Spy Pond

2019 Aquatic Management Program

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INTRODUCTION

The year end report for the 2019 management program at Spy Pond follows. This report will serve to document the herbicide treatment program and summarize results from the vegetation surveys performed at Spy Pond this season. Attached to this report are figures depicting vegetation distribution.

2019 VEGETATION MONITORING

The point-intercept method was utilized during the pre- and post-management surveys. Point-intercept surveys of Spy Pond were based on a 100-m grid within the littoral zone which resulted in a total of 87 data points. These point-intercept surveys were supplemented with an inspection of the entire littoral zone to identify beds of the target species. This 'bed identification' method, detailed below was employed each time SOLitude visited the pond so that any new growth of the target species may be identified and targeted for management as soon as possible.

Survey Methodology

Point Intercept Method

SOLitude Lake Management's biologists surveyed the water body using the aforementioned survey points uploaded to a GPS unit. The following data will be collected at each of the survey points:

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

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 was 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.

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: 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 however bottom sediments are not visible due to water clarity, regardless of vegetative growth. These points will be given a null (∅) designation, for data recording purposes.

Biomass Index

The biomass for each data point was recorded on a scale from zero to four:

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

Percentage of Target Species

The immediate area around the boat was observed for growth of *P. crispus, M. spicatum, Trapa natans,* and any other target species. Each point will be assigned the appropriate percentage.

Target Species Bed Identification

In order to identify target species bed perimeters, a boat was used to navigate around the pond while surveyors recorded the visual density of each bed. A GPS unit was used to track the boat as it moved around plant beds. This GPS track was uploaded to a GIS-based mapping program (ArcMap 9.3.x) and used to develop a pre-management map detailing the overall invasive/nuisance species situation, including relative densities and acreage of beds.

Early Season Point-intercept Survey

The early-season point-intercept survey was conducted on May 2, 2019 by a SOLitude biologist. A 10-foot Jon boat was used to tour the waterbody, locating the data points via a hand-held Garmin GPS. A throw-rake and under-water camera (Aqua-view) was used to observe submersed aquatic vegetation at each data point.

At the time of the survey, two submersed aquatic plants, one macro-alga, and filamentous algae were identified. Curly-leaf pondweed was the dominant species, present at 21 points (24%), followed by thin-leaf pondweed (10%), filamentous algae (9%), and stonewort (6%).The average depth of data points during the May survey was 10.3 feet with an average biovolume (height of plants in the water column) of 1.1. The average percent cover (or overall abundance) of plant cover was 29% with an overall abundance of target species present at 27%. *No Eurasian watermilfoil was observed at this time.*

2019 TREATMENT SUMMARY

The 2019 treatment program at Spy Pond proceeded as scheduled, with treatment technique decisions influenced by the results of the pre-treatment inspection. Prior to each application SLM posted the shoreline with signs that warned of the temporary water use restrictions to be imposed following treatment. A chronological list of the major program elements is provided below:

Management Activities	**Date**
Early-season Point-intercept Survey	May 2, 2019
License to Apply Chemicals (#19189)	June 7, 2019
Diquat Herbicide Treatment	July 12, 2019
Late-season Point-intercept Survey	August 15, 2019
Copper Sulfate Treatment	August 21, 2019
Copper Sulfate Treatment	September 5, 2019

Following the receipt of an approved MA DEP permit, SOLitude Lake Management conducted a series of herbicide/algaecide treatments. On July 12th, an herbicide treatment was performed to control identified areas of curly-leaf pondweed and any Eurasian milfoil that may have grown since the time of the survey using diquat herbicide. After the initial treatment, follow-up algaecide treatments were conducted on August 21st and September 5th in order to maintain control of algal blooms. All treatments were conducted by diluting concentrated herbicides or algaecide with pond water on board the treatment vessel, and evenly distributed across the identified treatment areas using a low-pressured, pump system. All applications at Spy Pond was performed using an 18-foot jon-boat. The rate of application was carefully monitored in accordance with the speed of the boat and width between passes of the boat.

Late Season Point-intercept Survey

The late-season point-intercept survey was conducted on August 15, 2019 by a SOLitude biologist. A 10-foot Jon boat was used to tour the waterbody, locating the data points via a hand-held Garmin GPS. A throw-rake and under-water camera (Aqua-view) was used to observe submersed aquatic vegetation at each data point.

At the time of the survey, the same species was observed as the early-season survey; however, thin-leaf pondweed was now the most dominant aquatic plant present at 14 points (or 16%). Stonewort (macro-alga) was observed at 31% of points, and filamentous algae was present at 12% of points. Due to it's growth habits, curly-leaf pondweed was present at only 3 points (3%). *No Eurasian watermilfoil was observed at this time.*

Table 1. Species List and Frequency of Occurrence

Macrophyte Species	Common Name	May	August
Potamogeton crispus	Curly-leaf Pondweed	24%	3%
Potamogeton pusillus	*Thin-leaf pondweed*	10%	16%
Nitella spp.	Stonewort	6%	31%
Benthic Filamentous Algae		9%	12%

Table 2. Average percentages of parameters

Averages	May	August
Total Percent Cover of All Species	29%	6%
Total Percent Cover of Target Species	27%	0.2%
Total Biovolume of Data Points	1.1	0.5
Depth of Data Points	10.3 ft	9.9 ft

Management Recommendations

- Budgeting for monthly algae sampling or montly algaecide treatments in 2020. With the history of algal blooms, conducting monthly low-dose copper treatment to avoid harmful algal blooms is recommended knowing the high public use of Spy Pond. By conducting algae sampling on a monthly basis, the algal cell counts can be monitored before they reach counts in which the pond has to be closed.

- Development of a water quality monitoring program which includes at least two sampling rounds (spring/fall) from multiple areas of the pond. Analyzing the water quality helps SŌLitude Biologists gain a better understanding of the nutrient load and growth within the pond. As mentioned, this program could also include algae ID testing on a monthly schedule from at least June-August.

- A low-dose alum application should be conducted early in the summer before high levels of microscopic algae become present; thereby, increasing the efficiency of phosphorus precipitation. Annual low-dose alum applications will have a cumulative effect on the total phosphorus levels and each year will observe an incremental improvement in water quality. Should the pond reach filamentous/microscopic algae growth of problematic densities, as-needed or requested, copper-based algaecide treatments are the best method for control.

Despite the success achieved in 2019, we feel that the recommendations are best for Spy Pond's long-term aesthetic, recreational, and ecological value. We look forward to working with you again in 2020. If you have any questions about the 2019 management program, or our 2020 management recommendations please do not hesitate to contact our office.

Appendix A

Point-intercept Data Maps

Figure 1: Data Points

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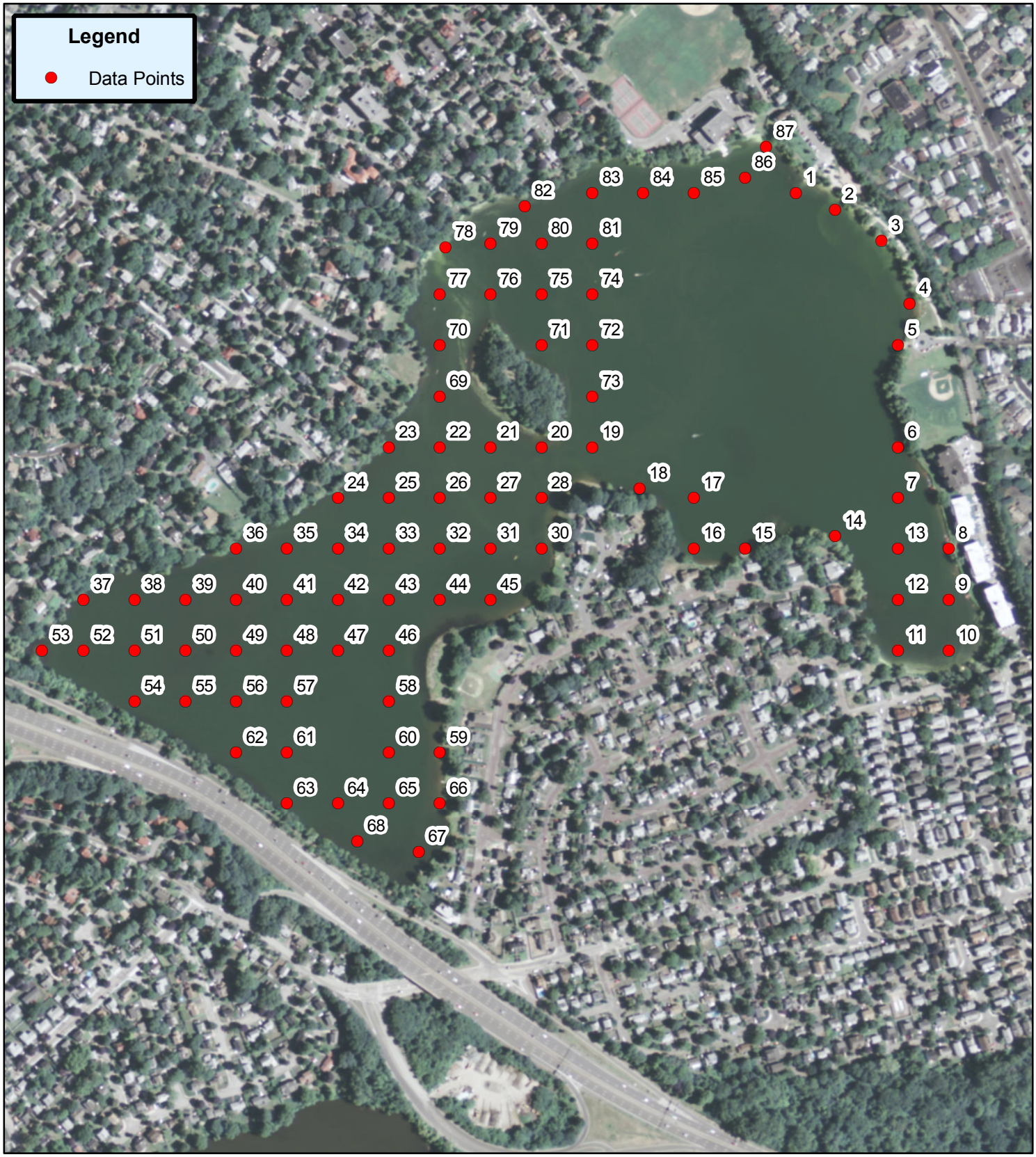

Spy Pond
Arlington, MA
Middlesex County
42.40913°, -71.15373°

Spy Pond

0 250 500 750 Feet

1:6,200

N

Map Date: 01/27/2020
Prepared by: ALM
Office: SHREWSBURY, MA

Figure 2: Depth of Data Points

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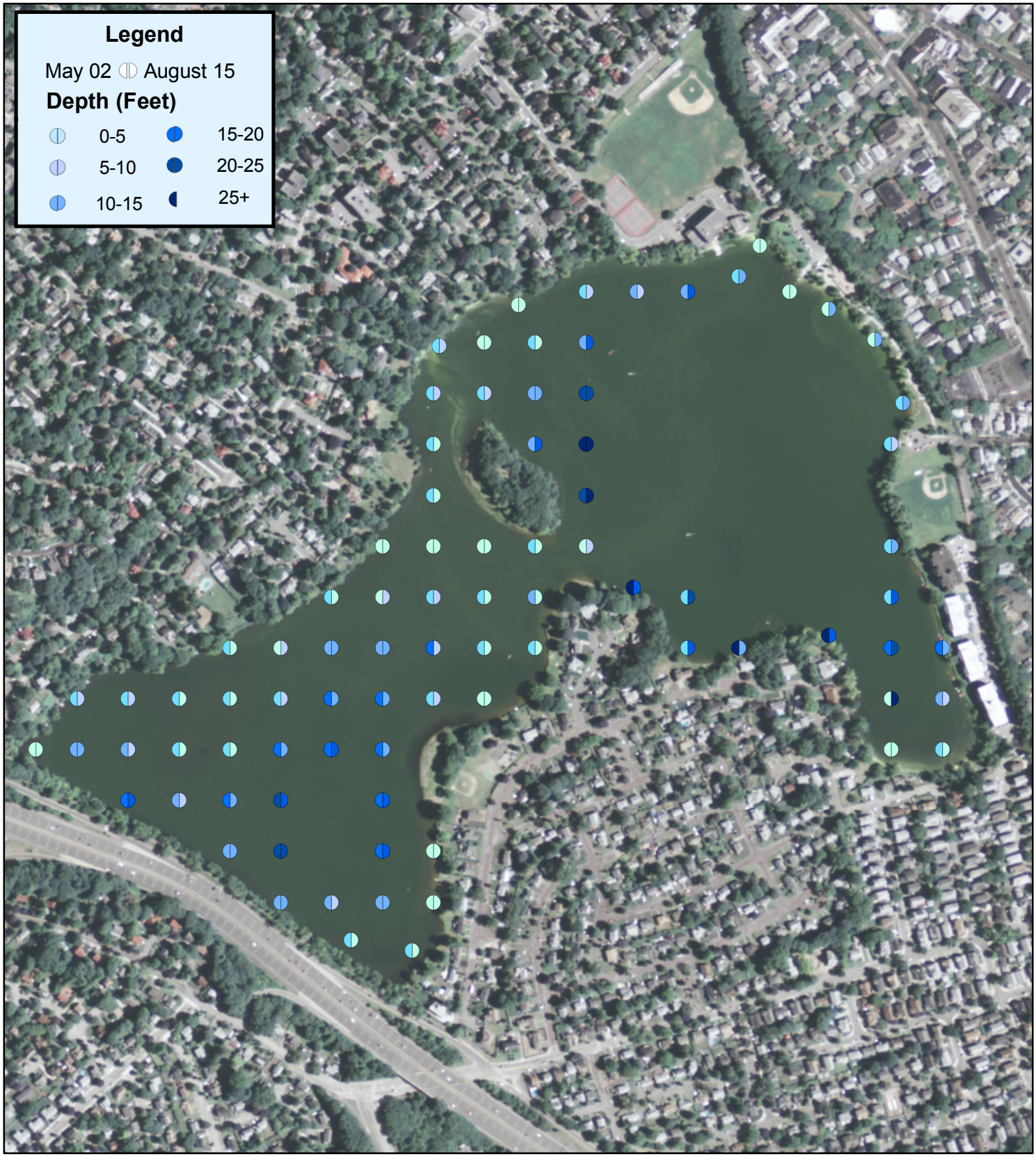

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Figure 3: Percent Cover of All Submersed Aquatic Vegetation

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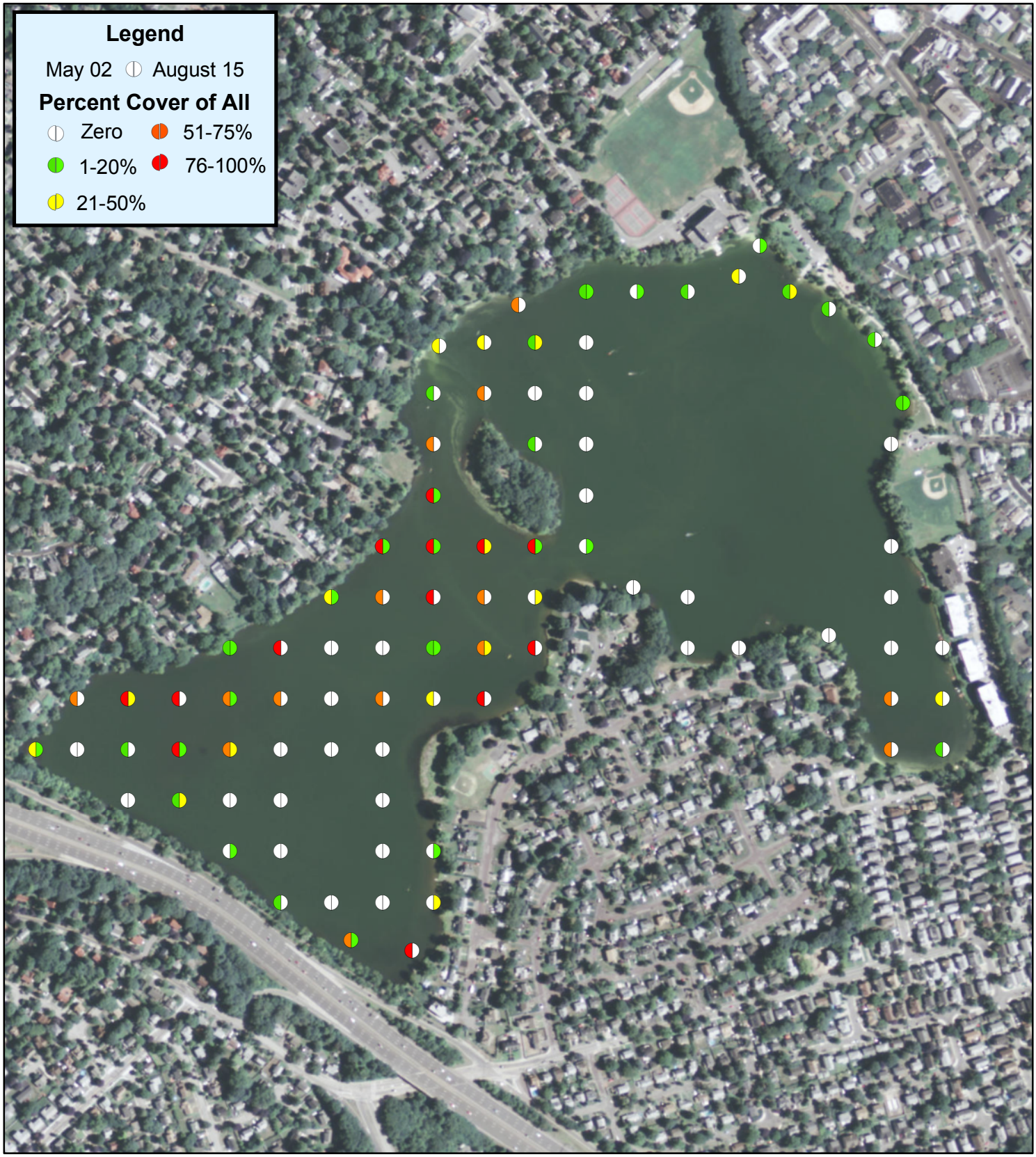

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Figure 4: Percent Cover of Target Species

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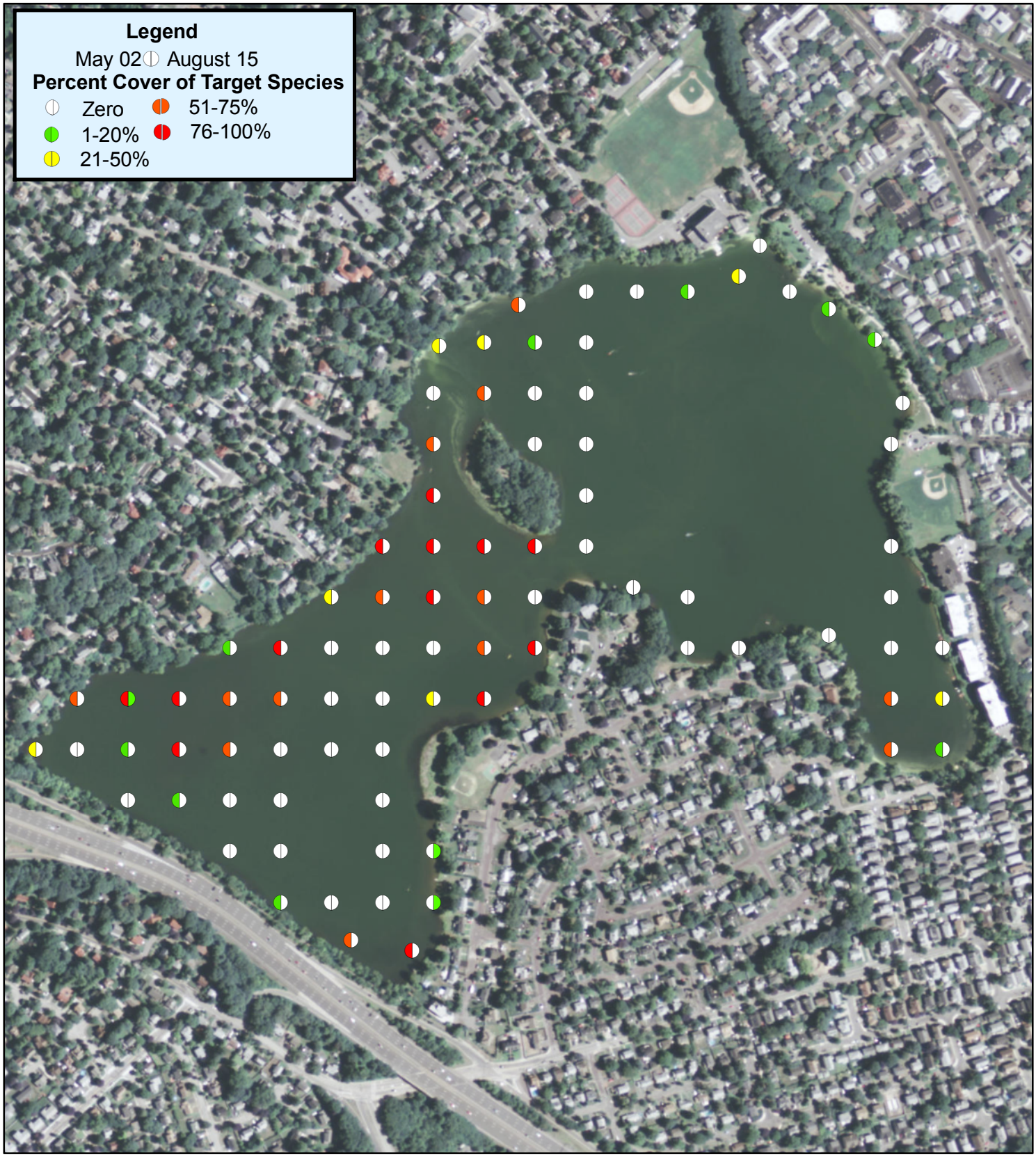

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Figure 5: Total Biovolume of Data Points

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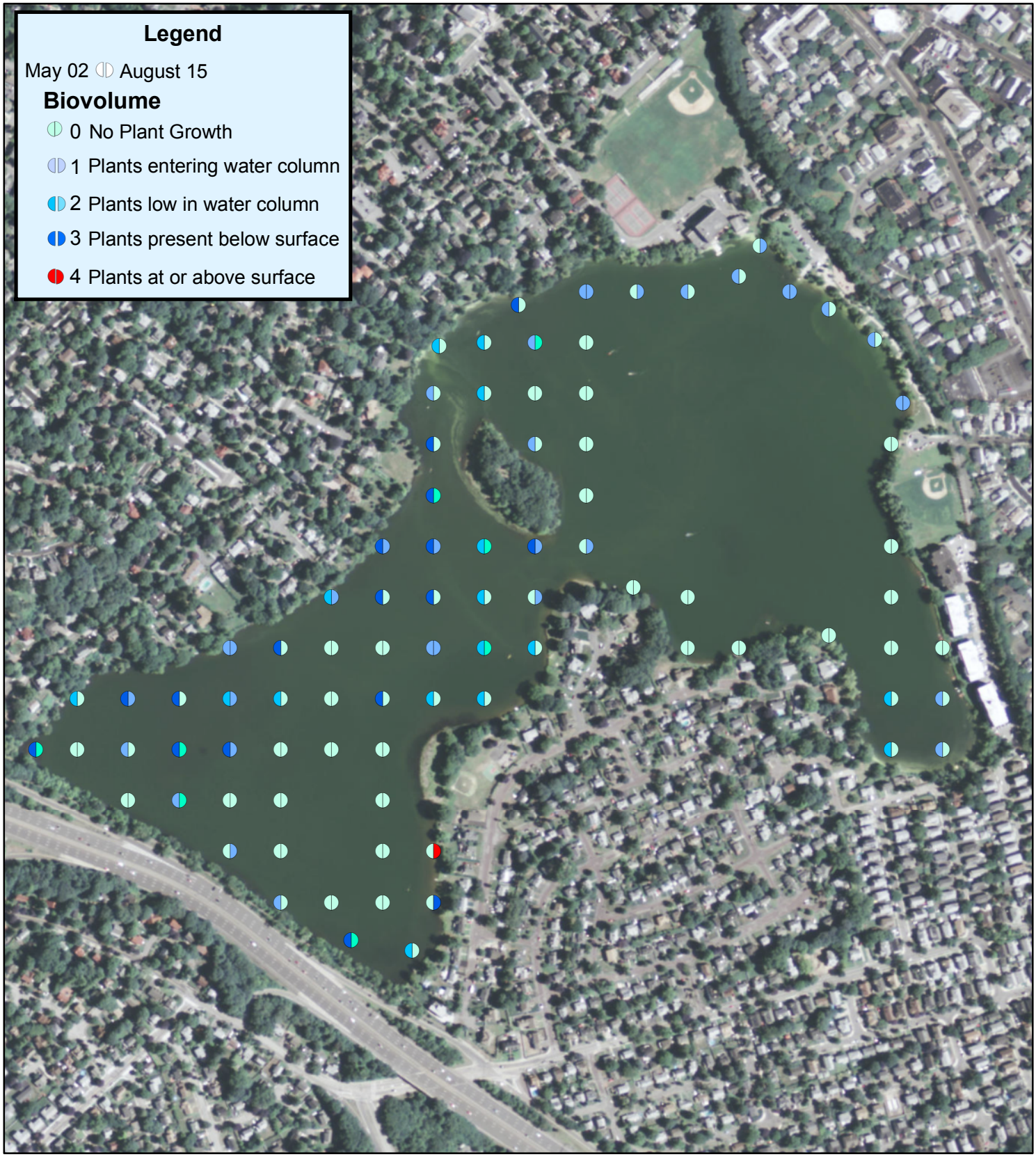

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Figure 6: Relative Abundance of Curly-leaf Pondweed *(P. crispus)*

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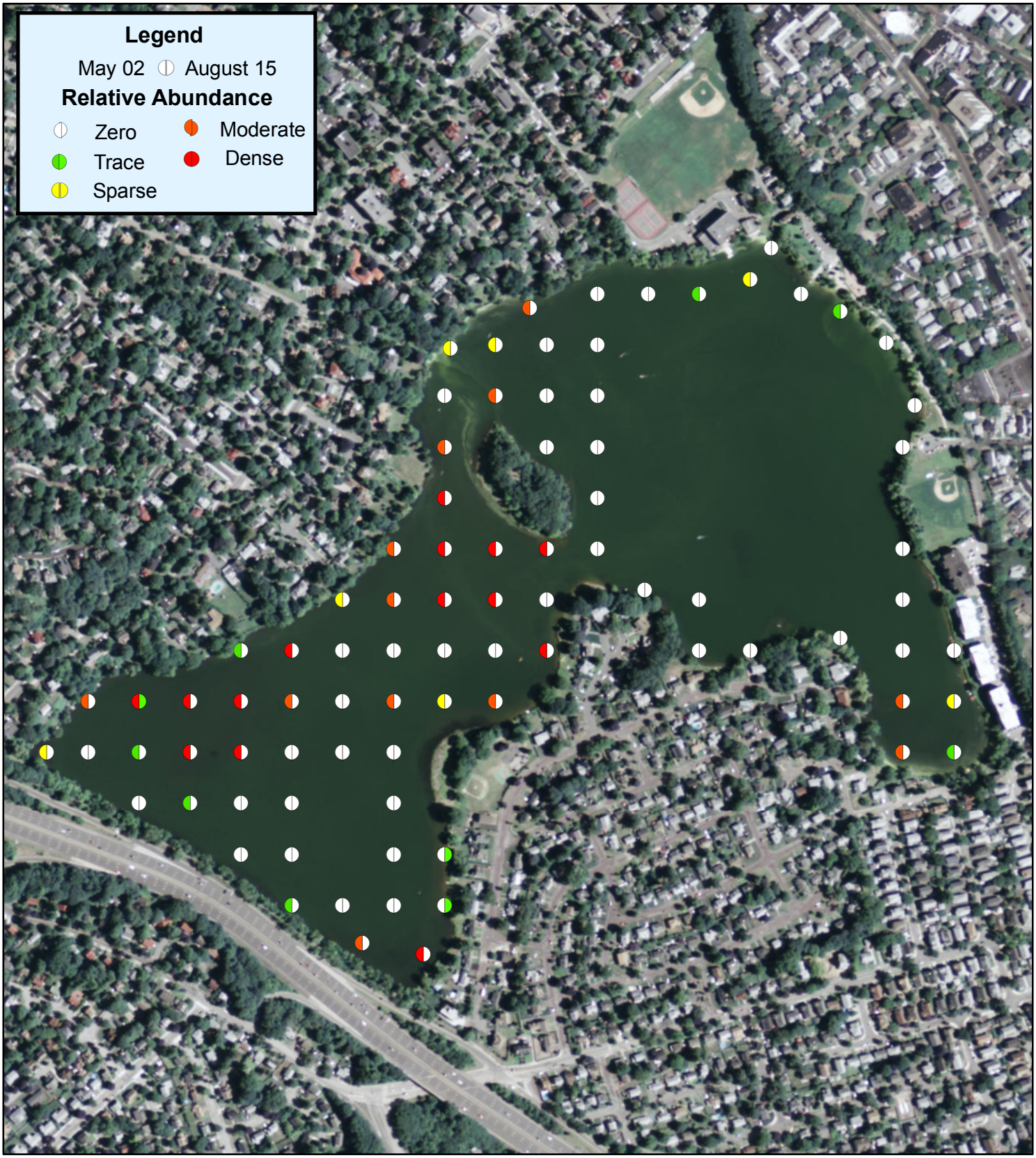

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Spy Pond
0 225 450 900 Feet
1:6,200

N

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Figure 7: Relative Abundance of Thin-leaf Pondweed *(P. pusillus)*

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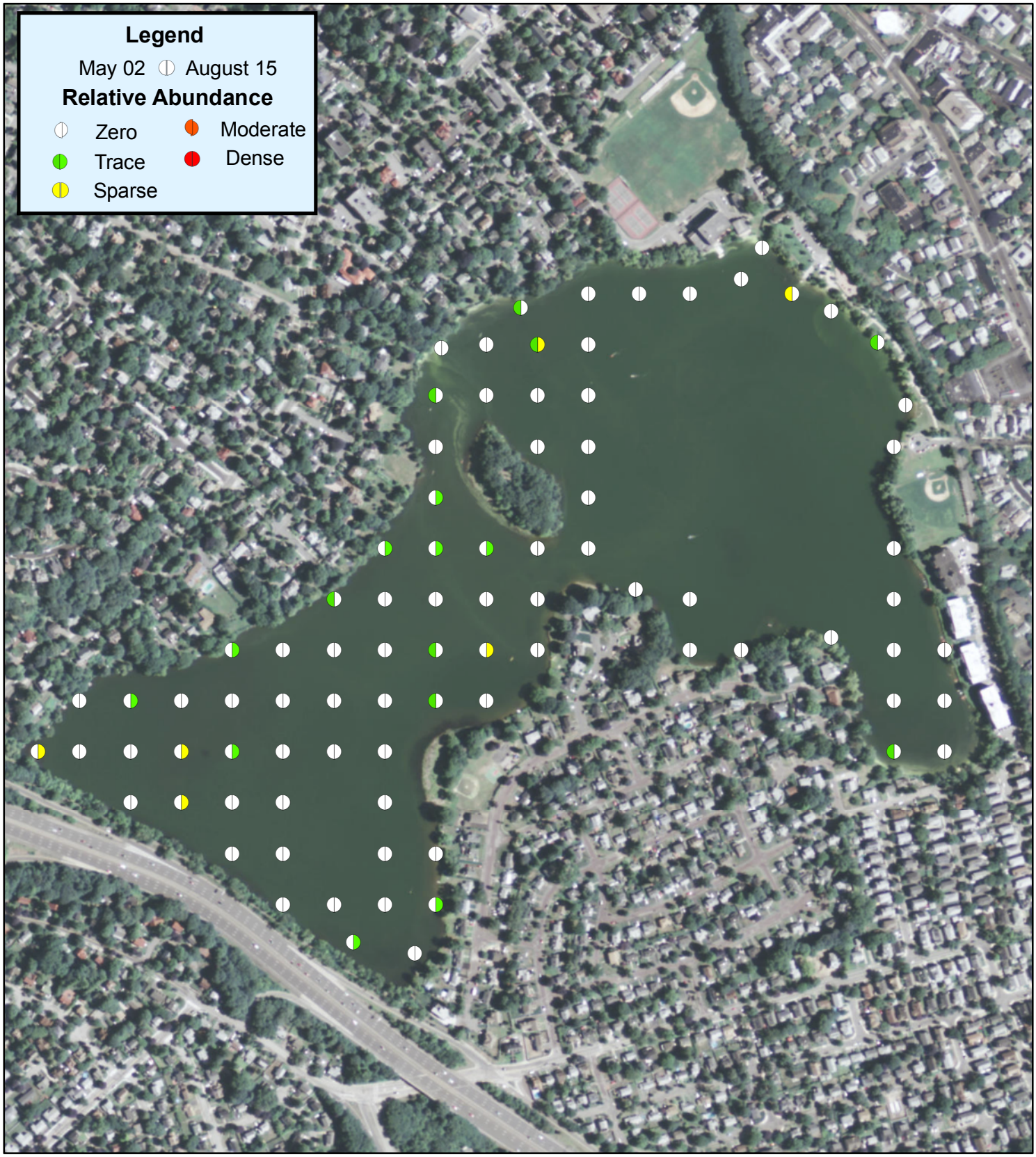

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Figure 8: Relative Abundance of Stonewort *(Nitella spp.)*

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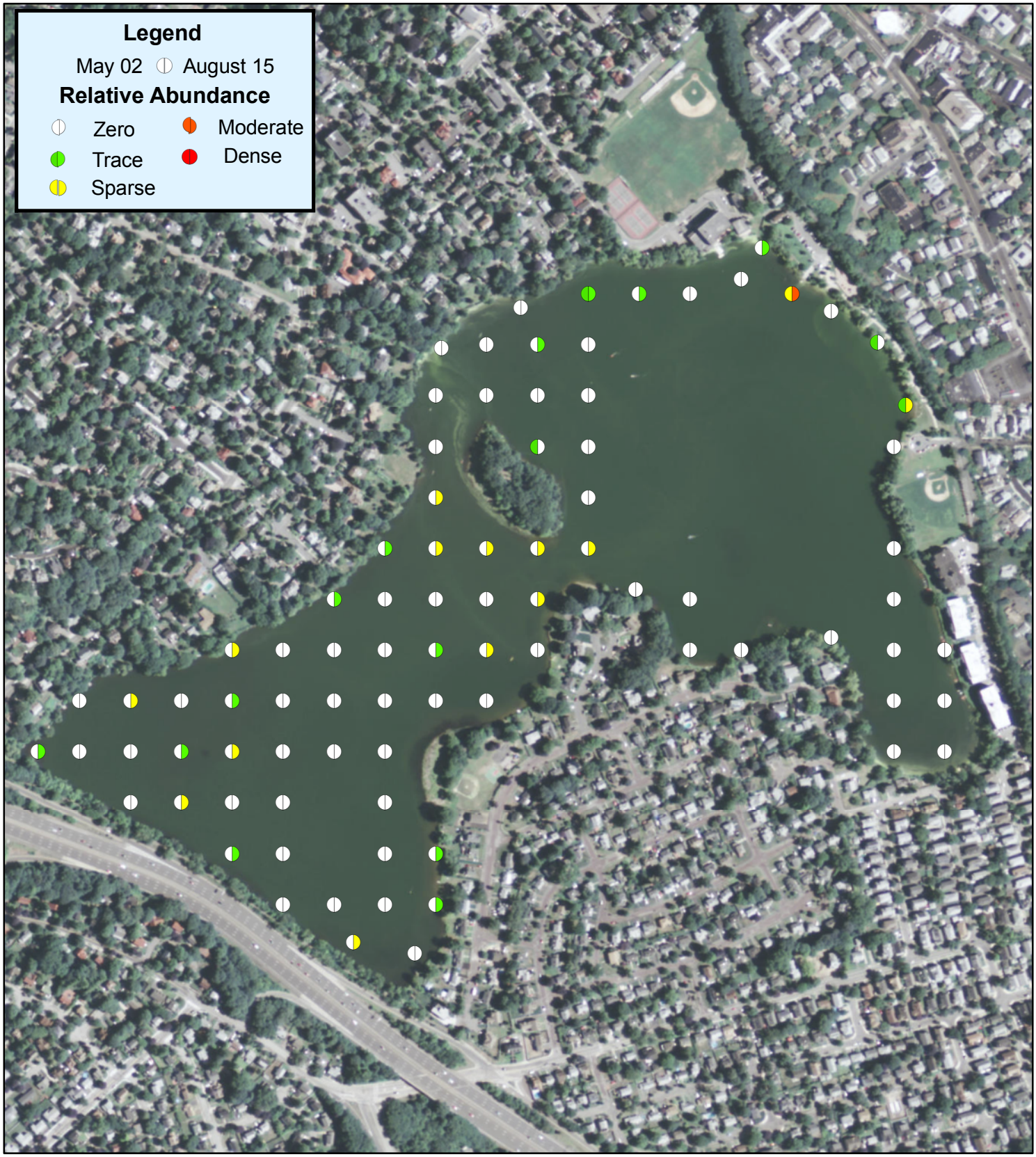

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Figure 9: Relative Abundance of Filamentous Algae

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Appendix B

Raw Data

Spy Pond
Point-intercept Raw Data
May 02, 2019

DATA POINT	DEPTH	BIOVOLUME	PERCENT COVER ALL	PERCENT COVER TARGET	CURLY-LEAF PONDWEED	THIN-LEAF PONDWEED	STONEWORT	FILAMENTOUS ALGAE
1	3.5	1	10	0	Z	S	S	Z
2	3.0	1	10	10	T	Z	Z	Z
3	4.5	1	10	10	Z	T	T	P
4	8.5	1	10	0	Z	Z	T	Z
5	6.8	0	0	0	Z	Z	Z	Z
6	8.0	0	0	0	Z	Z	Z	Z
7	8.0	0	0	0	Z	Z	Z	Z
8	19.3	0	0	0	Z	Z	Z	Z
9	10.8	1	25	25	S	Z	Z	Z
10	7.5	1	20	20	T	Z	Z	Z
11	3.5	2	75	70	M	T	Z	Z
12	4.5	2	55	55	M	Z	Z	Z
13	16.0	0	0	0	Z	Z	Z	Z
14	26.0	0	0	0	Z	Z	Z	Z
15	28.0	0	0	0	Z	Z	Z	Z
16	10.0	0	0	0	Z	Z	Z	Z
17	8.8	0	0	0	Z	Z	Z	Z
18	26.0	0	0	0	Z	Z	Z	Z
19	2.0	0	0	0	Z	Z	Z	P
20	6.0	3	100	100	D	Z	Z	Z
21	4.5	2	80	80	D	Z	Z	Z
22	5.0	3	90	90	D	Z	Z	Z
23	4.0	3	80	80	M	Z	Z	Z
24	8.0	2	30	25	S	T	Z	Z

Spy Pond
Point-intercept Raw Data
May 02, 2019

DATA POINT	DEPTH	BIOVOLUME	PERCENT COVER ALL	PERCENT COVER TARGET	CURLY-LEAF PONDWEED	THIN-LEAF PONDWEED	STONEWORT	FILAMENTOUS ALGAE
25	5.0	3	65	65	M	Z	Z	Z
26	7.0	3	95	95	D	Z	Z	Z
27	6.0	2	75	75	D	Z	Z	Z
28	10.5	0	0	0	Z	Z	Z	Z
30	7.0	2	100	100	D	Z	Z	Z
31	6.5	2	70	60	Z	Z	Z	Z
32	15.4	1	1	0	Z	T	Z	Z
33	14.0	0	0	0	Z	Z	Z	Z
34	12.2	0	0	0	Z	Z	Z	Z
35	5.0	3	90	90	D	Z	Z	Z
36	6.0	1	15	15	T	Z	Z	Z
37	7.0	2	65	65	M	Z	Z	Z
38	6.0	3	100	100	D	Z	Z	Z
39	6.0	3	100	100	D	Z	Z	Z
40	6.0	2	75	75	D	Z	Z	Z
41	7.0	2	70	70	M	Z	Z	Z
42	16.4	0	0	0	Z	Z	Z	Z
43	17.0	3	75	0	M	Z	Z	Z
44	8.0	2	35	30	S	T	Z	P
45	5.0	2	80	80	M	Z	Z	Z
46	15.2	0	0	0	Z	Z	Z	Z
47	17.9	0	0	0	Z	Z	Z	Z
48	15.8	0	0	0	Z	Z	Z	Z
49	6.0	3	75	75	D	Z	Z	Z

Spy Pond
Point-intercept Raw Data
May 02, 2019

DATA POINT	DEPTH	BIOVOLUME	PERCENT COVER ALL	PERCENT COVER TARGET	CURLY-LEAF PONDWEED	THIN-LEAF PONDWEED	STONEWORT	FILAMENTOUS ALGAE
50	6.0	3	80	80	D	Z	Z	Z
51	11.5	1	10	10	T	Z	Z	Z
52	13.5	0	0	0	Z	Z	Z	Z
53	4.0	3	35	35	S	Z	Z	P
54	16.2	0	0	0	Z	Z	Z	Z
55	10.5	1	5	5	T	Z	Z	Z
56	16.4	0	0	0	Z	Z	Z	Z
57	21.7	0	0	0	Z	Z	Z	Z
58	17.2	0	0	0	Z	Z	Z	Z
59	2.0	0	0	0	Z	Z	Z	P
60	17.0	0	0	0	Z	Z	Z	Z
61	23.0	0	0	0	Z	Z	Z	Z
62	11.0	0	0	0	Z	Z	Z	Z
63	10.6	1	5	5	T	Z	Z	Z
64	10.2	0	0	0	Z	Z	Z	Z
65	14.8	0	0	0	Z	Z	Z	P
66	3.0	0	0	0	Z	Z	Z	P
67	7.0	2	80	80	D	Z	Z	Z
68	6.0	3	75	75	M	Z	Z	Z
69	6.0	3	90	90	D	Z	Z	Z
70	6.0	3	65	65	M	Z	Z	Z
71	10.1	1	5	0	Z	Z	T	Z
72	27.8	0	0	0	Z	Z	Z	Z
73	21.5	0	0	0	Z	Z	Z	Z
74	22.8	0	0	0	Z	Z	Z	Z

Spy Pond
Point-intercept Raw Data
May 02, 2019

DATA POINT	DEPTH	BIOVOLUME	PERCENT COVER ALL	PERCENT COVER TARGET	CURLY-LEAF PONDWEED	THIN-LEAF PONDWEED	STONEWORT	FILAMENTOUS ALGAE
75	14.5	0	0	0	Z	Z	Z	Z
76	8.8	2	75	75	M	Z	Z	Z
77	9.0	1	5	0	Z	T	Z	Z
78	8.5	2	45	45	S	Z	Z	Z
79	4.8	2	25	25	S	Z	Z	Z
80	5.2	1	5	5	Z	T	Z	Z
81	14.5	0	0	0	Z	Z	Z	Z
82	5.0	3	75	70	M	T	Z	Z
83	6.7	1	10	0	Z	Z	T	Z
84	11.0	0	0	0	Z	Z	Z	P
85	12.0	1	10	10	T	Z	Z	Z
86	8.0	1	25	25	S	Z	Z	Z
87	2.0	0	0	0	Z	Z	Z	Z

Spy Pond
Point-intercept Raw Data
August 15, 2019

DATA POINT	DEPTH	BIOVOLUME	PERCENT COVER ALL	PERCENT COVER TARGET	CURLY-LEAF PONDWEED	THIN-LEAF PONDWEED	STONEWORT	FILAMENTOUS ALGAE
1	5	1	25	0	Z	Z	M	P
2	12	0	0	0	Z	Z	Z	Z
3	11	0	0	0	Z	Z	Z	Z
4	11	1	20	0	Z	Z	S	P
5	7	0	0	0	Z	Z	Z	P
6	10	0	0	0	Z	Z	Z	Z
7	18	0	0	0	Z	Z	Z	Z
8	11	0	0	0	Z	Z	Z	P
9	7	0	0	0	Z	Z	Z	P
10	3	0	0	0	Z	Z	Z	P
11	3	0	0	0	Z	Z	Z	Z
12	26	0	0	0	Z	Z	Z	Z
13	23	0	0	0	Z	Z	Z	Z
14	16	0	0	0	Z	Z	Z	Z
15	12	0	0	0	Z	Z	Z	Z
16	17	0	0	0	Z	Z	Z	Z
17	24	0	0	0	Z	Z	Z	Z
18	17	0	0	0	Z	Z	Z	Z
19	6	1	15	0	Z	Z	S	Z
20	4	1	20	0	Z	Z	S	Z
21	3	2	25	0	Z	T	S	Z
22	4	1	20	0	Z	T	S	Z
23	3	1	10	0	Z	T	T	Z
24	5	1	5	0	Z	Z	T	Z

Spy Pond
Point-intercept Raw Data
August 15, 2019

DATA POINT	DEPTH	BIOVOLUME	PERCENT COVER ALL	PERCENT COVER TARGET	CURLY-LEAF PONDWEED	THIN-LEAF PONDWEED	STONEWORT	FILAMENTOUS ALGAE
25	7	0	0	0	Z	Z	Z	Z
26	5	0	0	0	Z	Z	Z	Z
27	4	0	0	0	Z	Z	Z	Z
28	4	1	25	0	Z	Z	S	Z
30	3	0	0	0	Z	Z	Z	Z
31	4	2	35	0	Z	S	S	Z
32	6	1	10	0	Z	Z	T	Z
33	14	0	0	0	Z	Z	Z	Z
34	12	0	0	0	Z	Z	Z	Z
35	9	0	0	0	Z	Z	Z	Z
36	3	1	20	0	Z	T	S	Z
37	7	0	0	0	Z	Z	Z	Z
38	8	1	25	5	T	T	S	Z
39	5	0	0	0	Z	Z	Z	Z
40	5	1	10	0	Z	Z	T	Z
41	7	0	0	0	Z	Z	Z	Z
42	15	0	0	0	Z	Z	Z	Z
43	15	0	0	0	Z	Z	Z	Z
44	5	0	0	0	Z	Z	Z	Z
45	3	0	0	0	Z	Z	Z	Z
46	14	0	0	0	Z	Z	Z	Z
47	18	0	0	0	Z	Z	Z	Z
48	14	0	0	0	Z	Z	Z	Z
49	4	1	25	0	Z	T	S	Z

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50	3	2	20	0	Z	S	T	Z
51	9	0	0	0	Z	Z	Z	Z
52	11	0	0	0	Z	Z	Z	Z
53	3	2	20	0	Z	S	T	P
54	16	0	0	0	Z	Z	Z	Z
55	9	2	35	0	Z	S	S	Z
56	14	0	0	0	Z	Z	Z	Z
57	20	0	0	0	Z	Z	Z	Z
58	16	0	0	0	Z	Z	Z	Z
59	3	4	10	5	T	Z	T	P
60	15	0	0	0	Z	Z	Z	Z
61	20	0	0	0	Z	Z	Z	Z
62	11	1	5	0	Z	Z	T	Z
63	11	0	0	0	Z	Z	Z	Z
64	10	0	0	0	Z	Z	Z	Z
65	13	0	0	0	Z	Z	Z	P
66	3	3	25	5	T	T	T	P
67	3	0	0	0	Z	Z	Z	Z
68	4	2	20	0	Z	T	S	Z
69	3	2	20	0	Z	T	S	Z
70	3	0	0	0	Z	Z	Z	Z
71	17	0	0	0	Z	Z	Z	Z
72	25	0	0	0	Z	Z	Z	Z
73	26	0	0	0	Z	Z	Z	Z
74	21	0	0	0	Z	Z	Z	Z

Spy Pond
Point-intercept Raw Data
August 15, 2019

DATA POINT	DEPTH	BIOVOLUME	PERCENT COVER ALL	PERCENT COVER TARGET	CURLY-LEAF PONDWEED	THIN-LEAF PONDWEED	STONEWORT	FILAMENTOUS ALGAE
75	15	0	0	0	Z	Z	Z	Z
76	8	0	0	0	Z	Z	Z	Z
77	9	0	0	0	Z	Z	Z	Z
78	8	0	0	0	Z	Z	Z	Z
79	4	0	0	0	Z	Z	Z	Z
80	4	2	35	0	Z	S	T	Z
81	16	0	0	0	Z	Z	Z	Z
82	3	0	0	0	Z	Z	Z	Z
83	7	1	10	0	Z	Z	T	Z
84	7	1	5	0	Z	Z	T	Z
85	17	0	0	0	Z	Z	Z	Z
86	14	0	0	0	Z	Z	Z	Z
87	3	1	5	0	Z	Z	T	Z