HADDAM, CT.

Table listing Cyanophyta: Unicellular & Colonial Forms (Anabaena, Aphanocapsa, etc.) and Filamentous Non-Nitrogen Fixers (Arthrospira, Limnospira, etc.). Total Cell Count: 430 / ml.

Table listing Filamentous Nitrogen Fixers (Anabaenopsis, Aphanizomenon, etc.) with empty cells for data entry.

Total Cell Count: 430 / ml

Approved by: [Signature]

Northeast Laboratories, Inc. 129 Mill Street Berlin, CT 06037 www.nelabsct.com

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Alan C. Johnson,
Laboratory Director

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590 Lake Street
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EMAIL ADDRESS: amahaney@solitudelake.com

Table with 4 columns: Report Date (8/30/2021), Date Sampled (8/18/2021), Laboratory ID# (N2185077-02), Date Received (8/19/2021), Date Tested (8/26/2021). Includes Sample Site: SURFACE WATER LAKE HAYWARD, NORTH - EAST HADDAM, CT

Table listing Cyanophyta: Unicellular & Colonial Forms with counts for various species like Anabaena, Aphanocapsa (770), Synechococcus/Related (380), and Filamentous Non-Nitrogen Fixers like Arthrospira, Limonothrix, etc.

Table listing Filamentous Nitrogen Fixers with various species names like Anabaenopsis, Aphanizomenon, Calothrix/Rivularia, Chrysosporxium, etc.

Total Cell Count: 1200 / ml



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Table with 2 columns: Report Date, Laboratory ID#, Date Sampled, Date Received, Date Tested, and Sample Site. Sample Site: SURFACE WATER LAKE HAYWARD, NORTH - EAST HADDAM, CT

Table with 2 columns: Cyanophyta: Unicellular & Colonial Forms (Anabaena, Aphanocapsa, etc.) and Filamentous Non-Nitrogen Fixers (Arthrospira, Limnospira, etc.).

Table with 2 columns: Filamentous Nitrogen Fixers (Anabaenopsis, Aphanizomenon, etc.) and other categories.

Total Cell Count: 3800/ml

Approved by: [Signature]

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Table with 4 columns: Report Date, Laboratory ID#, Date Sampled, Date Received, Date Tested. Values include 6/25/2021, N2184346-02, 6/08/2021, 6/15/2021, 6/21/2021. Sample Site: SURFACE WATER LAKE HAYWARD, SOUTH - EAST HADDAM, CT

Table with 2 columns: Organism Name, Count. Includes Cyanophyta: Unicellular & Colonial Forms (Anabaena, Aphanocapsa, etc.) and Filamentous Non-Nitrogen Fixers (Arthrospira, Limnospira, etc.).

Table with 2 columns: Organism Name, Count. Includes Filamentous Nitrogen Fixers (Anabaenopsis, Aphanizomenon, etc.) and other filamentous bluegreens.

Total Cell Count: 4400/ml