First Sighting of Eurasian Watermilfoil in Spring Lake, July 12, 2021

Curlyleaf Pondweed Surveys and Aquatic Plant Point Intercept Survey for Spring Lake, Scott County, Minnesota in 2021

Curlyleaf Pondweed Meandering Survey: April 23, 2021
CLP Treatment: May 17, 2021, 22.65 ac (diquat)
Curlyleaf Pondweed Assessment Surveys: June 14, 2021
Summer Point Intercept Plant Survey: July 12, 2021
EWM Hand Removal: August 4, 2021
EWM Herbicide Treatment: September 15, 2021, 8.1 ac

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December 22, 2021

Curlyleaf Pondweed Surveys and Aquatic Plant Point Intercept Survey for Spring Lake, Scott County, Minnesota in 2021

Summary

Early Season CLP Delineation and Assessment: Curlyleaf pondweed (CLP) distribution and abundance were delineated in Spring Lake on April 23, 2021 to determine if curlyleaf control was needed. Curlyleaf growth was observed at 55 out of 142 sample sites (Figure S1). Growth ranged from light to heavy. Four areas totaling 22.65 acres were projected to produce abundant growth and were delineated for treatment (Figure S1).

Treatment of 22.65 acres occurred on May 17, 2021 using a diquat herbicide.

A post-treatment assessment survey included a line transect survey and a meandering survey and was conducted on June 14, 2021 to check the status of curlyleaf pondweed and native plant community in Spring Lake. CLP was observed at 6 locations with light growth. Treatment control in all areas was excellent (Figure S1).

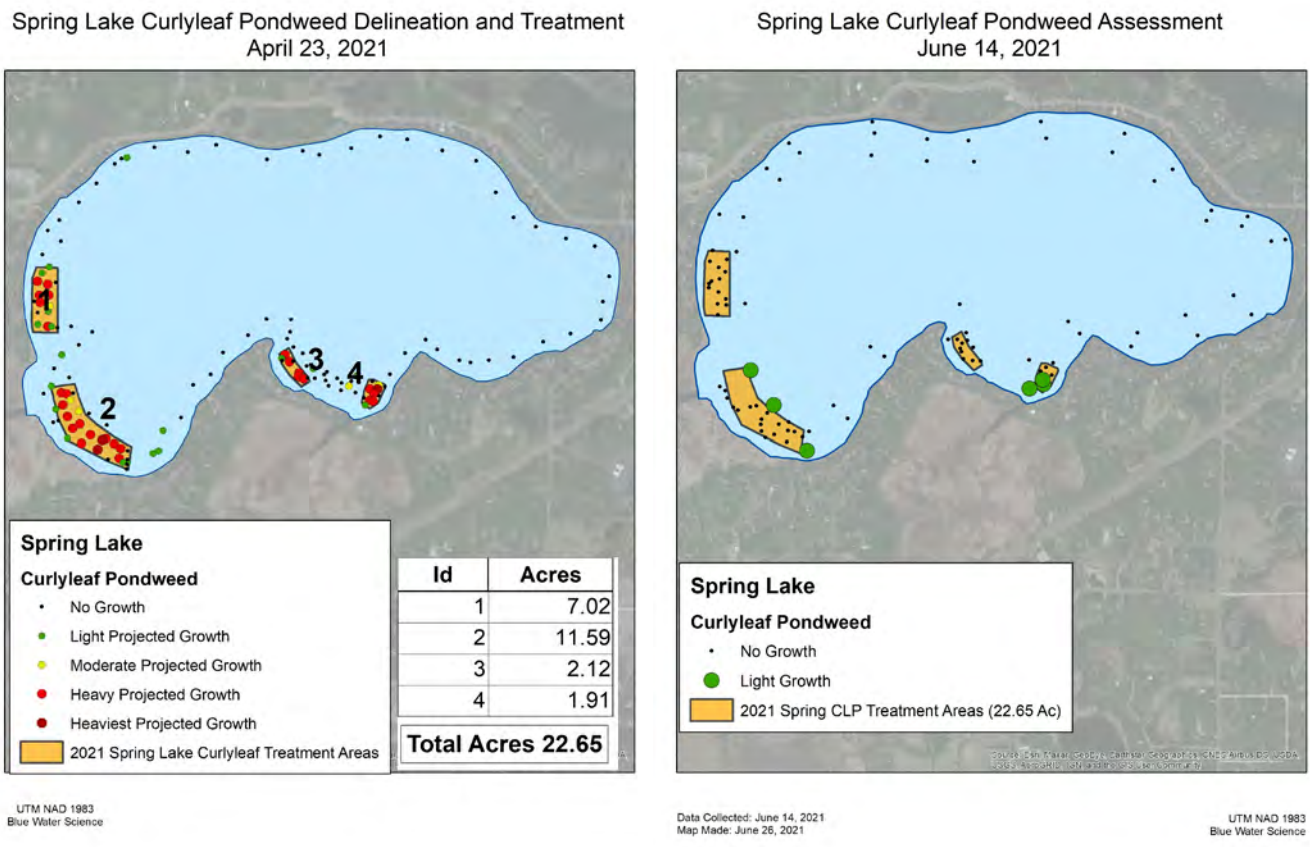


Figure S1. [left] curlyleaf pondweed delineation. [right] curlyleaf pondweed assessment (post treatment).

2021 Point Intercept Survey: A grid with points spaced 50 meters apart was put over the entire lake and sites were sampled throughout the growing zone. A total of 377 sites were sampled, plants were observed growing to a depth of 12 feet. Results of the summer aquatic plant point intercept survey conducted on July 12, 2021 found 15 submerged aquatic plant species with including CLP and Eurasian watermilfoil (EWM). Native plants were found around the perimeter of the basin of Spring Lake (Figure S2) out to a water depth of 12 feet.

Native aquatic plants were estimated to cover of the lake bottom (202 acres). Coontail was the dominant aquatic plant. The 15 aquatic plant species found in this survey represents a fair to good diversity for Spring Lake in late summer.

Eurasian watermilfoil was found for the first time at 3 sites in the point intercept survey and at an additional 9 sites with a meander search (Figure S2). Handpulling occurred on August 4, 2021 and 8 acres were treated on September 15, 2021 (Figure S2).

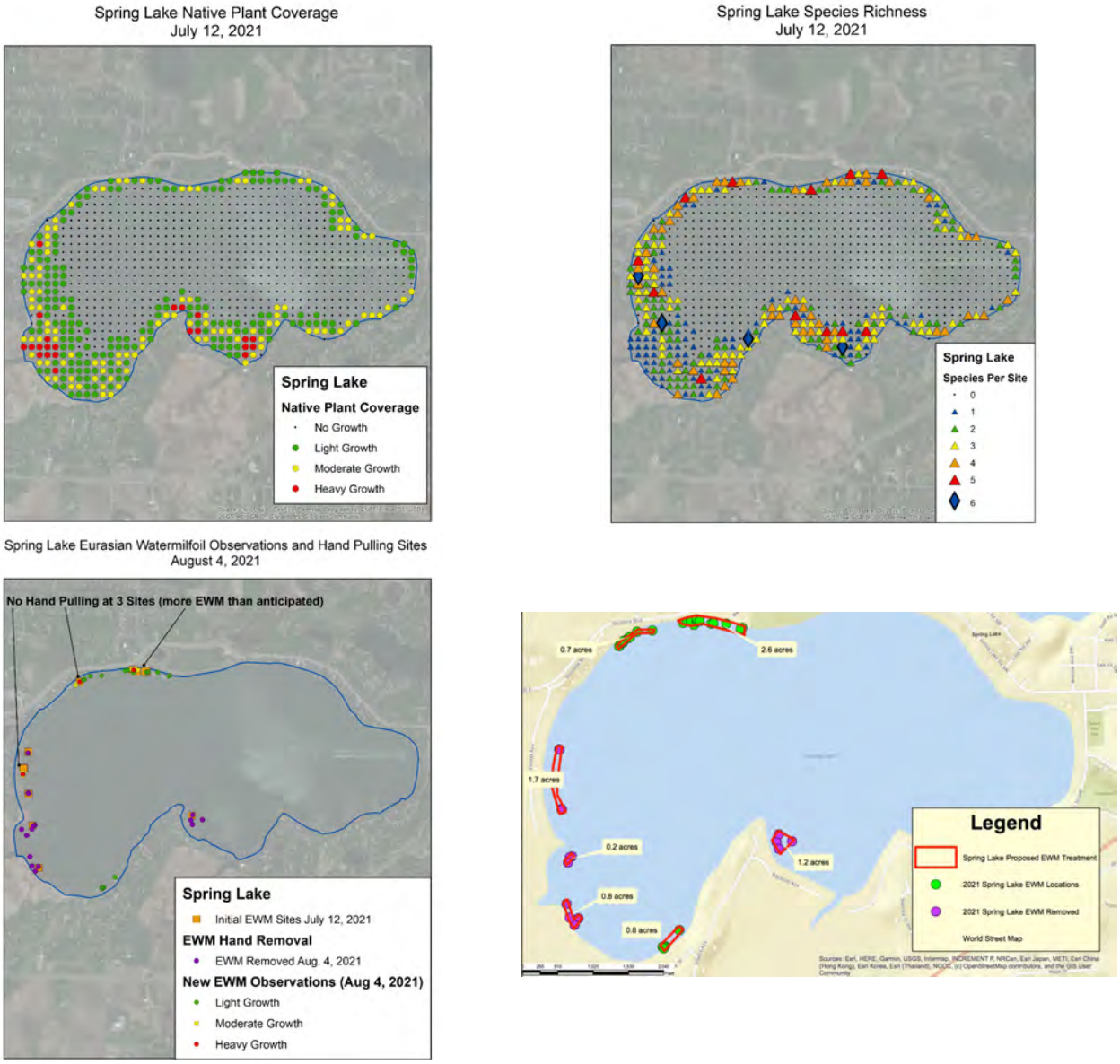


Figure S2. [top-left] Native plant distribution and abundance for the July 12, 2021 point intercept survey.
[top-right] Species richness for the July 12, 2021 point intercept survey.
[bottom-left] EWM observations and handpulling sites for August 4, 2021.
[bottom-right] Treatment sites for 2021.
Key: green = light growth, yellow = moderate growth, red = heavy growth, and black dot = no growth.

Comparison of 2015, 2018, 2019, 2020, 2021 Point Intercept Surveys: Point intercept surveys were conducted on Spring Lake in 2015, 2018, 2019, 2020, and 2021 and results are shown in Table S1. In 2015, elodea was the dominant plant but since then coontail has been dominant (Table S1). Several species increased in occurrence since 2015 including coontail, claspingleaf pondweed, water celery, and water stargrass. Elodea and sago pondweed have decreased (Table S1).

Table S1. Spring Lake aquatic plant occurrence for the point intercept surveys conducted in 2015, 2018, 2019, 2020, and 2021.

	2015 % Occur (113 sites)	2018 % Occur (248 sites)	2019 % Occur (214 sites)	2020 % Occur (298 sites)	2021 % Occur (377 Sites)
Cattails (*Typha sp*)		1		1	1
Watershield (*Brasenia Schreberi*)					1
Duckweed (*Lemna sp*)		1		1	
White water lilies (*Nymphaea ordata*)		1	5	2	1
Coontail (*Ceratophyllum demersum*)	15	56	47	51	52
Chara (*Chara sp*)	4	2	2	1	14
Chara - 2 (*Chara sp*)		1			
Moss (*Drepanocladus sp*)		1	2	1	
Elodea (*Elodea canadensis*)	42	36	3	5	6
Water stargrass (*Heteranthera dubia)*	5	12	10	19	21
Northern watermilfoil *(Myriophyllum sibiricum)*				1	2
Eurasian watermilfoil (*M. spicatum*)					1
Naiads (*Najas flexilis*)	21	23	9	39	22
Curlyleaf pondweed (*Potamogeton crispus*)	12	6		7	7
Fries pondweed (*P. Friesii*)					1
Claspingleaf pondweed (*P. Richardsonii*)	4	10	10	20	23
Floatingleaf (*P. sp*)					1
Stringy pondweed (*P. sp*)	29	7	4	19	19
Flatstem pondweed *(P. zosteriformis)*				1	1
Sago pondweed (*Stuckenia pectinata*)	17	11	9	5	22
Bladderwort (*Utricularia vulgaris*)		1			
Water celery (*Vallisneria americana*)	9	20	23	21	23
Number of submerged species	10	13	10	14	15
Depth of plant growth (ft)	9	8	8	9	12
Percent coverage of plants (%)	29 (175 ac)	21 (122 ac)	17 (98 ac)	25 (145 ac)	34 (197 ac)

Curlyleaf Pondweed Surveys and Aquatic Plant Point Intercept Survey for Spring Lake, Scott County, Minnesota in 2021

Introduction

Spring Lake has an area of 592 acres with a littoral area of 290 acres (source: MnDNR). The objectives of the plant surveys were to delineate and recommend areas to treat nuisance curlyleaf pondweed and to monitor the non-native and native plants over the summer.

A curlyleaf pondweed delineation survey was conducted on April 23, 2021.

Treatment occurred on May 17, 2021 and covered 22.65 acres.

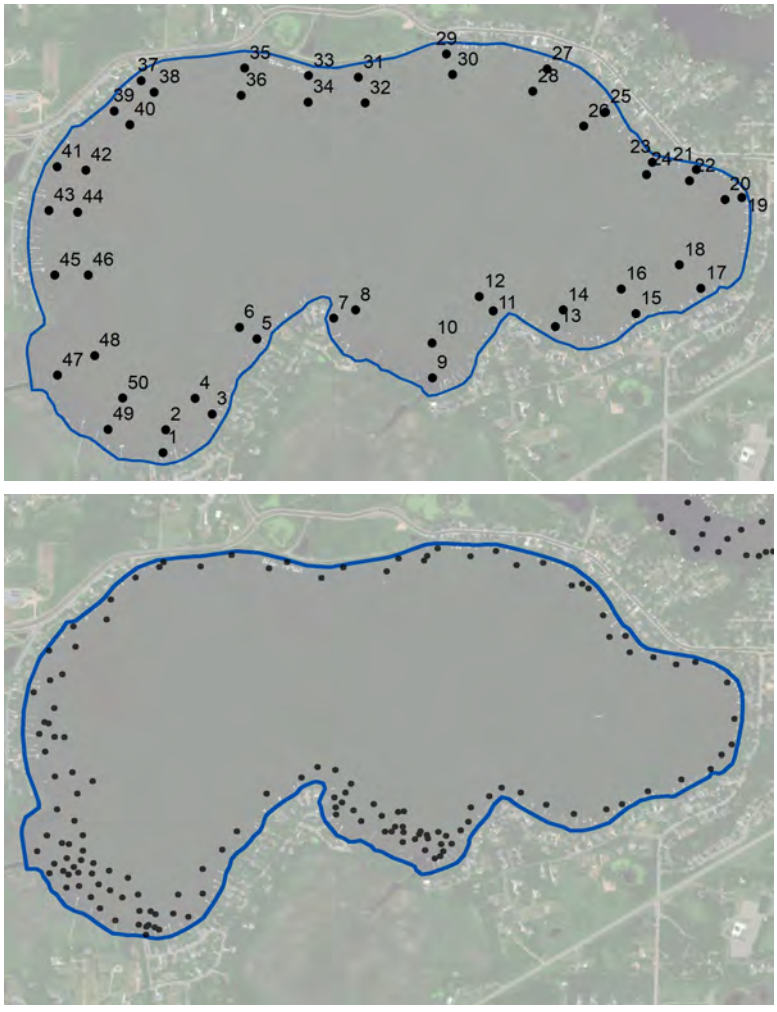
A curlyleaf pondweed assessment was conducted on June 14, 2021.

A summer aquatic plant point intercept survey was conducted on July 12, 2021 to check and inspect the native plant community in Spring Lake.

Figure 1. Rake sample of coontail sampled on April 23, 2021 in Spring Lake.

Survey Methods for Meandering and Line Transect Surveys: Determining what areas to treat to control excessive growth of curlyleaf pondweed has been an ongoing challenge. Curlyleaf growth in April and May is just starting to go into a rapid growth phase. However, not all early season curlyleaf growth will result in heavy curlyleaf growth in June. It appears there are factors that limit curlyleaf growth and significant variables are associated with sediment conditions. The question is how to best delineate areas to treat what could be heavy growth in June but not overtreat areas where growth wouldn't be a nuisance for the season. Currently, for Spring Lake, the method has been to use past treatment history combined with early season scouting and then a recheck to evaluate any treatment effects and see if curlyleaf areas were missed. A meandering survey was used to delineate CLP and a meandering survey was combined with a line transect survey to assess the CLP treatment (Figure 2).

Meander Delineation Survey: A meandering survey consists of using a meandering path around the nearshore area of the entire lake. Visual inspection along with plant sampling was conducted. At each sample point, plants were sampled with a rake sampler.



Line Transect Survey: We used 25 line transects with 2 depths per transect. The same transects have been used from 2000 through 2020. Plants were sampled with a rake attached to a pole to characterize species presence and its density along a transect. A total of 50 sites were sampled (Figure 2). For the assessment transect survey, plant density was estimated on a scale of 1 to 3 with 3 being the densest.

Figure 2. [top] Full lake transect survey sample sites. [bottom] Meander GPS sample points. The transect survey can be used for year to year comparisons and the meander GPS surveys help target abundant and nuisance non-native species.

Methods for the Point Intercept Survey: An aquatic plant point intercept survey of Spring Lake was conducted by Blue Water Science on July 12, 2021. A total 377 points in the growing zone out to 15 feet will be sampled. Sample points were spaced 50 meters apart on a grid that covered the lake (Figure 3). At each sample point, a sampling rake was lowered into the water and a plant sample was taken. The plant species were recorded and the density of each species was assigned. Densities were based on the coverage on the teeth of the rake. Density ratings ranged from 1 to 3 with 1 being sparse and 3 being heavy growth. Based on these sample sites, plant distribution maps were constructed.

Figure 3. Point intercept sample sites for Spring Lake in 2021. Sample sites were spaced 50 meters apart.

Results of Curlyleaf Pondweed Delineation April 23, 2021: A curlyleaf delineation using a meandered survey collected a total of 142 GPS points around the lake. Curlyleaf was found at 55 out of 142 sites (Figure 4). Curlyleaf was observed growing in water depths of 3-7 feet, notably, no curlyleaf was observed deeper than 7 feet of water depth. At total of 22.65 acres were delineated for treatment (Figure 4).

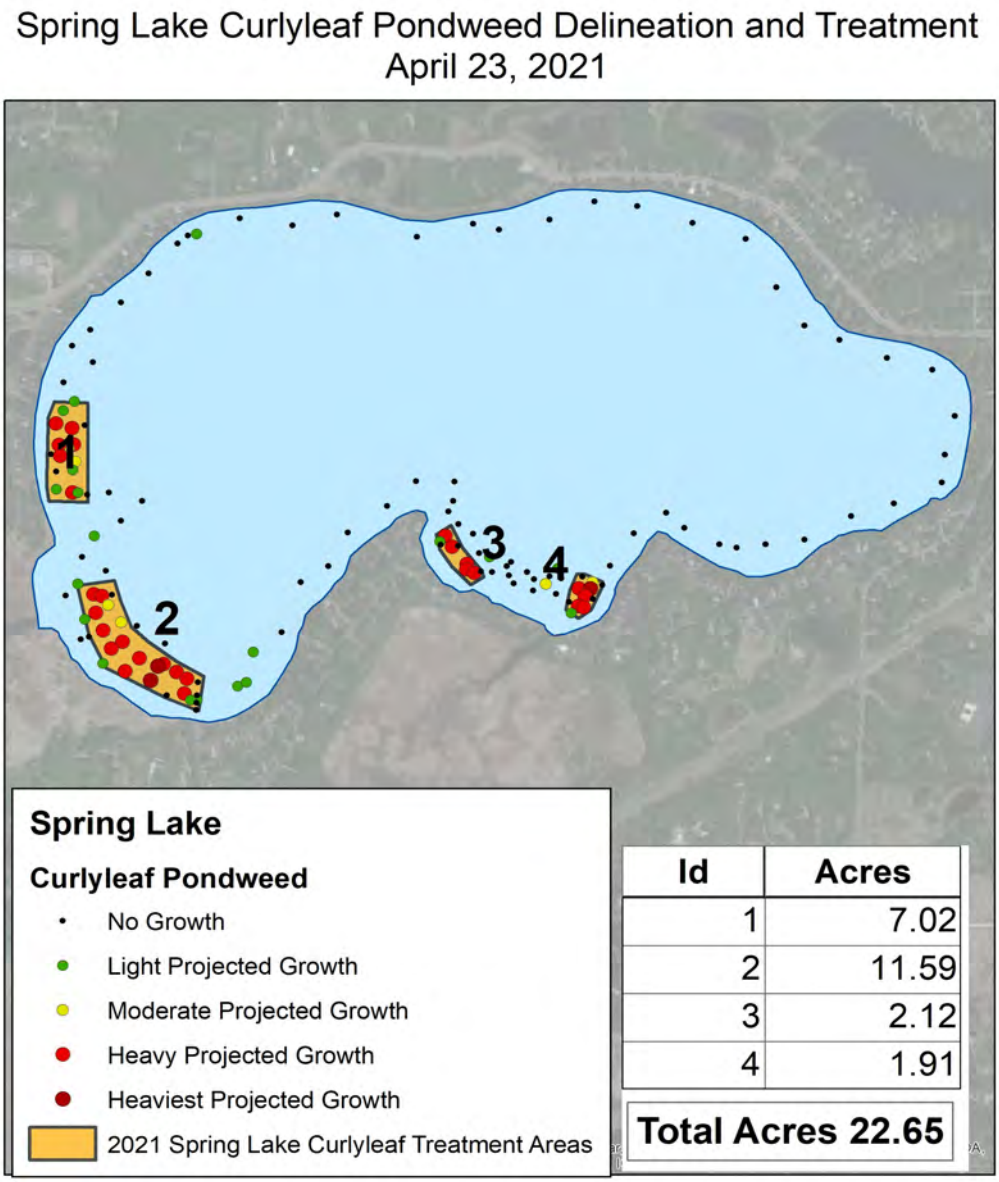


Figure 4. Map of curlyleaf pondweed for April 23, 2021. Colored sample areas indicate the growth in April of 2021 for curlyleaf pondweed. Key: green = light potential growth, yellow = moderate potential growth, red = heavy potential growth, and black dot = no curlyleaf.

Curlyleaf Pondweed Assessment, June 14, 2021: A curlyleaf assessment (post-treatment survey) was conducted on June 14, 2021, the survey included meandering survey collecting 33 GPS points and a line-transect survey which collect data on 50 established sites. Curlyleaf was found at 6 out of 83 of the total sites (Figure 5). Curlyleaf did not expand and the curlyleaf treatment was excellent.

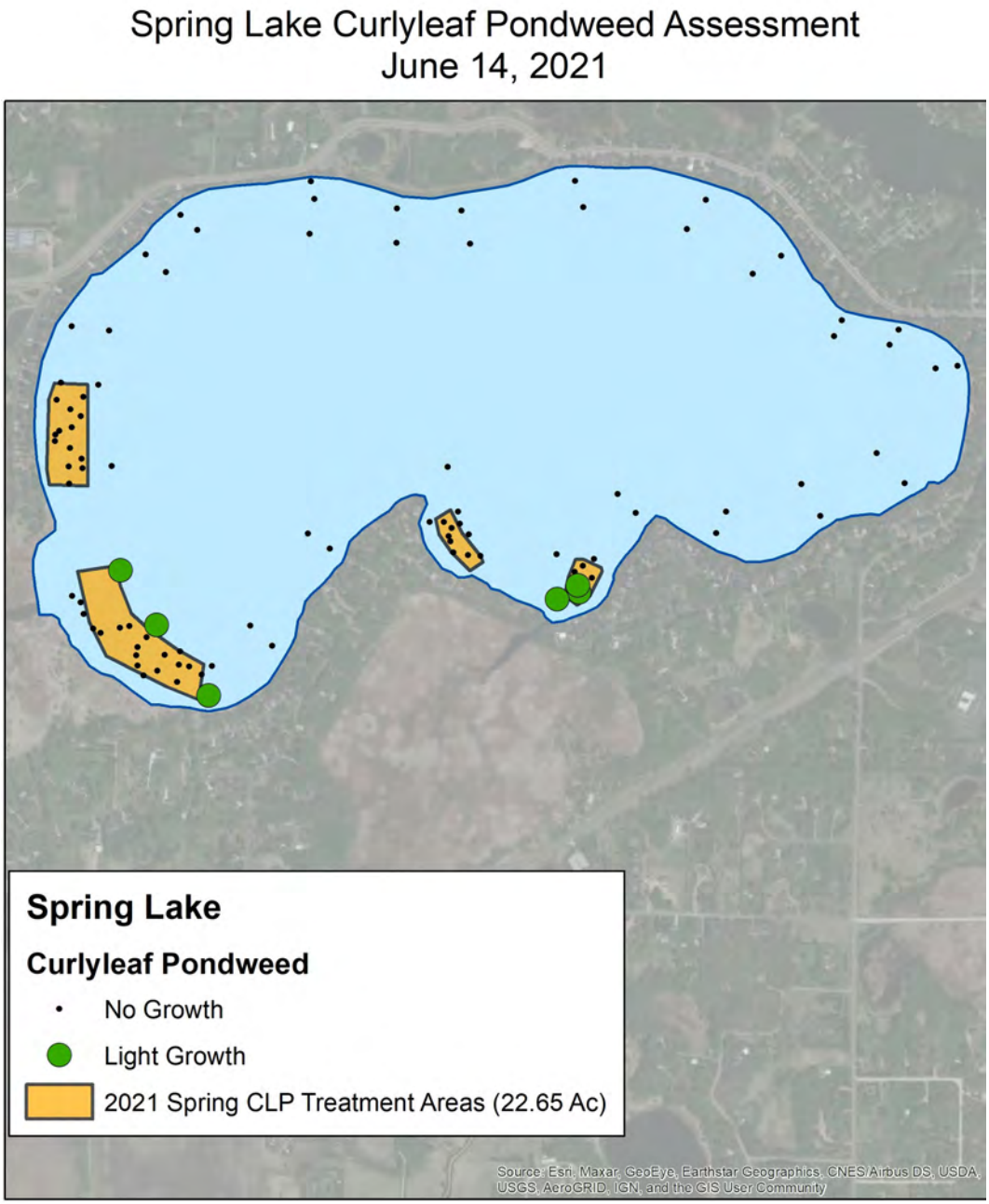


Figure 5. Curlyleaf pondweed assessment on June 14, 2021.
Key: green = light growth, black = no curlyleaf, yellow shading = treatment areas.

Summary of Curlyleaf Pondweed 2000 to 2021

Curlyleaf pondweed growth has been variable from 2000 through 2021. For the years 2007 to 2015 there were no CLP treatments. There may be a correlation to the use of an iron dosing station on the County 13 ditch where flows eventually enter Spring Lake and a reduction in Spring Lake curlyleaf. The amount of iron dosed is listed in Table 1. Likely only a small percentage of the dosed iron makes its way into Spring Lake. Iron in the water column that may inhibit CLP growth is speculative but heavy CLP growth, as shown in Figure 6, did not occur from 2007 through 2015 when some iron from the iron dosing operation may have entered Spring Lake. After a dosing station upgrade, in 2013, it is likely less iron entered Spring Lake and curlyleaf growth may have increased.

Table 1. Curlyleaf pondweed occurrence and acres either harvested or treated with herbicides from 2000 to 2021.

	Iron (kg)	$FeCl_3$ (gallons)	Curlyleaf Occurrence (based on 50 sites unless noted)	Harvesting Acres	Herbicide Treatment Acres	Total Curlyleaf Treatment (acres)
2000	?		49			
2001	?					
2002	?		43	60	14	74
2003	0	0	35	74	14	88
2004	0	0	40		59	59
2005	2,629	4,232	29		59	59
2006	895	1,440	32		59	59
2007	920	1,481	22			
2008	726	1,168	4			
2009	109	176	5			
2010	0	0	25			
2011	1,491	2,390	10			
2012	0	0	6			
2013	1,248 (J-A)	?	3			
2014	>4,547	>7,275	10			
2015	2,800	4,480	10			
2016	4,206	6,730	11		20.4	20.4
2017	4,544	7,270	11		3.7	3.7
2018	3,656	5,850	4			
2019	3,675	5,880	29 (144 sites)		15.7	15.7
2020			62 (254 sites)		14.92	14.92
2021			55 (142 sites)		22.65	22.65

Figure 6. Curlyleaf pondweed growth was very heavy in 2000.

New Findings of Eurasian Watermilfoil in Spring Lake in 2021

Eurasian watermilfoil was observed in Spring Lake on July 12, 2021. This was the first time EWM had been found in Spring Lake (Figure 7). Handpulling on August 4, 2021 removed some EWM and a herbicide treatment on September 15, 2021 treated 8.1 acres.

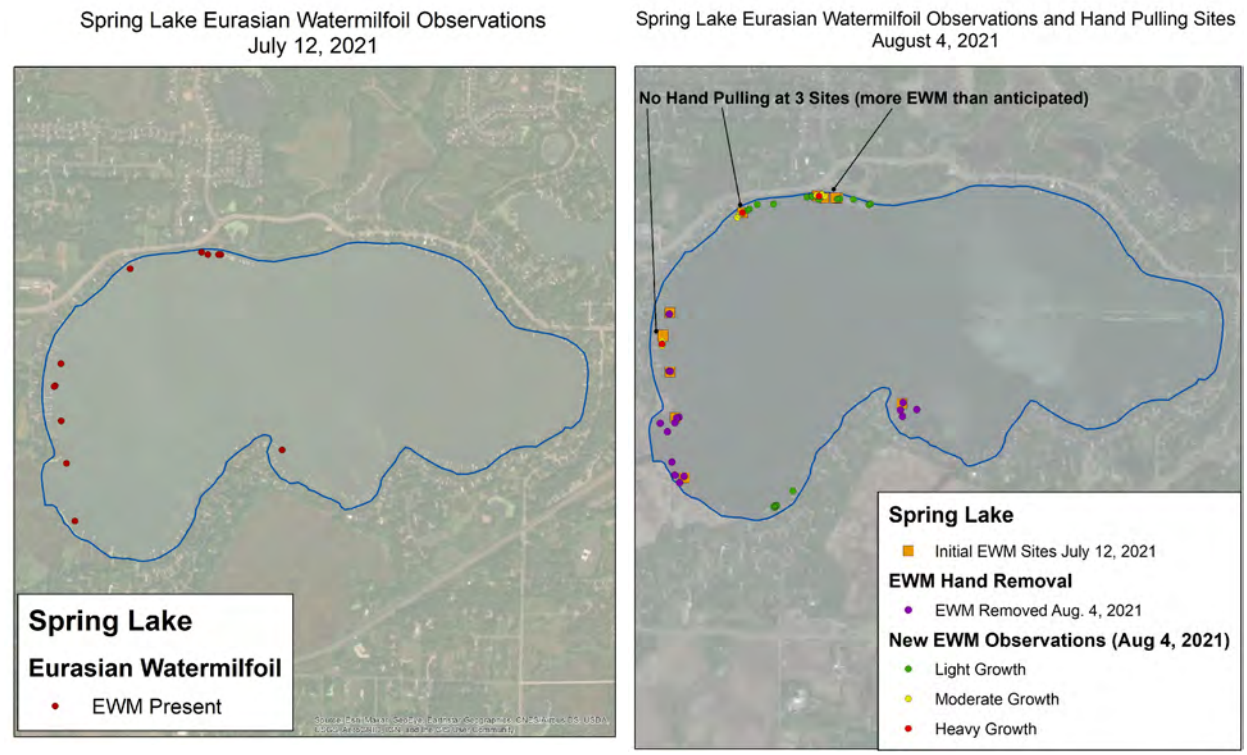


Figure 7. [top-left] Observations of Eurasian watermilfoil for the July 12, 2021 surveys.
[top-right] EWM observations and handpulling sites for August 4, 2021.
[bottom-left] A tub of Eurasian watermilfoil removed on August 4, 2021.
[bottom-right] Treatment on 8.1 ac occurred on September 15, 2021.
Key: green = light growth, yellow = moderate growth, red = heavy growth, and black dot = no growth.

Results - Point Intercept Aquatic Plant Survey on July 12, 2021

Results of the summer aquatic plant survey conducted on July 12, 201 found 15 submerged aquatic plant species, CLP was present in August and Eurasian watermilfoil was observed as well. Plant growth was observed to water depths of 12 feet in Spring Lake. A list of species and their percent occurrence is shown in Table 2. Aquatic abundance and species diversity is shown in Figure 8 and plant distribution and abundance for other species are shown in Figure 9. Native plants were estimated to cover 34% of the lake area.

Table 2. Spring Lake aquatic plant occurrence and density for the July 12, 2021 survey based on 377 sites. Density ratings are 1-3 with 1 being low and 3 being most dense.

	All Stations (n=377)		
	Occur	% Occur	Average Density
Cattails (*Typha sp*)	1	1	3.0
Watershield (*Brasenia Schreberi*)	1	1	1.0
White water lilies (*Nymphaea ordata*)	1	1	1.0
Coontail (*Ceratophyllum demersum*)	197	52	1.3
Chara (*Chara sp*)	52	14	1.1
Elodea (*Elodea canadensis*)	23	6	1.0
Water stargrass (*Heteranthera dubia)*	78	21	1.2
Northern watermilfoil (*Myriophyllum sibiricum*)	7	2	1.1
Eurasian watermilfoil (*Myriophyllum spicatum*)	3	1	1.0
Naiads (*Najas flexilis*)	84	22	1.0
Curlyleaf pondweed (*Potamogeton crispus*)	28	7	1.0
Fries pondweed *(P. friesii)*	1	1	1.0
Claspingleaf pondweed (*P. Richardsonii*)	85	23	1.4
Floatingleaf pondweed (*P. spp*)	1	1	1.0
Stringy pondweed (*P. sp*)	72	19	1.1
Flatstem pondweed (*P. zosteriformis*)	1	1	1.0
Sago pondweed (*Stuckenia pectinata*)	83	22	1.2
Water celery (*Vallisneria americana*)	85	23	1.3

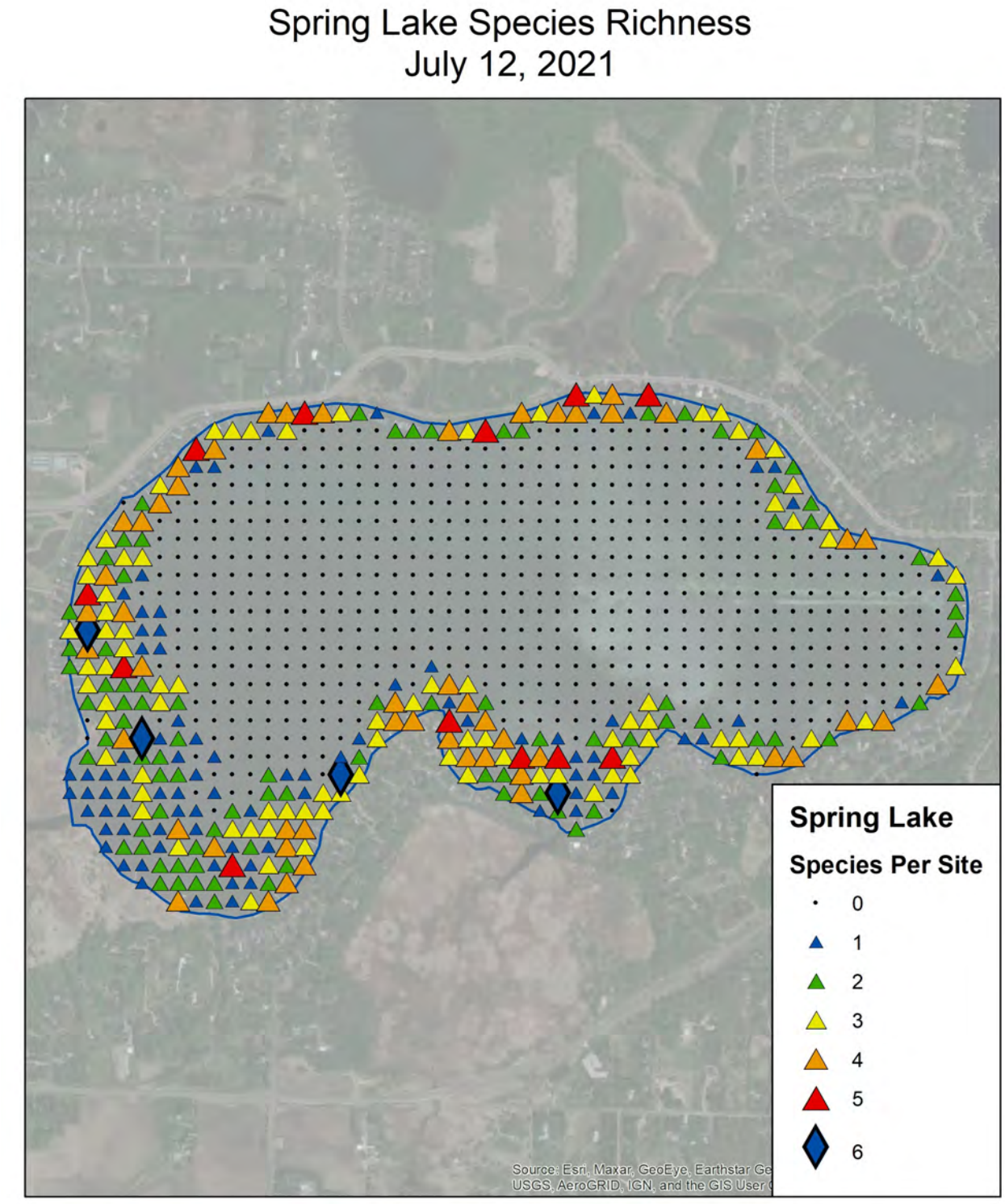


Figure 8. Species Richness or the number of species per site for the point intercept survey on July 12, 2021.

Aquatic Plant Maps: Coverage of the select native plants species found in the July 2021 survey are shown in Figure 9.

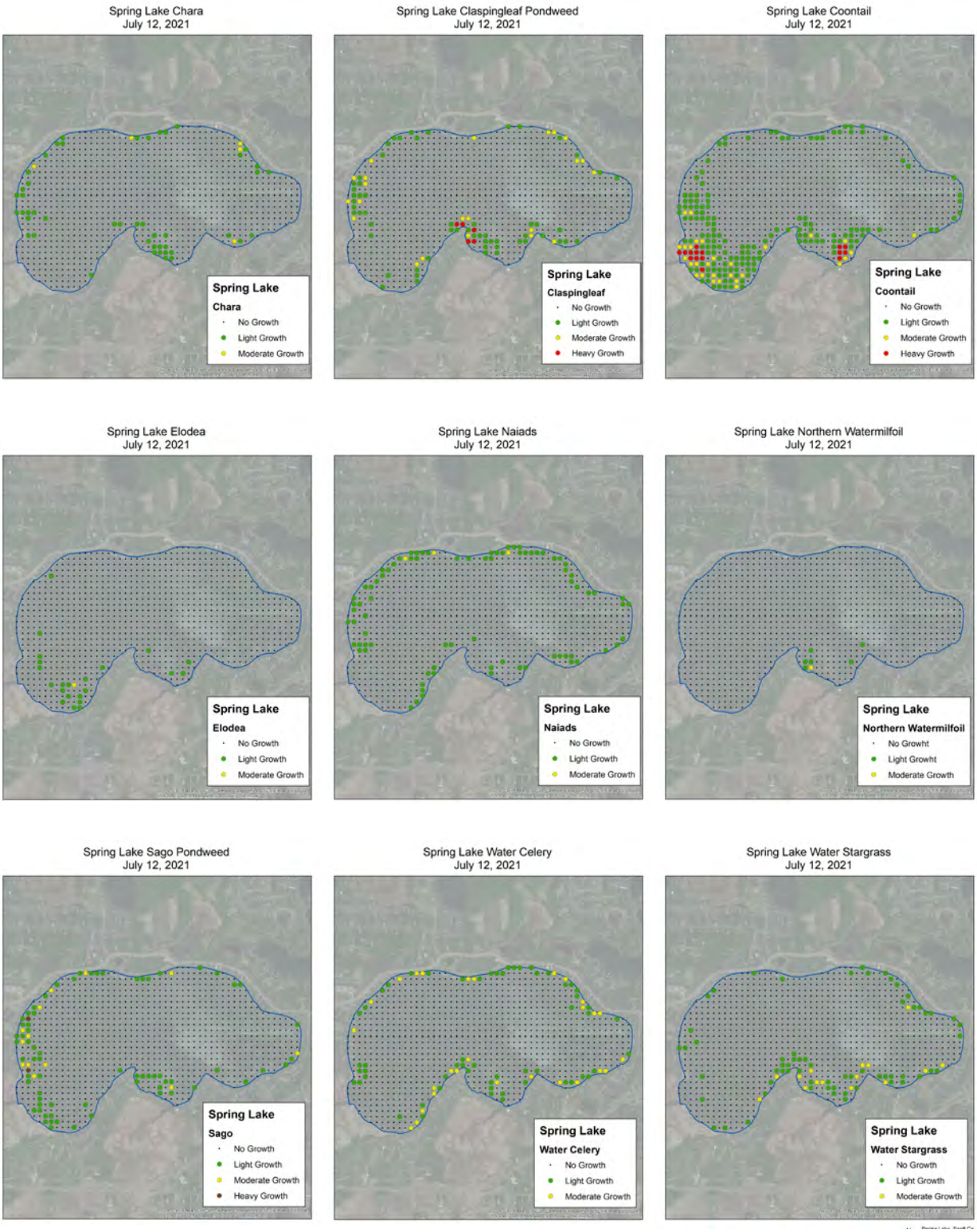


Figure 9. Distribution and abundance maps for common submerged aquatic plant species in Spring Lake on July 12, 2021.

Spring Lake Point Intercept Survey Statistics: A summary of plant statistics from the point intercept survey is shown in Tables 3 and 4 and Figure 10. A total of 364 points were sampled and plants were found out to 12 feet of water which included 358 sample points out to 12 feet. Plant occurrence and abundance for individual sites are shown in the Appendix.

Table 3. MnDNR Template Statistics

Total # Points Sampled	374
Depth Range of Rooted Veg	0-12 feet
Maximum Depth of Growth (95%) in feet	10.0
# Points in Max Depth Range	329
# Points in Littoral Zone (0-9 feet)	372
% Points w/ Submersed Native Taxa	63
Mean Submersed Native Taxa/Point	1.2
Mean Density of Submersed Native Taxa	1.1
# Submersed Native Taxa	13

Table 4. Aquatic plants sampled by depth.

Depth Bin (Feet)	# points sampled (0-12 ft)	% Sampling points with submersed species observed
0	0	0
1	21	95%
2	39	100%
3	48	100%
4	50	100%
5	36	97%
6	32	100%
7	20	95%
8	26	92%
9	31	81%
10	26	50%
11	21	48%
12	14	36%
13	6	0
	364	

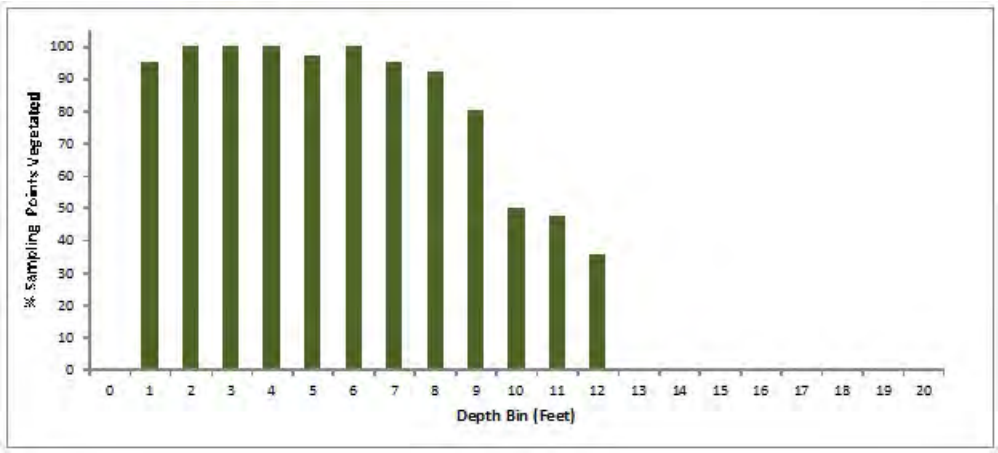


Figure 10. Depth of plant colonization (in feet).

Comparison of 2015, 2018, 2019, 2020, 2021 Point Intercept Surveys

Point intercept surveys were conducted on Spring Lake in 2015, 2018, 2019, 2020, and 2021 and results are shown in Table 5. In 2015, elodea was the dominant plant but since then coontail has been dominant (Table 5). Several species increased in occurrence since 2015 including coontail, claspingleaf pondweed, water celery, and water stargrass. Elodea and sago pondweed have decreased (Table 5).

Table 5. Spring Lake aquatic plant occurrence for the point intercept surveys conducted in 2015, 2018, 2019, 2020, and 2021.

	2015 % Occur (113 sites)	2018 % Occur (248 sites)	2019 % Occur (214 sites)	2020 % Occur (298 sites)	2021 % Occur (377 Sites)
Cattails (*Typha sp*)		1		1	1
Watershield (*Brasenia Schreberi*)					1
Duckweed (*Lemna sp*)		1		1	
White water lilies (*Nymphaea ordata*)		1	5	2	1
Coontail (*Ceratophyllum demersum*)	15	56	47	51	52
Chara (*Chara sp*)	4	2	2	1	14
Chara - 2 (*Chara sp*)		1			
Moss (*Drepanocladus sp*)		1	2	1	
Elodea (*Elodea canadensis*)	42	36	3	5	6
Water stargrass (*Heteranthera dubia)*	5	12	10	19	21
Northern watermilfoil *(Myriophyllum sibiricum)*				1	2
Eurasian watermilfoil (*M. spicatum*)					1
Naiads (*Najas flexilis*)	21	23	9	39	22
Curlyleaf pondweed (*Potamogeton crispus*)	12	6		7	7
Fries pondweed (*P. Friesii*)					1
Claspingleaf pondweed (*P. Richardsonii*)	4	10	10	20	23
Floatingleaf (*P. sp*)					1
Stringy pondweed (*P. sp*)	29	7	4	19	19
Flatstem pondweed *(P. zosteriformis)*				1	1
Sago pondweed (*Stuckenia pectinata*)	17	11	9	5	22
Bladderwort (*Utricularia vulgaris*)		1			
Water celery (*Vallisneria americana*)	9	20	23	21	23
Number of submerged species	10	13	10	14	15
Depth of plant growth (ft)	9	8	8	9	12
Percent coverage of plants (%)	29 (175 ac)	21 (122 ac)	17 (98 ac)	25 (145 ac)	34 (197 ac)

Native Plant Coverage Comparisons : Native aquatic plant distribution may have decreased slightly from 2015 to 2019 but then increased in 2020 and 2021 based on point intercept survey results (Figure 11). In 2015, plants grew to a depth of 9 feet and covered an estimated 175 acres of the lake (29%). In 2018, plants were found out to a depth of 8 feet and covered an estimated 122 acres of the lake (198 sites with plants 21%). In 2019, plant coverage was estimated at 98 acres or about 17% of the lake area (150 sites with plants). In 2020, plants grew out to 9 feet and covered approximately 25% of the lake bottom (Figure 11). In 2021, plants grew out to 12 feet and covered approximately 34% of the lake bottom (Figure 12).

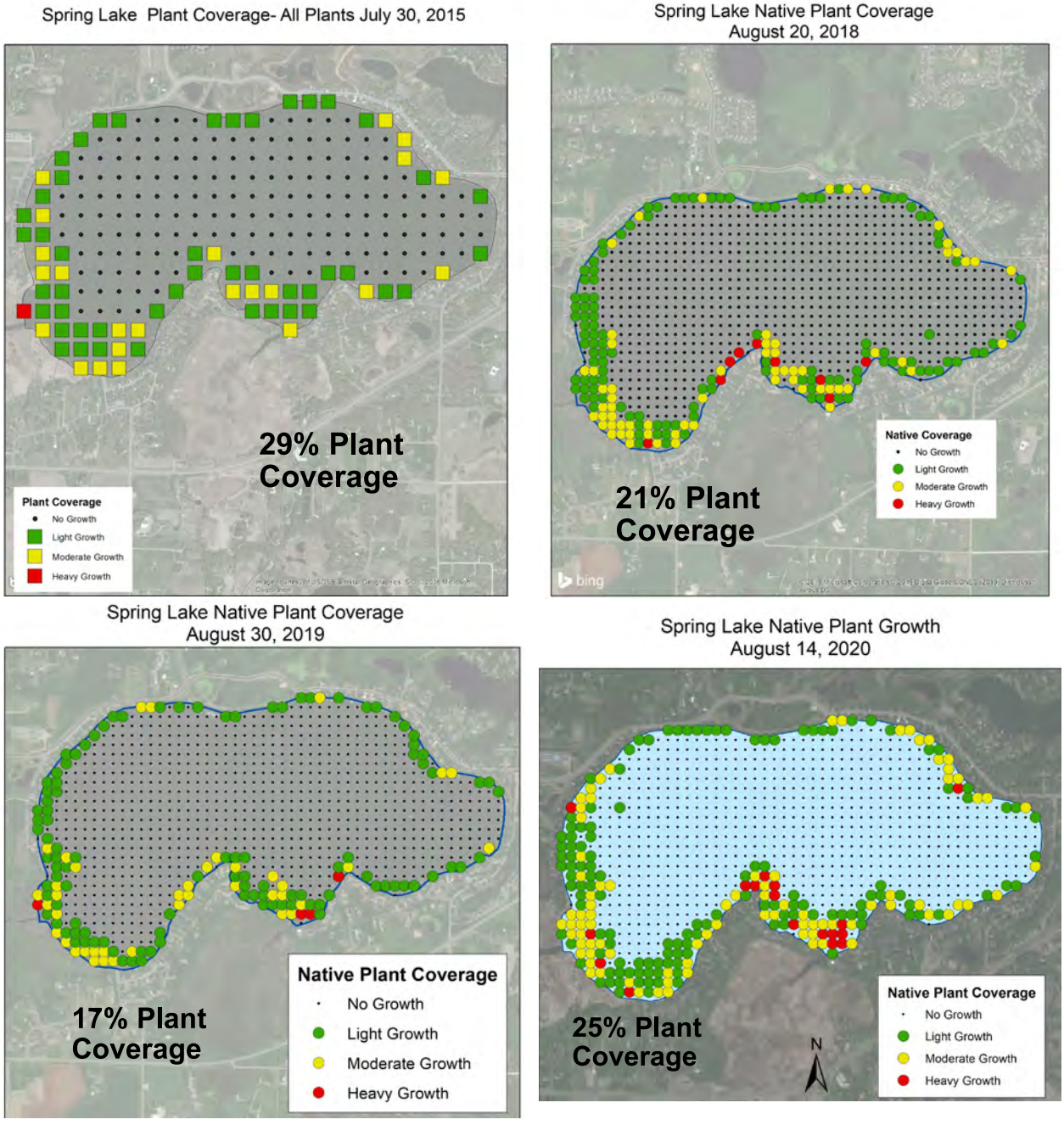


Figure 11. Aquatic plant distribution and abundance for the point intercept surveys in 2015, 2018, 2019, and 2020. Key: green = light growth, yellow = moderate growth, red = heavy growth, and black dot = no growth.

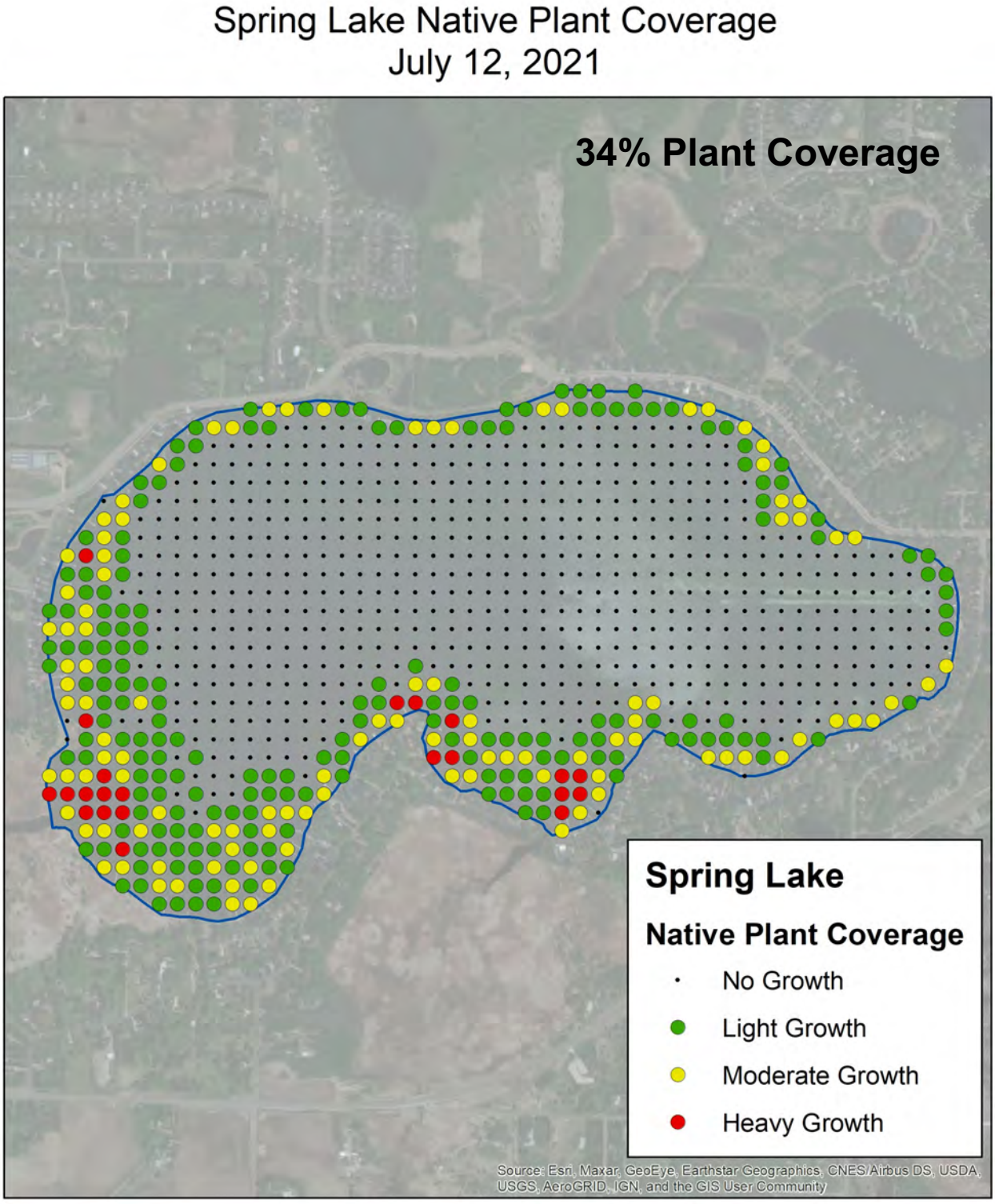


Figure 12. Spring Lake native plant coverage on July 12, 2021.
Key: green = light growth, yellow = moderate growth, and red = heavy growth.

Summary of Aquatic Plant Surveys from 1948 - 2021

Since 1948, specific plant species in Spring Lake have appeared and disappeared (Table 6). For a number of years, stringy pondweed, likely a *P. pusillus*, was the dominant plant species. However, from 2018 through 2021, coontail was the dominant plant (Table 6).

The number of aquatic plant species has range from a low of 5 to a peak of 15 which was recorded in 2021 (Table 6).

Table 6. Aquatic plant status for 1948 to 2021.

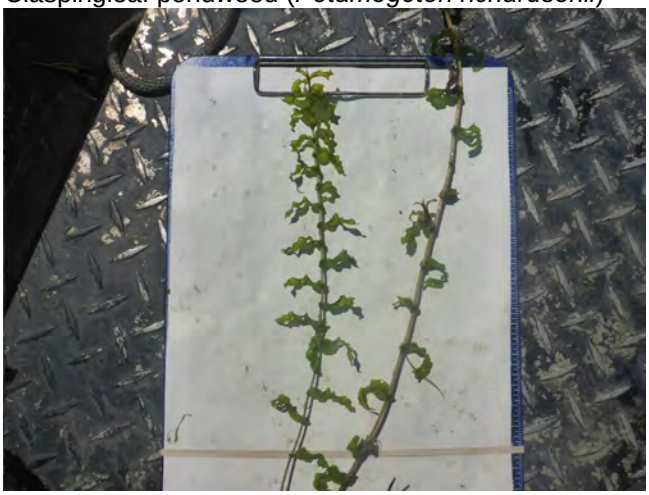
	Dominant Plant Occurrence (% occurrence based surveys)	Dominant Species in Mid Summer Survey	Number of Plant Species
1948	Rare (MnDNR)	All rare	7
1973	Rare-Common (MnDNR)	5 - common	8
1982	Rare-Common (MnDNR)	Coontail	8
1986	Present (MnDNR)	3 species	5
1988	Present-Occasional (MnDNR)	Sago + water stargrass	8
2000	40	Curlyleaf	9
2002	36	Sago	9
2004	68	Elodea	9
2005	76	Elodea	9
2006	48	Coontail	8
2007	30	Coontail	6
2008	24	Stringy	9
2009	66	Stringy	9
2010	34	Stringy	7
2011	64	Stringy	6
2012	72	Stringy	4
2013	19	Stringy	5
2014	48	Stringy	5
2015	42 (PI survey)	Elodea	10
2016	38	Elodea	6
2017	86	Stringy	8
2018	56 (PI survey)	Coontail	13
2019	47 (PI survey)	Coontail	10
2020	52 (PI survey)	Coontail	14
2021	52 (PI survey)	Coontail	15

Supplemental Data For Spring Lake

Common Aquatic Plants in Minnesota

Chara (*Chara sp*)

Claspingleaf pondweed (*Potamogeton richardsonii*)



Coontail (*Ceratophyllum demersum*)

Curlyleaf Pondweed (non-native)(*Potamogeton crispus*)

Eurasian watermilfoil (non-native)
(*Myriophyllum spicatum*)

Flatstem pondweed (*Potamogeton zosteriformis*)

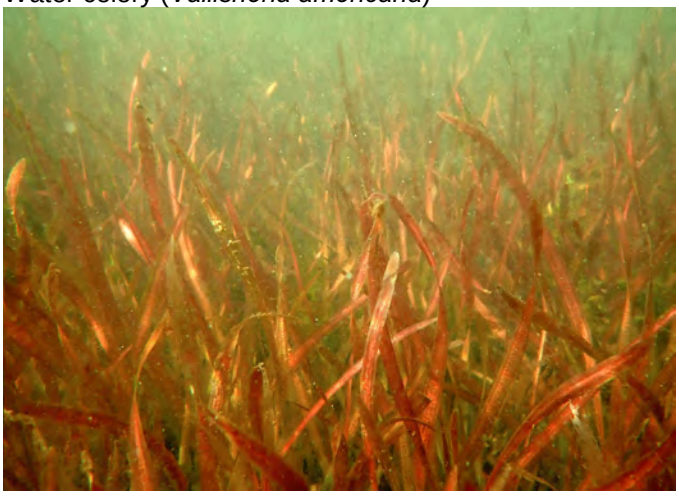
Naiad (*Najas sp*)

Northern watermilfoil (*Myriophyllum sibiricum*)

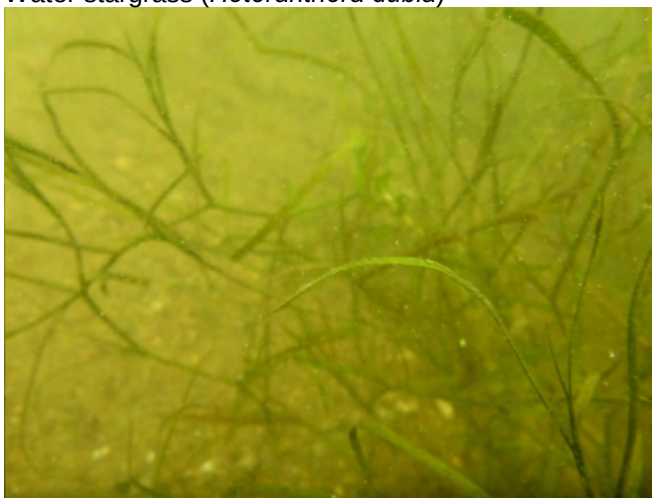
Sago pondweed (*Stuckenia pectinata*)

Stringy pondweed (*Potamogeton pusillus*)

Water celery (*Vallisneria americana*)



Water stargrass (*Heteranthera dubia*)



Spring Lake CLP Delineation, Individual Site Data April 23, 2021

Aquatic plant densities based on rake sampling for April 23, 2021. Densities are based on a scale from 1 to 3 with 3 being the densest. Curlyleaf stems per rake sample were also noted.

Site	Depth (ft)	CLP	Natives	no plants
1	4			1
2	5	2		
3	5			1
4	6			1
5	5	1	1	
6	5	1		
7	7	1		
8	5			1
9	8			1
10	6			1
11	8			1
12	3		1	
13	5			1
14	13			1
15	8			1
16	4			1
17	6		2	
18	4	5		
19	5	1		
20	4		1	
21	5	6		
22	5		1	
23	7			1
24	5			1
25	4	10		
26	4	12		
27	4	4		
28	4		1	
29	5	2		
30	3		1	
31	4			1
32	4		1	
33	3			1
34	2			1
35	4			1
36	3		1	
37	2			1
38	5	3		
39	6			1
40	7	1		
41	5		3	
42	4		3	
43	4		3	
44	6	8		
45	7		1	
46	5	3		
47	5	20	1	
48	5	7		
49	4	8		
50	3	2	1	
51	4	10	1	
52	4		1	
53	4			1
54	6			1
55	5			1
56	6			1
57	7			1
58	5			1
59	8			1

Site	Depth (ft)	CLP	Natives	no plants
60	8			1
61	9			1
62	10			1
63	10			1
64	6			1
65	15			1
66	17			1
67	10			1
68	16			1
69	5			1
70	6			1
71	7			1
72	6			1
73	10			1
74	8			1
75	5			1
76	6			1
77	9			1
78	6			1
79	9			1
80	7			1
81	12			1
82	8			1
83	6	2		
84	5			1
85	5			1
86	5		1	
87	6			1
88	4			1
89	4			1
90	8			1
91	4			1
92	6	2		
93	5	2		
94	5	4		
95	6	6		
96	8			1
97	6	8		
98	6	3		
99	5	7		
100	4			1
101	5	6		
102	6	3		
103	5	2		
104	4		1	
105	3	1		
106	5	4		
107	5	1		
108	5			1
109	6			1
110	8			1
111	9			1
112	5	1		
113	5		1	
114	8			1
115	5	2	1	
116	4		2	
117	6	4	1	
118	6	16		

Site	Depth (ft)	CLP	Natives	no plants
119	8			1
120	7	3		
121	5	14	1	
122	4	1	1	
123	4		1	
124	4		1	
125	5	9	1	
126	7	3		
127	7			1
128	5	16		
129	4	18		
130	4	1	1	
131	4	8	1	
132	5	15		
133	7			1
134	5	4		
135	5	20		
136	4	20		
137	4		1	
138	5	10		
139	5	14		
140	4	7		
141	5	2		
142	4		1	
Average		6.3	1.3	
Occurrence (142 sites)		55	32	66

Spring Lake CLP Assessment, Individual Site Data June 14, 2021

Aquatic plant densities based on rake sampling for June 14, 2021. Densities are based on a scale from 1 to 3 w ith 3 being the densest.

Way point	Site	Depth (ft)	White lily	Chara	Clasp-ingleaf	Coon-tail	CLP	Elodea	EWM	Naiads	Sago	Stringy	Water celery	Water star-grass	FA - benthic	No plants
	1	4			1	1	1	1				1			1	
	2	8				1		1				2			1	
	3	3									1	2	1			
	4	7										1	1			
	5	10														1
	6	3											1			
	7	3			1											
	8	6			3											
	9	3	1			3	1								1	
	10	8				1						1				
	11	3			3	1						1	1			
	12	7											1			
	13	3		1											1	
	14	7								1					1	
	15	3											1	1	1	
	16	8		1											1	
	17	3			1									1		
	18	8								1					1	
	19	3		1									1		1	
	20	8														1
	21	3			1								2		1	
	22	6			1										1	
	23	3			2								1		1	
	24	6			2									1	1	
	25	3			1								2	1		
	26	6												1		
	27	3			2								1	1		
	28	7													1	1
	29	4			1											
	30	8				1									1	
	31	4		1	2										1	
	32	6			1	1						1			1	
	33	4									1		2			
	34	9														1
	35	4				1			1				1	1		
	36	6				1										
	37	4			2							1	1			
	38	8				1						1			1	
	39	3			2	1							1			
	40	9														1
	41	3			1	1					1		1			
	42	9										1				
	43	4			3						1	1				
	44	8										1				
	45	4				2										
	46	8				1					1					
	47	4				2										
	48	7				2	1	1								
	49	4				1									1	
	50	7				1	1					1				
1																
2					1											
3					2											
4					1											
5					1											
6					1											
7					3											
8																

Aquatic plant densities based on rake sampling for June 14, 2021. Densities are based on a scale from 1 to 3 w ith 3 being the densest.

Way point	Site	Depth (ft)	White lily	Chara	Clasp-ingleaf	Coon-tail	CLP	Elodea	EWM	Naiads	Sago	Stringy	Water celery	Water star-grass	FA - benthic	No plants
9																
10					1											
11																
12							1									
13																
14																
15																
16																
17																
18																
19							1									
20																
21									1							
22																
23																
24																
25																
26																
27																
28																
29					1											
30																
31																
32																
33					2											
All sites	Average		1.0	1.0	1.6	1.3	1.0	1.0	1.0	1.0	1.0	1.2	1.2	1.0	1.0	
	Occur (83 sites)		1	4	27	18	6	3	2	2	5	13	16	7	19	5
	% occur		1	5	33	22	7	4	2	2	6	16	19	8	23	
Sites	Average		1.0	1.0	1.7	1.3	1.0	1.0	1.0	1.0	1.0	1.2	1.2	1.0	1.0	
	Occur (50 sites)		1	4	18	18	4	3	1	2	5	13	16	7	19	5
	% occur		2	8	36	36	8	6	2	4	10	26	32	14	38	
Way point	Average				1.4		1.0		1.0							
	Occur (33 sites)				9		2		1							

Spring Lake Point Intercept Survey, Individual Site Data July 12, 2021

July 12, 2021: Individual site data for the point intercept survey.

Way point	Site	Depth (ft)	Cat-tails	Water-shield	White lily	Chara	Clasp-ingleaf	Coon-tail	CLP	Elodea	EWM	Flat-stem	Floatin gleaf Not Natans	Fries	Naiads	NWM	Sago	Stringy	Water celery	Water star-grass	FA	No plants
	1	2					1	1									1			1		
	2	2						1														
	3	2						1												1		
	4	4						1													1	
	5	4						2		1							1					
	6	2						1		1					1				2			
	7	2						1														
	8	3						1									1					
	9	3						2									1					
	10	4						2									1					
	11	4						1		1												
	12	5						1														
	13	5						2														
	14	4						1		1												
	15	3					1								1				2	1		
	16	2						2														
	17	3						2														
	18	3						1									1					
	19	4						2									1					
	20	5					1	1														
	21	5						1														
	22	5						2	1	1								1	1			
	23	5						1														
	24	5						2	1	1												
	25	5					1	1													1	
	26	2				1									1		1		1			
	27	1						1														
	28	1						1									1					
	29	4						3									1					
	30	4						1														
	31	5						1	1									1				
	32	6						1										1				
	33	6						1	1	1								1				
	34	7						1														
	35							1										2				
	36	6																1				
	37	5					1	1		1								1			1	
	38	3						1							1				2			
	39	2						2														
	40	3						2														
	41	4						1									1					
	42	5						2														
	43	6						1	1	1							1					
	44	8																1				
	45	8						1		1											1	
	46	8						2	1	1												
	47	8						1		2								1				
	48	8						1	1									1				
	49	6					2	1									1	1				
	50	5						1							1			1	1			
	51	1			1			2														
	52	2						2														
	53	3						3														
	54	3						3														
	55	5						3									1			1		
	56	7							1									1				
	57	8						2														
	58	9						1														
	59	10																				1
	60	10						1	1													
	61	9						1														
	62	9						1	1									1				
	63	8						1		1								2				
	64	7					2	1										1				
	65	3					1	1												2		
	66	1				1																
	67	1				1													1			
	68	2						3														
	69	2						2												1		
	71	2						3														
	72	2						3														
	73	3						3														
	74	4						3														
	75	6						3									1	1				
	76	7						1														
	77	9						1														
	78	10																				1
	79	11						1														

July 12, 2021: Individual site data for the point intercept survey.

Way point	Site	Depth (ft)	Cat-tails	Water-shield	White lily	Chara	Clasp-ingleaf	Coon-tail	CLP	Elodea	EWM	Flat-stem	Floatin gleaf Not Natans	Fries	Naiads	NWM	Sago	Stringy	Water celery	Water star-grass	FA	No plants
	80	11																				1
	81	11																				1
	82	11						1										1				
	83	10						1										1				
	84	8																1				
	85	6						1							1			1				
	86	3													1				2	1		
	87	1				1	1															
	88	1				1									1		1		1			
	89	1				1	1															
	90	1				1		1		1							1		1	1		
	91	3						3														
	92	3						3		1										1		
	93	2						2														
	94	2						2														
	95	2						2														
	96	3						2														
	97	5						3														
	98	6						1		1								2				
	99	8						1										1				
	100	10						1										1				
	101	11						1														
	102	12																				1
	104	12																				1
	105	12						1										1				
	106	11						1														
	107	11						1														
	108	8																				
	109	5						2	1	1					1			1	2			
	110	3										1						1	1			
	111	2							1							1				2		
	112	2														2				1		
	113	2				1	1															
	114	1				1									1		1		1			
	115	1				1	1													1		
	116	4						1									2			1		
	117	4						3														
	118	6						3														
	119	4						1							1					2		
	120	1													1		1			1		
	122	1						1											1			
	123	1						1									1		1			
	124	5						2														
	125	7						2		1												
	126	9*						1										1				
	127	10						1														
	128	11																				1
	129	12						1														
	133	13																				1
	135	11																				1
	136	10						1														
	137	6																1		1		
	138	2					3	1									1					
	139	4					3	1	1							1						
	140	4				1		1								1				1		
	141	4					1	1												2		
	142	5					1	1										2	1	2		
	143	3					1										1		2	1		
	144	7						1	1						1		1	1				
	145	9						1														
	146	8						2														
	147	7					1	1		1						1		1				
	148	4					1	1											1			
	149	2					2													2		
	150	3					1												2	1		
	151	3				2	1												1			
	152	4				1									1				1	1		
	153	4					1								1		1		2			
	154																					1
	155	1				1											1					
	156	3				1											2	1	1			
	157	8					1	1		1							1	1		1		
	158	10						1														
	159	11						1										1				
	160	12						1														
	169	9						1														
	170	4												1					1	2		
	171	2					2	1									1			2		
	172	4					1	1									1					
	173	4					1	2									1					
	174	6				1	1	1									1					
	175	7															1					

July 12, 2021: Individual site data for the point intercept survey.

Way point	Site	Depth (ft)	Cat-tails	Water-shield	White lily	Chara	Clasp-ingleaf	Coon-tail	CLP	Elodea	EWM	Flat-stem	Floatingleaf Not Natans	Fries	Naiads	NWM	Sago	Stringy	Water celery	Water star-grass	FA	No plants
	176	9				1													1			
	176	11																				1
	177	10						1														
	179	11						1												1		
	180	9						1										1		1		
	181	6					1													2		
	182	3					2	1											2			
	183	1					1															
	184	4																		1		
	185	6							1						1					1		
	186	6				1									1					1		
	187	7													1			1				
	188	9													1					1		
	189	9																				1
	190	5				1		2											1			
	191	4																	1	1		
	192	1	3																			
	193	2													1		3		1			
	194	3													1				1			
	195	7																				1
	196	10																				1
	197	12						1														
	207	12																				1
	208	8						1	1											1		
	209	3					1										1		2	1		
	210	2					1	1											2	1		
	211	1					1	1										1	1	1		
	212	4					3															
	213	6						1		1						1				2		
	214	9																				1
	215	11																				1
	216	12																				1
	220	11						1														
	221	7						1										1	1			
	222	4					2	1												1		
	223	2						1											1			
	224	5																				1
	225	8						1									1					
	226	9																				1
	227	9					1															
	233	6							1								1		1	2		
	234	5						1											2	1		
	235	4						1							1				2	1		
	236	2													1		2					
	237	2													1		2		1			
	238	3													1				1			
	239	3					1								1							
	240	6						1									2	1				
	241	10						1										1				
	242	13																				1
	252	8				1									1							
	253	6				1	1								1					1	1	
	254	4					3												1	1		
	255	1					3												1			
	256	1				1																
	257	2				1	1	1											1			
	258	9						1												1		
	266	12																				1
	267	5					1									1				2		
	268	5					1													2		
	269	10																				1
	270	14																				1
	279	11																				1
	280	9																				1
	281	4																		2		
	282	4													1		1					
	283	2					2	1									1					
	284	4				1		1														
	285	5						1									1					
	286	6						1									1					
	287	6				1		1										1				
	288	9						1	1									1				
	289	13																				1
	300	8																		1		
	301	8																				1
	302	4					2												1	1		
	303	2					2	1											2	1		
	304	9						1							1					1		
	305	13																				1
	314	11																				1
	327	16																				1
	329	9																				1

July 12, 2021: Individual site data for the point intercept survey.

Way point	Site	Depth (ft)	Cat-tails	Water-shield	White lily	Chara	Clasp-ingleaf	Coon-tail	CLP	Elodea	EWM	Flat-stem	Floatin gleaf Not Natans	Fries	Naiads	NWM	Sago	Stringy	Water celery	Water star-grass	FA	No plants
	330	5						1							1		1		2			
	331	1				1		1														
	332	3				1	1	2														
	333	5				1	1	2														
	334	6				1	1	1							1			1				
	335	8						1		1							1	1				
	336	10																				1
	349	11																				1
	350	10																				1
	351	8																		1		
	352	10																				1
	353	14																				1
	354	16																				1
	379	10																				1
	380	5						1									2		1			
	381	3						1												1		
	382	4					1	1										1		1		
	383	5						1										1				
	384	6						1									1	1				
	385	8						1														
	386	10						1														
	401	13																				1
	430	9																				1
	431	3					2								1		1					
	432	4					1	1	1		1				1		2					
	433	5					2	1									1					
	434	7						1										1		1		
	435	9																1				
	436	11						1														
	480	9		1				1														
	481	2				1											1					
	482	3				1	1	1									1					
	483	6					1	1									2					
	484	7					1	1							1			1				
	485	9																1				
	486	11						1														
	530	12						1												1		
	531	3				1	1								1		2		2			
	532	6															1	1		1		
	533	7																1				
	534	10																				1
	579	5							1				1									
	580	2					1								1		1					
	581	4				1	1								1		1					
	582	6					2											2				
	583	10						1														
	627	9													1							
	628	3													1		1			1		
	629	2					2								1		1					
	630	3					1										3					
	631	6					2	1										1				
	632	10							1						1			1				
	673	12																				1
	674	10																				1
	675	4					1												1			
	676	4						1							1					1		
	677	2				1											1		1			
	678	4															1	2				
	679	9						1										1				
	680	12																				1
	717	4				1									1				1			
	718	3					2								1				2	1		
	719	2				1	1												2	1		
	720	2				2									1		1		1			
	721	5							1						1		2	1				
	722	12																				1
	747	4					2															
	756	9							1										1			
	757	7						1							1					2		
	758	4																	2	1		
	759	2				1													1	1		
	761	3					2												2			
	762	8						1	1						1			1				
	763	12																				1
	796	6						1							1					1		
	798	3					2												2			
	799	3				1											1			1		
	800	6					1			1					1			1				
	801	10																				1
	833	6				1									1							
	834	4					1												1	1		
	835	4													1		2		1	1		

July 12, 2021: Individual site data for the point intercept survey.

Way point	Site	Depth (ft)	Cat-tails	Water-shield	White lily	Chara	Clasp-ingleaf	Coon-tail	CLP	Elodea	EWM	Flat-stem	Floatingleaf Not Natans	Fries	Naiads	NWM	Sago	Stringy	Water celery	Water star-grass	FA	No plants
	836	9													1							
	837	9							1													
	867	8													1							
	868	4				2																
	869	3				1													1			
	870	4				1	1	1									1		1			
	871	7				1		1							1			1				
	872	10																				1
	883	11																				1
	901	6													1		1		1	1		
	902	3				2											1		1			
	903	3				1	1	1														
	904	3					1								1				2			
	905	7													2		1	1				
	906	9													1							
	907	10					1	1							1							
	909	13																				1
	912	10																				1
	913	8						1												1		
	914	7						1							1							
	915	4				2													1			
	916	4				1									1		1		2			
	917	3					2										1		2			
	918	7				1		1									1	1	1			
	919	9						1							1							
	920	8						1							1							
	921	11																				1
	931	10						1							1							
	932	6					1								1					1		
	933	3					2												2			
	934	3					1								1		1		1			
	935	3							1						1		2		2			
	936	3													1		1	1	2	1		
	937	3					1								1		1		1			
	938	5									1				2		1					
	939	4						1			1											
	940	5						1														
	941	2				1									1		1		1			
	942	5				1									1				1			
	943	5						1							1		2		1			
	944	7						1	1						2			1				
	945	9																1				
	946	8						1							1			1		1		
	947	9													1							
	948	8						1							1							
	949	6													1			1	1	1		
	950	5							1						1							
	951	4					2										1		1			
	952	5					2												2	1		
	953	2				1	1								1			1	1			
	954	3						1							1				1			
	955	3					1	1							1				1			
	956	4						1									1	1	1	1		
1																						1
2											1											
3																						1
4																						1
5																1						
6																						1
7		3														3						
8											1											
9											1											
10											1											
11											1											
12											1											
13											1											
14											1											
15											1											
All sites	Average		3.0	1.0	1.0	1.1	1.4	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.3	1.2	1.1	1.3	1.2	1.0	
	Occur (392 sites)		1	1	1	52	85	197	28	23	12	1	1	1	84	9	83	72	85	78	5	57
Sites	Average		3.0	1.0	1.0	1.1	1.4	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.2	1.1	1.3	1.2	1.0	
	Occur (377 sites)		1	1	1	52	85	197	28	23	3	1	1	1	84	7	83	72	85	78	5	53
	% occur		0	0	0	14	23	52	7	6	1	0	0	0	22	2	22	19	23	21	1	
Way point	Average										1.0					2.0						
	Occur (15 sites)										9					2						4