

# LAKE ST. CATHERINE

Aquatic Vegetation Management Program

2021 Annual Report

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## 1 INTRODUCTION

The 2021 season was SŌlitude Lake Management's seventeenth year of involvement in an Integrated Management Plan at Lake St. Catherine developed to control non-native Eurasian watermilfoil (*Myriophyllum spicatum*) throughout the lake. Under this plan, Eurasian watermilfoil management efforts have included herbicide treatment, diver assisted suction harvesting (DASH) and hand-pulling, boat ramp monitoring and educating lake residents and users.

In 2021, management activities included spot-treatment of three areas in the Main Basin totaling 22.6 acres and a 70.2 acre area in Little Lake with ProcellaCOR EC (florpyrauxifen-benzyl) herbicide, as well as diver hand-pulling and diver assisted suction harvesting. These efforts were consistent with the current five-year Integrated Management Plan (2019-2023).

The following report summarizes the results of the 2021 Treatment Program and details findings from the late season comprehensive aquatic plant survey that has been performed annually to document in-lake plant conditions and help evaluate and refine management goals. Specific information on the 2021 diver hand-pulling and diver assisted suction harvesting efforts will be provided by the Lake St. Catherine Association (LSCA) under a separate cover.

## 2 HERBICIDE TREATMENT PROGRAM - 2021

### 2.1 Program Chronology

A chronology of the 2021 treatment program is provided below:

- |   |                   |
|---|-------------------|
| <input type="checkbox"/> Pre-treatment inspection to finalize treatment areas | May 13            |
| <input type="checkbox"/> Treatment of 92.8 acres with ProcellaCOR EC          | June 22           |
| <input type="checkbox"/> Herbicide residue monitoring                         | June 28           |
| <input type="checkbox"/> Interim post-treatment survey                        | July 23           |
| <input type="checkbox"/> Comprehensive aquatic plant survey                   | September 20 & 21 |

### 2.2 Pre-Treatment Inspection

On May 13 the potential management areas within Lake St. Catherine (Lily Pond, Main Lake and Little Lake) were visually surveyed by SŌlitude biologist Kara Sliwoski to assess the stage of Eurasian watermilfoil (EWM) growth and finalize management areas for the 2021 season. In the Main Basin, on both new and old EWM plants approximately 1-foot of active growth was present along with red tips on the apical meristems. In Little Lake, EWM stems were already at or approaching the water's surface and the active growth was more pronounced than what was seen in the Main Basin.

Results of the survey were further communicated to LSCA for their input and final determination on proposed treatment and DASH areas. Once final management areas were agreed to, the required pre-treatment notification information was provided to the Vermont DEC, Lakes & Ponds Program on May 22, 2021 and final approval to proceed was received on June 14, 2021.

### **2.3 Summary of 2021 Treatment**

A total of 92.8 acres amongst three areas were targeted for treatment (Figure 1). Consistent with previous years, each treatment area was evaluated with regards to EWM cover/distribution as well as several other factors including: potential for increased EWM spread; potential for effective treatment; and the overall benefit of milfoil control with respect to the lake, lake residents and other potential users.

Treatment was conducted on Wednesday, June 22, 2021 to allow enough time to comply with the notification requirements of ANC Permit #2770-ANC-C and so that the water-use recommendations would not be imposed over a weekend.

Weather conditions on the day of treatment were mostly overcast skies with occasional drizzle and light rain and an approximate air temperature of 70°F; wind was out of the south/southwest, estimated at 5-10 mph. Surface water temperature in the main basin was approximately 21.7°C.

The treatment was conducted with an 18-foot aluminum airboat. The ProcellaCOR EC herbicide was injected at depth subsurface using hoses on the stern of the airboat. An onboard GPS unit was used to provide real-time guidance and ensure an even application in each of the treated areas. The State boat ramp located on the channel between the Main Lake and Little Lake was used as the base of operations.

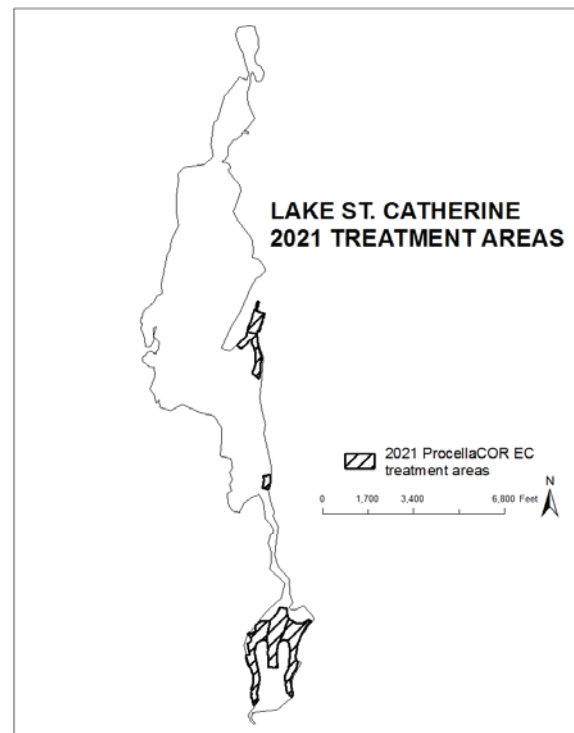
The application rate for ProcellaCOR was 2-3 PDUs/ac-ft (3.86-5.79 ppb/ac-ft); a total of 1003.2 PDUs were applied. The treatment took approximately 5 hours to complete between 12:00 and 5:00 pm.

### **2.4 Herbicide Residue Testing**

In compliance with conditions of the ANC Permit #2770-ANC-C, water samples were collected from within and immediately downstream of Lake St. Catherine following treatment for analysis of ProcellaCOR concentrations.

A map of the sampling locations is attached in Appendix A. Sampling instructions and sample bottles were provided to LSCA representatives by SÖLitude and SePRO. Collected samples were shipped via overnight delivery to SePRO's laboratory in Whittakers, North Carolina.

Due to a shortage in bottles with the required preservative, samples were collected and shipped on June 28. All locations were at or below the laboratory detection limit of 1.0 ppb. A copy of the results is attached in Appendix A.



### 3 LATE SEASON COMPREHENSIVE AQUATIC VEGETATION SURVEY

#### 3.1 Survey Methods

Using methods employed in previous years of this management program, the late season comprehensive aquatic vegetation survey was conducted on September 20 and 21. All three lake basins were systematically toured by boat by SÖLitude biologists. Transect and data point locations established in 2001 were relocated using a Differential GPS system (Appendix B – Figure 1).

Weather conditions on both days were mostly sunny, with light and variable breeze providing good to excellent visibility.

Recorded at each data point was the following information: aquatic plants present, dominant species, plant biomass, percent total plant cover and percent EWM cover. Water depths that were recorded during the pre-treatment survey were verified using a high-resolution depth finder. The plant community was assessed through visual inspection, use of a throw-rake and with an Aqua-Vu underwater camera system. Locations where EWM plants were observed were recorded with a GPS unit. Plants were identified to genus and species level when possible. Plant cover was given a percentage rank based on the aerial coverage of plants within an approximate 400 square foot area assessed at each data point. Generally, in areas with 100% cover, bottom sediments could not be seen through the vegetation; percentages less than 100% indicated the amount of bottom area covered by plant growth. The percentage of EWM was also recorded at each data point. In addition to cover percentage, a plant biomass index was assigned at each data point to document the amount of plant growth vertically through the water column. Plant biomass was estimated on a scale of 0-4, as follows:

- 0 No biomass; plants generally absent
- 1 Low biomass; plants growing only as a low layer on the sediment
- 2 Moderate biomass; plants protruding well into the water column but generally not reaching the water surface
- 3 High biomass; plants filling enough of the water column and/or covering enough of the water surface to be considered a possible recreational nuisance or habitat impairment
- 4 Extremely high biomass; water column filled and/or surface completely covered, obvious nuisance conditions and habitat impairment severe

#### 3.2 Survey Findings

Quantitative measures of the aquatic plant community documented in 2021 were comparable with prior years. Lake-wide EWM distribution (FOC - frequency of occurrence) decreased slightly from 35.2% in 2020 to 30.2% in 2021. The FOC of EWM was higher in Lily Pond and the Main Basin, but significantly lower in Little Lake. In addition, more than 80% of the surveyed points only had trace amounts of EWM. This was consistent with the reduction in overall EWM abundance (% cover) that decreased from 9.7% in 2020 to 3.3% in 2021.

Overall vegetative cover remains comparable with previous years, with indices of 63% in 2019, 61% in 2020, and 63% in 2021. The composition of the vegetative community has also remained relatively unchanged since 2001 and is dominated by native submersed species (in decreasing FOC): *Potamogeton robbinsii*, *Potamogeton illinoensis*, *Elodea canadensis*, and *Zosterella dubia*. Diversity also increased slightly from the 2020 survey with 34 different aquatic plant species identified in 2021 and an average of approximately 5.1 species per survey point.

Comparative summary data for all three basins, and overall lake system, collected during late season surveys performed between 2001 and 2021 is listed below (Table 1).

**Table 1. Summary of Annual Survey Data, 2001-2021**

LILY POND	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
# of Data Points	24																		
Total Plant Cover	90	80	98	88	91	98	94	98	93	94	96	94	90	78	60	99	99	88	92
Milfoil Cover	9	6	2	0	2	7	<1	<1	<1	1	5	1.5	2.2	7	6	6.7	9.6	0	1
Plant Biomass Index	3.1	2.5	3.3	2.5	2.8	3.3	2.7	2.3	2.9	3.1	3.5	3.4	3.5	3.2	2.9	3.9	3.7	4.0	4.0
Average Species Richness	5.67	3.58	5.17	3.59	4.54	5.58	4.83	5.46	4.13	4.21	4.46	5.04	4.8	5.5	5.54	7.75	7.04	5.38	5.63
LAKE ST. CATHERINE (Main Basin)	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
# of Data Points	129																		
Total Plant Cover	66	46	51	57	58	66	58	63	59	56	63	63	63	37	43	60	47	51	55
Milfoil Cover	43	16	0	4	11	4	5	2	7	8	16	15	7	6	7	16	1.9	2.9	3.1
Plant Biomass Index	1.9	1.5	1.6	1.8	2	2	2	1.3	1.8	1.5	2	2	2	2.6	1.6	2.9	2.7	2.9	3
Average Species Richness	2.96	2.39	2.85	3.5	3.75	4.09	3.68	3.06	2.88	2.88	2.85	2.87	3.2	3.1	3.35	4.59	3.98	4.26	4.73
LITTLE LAKE	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
# of Data Points	43																		
Total Plant Cover	72	66	78	83	83	77	56	62	76	81	80	86	96	54	49	84	90	80	71
Milfoil Cover	15	0	0	2	7	10	<1	5	9	14	7	10	42	25	13	22	41	36	5
Plant Biomass Index	2.3	2.1	2.4	2.9	2.8	2.7	2.2	2.7	3.3	2.5	3	3.2	3.8	3.8	2.3	3.9	3.9	3.7	3.5
Average Species Richness	5.62	3.23	3.3	3.81	4.58	4.3	4.23	4.65	3.84	4.42	4.63	4.77	4.4	4	5.49	6.79	6.26	6.40	5.56
OVERALL	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
# of Data Points	199																		
Total Plant Cover (%)	70	54	63	66	67	73	63	67	67	66	70	72	-	45	46	70	63	61	63
Milfoil Cover (%)	49	0.1	0.5	3	9	5	3	3	7	8	13	12	13	10	8	16	11	10	3.3
Plant Biomass Index	2	2	2	2	2	2	2	2	2	2	2	2	-	3	2	3.2	3.1	3.2	3.2
Average Species Richness	-	-	-	3.57	4.03	4.32	3.94	3.7	3.23	3.38	3.44	3.56	3.71	3.52	4.08	5.45	4.84	4.85	5.08

**Table 2.** Entire Lake System – Annual Species List and Frequency of Occurrence (%), 2001-2021

Macrophyte Species (Common Name / Scientific Name)	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Water marigold <i>Bidens beckii</i>	3	0	0	0	0	0	0	0	1	0	0	0.5	0	0	0	0	0	<1	0
Watershield <i>Brasenia schreberi</i>	4	8	7	7	7	6	5	5	5	3	4	4	3	3	3	5	5	3	1
Coontail <i>Ceratophyllum demersum</i>	20	8	11	12	21	18	17	22	10	21	15	17	15	14	21	24	17	4	6
Spineless hornwort <i>Ceratophyllum echinatum</i>																	3	0	<1
Muskgrass / Stonewort <i>Chara sp. / Nitella sp.</i>	17	6	36	40	14	14	13	2	2	1	0	3	19	5	8	12	3	8	15
Spikerush <i>Eleocharis asicularia</i>	1	1	1	0	0	0	0	0	0	0	0	0	2	<1	0	0	0	1	<1
Common waterweed <i>Elodea canadensis</i>	32	1	1	1	5	43	60	30	10	14	23	12	30	38	50	61	70	57	56
Quillwort <i>Isoetes sp.</i>	2	6	2	5	2	3	1	0	1	1	0	0	1	<1	<1	<1	0	1	0
Common duckweed <i>Lemna minor</i>	7	1	0	1	0	1	1	0	0	0	0	0	<1	<1	<1	0	0	0	0
Eurasian watermilfoil <i>Myriophyllum spicatum</i>	94	44	17	33	74	65	38	40	43	51	64	54	48	25	62	69	37	35	30
Whorled watermilfoil <i>Myriophyllum verticillatum</i>													1	0	5	0	<1	<1	0
Slender naiad <i>Najas flexilis</i>	22	0	8	39	34	22	15	16	14	8	4	7	10	9	20	19	17	22	17
Thread leaf naiad <i>Najas gracillima</i>																5	1	1	2
Spiny naiad <i>Najas minor</i>	0	0	0	0	0	0	0	0	0	0	0	0	<1	2	0	1	2	2	1
Yellow waterlily <i>Nuphar variegata</i>	5	5	5	2	2	1	2	1	2	1	1	0	2	<1	13	2	2	2	2
White waterlily <i>Nymphaea odorata</i>	16	5	11	10	11	11	10	7	7	12	12	14	13	8	1	24	21	20	24
Large-leaf pondweed <i>Potamogeton amplifolius</i>	33	38	43	49	52	53	51	56	23	35	32	31	13	20	19	23	22	28	29
Berchtold's pondweed <i>Potamogeton berchtoldii</i>																	4	0	3
Curly-leaf pondweed <i>Potamogeton crispus</i>	2	1	7	5	3	1	0	0	1	1	0	1	0	<1	1	0	<1	2	1
Ribbon-leaf pondweed <i>Potamogeton epihydrus</i>	2	6	7	3	3	5	1	1	1	4	1	2	<1	1	2	8	7	7	4



**Table 2.** Entire Lake System – Annual Species List and Frequency of Occurrence (%), 2001-2021

Macrophyte Species (Common Name / Scientific Name)	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Leafy Pondweed <i>Potamogeton foliosus</i>																12	3	3	1
Variable-leaf pondweed <i>Potamogeton gramineus</i>	23	1	6	6	2	4	4	4	11	8	3	3	4	3	4	14	9	8	8
Illinois pondweed <i>Potamogeton illinoensis</i>	4	1	2	9	23	39	29	36	35	53	56	57	44	47	50	43	57	66	70
Floating-leaf pondweed <i>Potamogeton natans</i>	0	0	0	9	0	8	8	13	8	0	0	13	0	0	0	<1	0	<1	<1
White-stem pondweed <i>Potamogeton praelongus</i>	0	0	0	0	0	0	0	0	0	<1	<1	3	6	10	<1	5	10	0	0
Thin-leaf pondweed <i>Potamogeton pusillus</i>	0	0	0	5	12	6	5	12	12	5	4	0	14	2	0	12	0	20	21
Robbins' pondweed <i>Potamogeton robbinsii</i>	52	76	88	74	77	68	84	78	57	76	76	73	57	58	65	69	70	74	71
Vasey's pondweed <i>Potamogeton vaseyi</i>																	6	0	0
Flat-stemmed pondweed <i>Potamogeton zosteriformis</i>	28	3	29	29	23	19	16	26	22	20	23	36	15	16	15	31	20	26	28
White water crowfoot <i>Ranunculus aquatilis</i>															2	0	2	<1	0
Arrowhead <i>Sagittaria sp.</i>																		<1	0
Sago pondweed <i>Stuckenia pectinata</i>																	2	1	1
Humped bladderwort <i>Utricularia gibba</i>	2	0	1	5	1	1	4	1	0	0	0	0	2	5	5	5	2	5	4
Flat-leaf bladderwort <i>Utricularia intermedia</i>																3	1	2	3
Purple bladderwort <i>Utricularia purpurea</i>																8	0	0	0
Common bladderwort <i>Utricularia vulgaris</i>	8	9	2	6	7	7	11	8	2	4	4	7	7	4	10	13	13	15	13
Tape grass <i>Vallisneria spiralis</i>	29	13	2	4	9	8	15	15	14	15	18	19	26	21	24	34	34	35	39
Watermeal <i>Wolffia sp.</i>	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water stargrass <i>Zosterella dubia</i>	1	1	9	8	23	17	7	13	4	2	4	11	15	19	20	38	37	38	47

### 3.3 Lily Pond

The FOC of EWM increased because no treatment work was performed during the 2021 season and four surveyed points supported trace levels of EWM growth. There are fewer survey data points in Lily Pond which causes greater fluctuation in the year-to-year FOC index. The percent cover of EWM remained favorably low at only 1%.

Other survey quantitative survey metrics were fairly steady. The total plant cover, biomass and species richness were largely unchanged from recent years.

Native plants observed in 2021 were consistent with prior years. *Potamogeton robbinsii* (96%) remained the most abundant plant in the basin followed by *Elodea canadensis* (75%), *Potamogeton illinoensis* (67%), *Nymphaea odorata* (67%), *Utricularia vulgaris* (63%), *Potamogeton zosteriformis* (63%), and *Potamogeton amplifolius* (38%) (Table 3). All other native species were present below 20% FOC, including *Zosterella dubia*, *Utricularia intermedia*, *Utricularia radiata*, *Utricularia minor*, *Ceratophyllum demersum*, *Vallisneria americana*, *Nuphar variegata*, *Utricularia gibba*, *Potamogeton natans*, *Brasenia schreberi*, and *Potamogeton crispus*.

Figure 2: Lily Pond - Fall 2021 EWM distribution

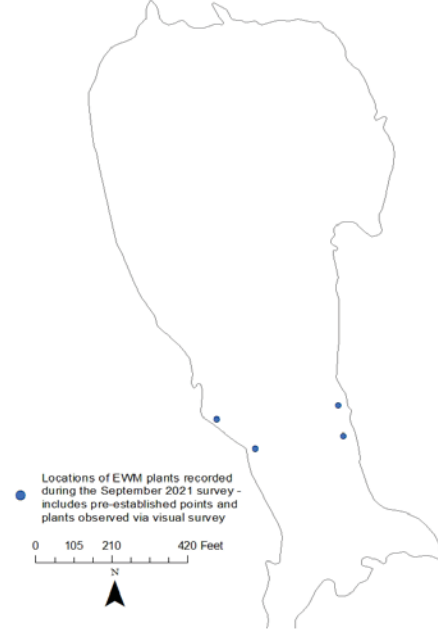
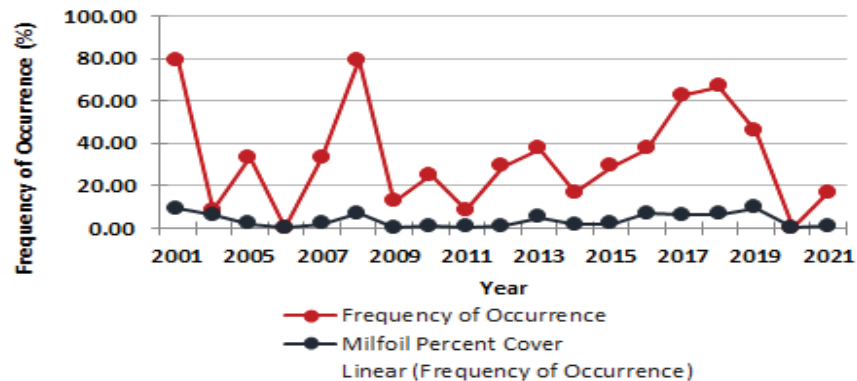


Chart 1: Lily Pond - EWM Frequency of Occurrence and Percent Cover



**Table 3.** Lily Pond – Annual Species List and Frequency of Occurrence (%), 2001-2021

Macrophyte Species (Common Name / Scientific Name)	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Watershield <i>Brasenia schreberi</i>	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Coontail <i>Ceratophyllum demersum</i>	71	4	50	46	83	83	83	79	75	63	67	54	64	67	67	92	75	0	8
Spineless hornwort <i>Ceratophyllum echinatum</i>																	13	0	0
Muskgrass / Stonewort <i>Chara</i> sp. / <i>Nitella</i> sp.	0	0	0	5	4	0	0	0	0	0	0	0	0	0	4	0	0	0	0
Common waterweed <i>Elodea canadensis</i>	29	0	8	0	8	29	46	79	17	29	17	13	48	63	83	88	92	63	75
Quillwort <i>Isoetes</i> sp.	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common duckweed <i>Lemna minor</i>	46	8	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eurasian watermilfoil <i>Myriophyllum spicatum</i>	79	8	33	0	33	79	13	25	8	29	42	17	28	38	63	67	46	0	17
Whorled watermilfoil <i>Myriophyllum</i>																	4	0	0
Slender naiad <i>Najas flexilis</i>	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yellow waterlily <i>Nuphar variegatum</i>	17	17	17	0	0	0	0	4	4	0	0	0	0	0	0	0	0	0	4
White waterlily <i>Nymphaea odorata</i>	63	17	29	9	21	25	33	17	25	29	38	38	28	33	42	71	67	67	67
Large-leaf pondweed <i>Potamogeton amplifolius</i>	33	100	92	77	79	88	92	88	38	46	75	75	24	50	38	54	42	54	38
Curly-leaf pondweed <i>Potamogeton crispus</i>	4	4	4	5	13	0	0	0	4	0	0	0	0	0	0	0	4	0	4
Ribbon-leaf pondweed <i>Potamogeton epihydrus</i>	0	13	4	0	4	4	4	0	4	4	0	0	0	4	0	8	0	4	0
Leafy Pondweed <i>Potamogeton foliosus</i>																		8	0
Variable leaf pondweed <i>Potamogeton aramineus</i>	17	0	8	0	4	0	8	0	8	8	0	0	0	0	0	0	0	0	0

**Table 3.** Lily Pond – Annual Species List and Frequency of Occurrence (%), 2001-2021

Macrophyte Species (Common Name / Scientific Name)	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Illinois pondweed <i>Potamogeton illinoensis</i>	0	4	8	9	46	42	25	17	46	42	46	54	16	46	33	29	38	75	67
Floating leaf pondweed <i>Potamogeton natans</i>	0	0	0	9	0	8	8	13	8	0	0	13	0	0	0	4	0	4	4
Whitestem pondweed <i>Potamogeton praelongus</i>																17	46	0	0
Thin-leaf pondweed <i>Potamogeton pusillus</i>																4	0	0	0
Robbins' pondweed <i>Potamogeton robbinsii</i>	96	92	96	96	92	88	96	96	86	96	100	100	68	71	92	100	96	92	96
Flat-stem pondweed <i>Potamogeton</i>	58	8	63	0	25	46	13	67	46	33	29	67	48	46	33	79	54	88	15
Humped bladderwort <i>Utricularia gibba</i>	0	0	0	41	0	0	4	0	0	0	0	0	12	25	8	0	0	0	4
Purple bladderwort <i>Utricularia purpurea</i>																17	0	0	0
Common bladderwort <i>Utricularia vulgaris</i>	29	38	0	27	4	13	17	4	17	21	17	29	28	29	50	67	63	67	63
Tape grass <i>Vallisneria americana</i>	33	46	0	0	0	0	8	4	4	0	0	0	4	38	0	8	4	4	4
Watermeal <i>Wolffia</i> sp.	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water stargrass <i>Zosterella dubia</i>	4	0	38	0	25	21	8	50	0	0	0	17	40	58	29	63	50	13	13

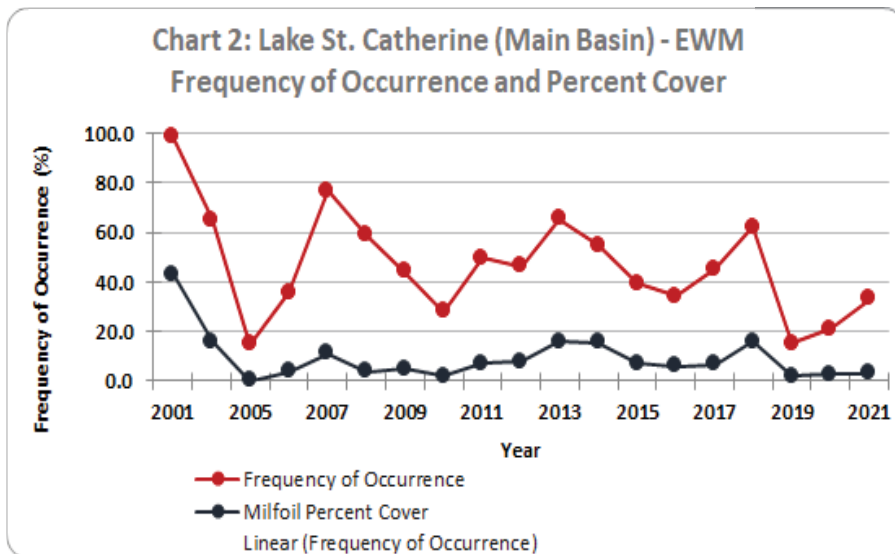
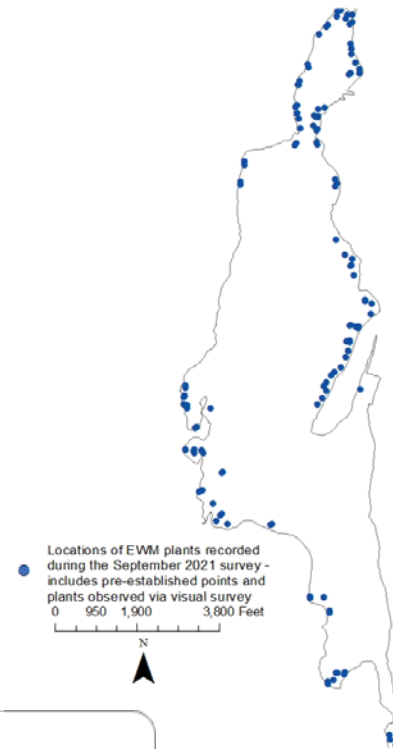
### 3.4 Lake St. Catherine (Main Basin)

Similar to what was seen in Lily Pond, the EWM growth in the Main Basin had a slightly higher FOC index (33% in 2021 vs. 21% in 2020), but percent cover of EWM remained low, around 3%, and of the 44 data points were EWM was documented, more than 90% only supported only trace levels of growth. The herbicide treatment areas were almost completely free of EWM growth. Areas where EWM was encountered most frequently included the east shore from Cone's Point to the State Park, throughout North Bay, in Ox-Bow, Horseshoe, Atwater and Forest House Bays.

Locations of EWM observed during the survey, in addition to those survey points where observed, were recorded with a GPS unit. All EWM points observed during the September 2021 survey are depicted in Figure 3.

Chart 2 (below) illustrates the year-to-year change in EWM frequency of occurrence and percent cover in the Main Basin.

**Figure 3: Main Basin - Fall 2021 EWM distribution**



Dominant native plant growth remained fairly consistent with prior years. Dominant plants included: *Potamogeton illinoensis* (71%), *Potamogeton robbinsii* (57%), *Zosterella dubia* (57%), *Elodea canadensis* (55%), *Vallisneria americana* (39%), *Potamogeton pusillus* (30%). All other native species were present below 20% FOC.

**Table 4.** Main Basin – Annual Species List and Frequency of Occurrence (%), 2001-2021

Macrophyte Species (Common Name / Scientific Name)	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Water marigold <i>Bidens beckii</i>	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	0
Watershield <i>Brasenia schreberi</i>	0	<1	<1	2	2	2	2	2	2	<1	<1	2	3	3	2	5	2	2	<1
Coontail <i>Ceratophyllum demersum</i>	11	11	6	7	11	10	8	14	6	11	2	5	3	5	5	6	2	<1	3
Spineless hornwort <i>Ceratophyllum echinatum</i>																	1	0	0
Muskgrass / Stonewort <i>Chara</i> sp. / <i>Nitella</i> sp.	2	17	62	57	21	22	19	2	<1	0	0	5	16	9	11	14	5	11	18
Spikerush <i>Eleocharis asicularia</i>																		<1	0
Common waterweed <i>Elodea canadensis</i>	28	0	0	<1	5	52	71	15	9	7	19	7	30	37	45	58	64	58	55
Quillwort <i>Isoetes</i> sp.	2	9	<1	6	2	5	0	0	<1	<1	0	0	2	0	<1	<1	0	<1	0
Common duckweed <i>Lemna minor</i>	2	0	0	0	0	<1	<1	0	0	0	0	0	<1	0	0	0	0	0	0
Eurasian watermilfoil <i>Myriophyllum spicatum</i>	98	65	15	36	77	59	44	28	50	47	66	56	39	34	46	62	15	21	33
Slender naiad <i>Najas flexilis</i>	19	0	12	57	50	34	22	25	20	12	6	6	16	2	28	25	24	29	20
Thread-leaf naiad <i>Najas gracillima</i>																8	2	2	3
Brittle naiad <i>Najas minor</i>																2	2	2	2
Yellow waterlily <i>Nuphar variegata</i>	<1	0	0	<1	<1	0	0	<1	<1	0	0	0	0	0	2	0	1	0	0
White waterlily <i>Nymphaea odorata</i>	3	2	2	3	3	3	3	2	2	2	<1	2	5	2	0	8	5	5	9
Large-leaf pondweed <i>Potamogeton amplifolius</i>	29	15	26	34	39	38	41	44	26	35	27	25	12	12	18	15	17	21	26
Berchtold's pondweed <i>Potamogeton berchtoldii</i>																	5	0	5

Macrophyte Species (Common Name / Scientific Name)	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Curly-leaf pondweed <i>Potamogeton crispus</i>	2	0	9	5	2	<1	0	0	0	0	0	<1	0	0	<1	0	0	0	0
Ribbon-leaf pondweed <i>Potamogeton epihydrus</i>	2	3	5	2	<1	4	<1	<1	<1	2	0	2	0	0	<1	4	5	<1	<1
Leafy pondweed <i>Potamogeton foliosus</i>																17	4	2	<1
Variable leaf pondweed <i>Potamogeton gramineus</i>	18	0	5	2	2	6	3	6	15	9	3	4	6	4	5	21	14	12	9
Illinois pondweed <i>Potamogeton illinoensis</i>	6	<1	<1	9	16	34	23	31	33	53	57	56	40	38	52	34	60	64	71
Whitestem pondweed <i>Potamogeton praelongus</i>																4	5	0	0
Thin-leaf pondweed <i>Potamogeton pusillus</i>	0	0	0	5	12	6	5	12	12	5	4	0	14	2	0	17	0	29	30
Robbins' pondweed <i>Potamogeton robbinsii</i>	31	65	82	62	67	58	78	73	58	67	66	61	49	47	44	58	57	58	57
Vasey's pondweed <i>Potamogeton vaseyi</i>																	8	0	5
Flat-stem pondweed <i>Potamogeton zosteriformis</i>	24	2	31	42	28	19	19	23	30	20	20	32	10	4	10	23	11	14	19
White water crowfoot <i>Ranunculus aquatilis</i>																	2	<1	0
Arrowhead <i>Sagittaria sp.</i>																		<1	0
Sago pondweed <i>Stuckenia pectinata</i>																	3	<1	<1
Common bladderwort <i>Utricularia vulgaris</i>	<1	<1	<1	0	0	2	<1	3	0	<1	0	<1	<1	<1	2	2	3	2	2
Tape grass <i>Vallisneria americana</i>	14	3	<1	3	9	9	13	13	10	9	15	14	23	20	19	31	33	33	39
Water stargrass <i>Zosterella dubia</i>		<3	5	12	28	22	8	9	5	2	2	13	13	24	21	32	42	47	57

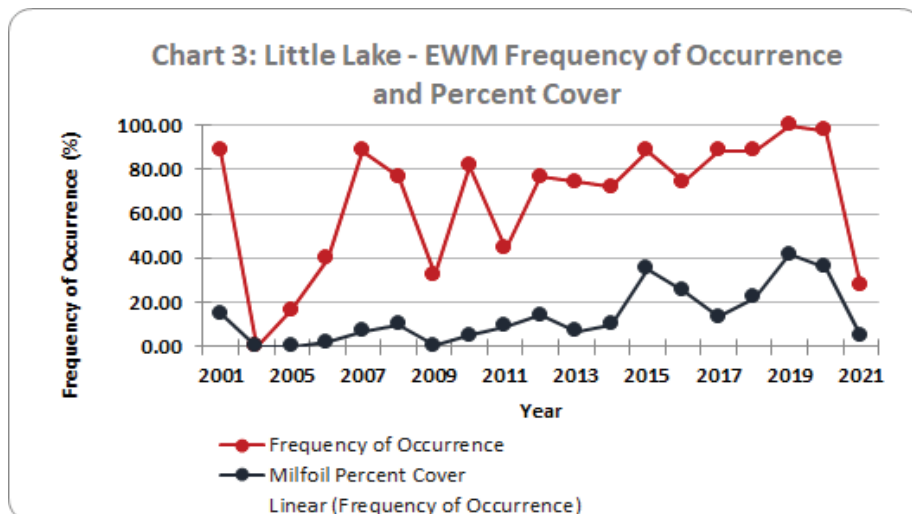
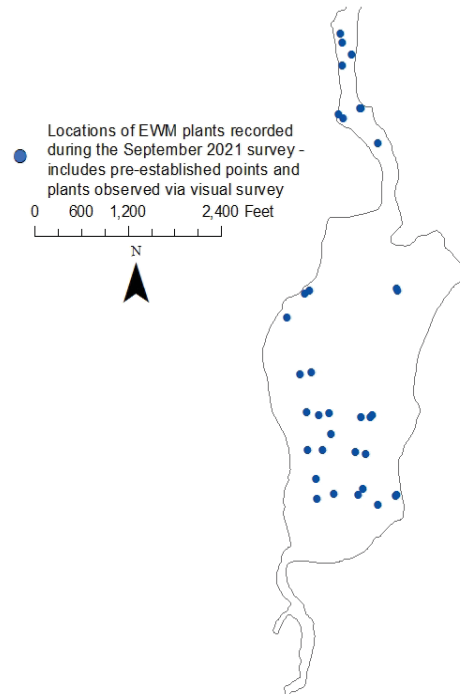
### 3.5 Little Lake

The most significant changes to the aquatic plant community in the Lake St. Catherine system during the 2021 season occurred in Little Lake. This was due to the fact approximately 40% of the surface area of Little Lake was treated with ProcettaCOR herbicide. The EWM FOC index was reduced from 98% in 2020 to 28% in 2021, which represents a 70% reduction. The percent cover of EWM was reduced by almost 90%, from 36% in 2020 to 5% in 2021. Most of the remaining EWM growth seen during the late season survey was found in the southern half of Little Lake, areas that were not treated in 2021.

Overall plant cover within Little Lake was reduced which would be expected following a sizeable herbicide treatment, but this was primarily attributed to the drop in EWM cover. Species richness was also lower, again due primarily to the reduction in EWM. Twenty-four (24) species were observed within this basin this year, compared to twenty (20) last year. Little Lake's consistent, shallow depth (6-foot average), allows for a diverse plant community, but also allows for plant growth to fill the entire water column, hindering recreational uses of the basin.

The native plant community continued to be robust following treatment. Watershield (*Brasenia schreberi*) was not recorded during the post-treatment survey and may have been impacted by the treatment. White waterlily (*Nymphaea odorata*) did appear to be impacted immediately following treatment, but it recovered to similar FOC values by the time the late season survey was performed. Other dominant native species included: *Potamogeton robbinsii* (84%), *Potamogeton illinoensis* (65%), *Vallisneria americana* (58%), *Elodea canadensis* (47%), *Nymphaea odorata* (47%), *Potamogeton zosteriformis* (37%), *Potamogeton amplifolius* (32%) and *Zosterella dubia* (26%). The remaining plants had FOC indices less than 20%.

Figure 4: Little Lake - Fall 2021 EWM distribution





**Table 5: Little Lake – Annual Species List and Frequency of Occurrence (%), 2001-2021**

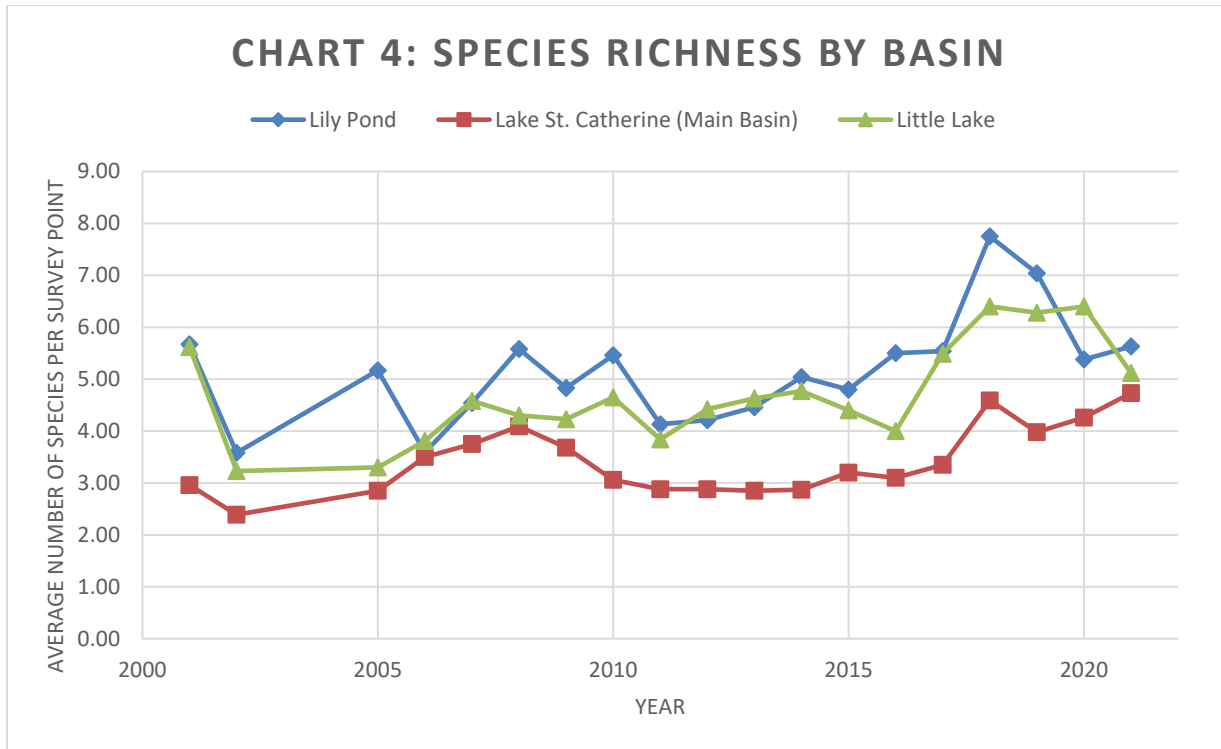
Macrophyte Species (Common Name / Scientific Name)	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Water marigold <i>Bidens beckii</i>	7	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
Watershield <i>Brasenia schreberi</i>	14	30	30	23	26	21	14	12	14	12	14	12	2	2	5	7	21	7	0
Muskgrass / Stonewort <i>Chara sp. / Nitella sp.</i>	7	5	7	12	0	0	2	0	5	2	0	0	2	0	0	12	0	2	12
Coontail <i>Ceratophyllum demersum</i>	21	0	2	9	16	7	9	16	28	28	28	35	23	14	44	40	30	14	14
Spineless hornwort <i>Ceratophyllum echinatum</i>																	2	0	2
Spikerush <i>Eleocharis sp.</i>	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Common waterweed <i>Elodea canadensis</i>	47	5	0	0	2	23	40	47	21	28	40	26	28	28	74	54	74	51	47
Quillwort <i>Isoetes sp.</i>	0	0	5	2	0	0	2	0	0	2	0	0	0	0	0	0	0	2	0
Eurasian watermilfoil <i>Myriophyllum spicatum</i>	88	0	16	40	88	77	32	81	44	77	74	72	86	74	88	88	100	98	28
Whorled watermilfoil <i>Myriophyllum verticillatum</i>													4	0	5	0	0	2	0
Slender naiad <i>Najas flexilis</i>	40	0	0	5	2	0	5	0	5	0	2	14	0	2	7	9	5	14	16
Yellow waterlily <i>Nuphar variegatum</i>	9	14	12	7	7	2	7	2	5	2	2	0	7	5	5	9	5	7	7
White waterlily <i>Nymphaea odorata</i>	30	9	26	30	28	10	19	19	23	32	30	37	27	12	42	44	44	40	47
Large-leaf pondweed <i>Potamogeton amplifolius</i>	44	72	70	77	74	77	56	72	28	30	21	23	14	28	12	26	28	35	32
Berchtold's pondweed <i>Potamogeton berchtoldii</i>																	2	0	0
Curly-leaf pondweed <i>Potamogeton crispus</i>	0	0	0	2	0	0	0	0	0	2	0	0	0	0	2	0	0	7	2

**Table 5: Little Lake – Annual Species List and Frequency of Occurrence (%), 2001-2021**

Macrophyte Species (Common Name / Scientific Name)	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Ribbon-leaf pondweed <i>Potamogeton epihydrus</i>	0	12	14	7	7	7	0	0	2	9	2	2	2	2	5	21	19	28	14
Leafy Pondweed <i>Potamogeton foliosus</i>																		2	2
Variable leaf pondweed <i>Potamogeton gramineus</i>	42	5	9	23	0	0	5	0	5	5	2	0	0	0	2	0	0	0	7
Illinois pondweed <i>Potamogeton illinoensis</i>	0	0	0	9	33	47	49	36	62	61	61	65	71	72	51	61	58	63	65
Whitestem pondweed <i>Potamogeton praelongus</i>																	5	0	0
Thin-leaf pondweed <i>Potamogeton pusillus</i>	0	0	0	2	7	2	0	0	0	0	0	0	2	0	0	0	0	5	5
Robbins' pondweed <i>Potamogeton robbinsii</i>	88	100	100	100	100	88	95	81	86	91	93	95	73	86	86	81	86	95	84
Flat-stem pondweed <i>Potamogeton zosteriformis</i>	23	2	5	5	7	5	7	9	9	14	28	33	11	19	19	30	30	28	37
White water crowfoot <i>Ranunculus aquatilis</i>															2	0	0	0	0
Sago Pondweed <i>Stuckenia pectinata</i>																		2	2
Humped bladderwort <i>Utricularia gibba</i>	7	0	2	0	5	2	14	5	0	0	0	0	2	7	16	21	9	21	14
Flat leaf bladderwort <i>Utricularia intermedia</i>																12	5	7	7
Purple bladderwort <i>Utricularia purpurea</i>																26	0	0	0
Common bladderwort <i>Utricularia vulgaris</i>	16	19	7	12	30	19	35	26	5	2	9	14	14	0	11	14	14	28	16
Tape grass <i>Vallisneria americana</i>	72	26	7	9	14	9	26	26	35	40	40	44	50	35	0	58	54	56	58
Water stargrass <i>Zosterella dubia</i>	2	2	5	0	7	2	5	5	2	5	14	2	9	9	9	42	14	23	26

### 3.6 Species Richness

The only notable change in the species richness was the drop seen in Little Lake that was probably mostly attributed to reduction in EWM seen in that basin (Table 1, Chart 4). Throughout the entire lake system, the overall species richness index was up slightly from 4.85 in 2020 to 5.12 in 2021. Species richness has been relatively stable over the past several years, which is likely due to the integrated management approach and use of herbicides that are highly selective for EWM.



## 4 SUMMARY OF 2021 AQUATIC VEGETATION MANAGEMENT PROGRAM

### 4.1 ProcellaCOR Herbicide Treatment

Results of the 2021 ProcellaCOR herbicide treatment program at Lake St. Catherine were favorable with little EWM regrowth observed in the treatment areas in the Main Basin. Approximately one-month after treatment, there was little EWM growth found in Little Lake. Partial or temporary EWM control was seen outside of the treatment areas, but EWM plants recovered by the time the late season survey was performed.

Additional recovery of EWM in areas that were treated during the 2018 and 2019 seasons was seen by the time the late season survey was completed. EWM frequency of occurrence indices were lower in the entire lake system due to the dramatic reduction in Little Lake, but slightly higher values were seen in Lily Pond and the Main Basin.

Species richness and frequency of occurrence indices have fluctuated within each basin over time. However, no major plant composition changes were observed as a result of this year's ProcellaCOR treatment; trends will continue to be monitored through future management years.

#### 4.2 Spread Prevention and Non-Chemical Control Activities

As required by the ANC Permit, non-chemical milfoil control activities continued at Lake St. Catherine during the 2021 season. Efforts included volunteer monitoring, boat ramp greeter program, diver assisted suction harvesting and other educational efforts. Details of the non-chemical control efforts will be provided by LSCA under separate cover.

### 5 RECOMMENDATIONS FOR 2022 SEASON

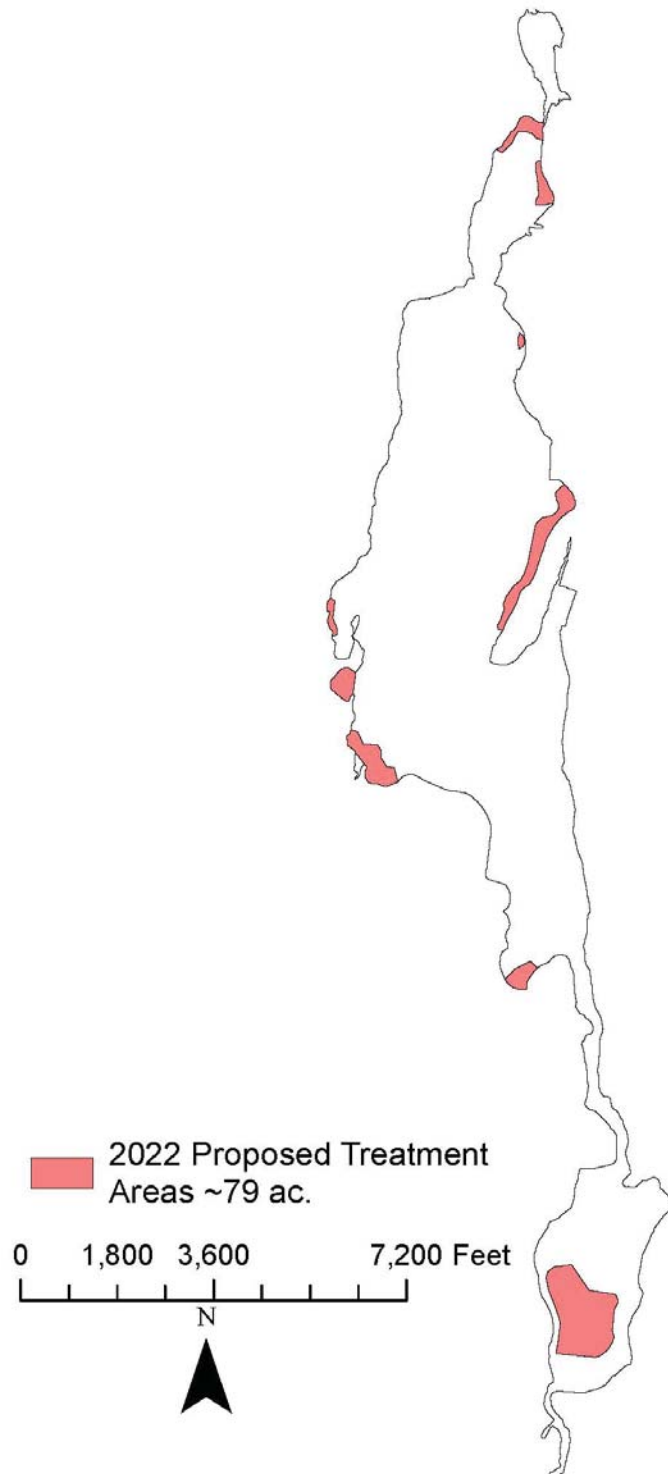
Continuation of an integrated management program utilizing the combination of DASH and spot-treatment with ProcellaCOR herbicide is recommended for the 2022 season. It appears that the duration of EWM control following prior ProcellaCOR treatments at Lake St. Catherine are lasting 2-3 years. This is an improvement over the results that were obtained with Renovate (triclopyr) herbicide in prior years, but EWM recovery is still occurring and ongoing management is recommended. As the size of spot-treatment areas get smaller, ProcellaCOR application rates will likely need to be increased to help overcome the effects of dilution. We will continue to work closely with LSCA and SePRO, the manufacturer of ProcellaCOR to fine-tune treatment protocols in an effort to maximize the duration of control and reduce the frequency and scope of maintenance treatments.

Based on the distribution of EWM seen during the late season survey, we would expect that spot-treatment areas may be warranted in the following areas:

Location	Estimated Acreage
North Bay	10 – 15
State Park shoreline	2 – 5
Cone's Point shoreline	5 – 10
Ox-Bow Bay	2 – 5
Horseshoe Bay	2 – 5
Atwater Bay	5 – 10
Forest House Bay	2 – 5
Channel	2 – 5
Little Lake	25 – 30
<i>ESTIMATED TOTAL</i>	<i>55 - 90</i>

Most of the EWM growth that was documented during the late season survey in 2021 was in "trace" densities, so it is difficult to predict exactly how much acreage will require treatment in 2021 and which areas may continue to be effectively managed with the DASH program. Potential treatment areas will be inspected in the early spring and treatment areas will be finalized in coordination with the LSCA and VT DEC prior to finalizing the 2022 management program.

Figure 5: Preliminary 2022 Spot-Treatment Areas



## ***APPENDIX A***

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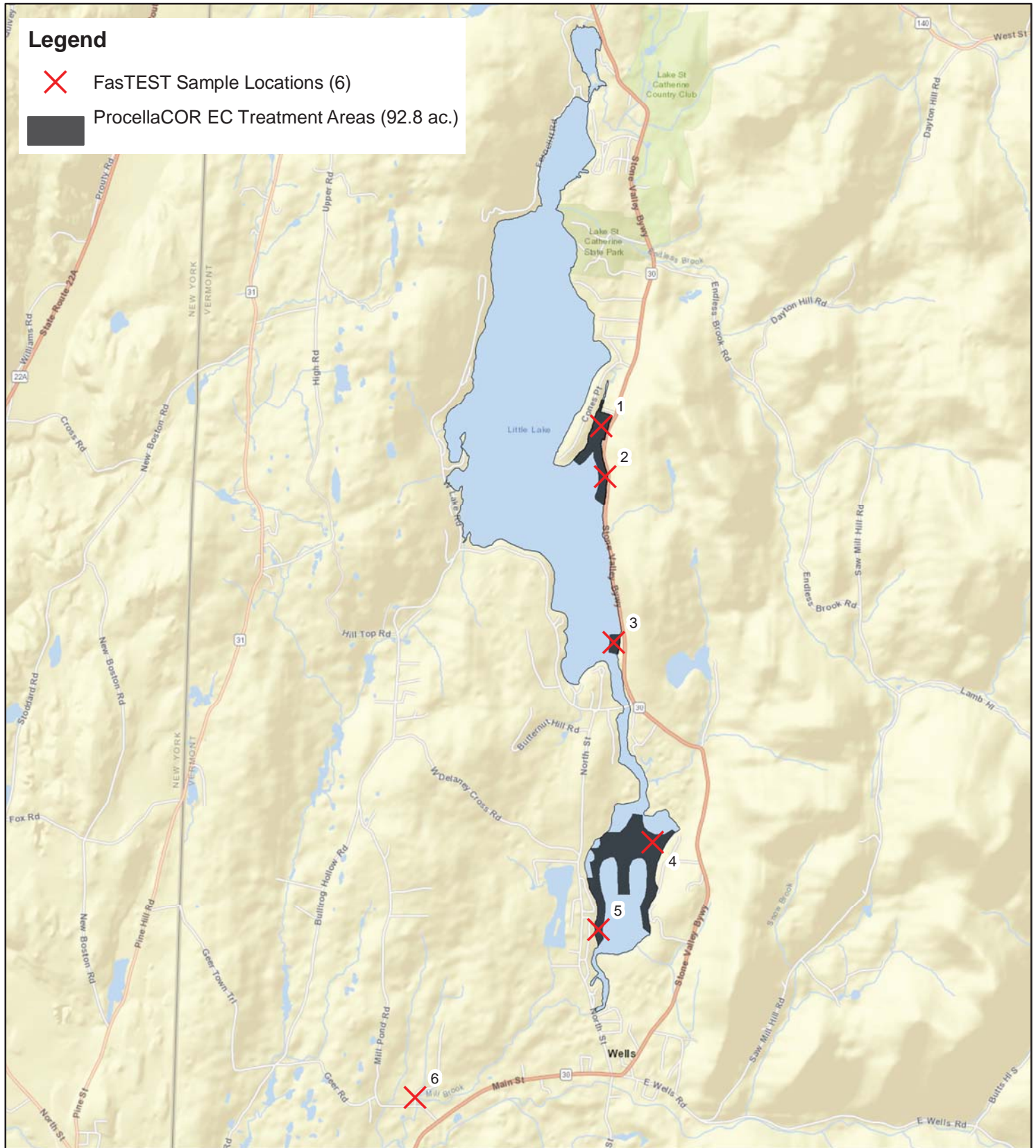
### **Herbicide Residue Testing Results**

- FastEST Sampling Location Map
- SePRO Laboratory Report – 06/28/21

# 2021 FasTEST Sample Locations

**SOLITUDE**  
LAKE MANAGEMENT

888.480.5253  
solitudelakemanagement.com



**Lake St. Catherine**  
Wells / Poultney, VT  
Rutland County  
43.4657° N, 73.2146° W



## Lake St. Catherine

0 3,800 7,600 Feet  
1:44,378

Map Date: 05/21/21  
Prepared by: KS  
Office: SHREWSBURY, MA





16013 Watson Seed Farm Road, Whitakers, NC 27891

Chain of Custody: COC10085 **LABORATORY REPORT**

**Customer Company Customer Contact**

Company Name SOLitude Lake Management	Contact Person: Kara Sliwoski
Address: 1320 Brookwood Drive, Ste. H Little Rock, AR 72202	E-mail Address: ksliwoski@solitudelake.com
	Phone: 508.885.0101

**Waterbody Information**

Waterbody:	Lake St. Catherine - VT
Waterbody size:	1100
Depth Average:	25

Sample ID	Sample Location	Test	Method	Results	Sampling Date / Time
CTM28373-1	1	ProcellaCOR/lorpyrauxifen-benzyl (ug/L) ProcellaCOR acid/lorpyrauxifen (ug/L)	FAST 16 FAST 16	<1 <1	06/28/2021
CTM28374-1	2	ProcellaCOR/lorpyrauxifen-benzyl (ug/L) ProcellaCOR acid/lorpyrauxifen (ug/L)	FAST 16 FAST 16	<1 <1	06/28/2021
CTM28375-1	3	ProcellaCOR/lorpyrauxifen-benzyl (ug/L) ProcellaCOR acid/lorpyrauxifen (ug/L)	FAST 16 FAST 16	<1 <1	06/28/2021
CTM28376-1	4	ProcellaCOR/lorpyrauxifen-benzyl (ug/L) ProcellaCOR acid/lorpyrauxifen (ug/L)	FAST 16 FAST 16	<1 <1	06/28/2021
CTM28377-1	5	ProcellaCOR/lorpyrauxifen-benzyl (ug/L) ProcellaCOR acid/lorpyrauxifen (ug/L)	FAST 16 FAST 16	<1 <1	06/28/2021
CTM28378-1	6	ProcellaCOR/lorpyrauxifen-benzyl (ug/L) ProcellaCOR acid/lorpyrauxifen (ug/L)	FAST 16 FAST 16	<1 1.0	06/28/2021

**ANALYSIS STATEMENTS:**

**SAMPLE RECEIPT /HOLDING TIMES:** All samples arrived in an acceptable condition and were analyzed within prescribed holding times in accordance with the SRTC Laboratory Sample Receipt Policy unless otherwise noted in the report.

**PRESERVATION:** Samples requiring preservation were verified prior to sample analysis and any qualifiers will be noted in the report.

**QA/QC CRITERIA:** All analyses met method criteria, except as noted in the report with data qualifiers.



COMMENTS: No significant observations were made unless noted in the report.

MEASUREMENT UNCERTAINTY: Uncertainty of measurement has been determined and is available upon request.

**Laboratory Information**

Date / Time Received: 06/29/21 11:30 AM

Date Results Sent: Thursday, July 1, 2021

*Disclaimer: The results listed within this Laboratory Report relate only to the samples tested in the laboratory. The analyses contained in this report were performed in accordance with the applicable certifications as noted. All soil samples are reported on a dry weight basis unless otherwise noted in the report. This Laboratory Report is confidential and is intended for the exclusive use of SRTC Laboratory and its client. This report shall not be reproduced, except in full, without written permission from SRTC Laboratory. The Chain of Custody is included and is an essential component of this report.*

*This entire report was reviewed and approved for release.*



*Reviewed By: Laboratory Supervisor*

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## ***APPENDIX B***

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### **Comprehensive Aquatic Vegetation Survey Information**

Survey Point Location Maps

2021 Total Vegetation Biomass

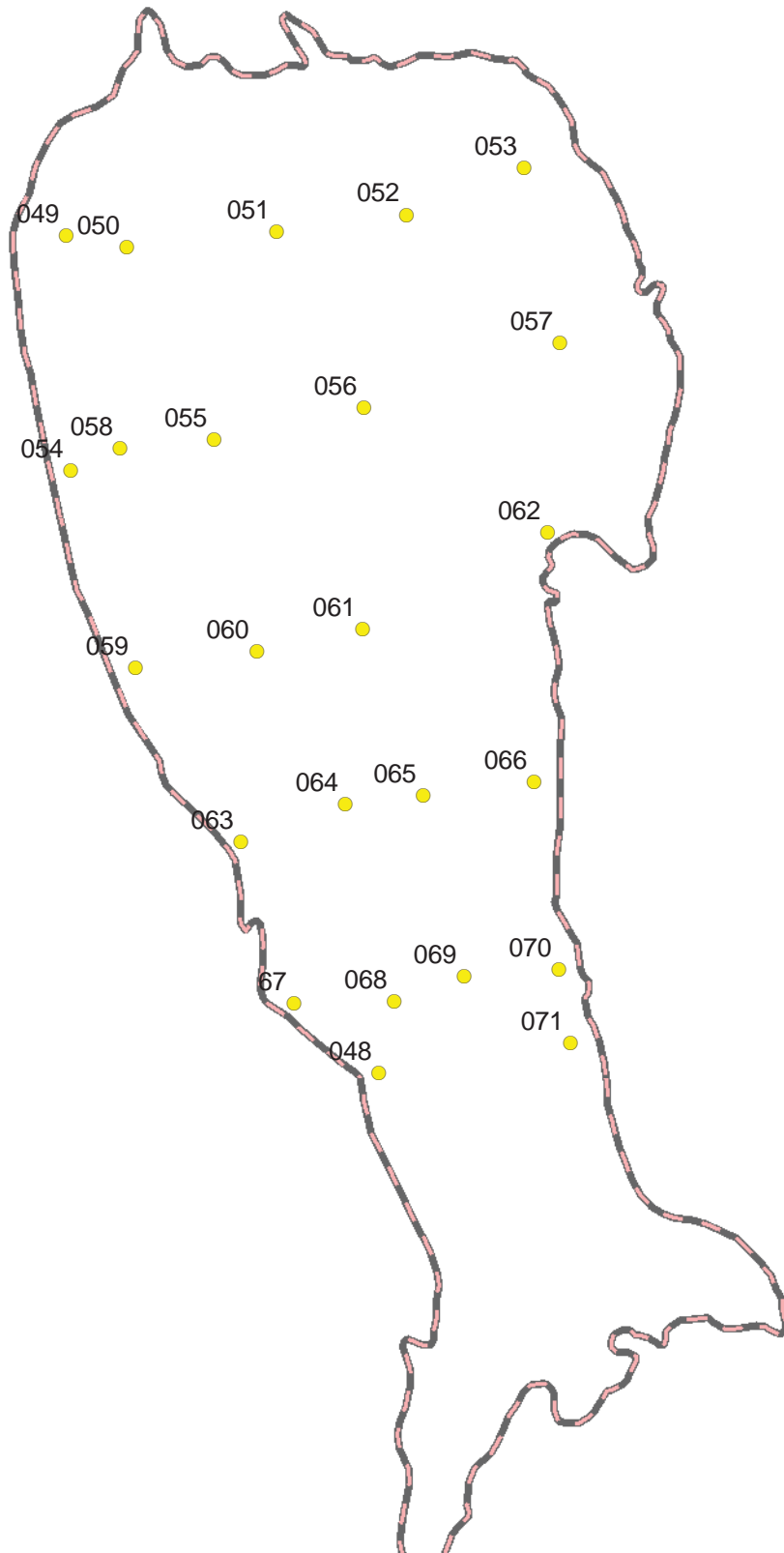
Fall 2021 Native Vegetation Distribution Maps

Fall 2021 Eurasian Watermilfoil Distribution Map

Field Data Tables

## Legend

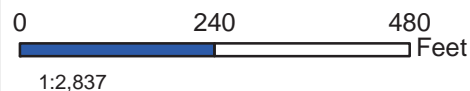
● Data Points



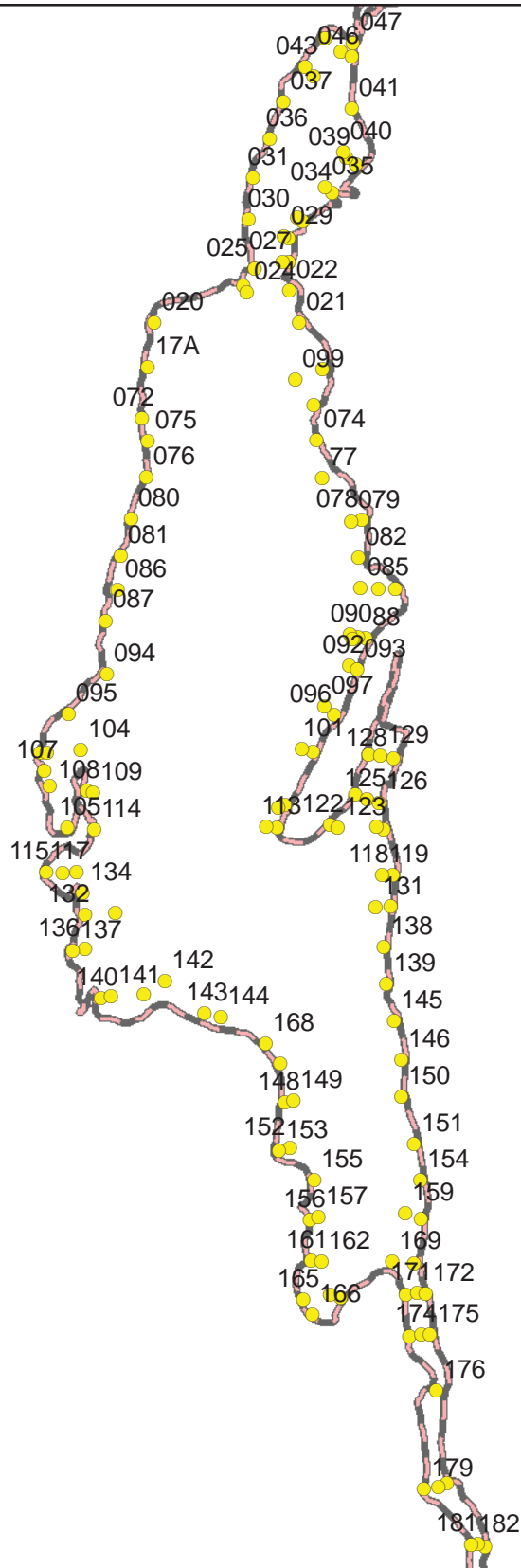
**Lake St. Catherine**  
Wells / Poultney, VT  
Rutland County  
43.4657° N, 73.2146° W



## Lake St. Catherine



Date: 10/18/2021  
Prepared by: AM  
Office: SHREWSBURY, MA



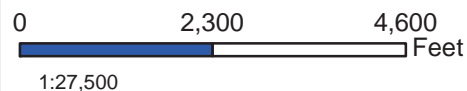
## Legend

● Data Points

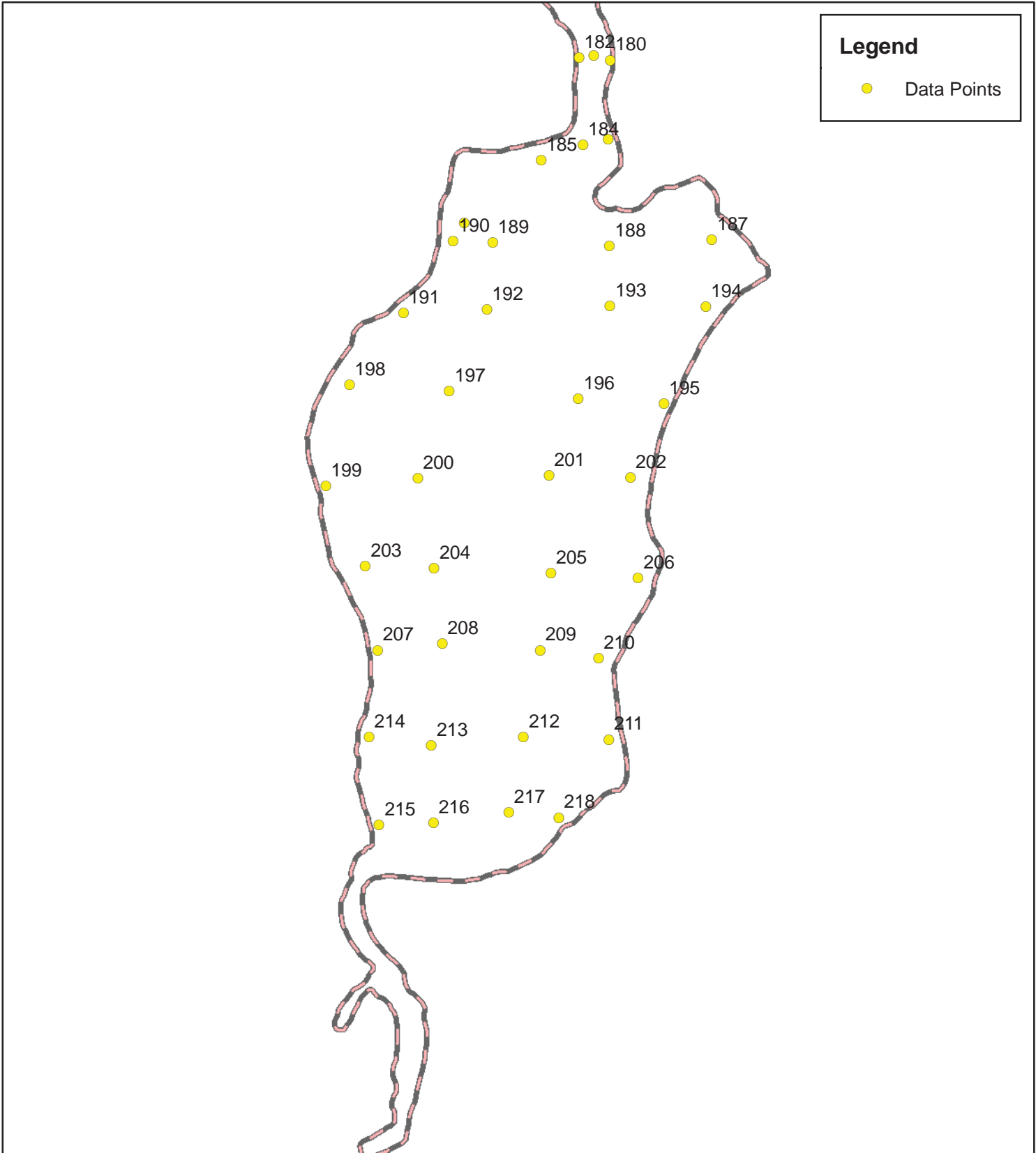
**Lake St. Catherine**  
Wells / Poultney, VT  
Rutland County  
43.4657° N, 73.2146° W



## Lake St. Catherine



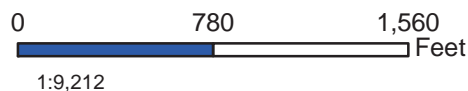
Date: 10/18/2021  
Prepared by: AM  
Office: SHREWSBURY, MA



**Lake St. Catherine**  
Wells / Poultney, VT  
Rutland County  
43.4657° N, 73.2146° W



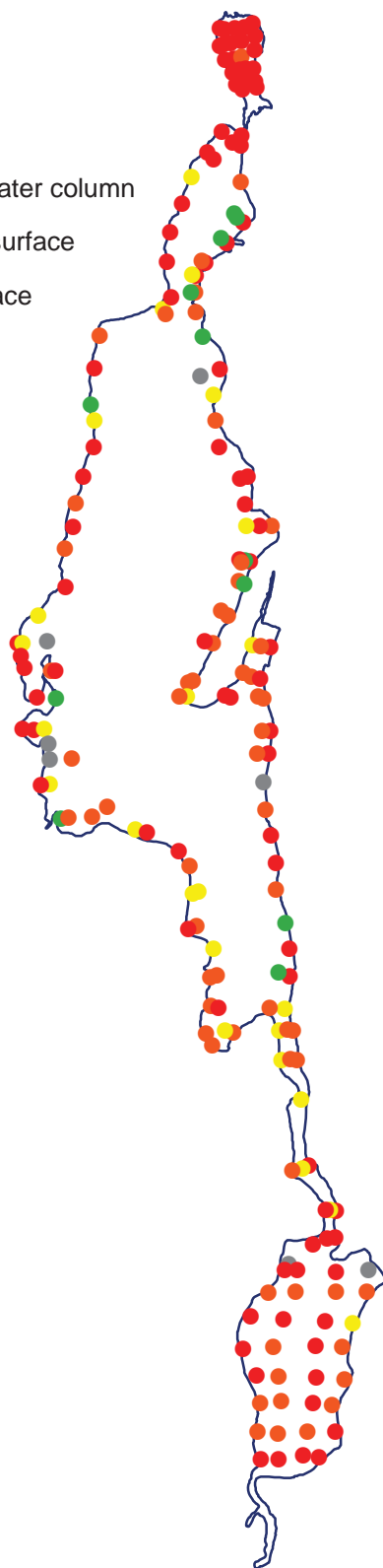
**Lake St. Catherine**



Date: 10/18/2021  
Prepared by: AM  
Office: SHREWSBURY, MA

## Legend

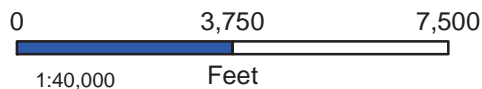
- 0 - No Plant Growth
- 1 - Very low plant growth
- 2 - Plant growth extending into water column
- 3 - Plant growth extending near surface
- 4 - Plant growth at or above surface



**Lake St. Catherine**  
Wells / Poultney, VT  
Rutland County  
43.4657° N, 73.2146° W

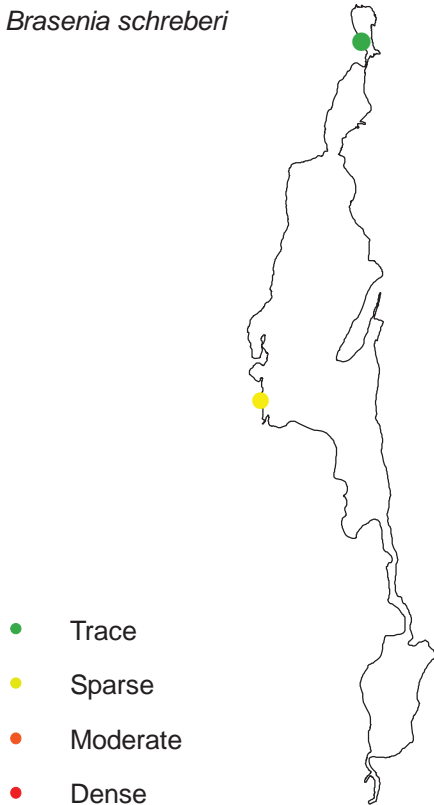


## Lake St. Catherine

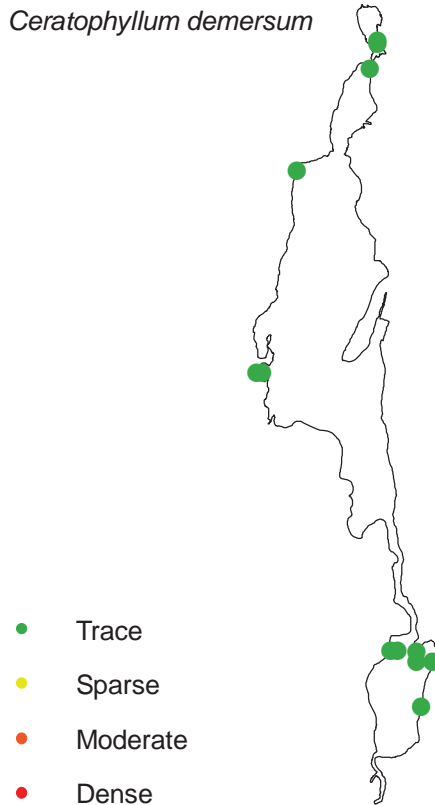


Date: 11/03/2021  
Prepared by: AM  
Office: SHREWSBURY, MA

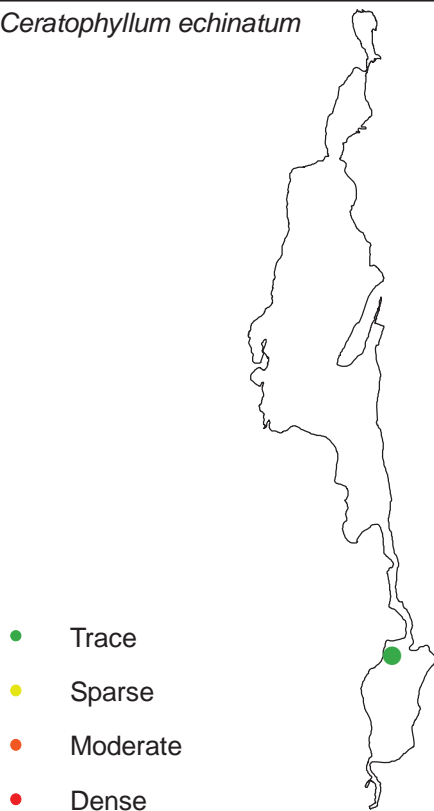
*Brasenia schreberi*



*Ceratophyllum demersum*



*Ceratophyllum echinatum*



*Elodea spp.*



**Lake St. Catherine**  
Wells / Poultney, VT  
Rutland County  
43.4657° N, 73.2146° W



**Lake St. Catherine**

0 6,400 12,800 Feet  
1:79,000



Map Date: 10/26/2021  
Prepared by: AM  
Office: Shrewsbury, MA

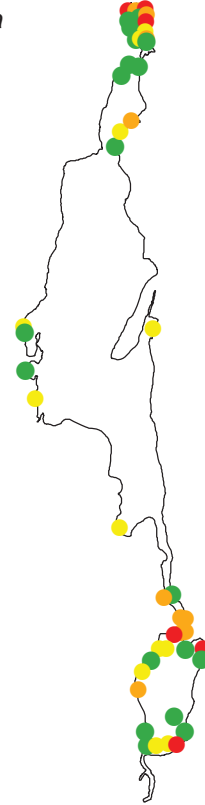
*Eleocharis spp.*

- Trace
- Sparse
- Moderate
- Dense



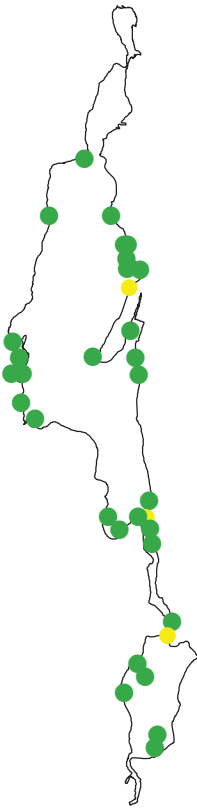
*Nymphaea odorata*

- Trace
- Sparse
- Moderate
- Dense



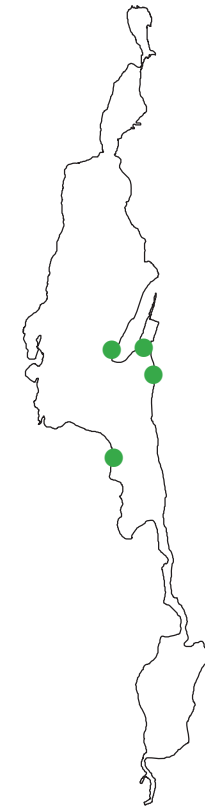
*Najas flexilis*

- Trace
- Sparse
- Moderate
- Dense



*Najas gracillima*

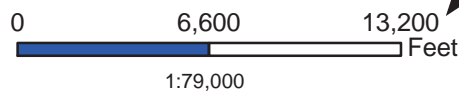
- Trace
- Sparse
- Moderate
- Dense



**Lake St. Catherine**  
Wells / Poultney, VT  
Rutland County  
43.4657° N, 73.2146° W



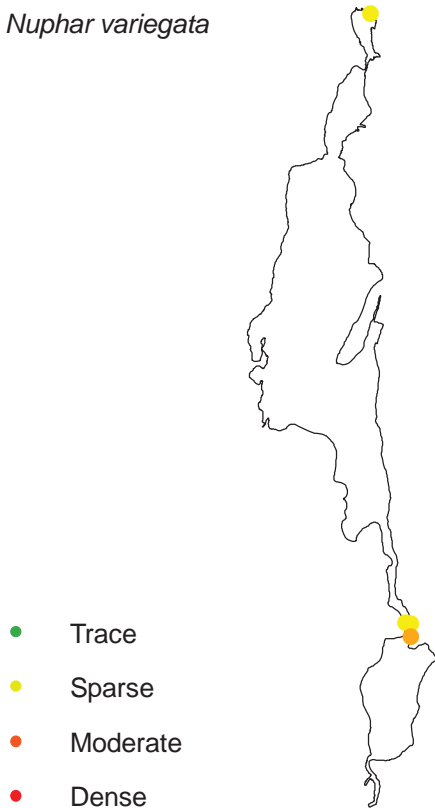
## Lake St. Catherine



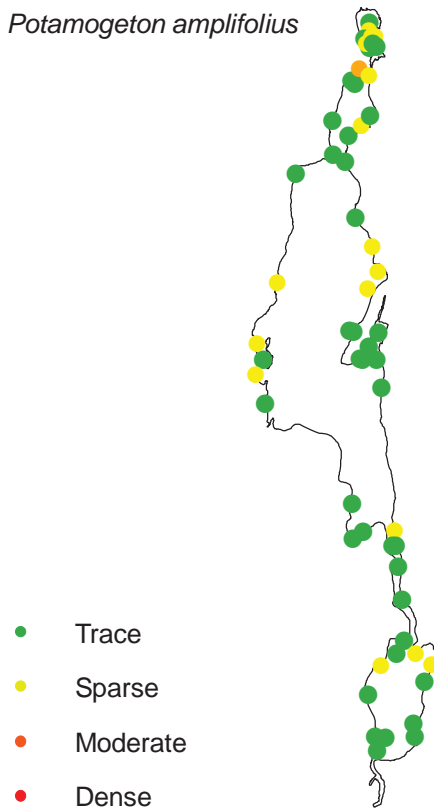
Map Date: 10/26/2021  
Prepared by: AM  
Office: Shrewsbury, MA



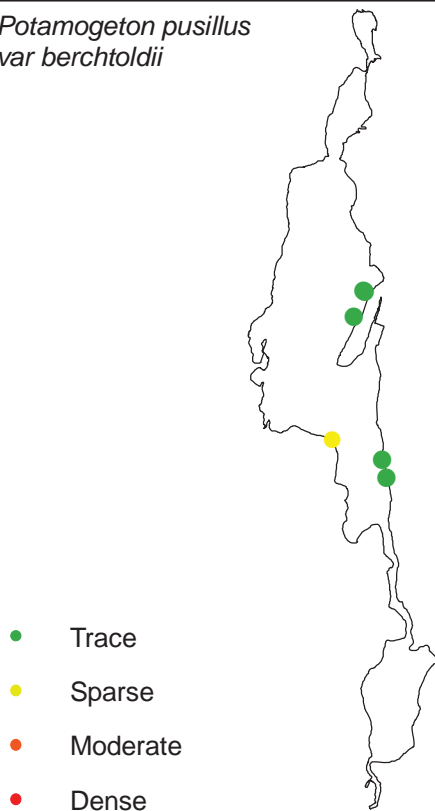
*Nuphar variegata*



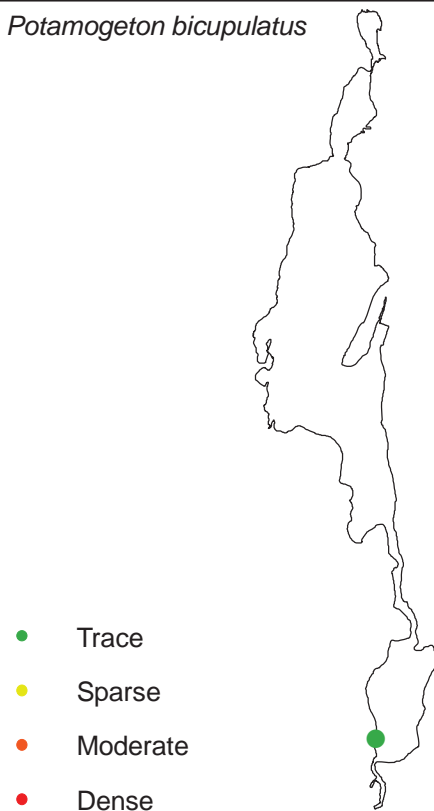
*Potamogeton amplifolius*



*Potamogeton pusillus*  
*var berchtoldii*



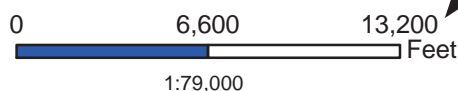
*Potamogeton bicupulatus*



**Lake St. Catherine**  
Wells / Poultney, VT  
Rutland County  
43.4657° N, 73.2146° W



## Lake St. Catherine



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*Potamogeton crispus*

- Trace
- Sparse
- Moderate
- Dense



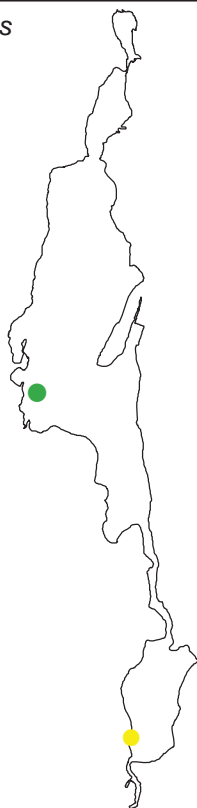
*Potamogeton epihydrus*

- Trace
- Sparse
- Moderate
- Dense



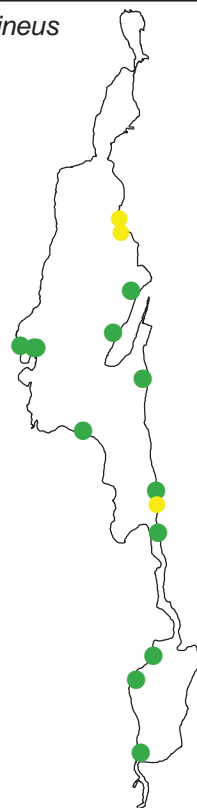
*Potamogeton foliosus*

- Trace
- Sparse
- Moderate
- Dense



*Potamogeton gramineus*

- Trace
- Sparse
- Moderate
- Dense



**Lake St. Catherine**  
Wells / Poultney, VT  
Rutland County  
43.4657° N, 73.2146° W



## Lake St. Catherine

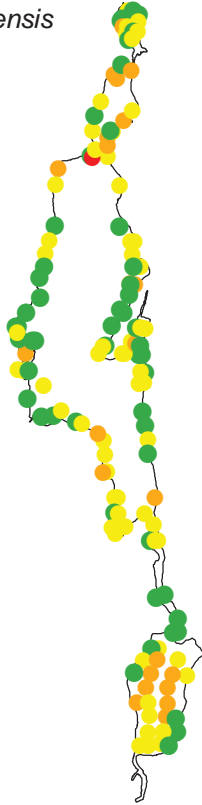
0 6,600 13,200  
Feet  
1:79,000



Map Date: 10/26/2021  
Prepared by: AM  
Office: Shrewsbury, MA

*Potamogeton illinoensis*

- Trace
- Sparse
- Moderate
- Dense



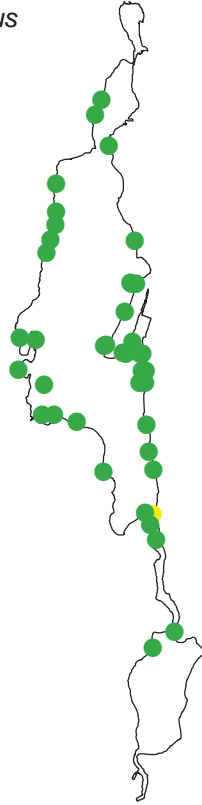
*Potamogeton natans*

- Trace
- Sparse
- Moderate
- Dense



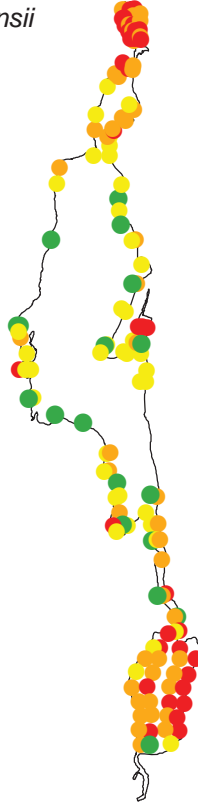
*Potamogeton pusillus*

- Trace
- Sparse
- Moderate
- Dense



*Potamogeton robbinsii*

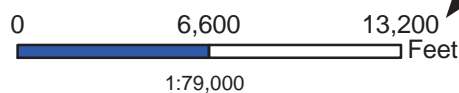
- Trace
- Sparse
- Moderate
- Dense



**Lake St. Catherine**  
Wells / Poultney, VT  
Rutland County  
43.4657° N, 73.2146° W

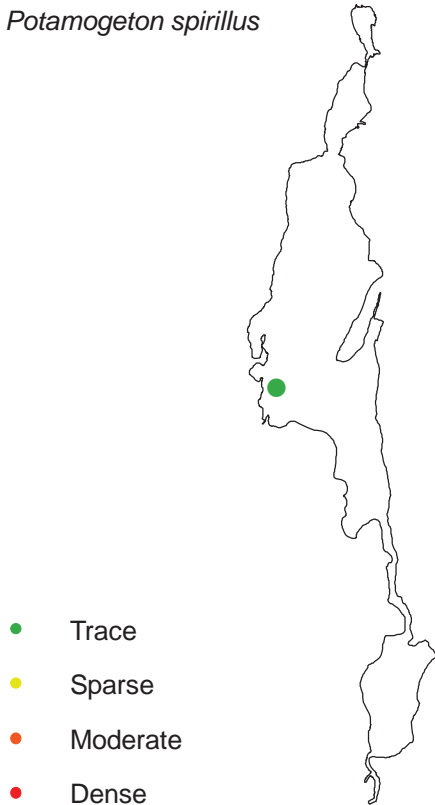


**Lake St. Catherine**

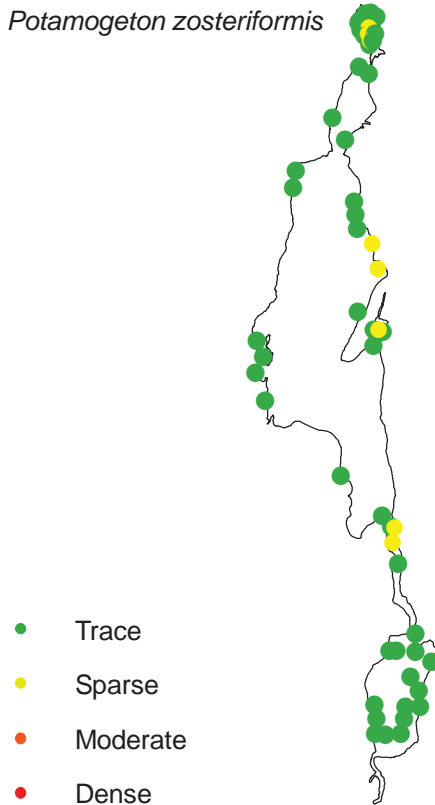


Map Date: 10/26/2021  
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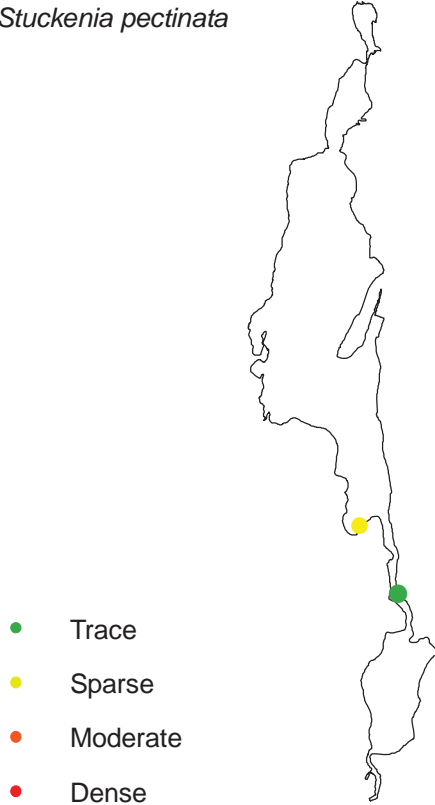
*Potamogeton spirillus*



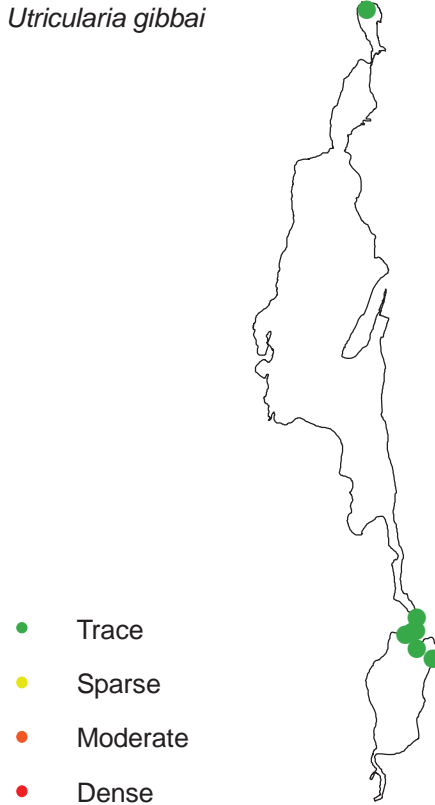
*Potamogeton zosteriformis*



*Stuckenia pectinata*



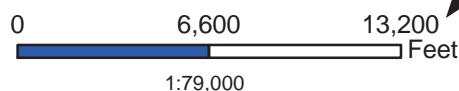
*Utricularia gibbii*



**Lake St. Catherine**  
Wells / Poultney, VT  
Rutland County  
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**Lake St. Catherine**



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*Utricularia intermedia*

- Trace
- Sparse
- Moderate
- Dense



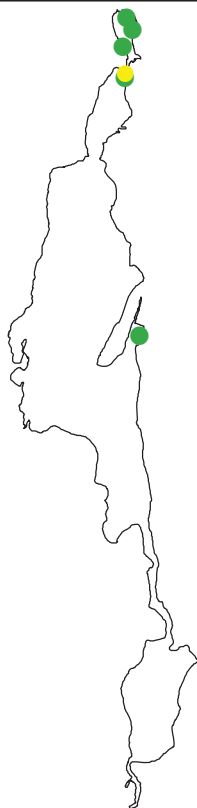
*Utricularia minor*

- Trace
- Sparse
- Moderate
- Dense



*Utricularia radiata*

- Trace
- Sparse
- Moderate
- Dense



*Utricularia vulgaris*

- Trace
- Sparse
- Moderate
- Dense



**Lake St. Catherine**  
Wells / Poultney, VT  
Rutland County  
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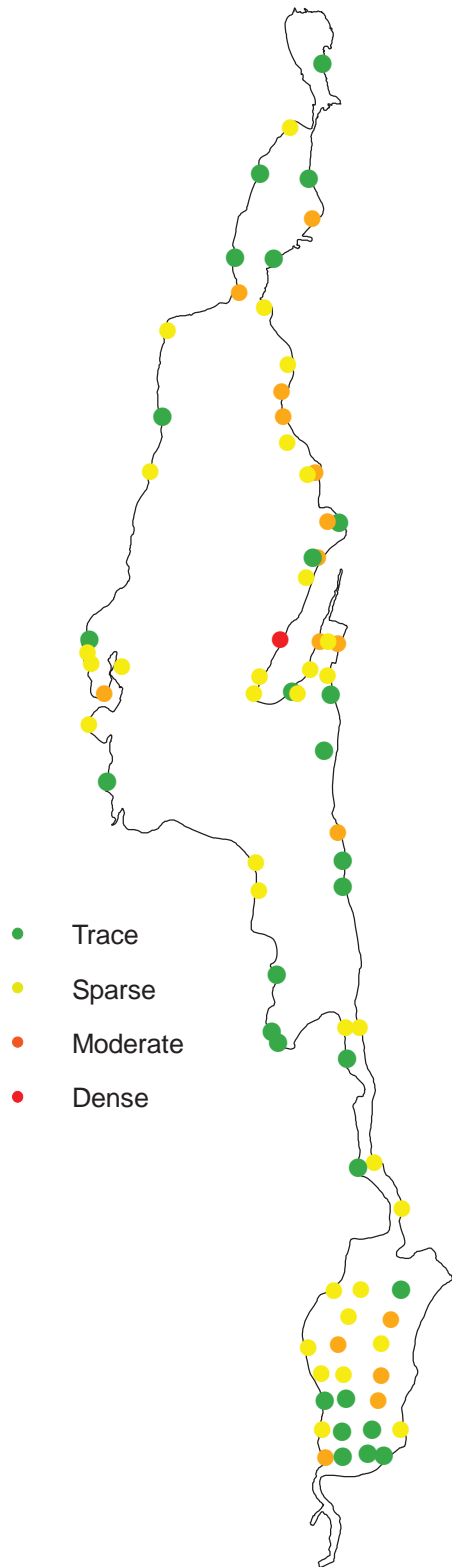
## Lake St. Catherine

0 6,600 13,200  
Feet  
1:79,000



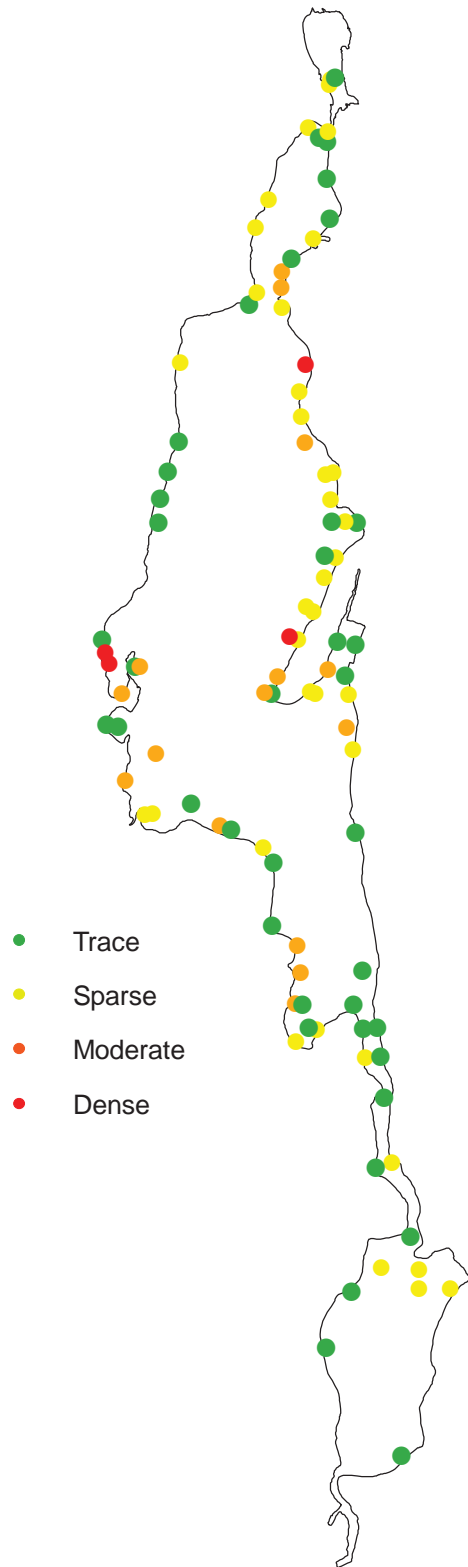
Map Date: 10/26/2021  
Prepared by: AM  
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*Vallisneria americana*



- Trace
- Sparse
- Moderate
- Dense

*Zosterella dubia*

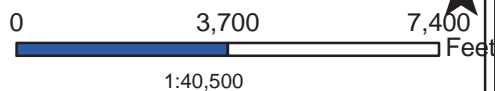


- Trace
- Sparse
- Moderate
- Dense

**Lake St. Catherine**  
Wells / Poultney, VT  
Rutland County  
43.4657° N, 73.2146° W



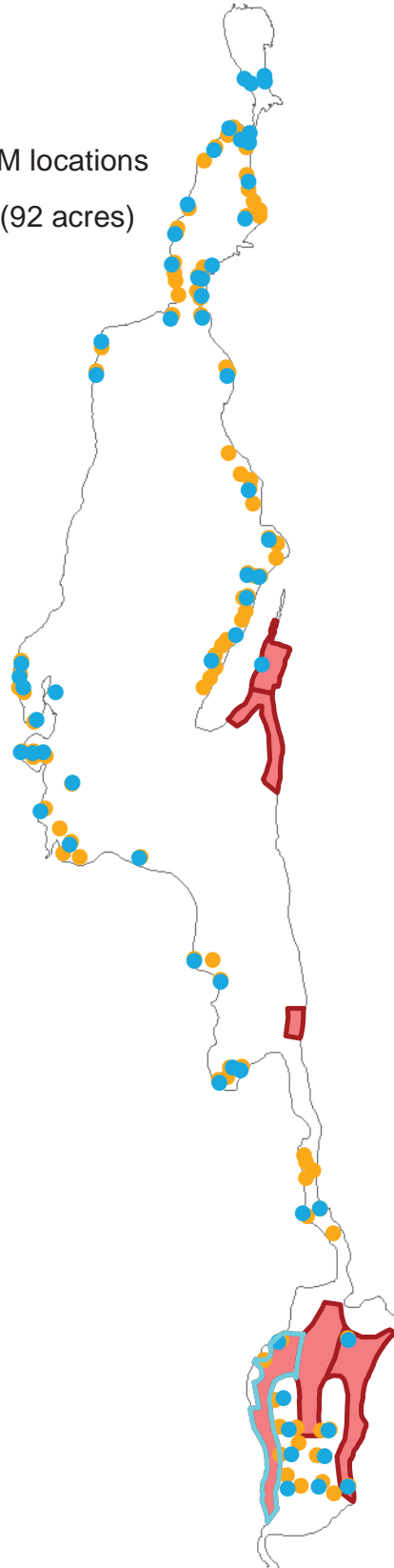
**Lake St. Catherine**



Map Date: 10/26/2021  
Prepared by: AM  
Office: Shrewsbury, MA

## Legend

- Littoral zone EWM locations
- Pre-established survey point EWM locations
- 2021 Herbicide Treatment Areas (92 acres)



**Lake St. Catherine**  
Wells / Poultney, VT  
Rutland County  
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## Lake St. Catherine

0 3,500 7,000  
1:37,000 Feet



Map Date: 11/03/2021  
Prepared by: AM  
Office: SHREWSBURY, MA