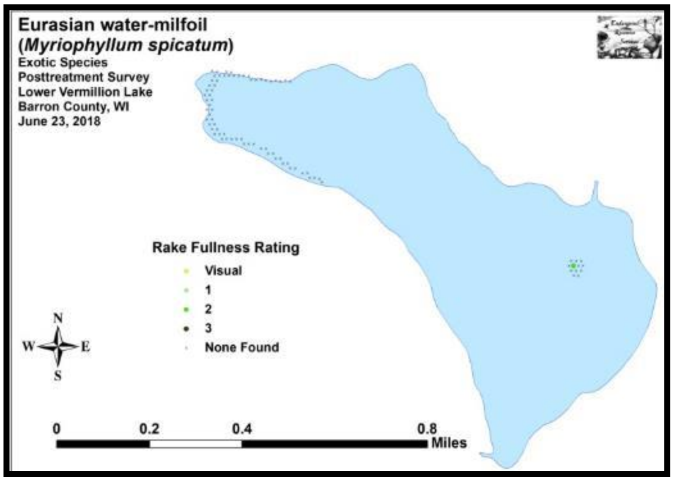
Eurasian water-milfoil (*Myriophyllum spicatum*) and Curly-leaf pondweed (*Potamogeton crispus*)
Pre/Posttreatment Surveys
Lower Vermillion Lake – WBIC: 2098200
Barron County, Wisconsin



2018 EWM Posttreatment Distribution Lower Vermillion Lake

Eurasian water milfoil (Berg 2007)

Project Initiated by:

Vermillion Lakes Association, Wisconsin Department of Natural Resources and Lake Education and Planning Services, LLC (WDNR Grant ACEI20518)

2018 CLP/EWM treatment areas

Surveys Conducted by and Report Prepared by:

Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin
June 4 and June 23, 2018

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INTRODUCTION:

Lower Vermillion Lake (WBIC 2098200) is a 215 acres stratified drainage lake in northwestern Barron County, Wisconsin in the Town of Cumberland (T35N R13W S22 SW NE). It reaches a maximum depth of 55 feet in the central basin and has an average depth of approximately 25ft (Busch et al 1967). The lake is mesotrophic in nature, and, from 2000-2018, water clarity has been fair to good with summer Secchi readings ranging from 6-12ft and averaging 9.0ft (WDNR 2018). This clarity produced a littoral zone that reached approximately 11ft in 2018. Bottom substrates along the north, south, and southeastern shorelines are primarily rock and sand, while most of the east bay and main basin are organic muck or sandy muck.

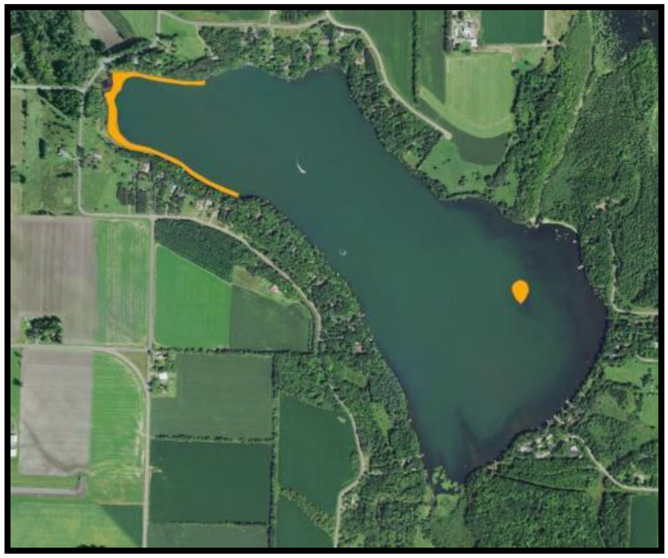


Figure 1: Aerial of 2018 EWM/CLP Treatment Areas

BACKGROUND AND STUDY RATIONALE:

In 2008, the Wisconsin Department of Natural Resources (WDNR) confirmed the presence of Eurasian Water-milfoil (EWM) (*Myriophyllum spicatum*) in Lower Vermillion Lake, and the Vermillion Lakes Association (VLA) has been actively working to control this invasive exotic species ever since. Following the 2017 fall EWM bed mapping survey that found scattered patches of EWM throughout the northwest bay near the boat landing and a small but dense canopied bed in the east bay, the VLA, under the direction of D. Blumer - Lake Education and Planning Services, LLC (LEAPS) and in accordance with their WDNR approved Aquatic Plant Management Plan, decided to chemically treat two areas totaling 4.54 acres (2.11% of the lake's total surface area) in 2018. The majority of these areas were simultaneously treated for Curly-leaf pondweed (*Potamogeton crispus*) – another exotic invasive species that is locally abundant early in the growing season (Figure 1).

On June 4th, we conducted a pretreatment survey to gather baseline data from the scheduled treatment areas and to allow LEAPS and the VLA to finalize treatment plans. Following the herbicide application that occurred later that same day, we conducted a June 23rd posttreatment survey to evaluate the effectiveness of the treatment. This report is the summary analysis of these two field surveys.

METHODS:

Pre/Post Herbicide Survey:

LEAPS provided treatment area shapefiles, and we generated pre/post survey points based on the size and shape of the proposed treatment areas. The 80 point sampling grid at 17m resolution approximated to 17 pts/acre. Although this was almost double the 4-10 pts/acre required by WDNR protocol for pre/post treatment surveys, the high number of points was requested due to the narrowness of the treatment area and the difficulty in getting enough points in the target depths (Appendix I).

These points were uploaded to a handheld mapping GPS (Garmin 76CSx) and located on the lake. At each point, we recorded the depth and bottom substrate and used a rake to sample an approximately 2.5ft section of the bottom. CLP was assigned a rake fullness value of 1-3 as an estimation of abundance (Figure 2). We also recorded visual sightings of CLP within six feet of the sample point. Because visual sightings are not calculated into the pre/post statistical formulas, we only assigned a rake fullness value for non-CLP plants. A cumulative rake fullness value was also noted.

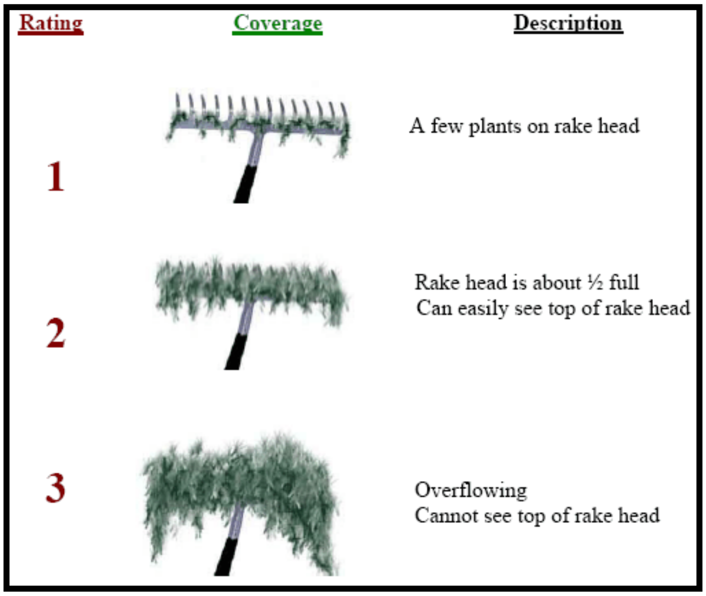


Figure 2: Rake Fullness Ratings

We entered all data collected into the standard APM spreadsheet (Appendix II) (UWEX 2010). Data was analyzed using the linked statistical summary sheet and the WDNR pre/post analysis worksheet (UWEX 2010). For pre/post differences of individual plant species as well as count data, we used the Chi-square analysis on the WDNR pre/post survey worksheet. For comparing averages (mean species/point and mean rake fullness/point), we used t-tests. Differences were determined to be significant at $p < .05$, moderately significant at $p < .01$ and highly significant at $p < .001$.

RESULTS AND DISCUSSION:

Finalization of Treatment Areas:

Initial expectations were to treat two areas totaling 4.54 acres (Table 1). Although Eurasian water-milfoil was only found in the rake at a single point during the pretreatment survey, scattered plants were observed throughout both proposed treatment areas. Because of this, it was decided to continue with the initial EWM treatment as planned. However, Curly-leaf pondweed was largely absent from the sand/gravel shorelines found in the northeastern and southeastern lobes of Area 1 (3.87 acres) - a narrow horseshoe-shaped polygon that wrapped around the northwest shoreline. Because of this, although liquid 2,4-D was used throughout, liquid Endothall was only applied in Areas 1A and 1B within this larger treatment polygon. On the lake's east side where chemical dispersal was a concern, both granular 2,4-D and granular Endothall were used in an attempt to get satisfactory results within Area 2 – a small bed (0.67 acres) located next to a sharp drop-off into the lake's deep central basin (Figure 3) (Appendix I). The treatment was conducted by Northern Aquatic Services (Dresser, WI) on June 4th. The reported water temperature at the time of treatment was 66°F, while the air temp was 75°F. Winds were out of the west at 3-6mph.

Table 1: EWM/CLP Treatment Summary
Lower Vermillion Lake – June 4, 2018

Area	Total Acreage	Chemical (Brand), Rate, and Total lbs/gal
1	3.87	2,4-D (Shredder Amine 4) – 3ppm – 41.2 gallons
1A	(.56)	Aquathol K (Endothall) – 2ppm – 3.7 gallons
1B	(1.42)	Aquathol K (Endothall) – 2ppm – 7.6 gallons
2	0.67	2,4-D (Sculpin G) – 4ppm – 350.5lbs Aquathol Super K (Endothall) – 2ppm – 47.2 lbs
Total Acres	**4.54**	

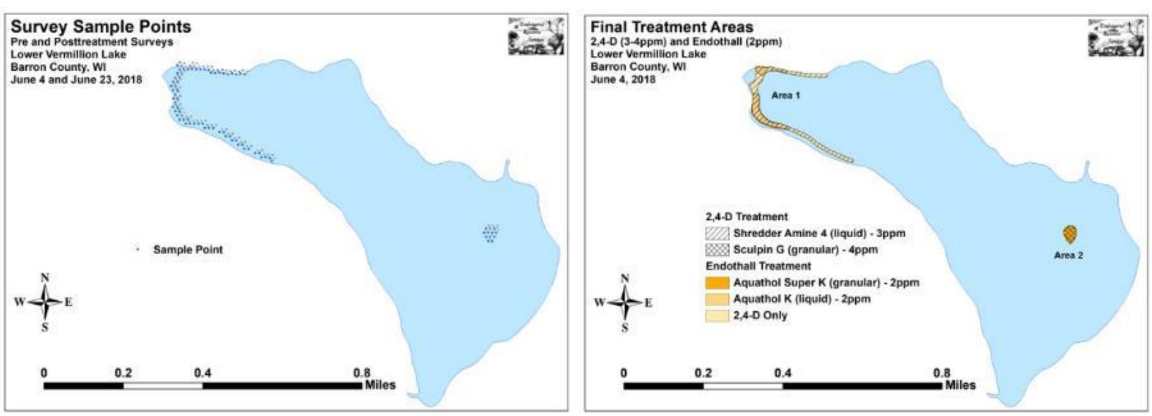


Figure 3: 2018 Survey Sample Points and Final Treatment Areas

Pre/Post Herbicide Survey:

All points occurred in areas between 1.0ft and 14.0ft of water. The mean depth for all plants was 4.9ft during the pretreatment survey before declining slightly to 4.5ft posttreatment; however, the median depth was unchanged at 4.0ft for both (Table 2). Most Eurasian water-milfoil was established over sand and gravel, while Curly-leaf pondweed reached its highest densities over areas with at least some organic muck (Figure 4) (Appendix III).

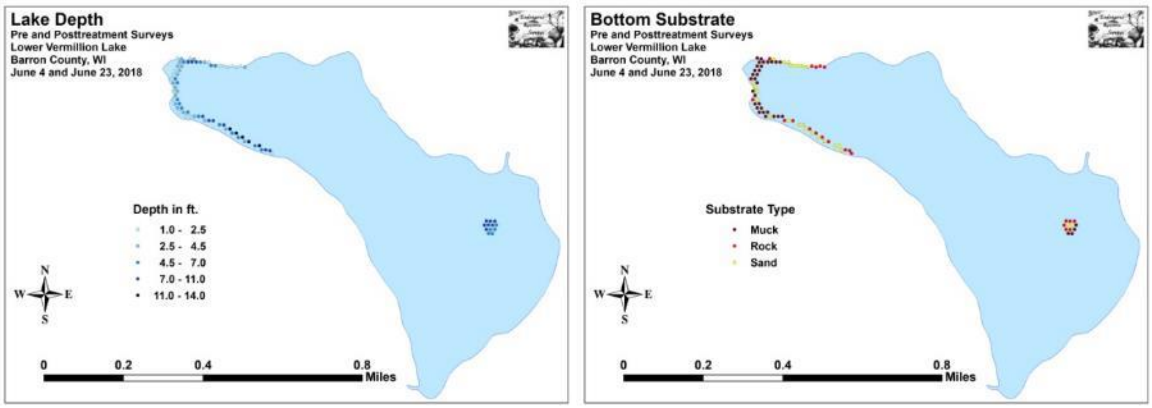


Figure 4: Treatment Area Depths and Bottom Substrate

The littoral zone was essentially unchanged at 11.0ft pretreatment and 10.5ft posttreatment. Within this zone, plants covered the majority of the bottom during both surveys as the frequency of occurrence was 92.0% pre and 90.3% posttreatment (Figure 5) (Appendix IV).

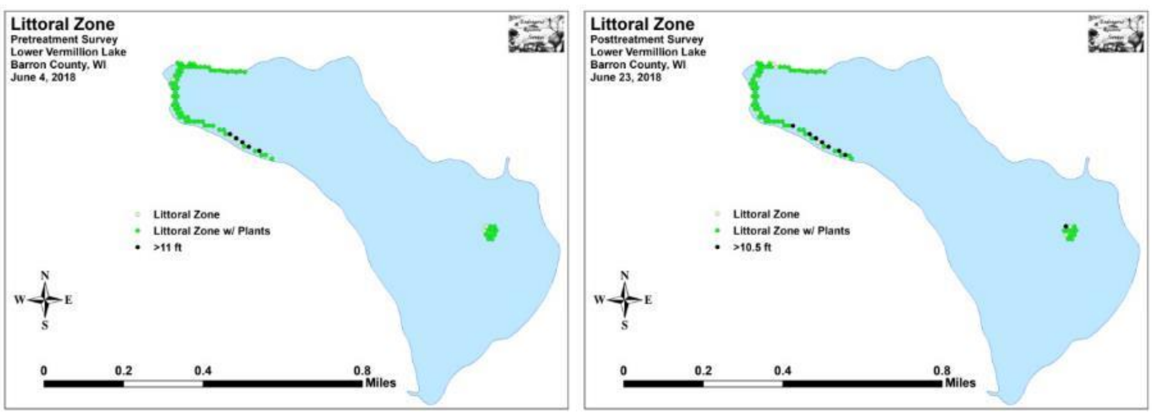


Figure 5: Pre/Posttreatment Littoral Zone

Diversity within the beds was high with a Simpson Index value of 0.88 during both surveys. The Floristic Quality Index, another measure of only native species, increased sharply from 23.3 pretreatment to 29.2 posttreatment. Total richness also increased slightly from 18 species pretreatment to 20 species posttreatment. However, the mean native species richness at sites with native vegetation experienced a non-significant decline (p=0.23) from 2.15 species/site pretreatment to 2.00 species/site posttreatment (Figure 6). Total rake fullness increased slightly from a low/moderate 1.49 pretreatment to 1.52 posttreatment (Figure 7), but this wasn't significant either (p=0.40) (Appendix IV).

Table 2: Pre/Posttreatment Surveys Summary Statistics
Lower Vermillion Lake, Barron County
June 4 and June 23, 2018

Summary Statistics:	Pre	Post
Total number of points sampled	80	80
Total number of sites with vegetation	69	65
Total number of sites shallower than the maximum depth of plants	75	72
Freq. of occur. at sites shallower than max. depth of plants (in percent)	92.0	90.3
Simpson Diversity Index	0.88	0.88
Mean Coefficient of Conservatism	5.8	5.9
Floristic Quality Index	23.3	29.2
Maximum depth of plants (ft)	11.0	10.5
Mean depth of plants (ft)	4.9	4.6
Median depth of plants (ft)	4.0	4.0
Average number of all species per site (shallower than max depth)	2.24	1.83
Average number of all species per site (veg. sites only)	2.43	2.03
Average number of native species per site (shallower than max depth)	1.95	1.78
Average number of native species per site (sites with native veg. only)	2.15	2.00
Species Richness	18	20
Mean Rake Fullness (veg. sites only)	1.49	1.52

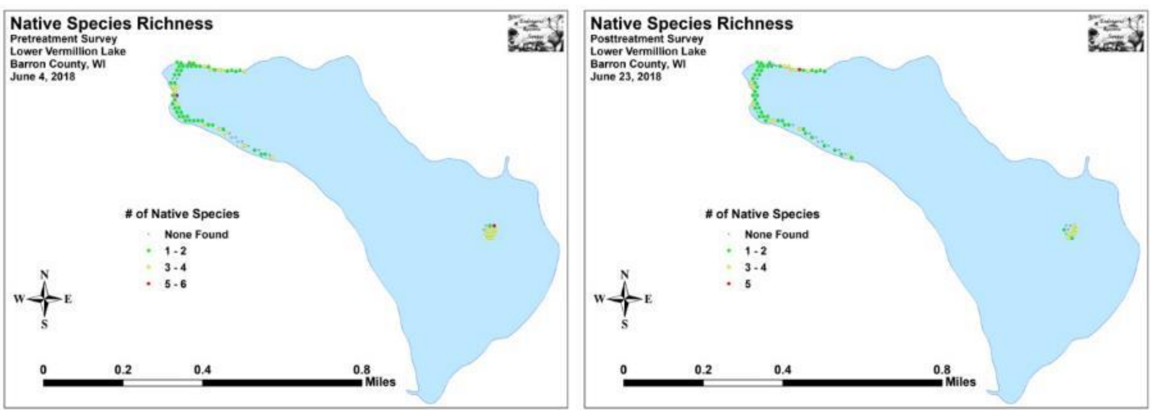


Figure 6: Pre/Posttreatment Native Species Richness

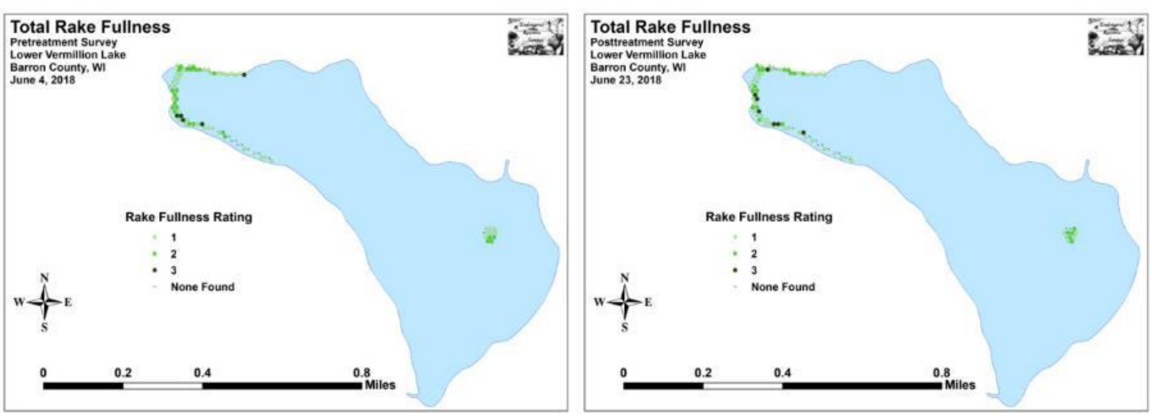


Figure 7: Pre/Posttreatment Total Rake Fullness

We found Eurasian water-milfoil at a single point with a rake fullness of 1 during the pretreatment survey. Despite this, we did note plants as visuals at 13 points and also found them inter-point in both treatment areas. During the posttreatment survey, we again located EWM at a single point in the eastern bay. Although this large plant was chemically burned, it showed significant regrowth, and we rated it a 2. Elsewhere, we saw almost no evidence of EWM (Figure 8) (Appendix V). Statistically, our findings suggested there was no significant change in EWM distribution; however, the decline in visual sightings within the treatment areas was highly significant (Figure 9).

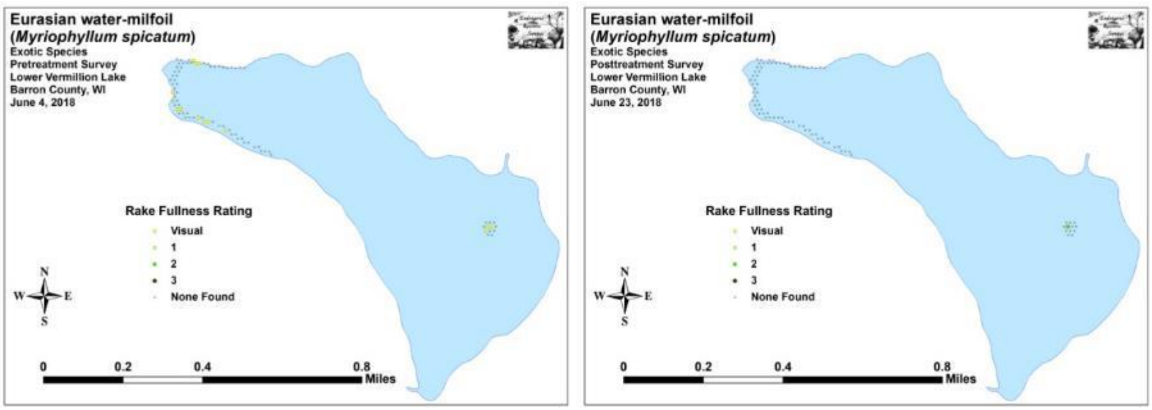
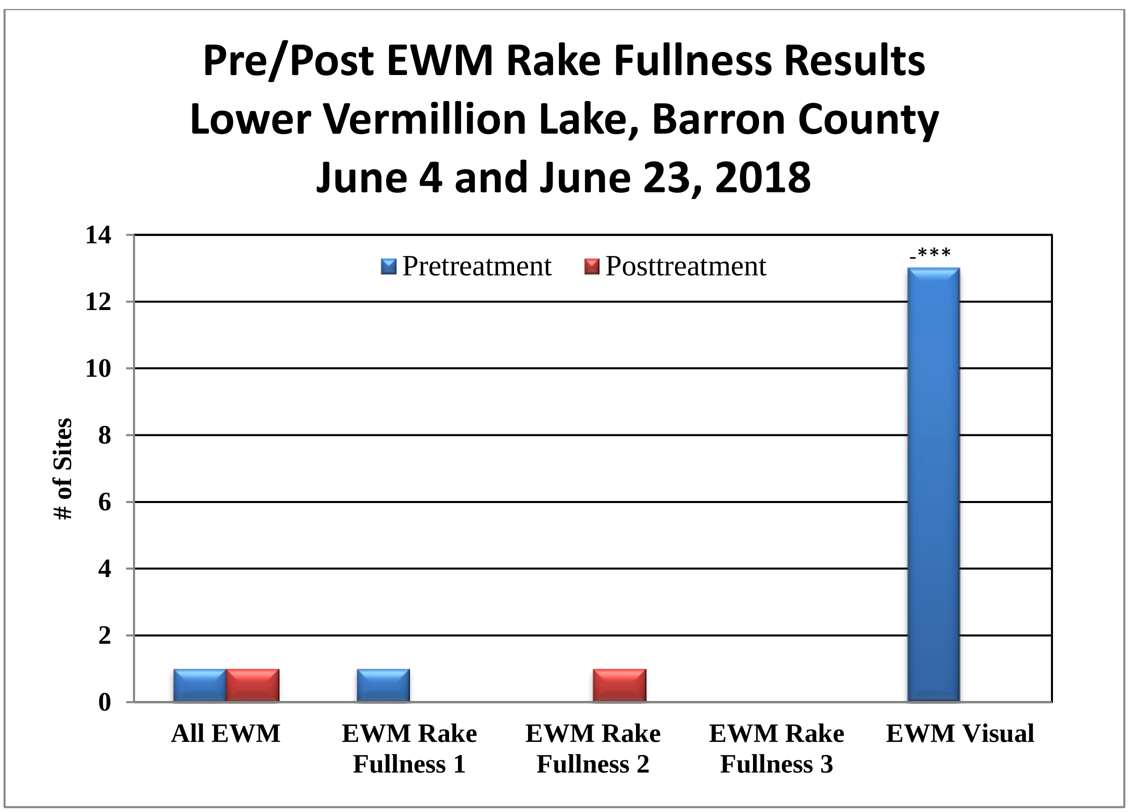


Figure 8: Pre/Posttreatment EWM Density and Distribution



Significant differences = * $p < .05$, ** $p < .01$, *** $p < .001$

Figure 9: Pre/Posttreatment Changes in EWM Rake Fullness

Curly-leaf pondweed was present at 21 of 80 sites during the pretreatment survey (26.3% coverage) with 16 additional visual sightings (Figure 10). Of these, four had a rake fullness rating of 3, nine rated a 2, and the remaining eight were a 1. This produced a mean rake fullness of 1.81 and suggested that 16.3% of the treatment areas had a significant infestation (rake fullness 2 or 3). During the posttreatment survey, we found CLP at just three points (3.8% coverage) with one point rating a 2 and the other two rating a 1 (mean rake fullness of 1.33) (Appendix V). **Our results demonstrated a highly significant decline in total CLP distribution and visual sightings; a moderately significant reduction in rake fullness 2; and a significant decline in rake fullness 3** (Figure 11).

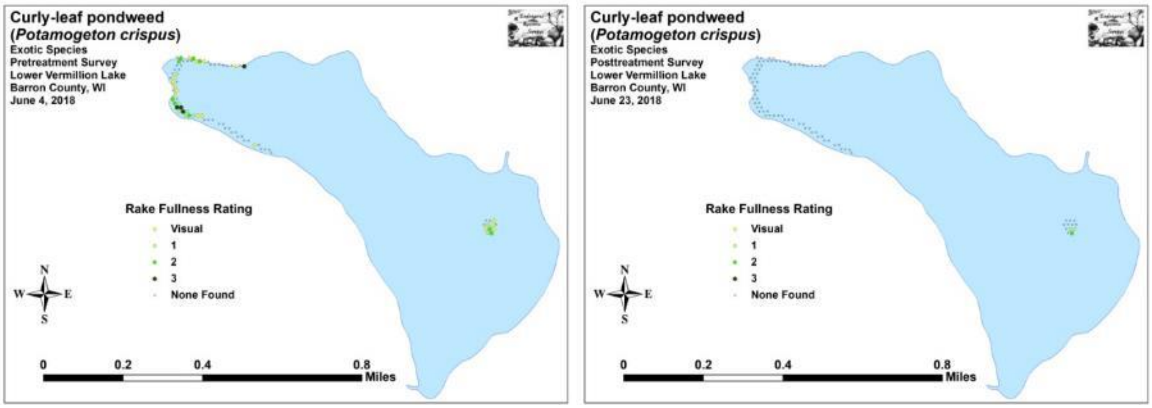
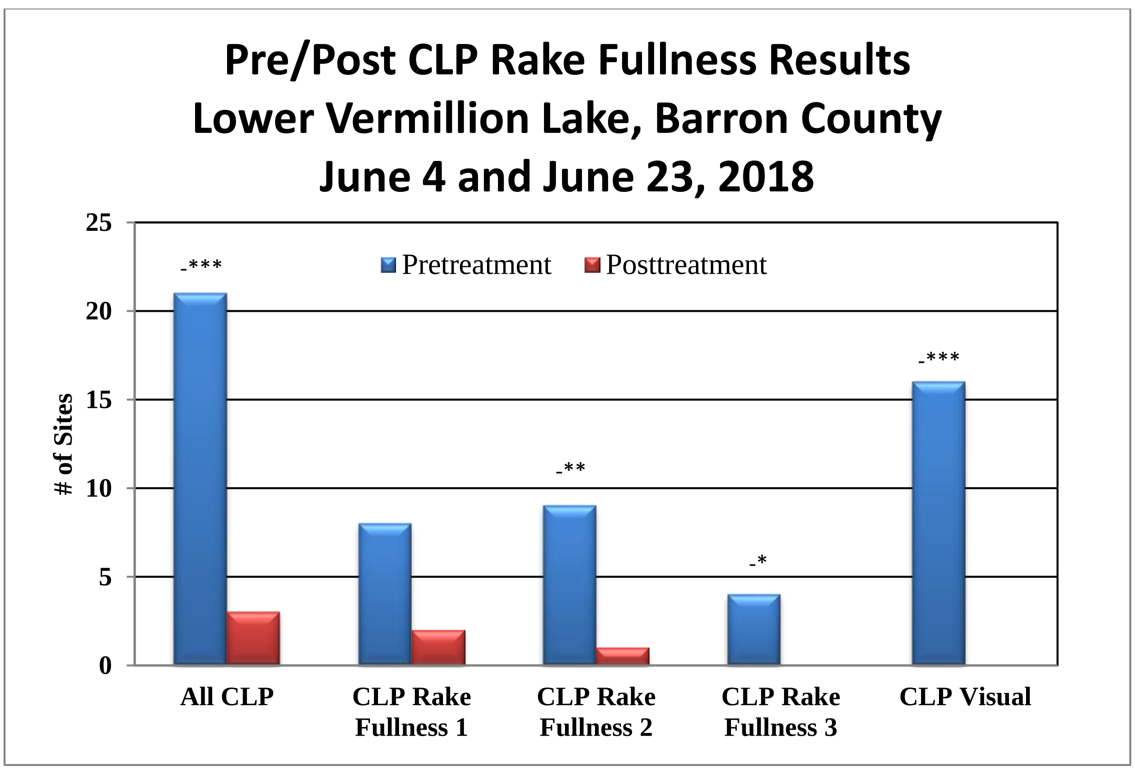


Figure 10: Pre/Posttreatment CLP Density and Distribution



Significant differences = * *p* < .05, ** *p* < .01, * *p* < .001**

Figure 11: Pre/Posttreatment Changes in CLP Rake Fullness

We found Coontail (*Ceratophyllum demersum*) and Flat-stem pondweed (*Potamogeton zosteriformis*) were the two most common native species in both the pre and posttreatment surveys (Tables 3 and 4). Present at 40 sites during the pretreatment survey, Coontail experience a non-significant decline in distribution to 36 sites posttreatment. It also saw a non-significant increase in mean rake fullness from 1.38 pre to 1.42 post (Figure 12).

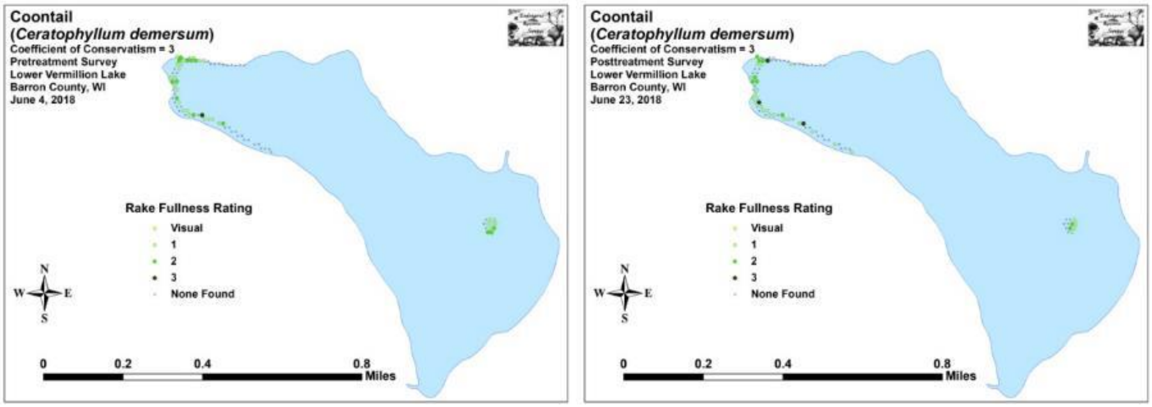


Figure 12: Pre/Post Coontail Density and Distribution

Flat-stem pondweed was present at 28 sites with a mean rake fullness of 1.11 during the pretreatment survey (Figure 13). Posttreatment, we found it at just 15 sites with a mean rake fullness of 1.00. This significant decline in both distribution **(*p*=0.02)** and density **(*p*=0.04)** is potentially tied to this species sensitivity to Endothall.

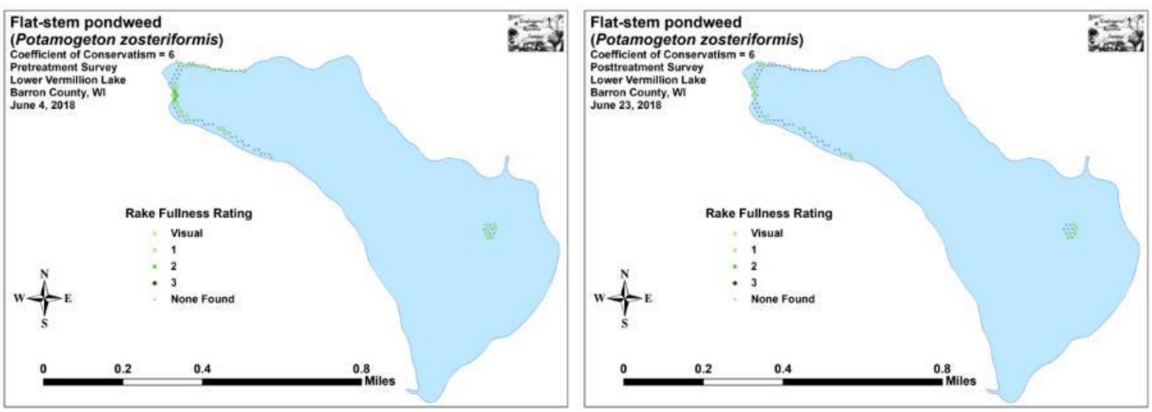


Figure 13: Pre/Post Flat-stem Pondweed Density and Distribution

No other species showed a significant decline in distribution posttreatment, although Northern water-milfoil (*Myriophyllum sibiricum*) and Small pondweed (*Potamogeton pusillus*) both declined sharply and were near significant (*p*=0.11/*p*=0.051). Wild celery (*Vallisneria americana*), a late-growing species, demonstrated the only significant increase in distribution posttreatment (Figure 14) (Maps for all native species from the pre and posttreatment surveys can be found in Appendixes VI and VII).

Table 3: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Pretreatment Survey Lower Vermillion Lake, Barron County
June 4, 2018

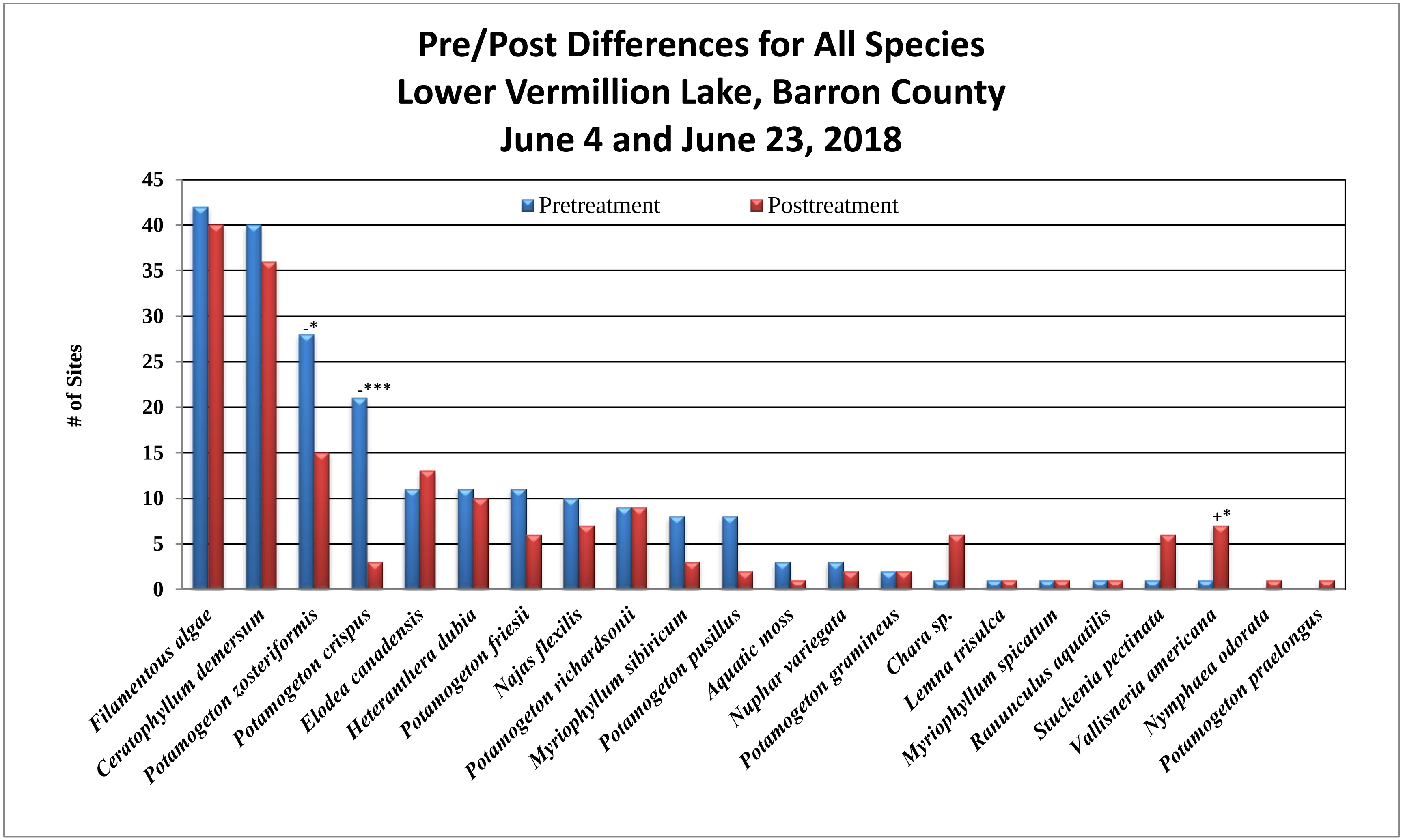
Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
	Filamentous algae	42	*	60.87	56.00	1.10	0
Ceratophyllum demersum	Coontail	40	23.81	57.97	53.33	1.38	0
Potamogeton zosteriformis	Flat-stem pondweed	28	16.67	40.58	37.33	1.11	0
Potamogeton crispus	Curly-leaf pondweed	21	12.50	30.43	28.00	1.81	16
Elodea canadensis	Common waterweed	11	6.55	15.94	14.67	1.18	0
Heteranthera dubia	Water star-grass	11	6.55	15.94	14.67	1.18	0
Potamogeton friesii	Fries' pondweed	11	6.55	15.94	14.67	1.09	0
Najas flexilis	Slender naiad	10	5.95	14.49	13.33	1.00	0
Potamogeton richardsonii	Clasping-leaf pondweed	9	5.36	13.04	12.00	1.00	0
Myriophyllum sibiricum	Northern water-milfoil	8	4.76	11.59	10.67	1.13	0
Potamogeton pusillus	Small pondweed	8	4.76	11.59	10.67	1.00	0
Nuphar variegata	Spatterdock	3	1.79	4.35	4.00	1.00	0
	Aquatic moss	3	*	4.35	4.00	1.67	0
Potamogeton gramineus	Variable pondweed	2	1.19	2.90	2.67	1.00	0
Chara sp.	Muskgrass	1	0.60	1.45	1.33	1.00	0
Lemna trisulca	Forked duckweed	1	0.60	1.45	1.33	1.00	0
Myriophyllum spicatum	Eurasian water-milfoil	1	0.60	1.45	1.33	1.00	13
Ranunculus aquatilis	White water crowfoot	1	0.60	1.45	1.33	1.00	0
Stuckenia pectinata	Sago pondweed	1	0.60	1.45	1.33	1.00	0
Vallisneria americana	Wild celery	1	0.60	1.45	1.33	1.00	0

* Excluded from Relative Frequency Analysis

Table 4: Frequencies and Mean Rake Sample of Aquatic Macrophytes Posttreatment Survey Lower Vermillion Lake, Barron County June 23, 2018

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
	Filamentous algae	40	*	61.54	55.56	1.63	0
Ceratophyllum demersum	Coontail	36	27.27	55.38	50.00	1.42	0
Potamogeton zosteriformis	Flat-stem pondweed	15	11.36	23.08	20.83	1.00	0
Elodea canadensis	Common waterweed	13	9.85	20.00	18.06	1.85	0
Heteranthera dubia	Water star-grass	10	7.58	15.38	13.89	1.00	0
Potamogeton richardsonii	Clasping-leaf pondweed	9	6.82	13.85	12.50	1.11	0
Najas flexilis	Slender naiad	7	5.30	10.77	9.72	1.43	0
Vallisneria americana	Wild celery	7	5.30	10.77	9.72	1.00	0
Chara sp.	Muskgrass	6	4.55	9.23	8.33	1.33	0
Potamogeton friesii	Fries' pondweed	6	4.55	9.23	8.33	1.33	0
Stuckenia pectinata	Sago pondweed	6	4.55	9.23	8.33	1.17	0
Myriophyllum sibiricum	Northern water-milfoil	3	2.27	4.62	4.17	1.00	0
Potamogeton crispus	Curly-leaf pondweed	3	2.27	4.62	4.17	1.33	0
Nuphar variegata	Spatterdock	2	1.52	3.08	2.78	1.50	0
Potamogeton gramineus	Variable pondweed	2	1.52	3.08	2.78	1.00	0
Potamogeton pusillus	Small pondweed	2	1.52	3.08	2.78	1.00	0
Lemna trisulca	Forked duckweed	1	0.76	1.54	1.39	1.00	0
Myriophyllum spicatum	Eurasian water-milfoil	1	0.76	1.54	1.39	2.00	0
Nymphaea odorata	White water lily	1	0.76	1.54	1.39	1.00	0
Potamogeton praelongus	White-stem pondweed	1	0.76	1.54	1.39	1.00	0
Ranunculus aquatilis	White water crowfoot	1	0.76	1.54	1.39	1.00	0
	Aquatic moss	1	*	1.54	1.39	3.00	0

* Excluded from Relative Frequency Analysis



Significant differences = * *p* < .05, ** *p* < .01, * *p* < .001**

Figure 14: Pre/Posttreatment Macrophyte Changes

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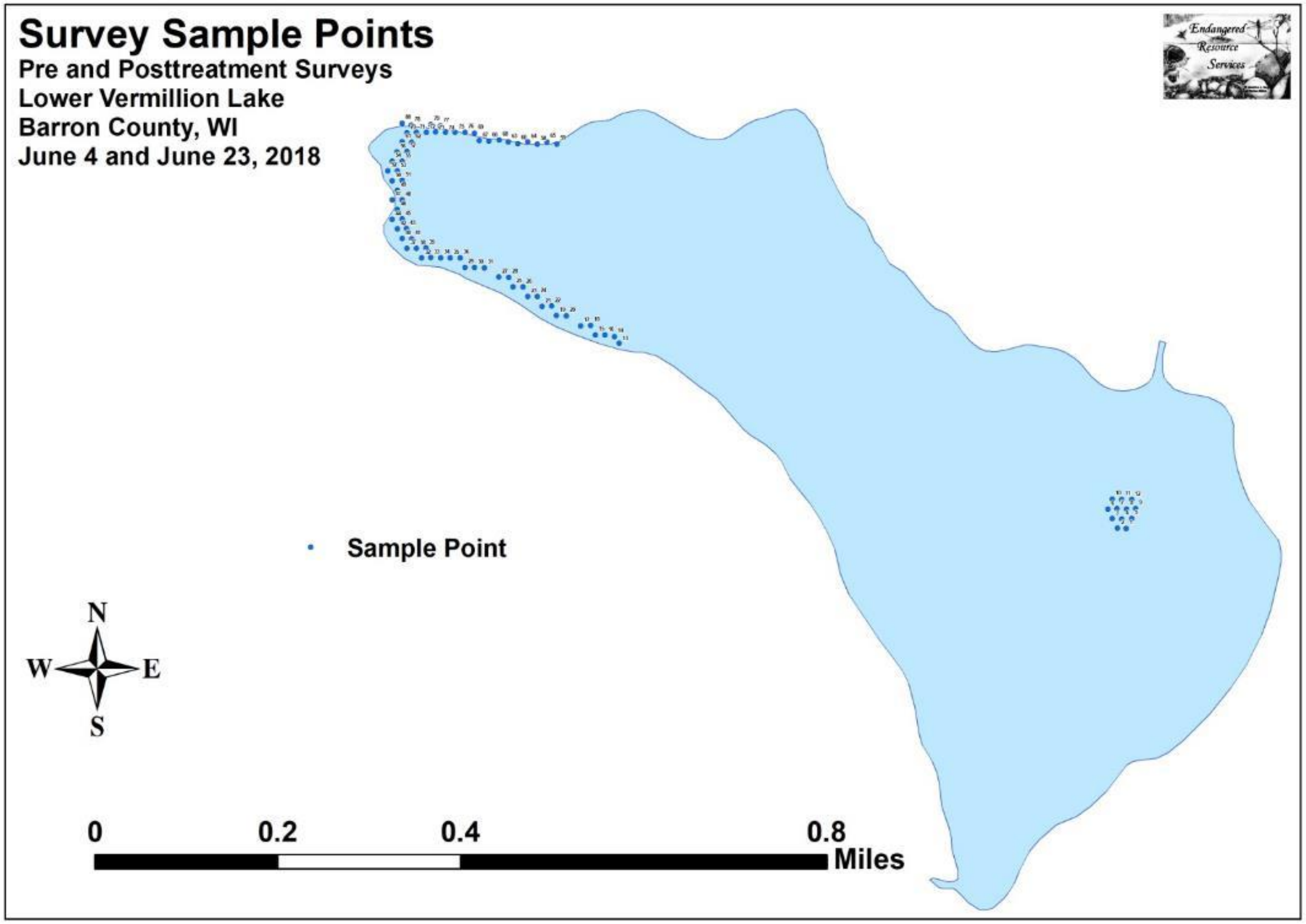
Appendix I: Survey Sample Points and EWM/CLP Treatment Areas


Survey Sample Points
Pre and Posttreatment Surveys
Lower Vermillion Lake
Barron County, WI
June 4 and June 23, 2018
Sample Point
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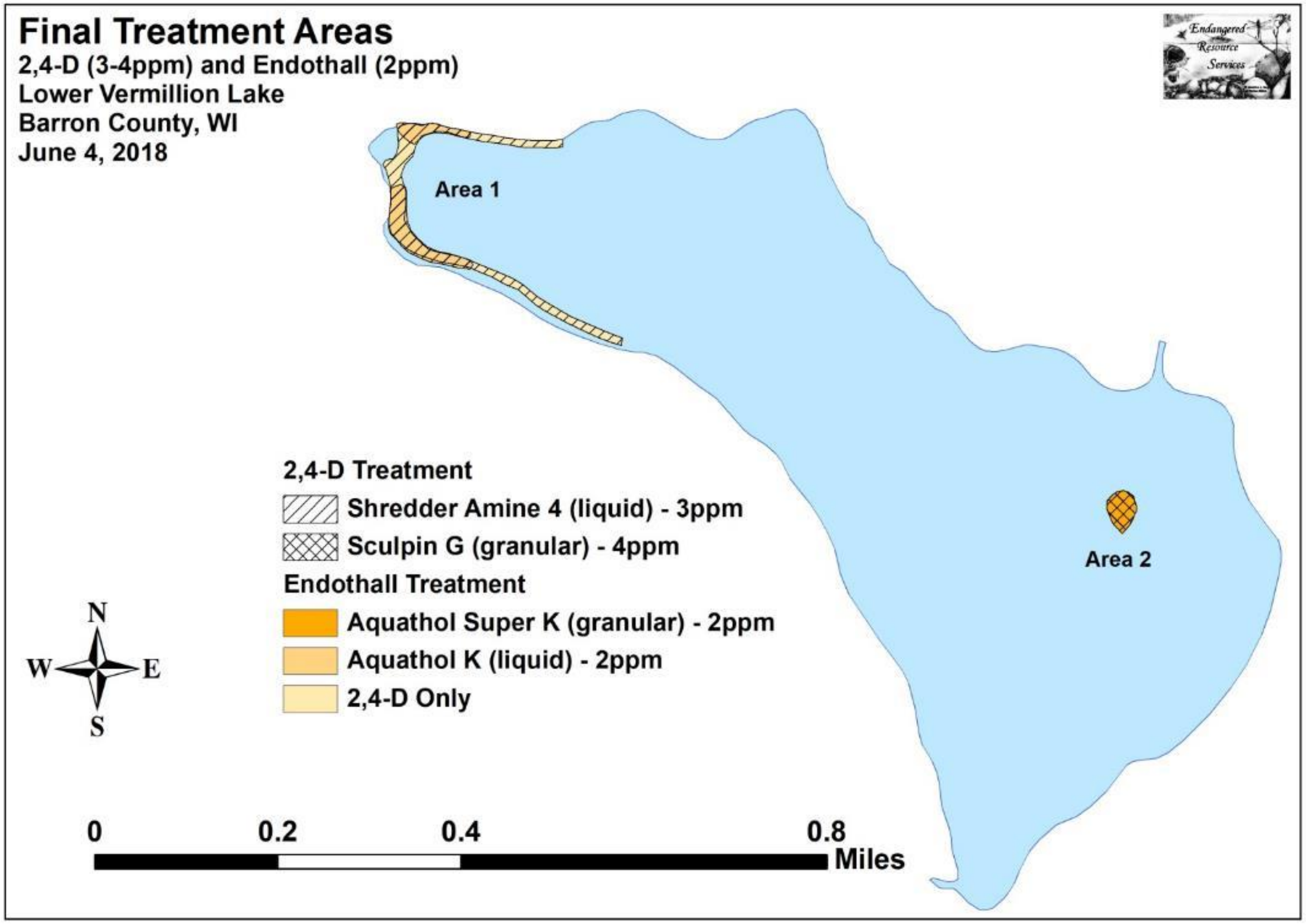
W
E
S
0
0.2
0.4
0.8
Miles
Endangered
Resource
Services


Final Treatment Areas
2,4-D (3-4ppm) and Endothall (2ppm)
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Endangered Resource Services
Area 1
Area 2
2,4-D Treatment
Shredder Amine 4 (liquid) - 3ppm
Sculpin G (granular) - 4ppm
Endothall Treatment
Aquathol Super K (granular) - 2ppm
Aquathol K (liquid) - 2ppm
2,4-D Only
N
W
E
S
0
0.2
0.4
0.8
Miles

Appendix II: Vegetative Survey Datasheet

Observers for this lake: names and hours worked by each:																									
Lake:									**WBIC**									**County**						**Date:**	
Site #	**Depth (ft)**	**Muck (M), Sand (S), Rock (R)**	**Rake pole (P) or rake rope (R)**	**Total Rake Fullness**	**EWM**	**CLP**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
1																									
2																									
3																									
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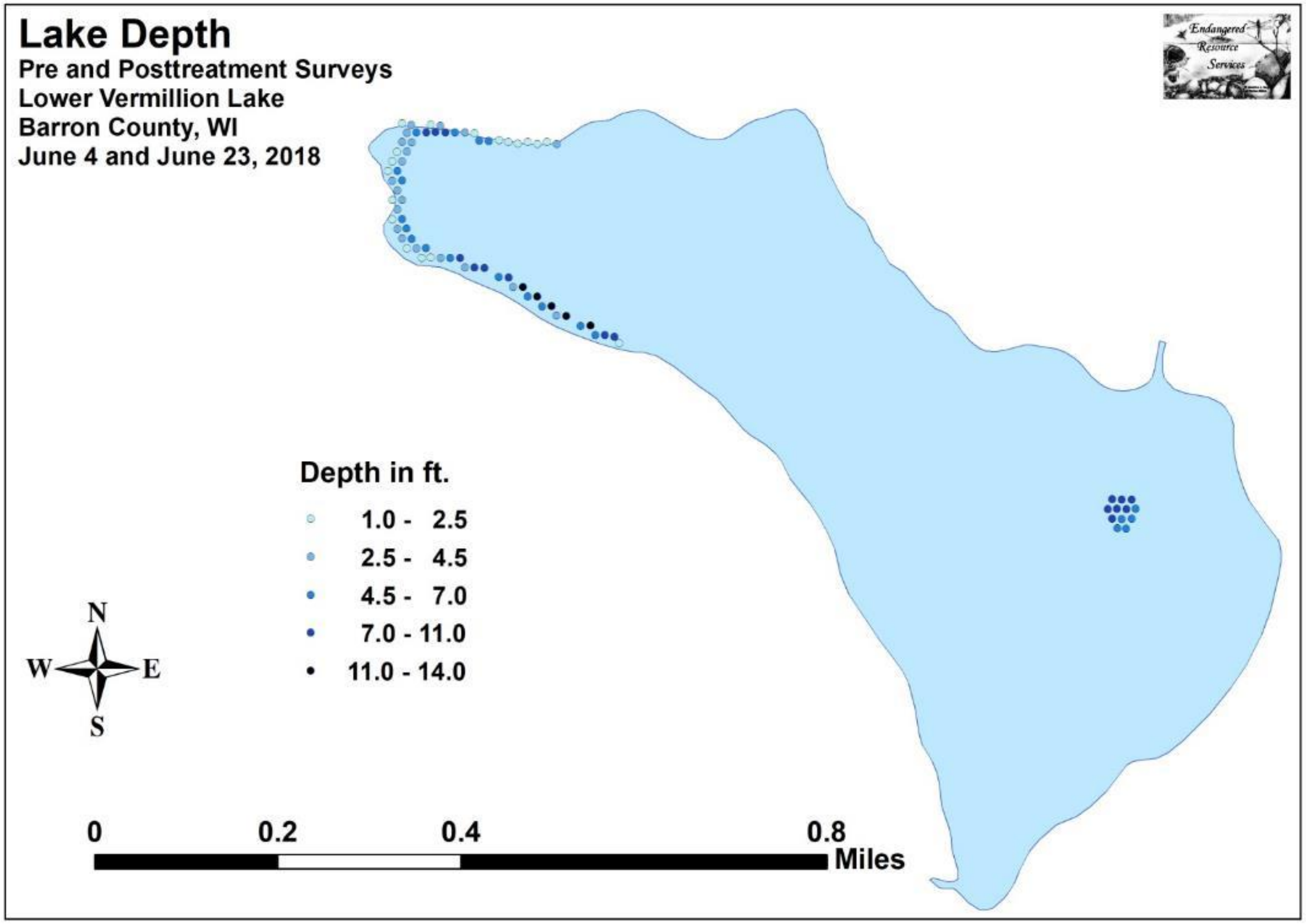
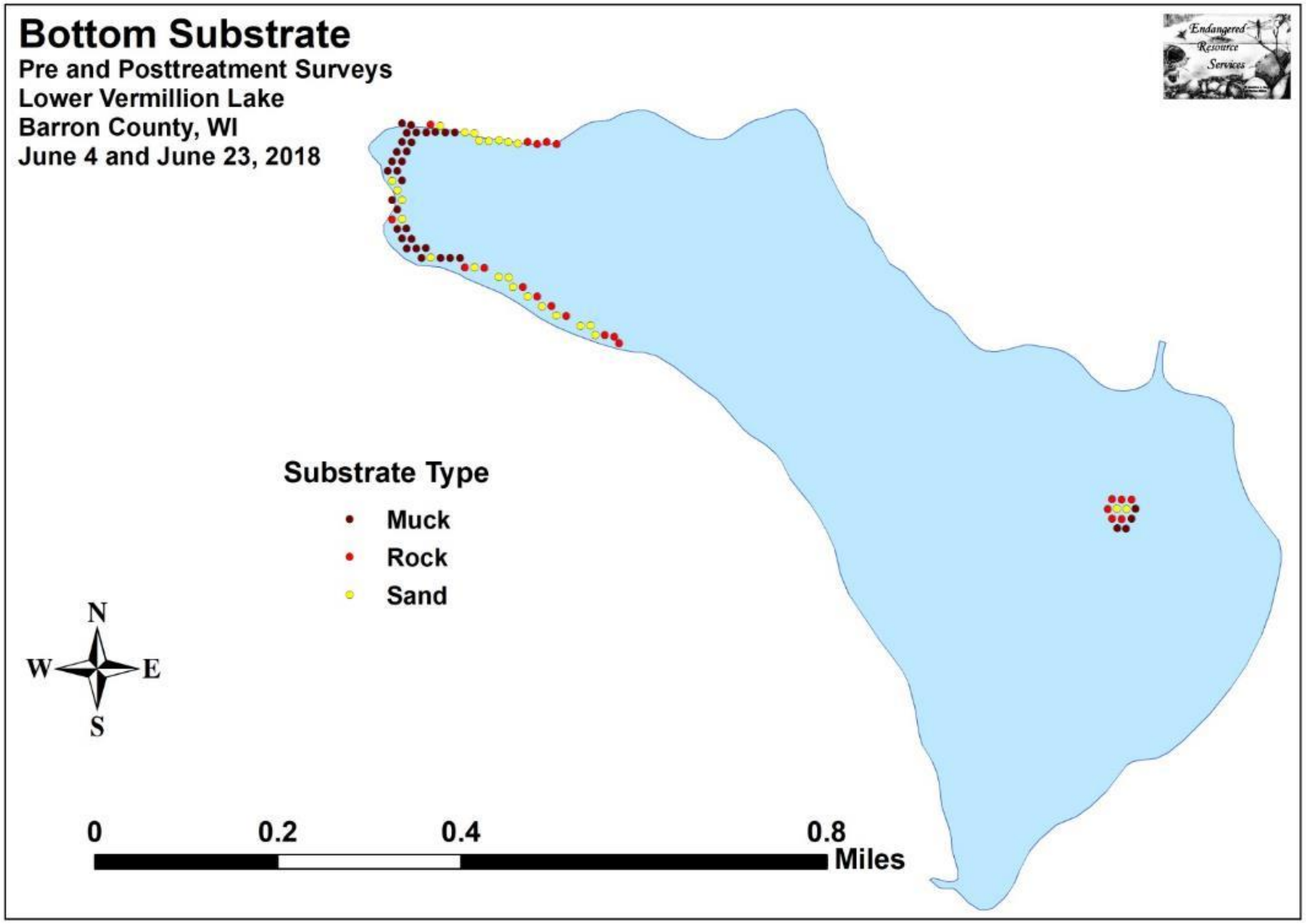
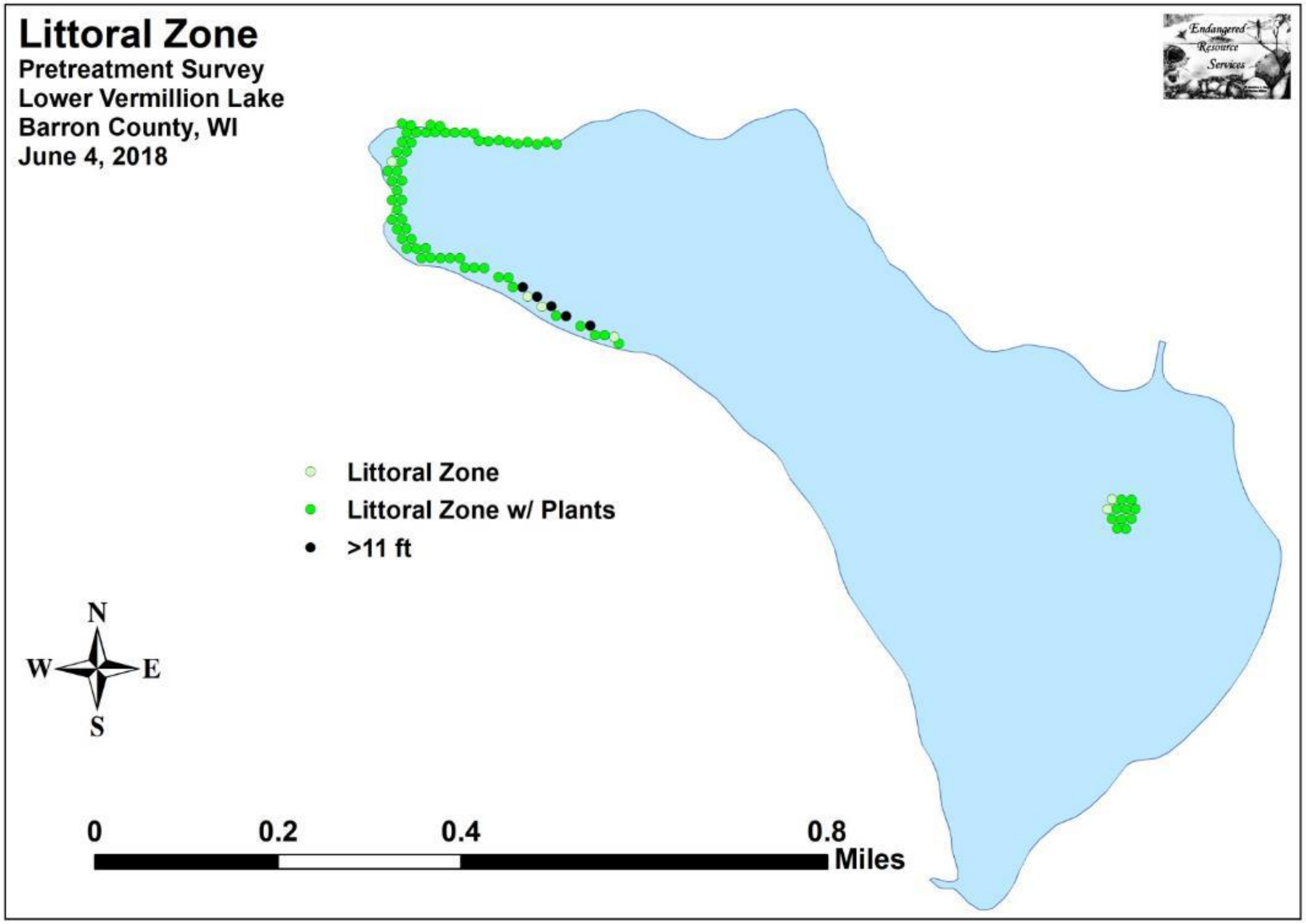
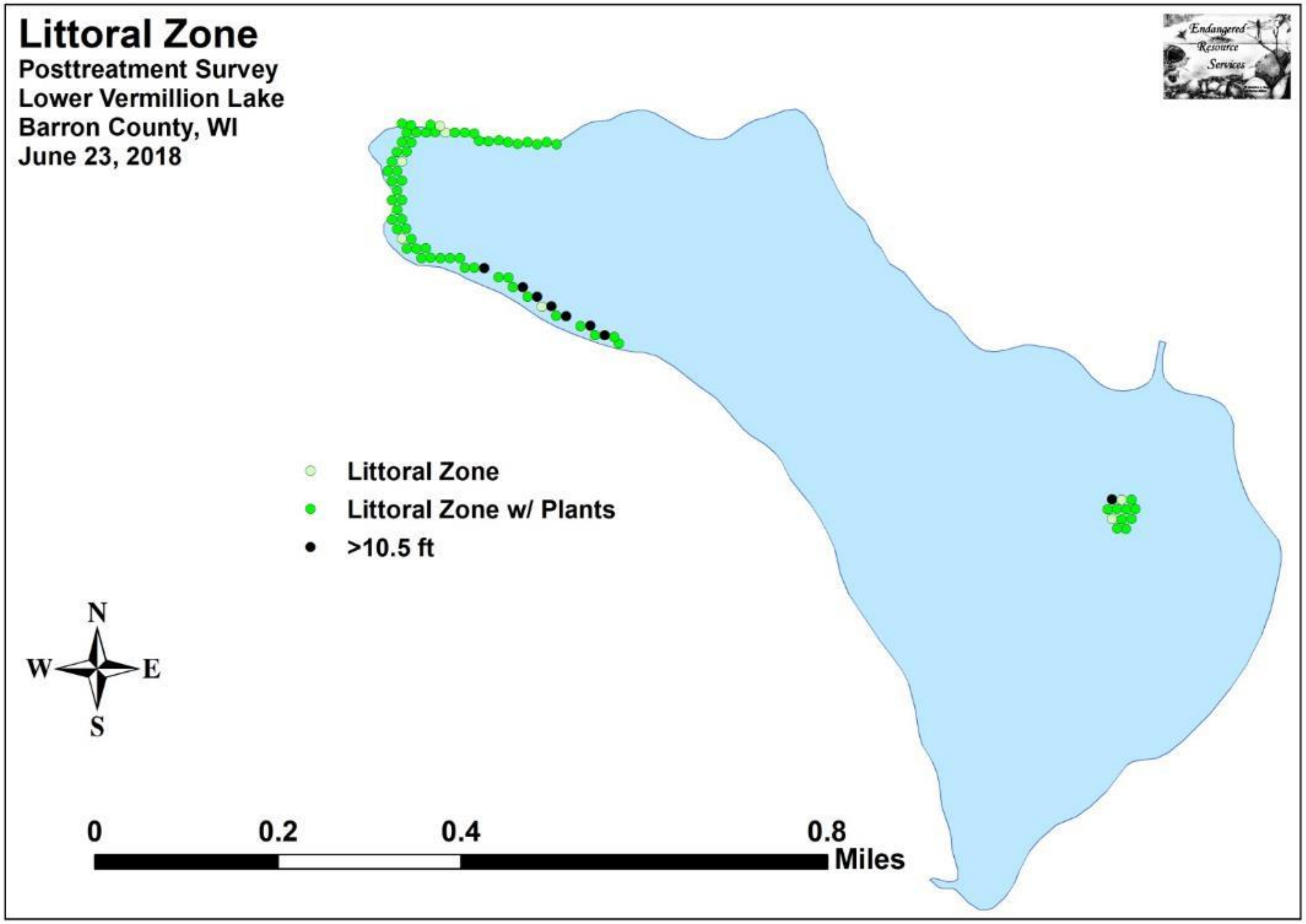
Appendix III: Pre/Post Habitat Variables

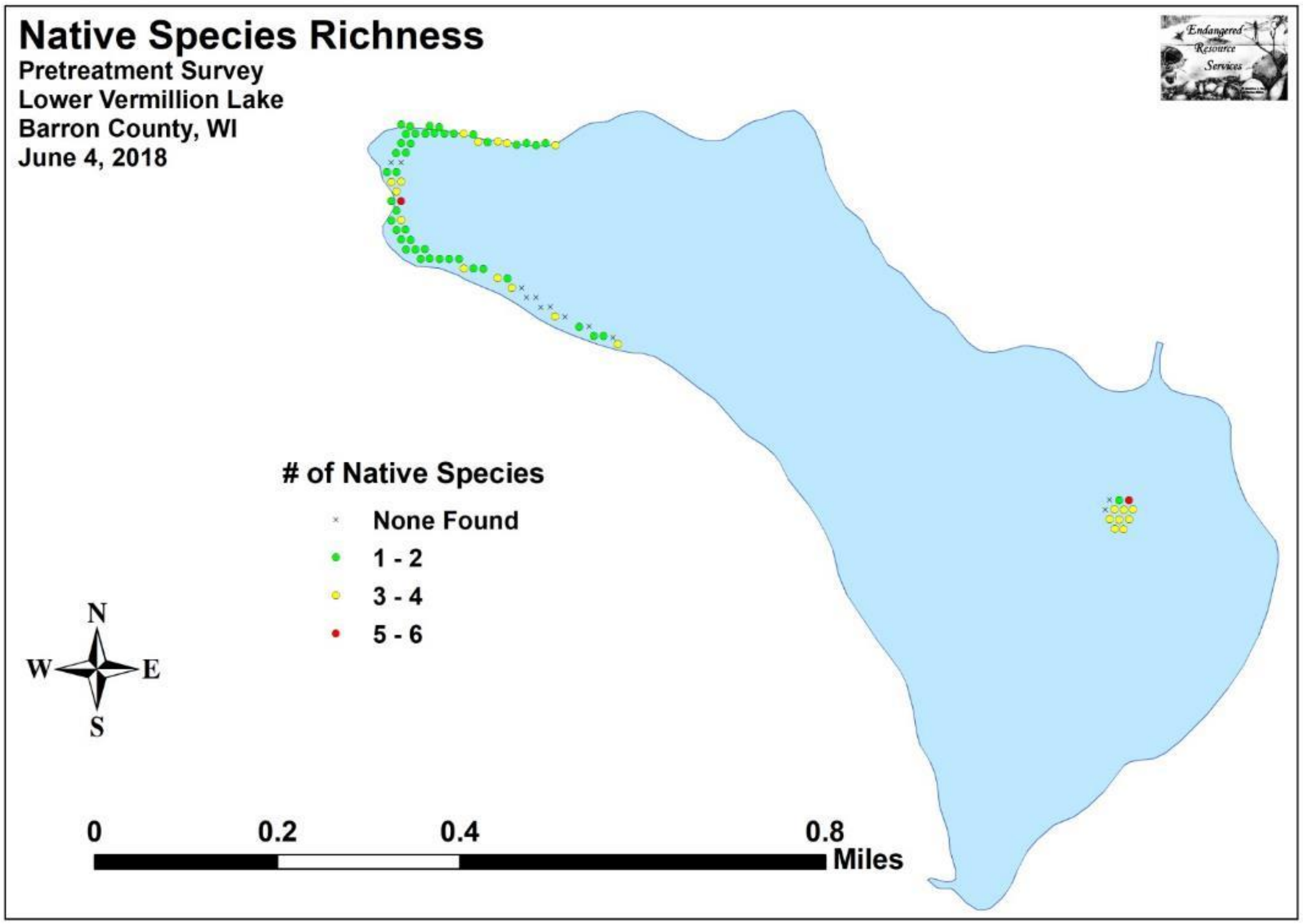

Lake Depth
Pre and Posttreatment Surveys
Lower Vermillion Lake
Barron County, WI
June 4 and June 23, 2018
Depth in ft.
1.0 - 2.5
2.5 - 4.5
4.5 - 7.0
7.0 - 11.0
11.0 - 14.0
N
W
E
S
0
0.2
0.4
0.8
Miles

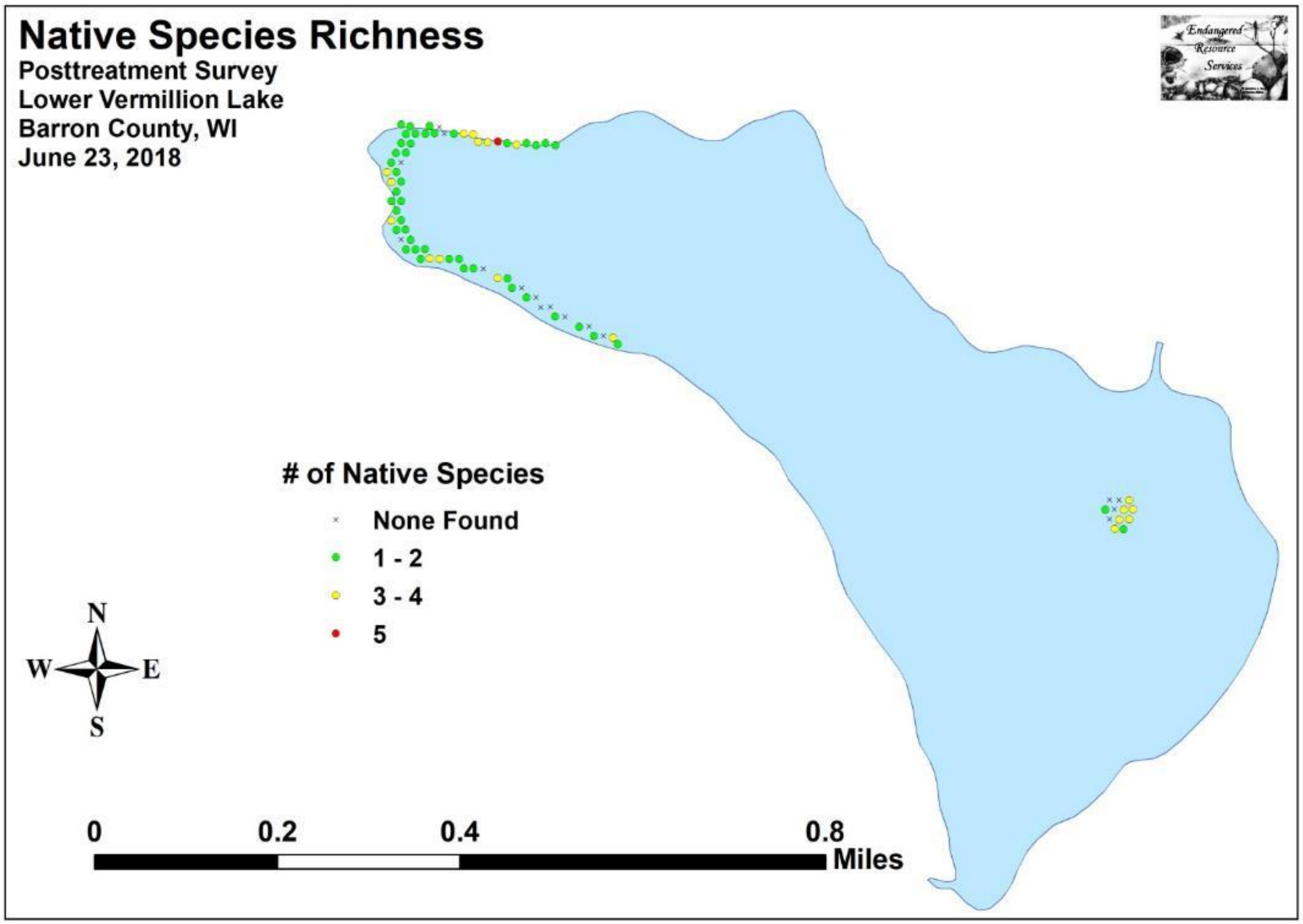

Bottom Substrate
Pre and Posttreatment Surveys
Lower Vermillion Lake
Barron County, WI
June 4 and June 23, 2018
Endangered Resource Services
Substrate Type
Muck
Rock
Sand
N
W
E
S
0
0.2
0.4
0.8
Miles

Appendix IV: Pre/Post Littoral Zone, Native Species Richness and Total Rake Fullness

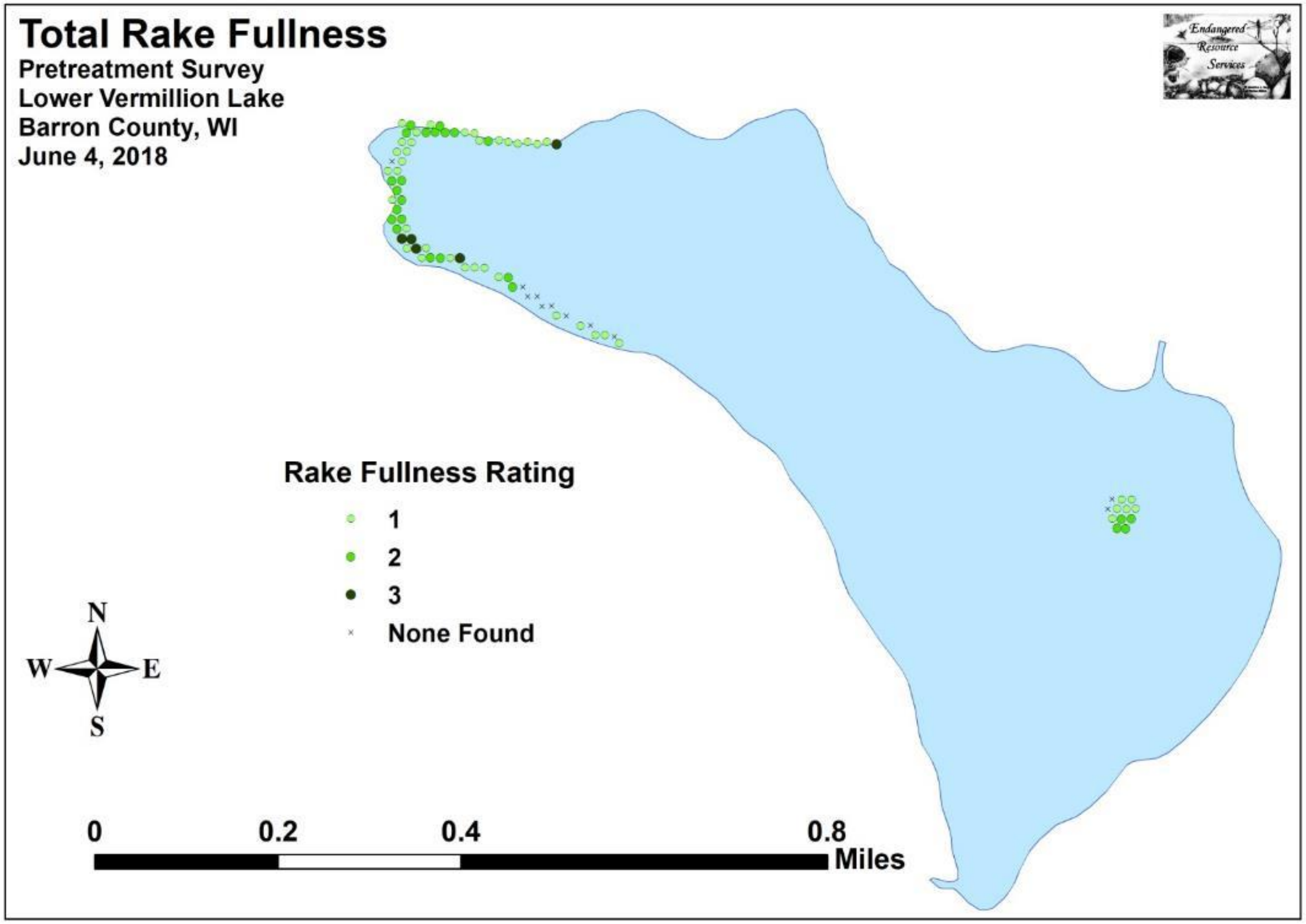

Littoral Zone
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Endangered Resource Services
Littoral Zone
Littoral Zone w/ Plants
>11 ft
N
W
E
S
0
0.2
0.4
0.8
Miles

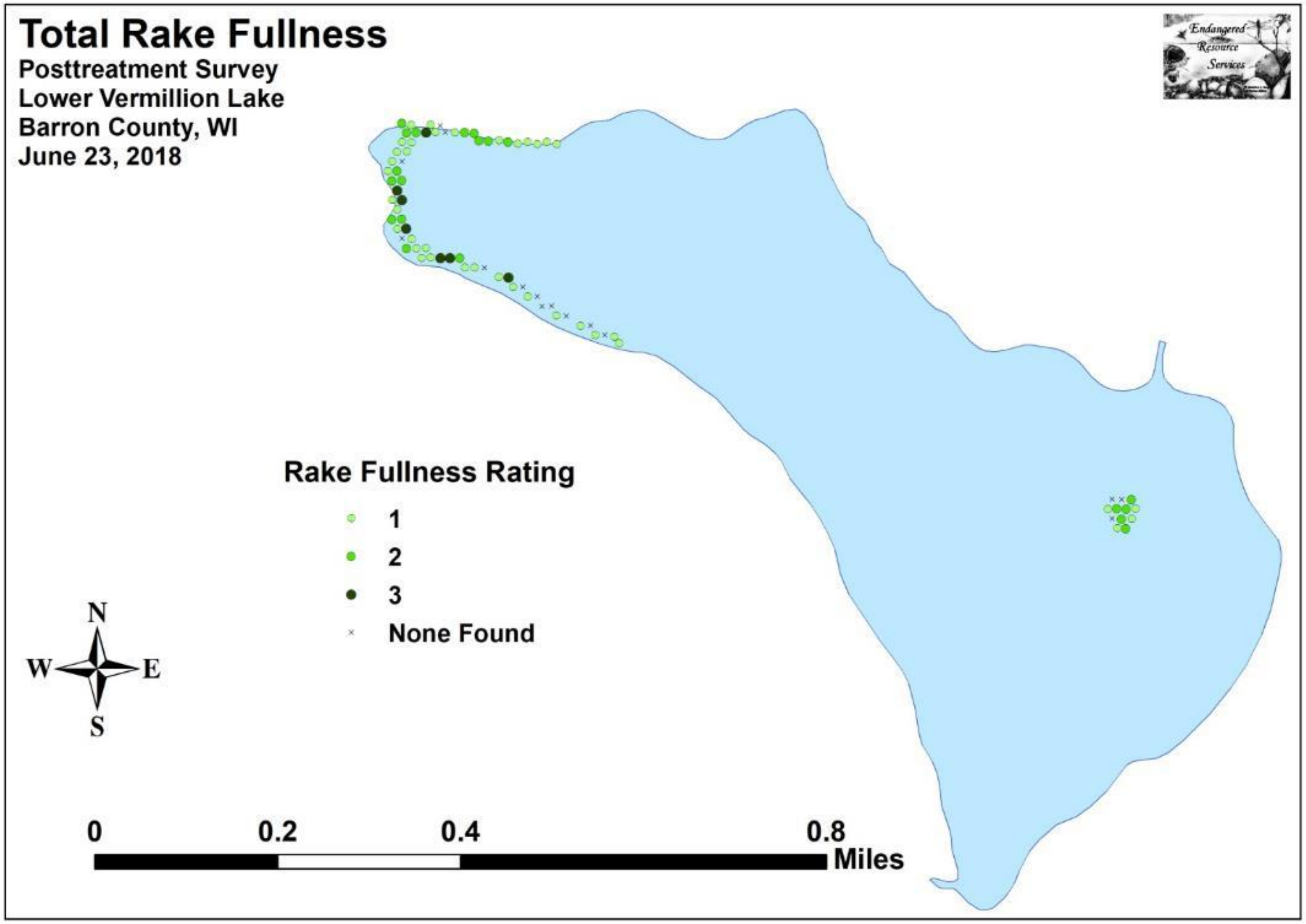

Littoral Zone
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Littoral Zone
Littoral Zone w/ Plants
>10.5 ft
N
W
E
S
0
0.2
0.4
0.8
Miles


Native Species Richness
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Endangered Resource Services
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
N
W
E
S
0
0.2
0.4
0.8
Miles

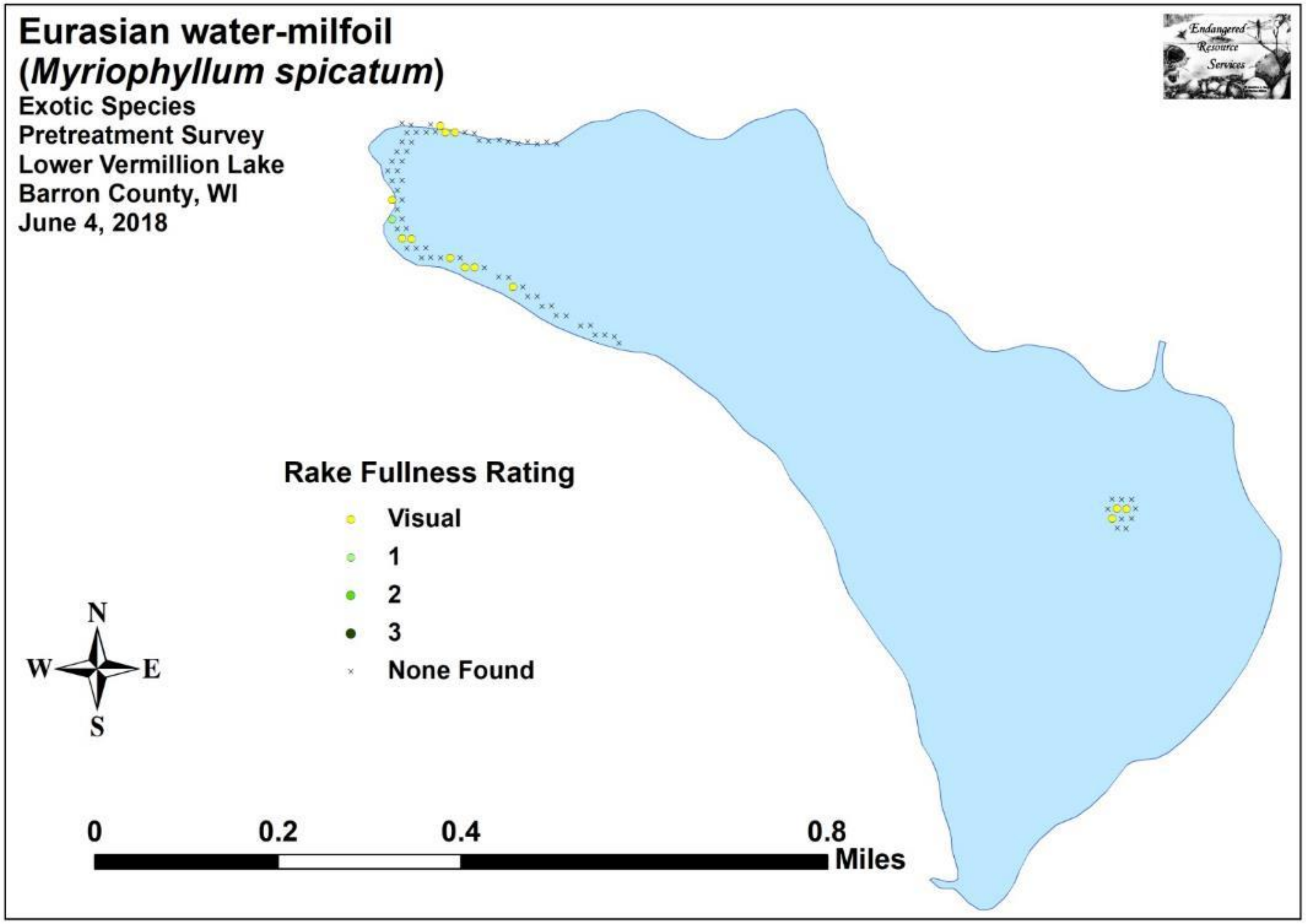


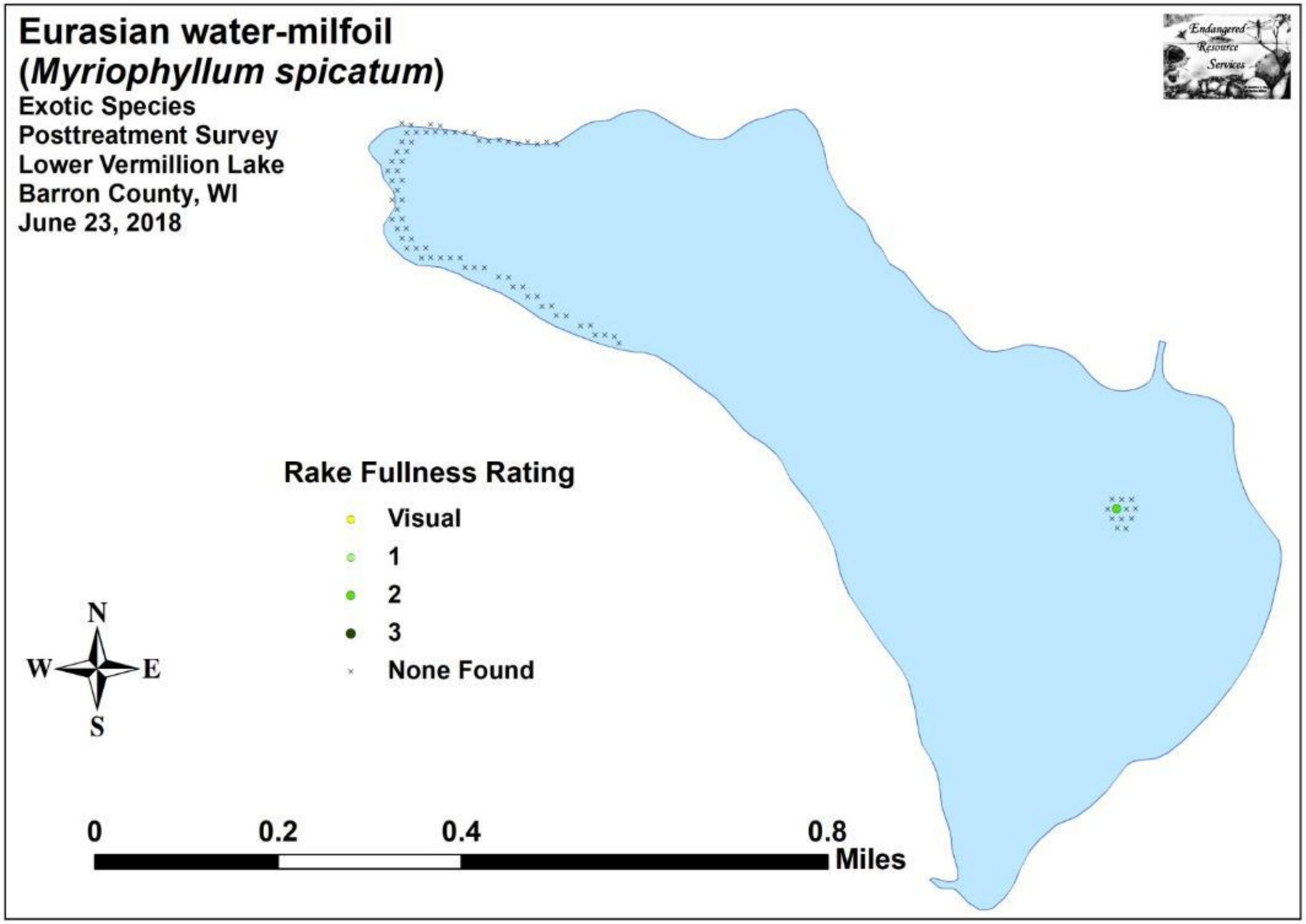
Native Species Richness
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
# of Native Species
None Found
1 - 2
3 - 4
5
N
W
E
S
0
0.2
0.4
0.8
Miles


Total Rake Fullness
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Rake Fullness Rating
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

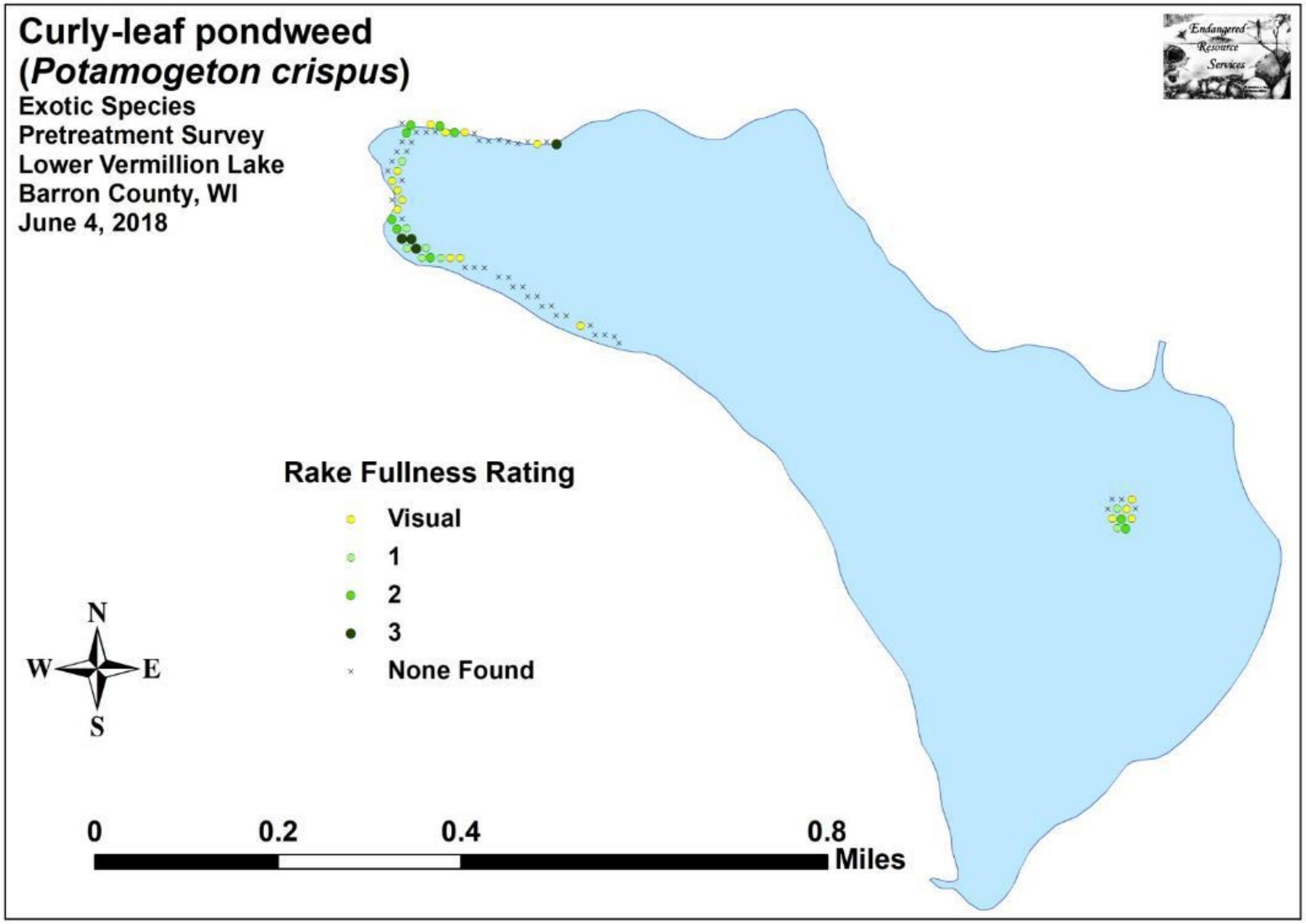

Total Rake Fullness
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Rake Fullness Rating
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

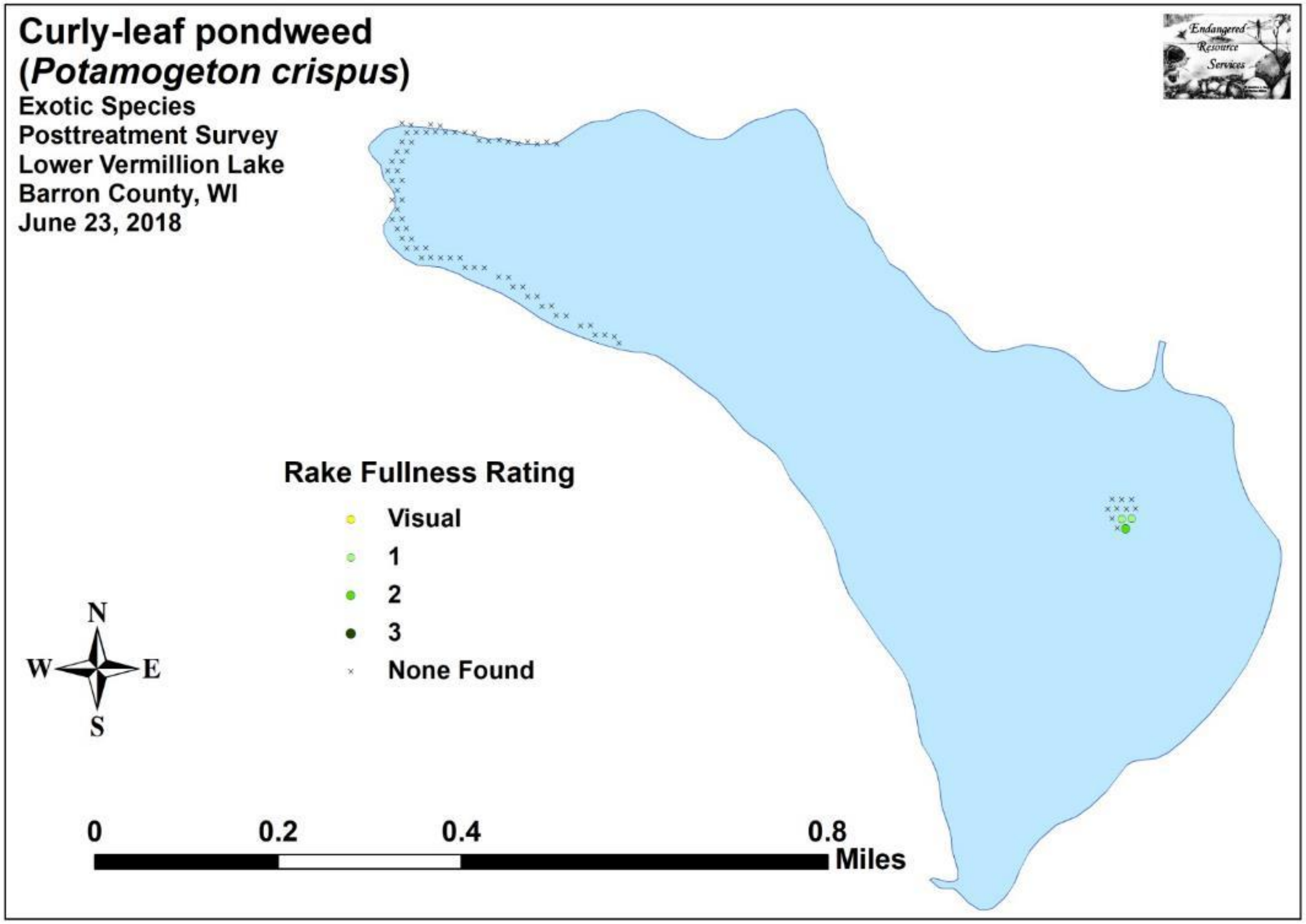
Appendix V: EWM and CLP Pre/Post Density and Distribution


Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic Species
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

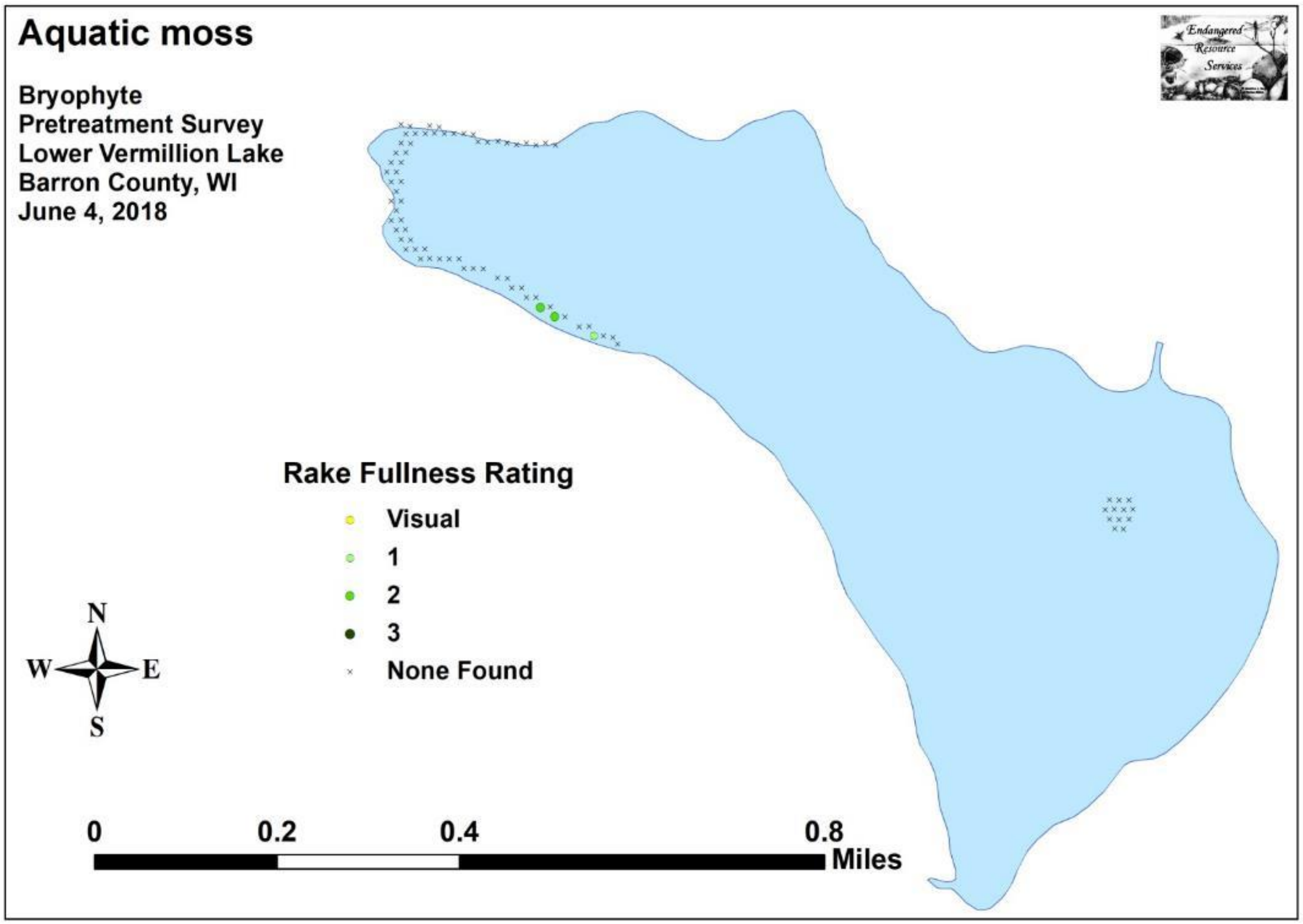


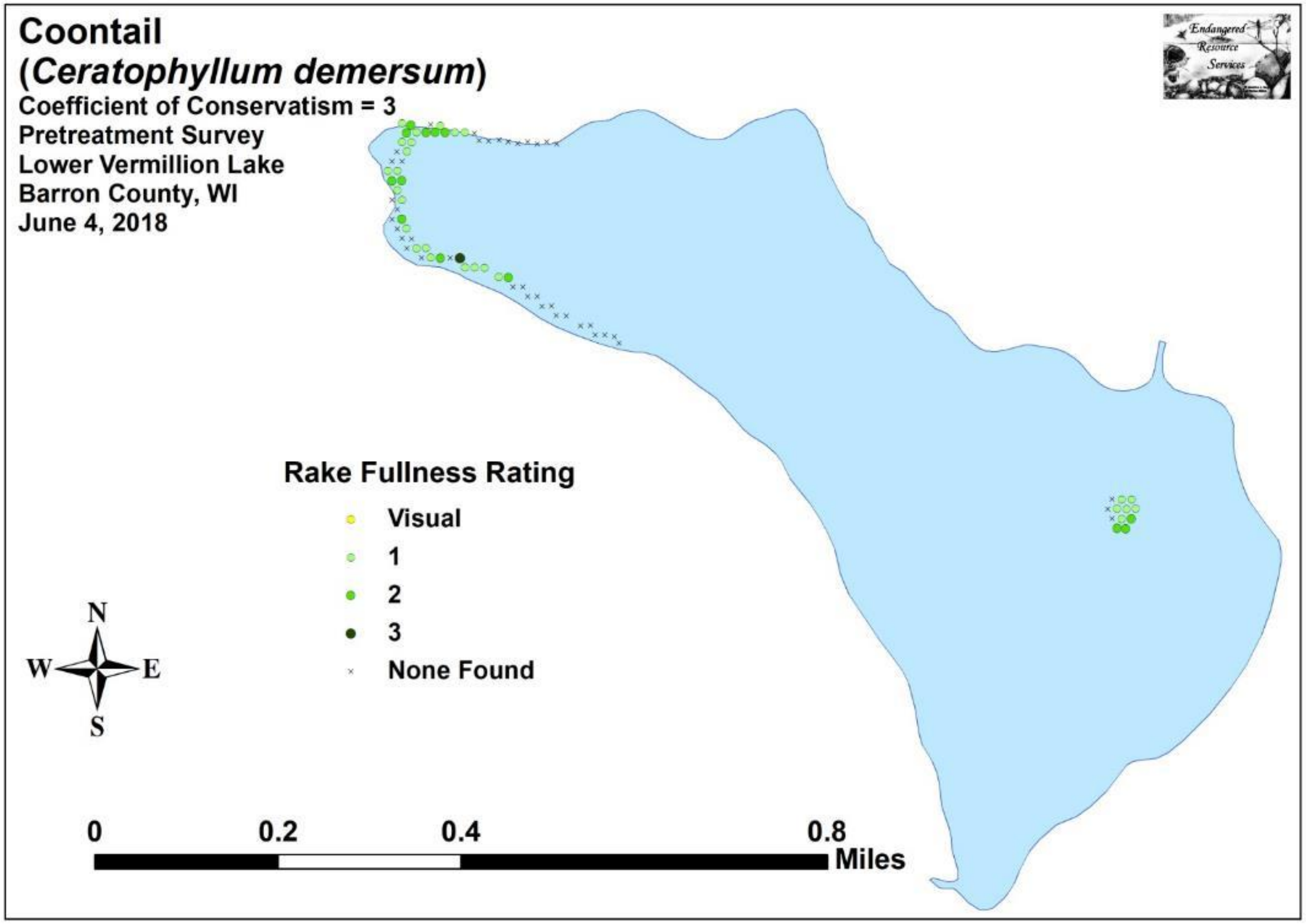
Eurasian water-milfoil
(*Myriophyllum spicatum*)
Exotic Species
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

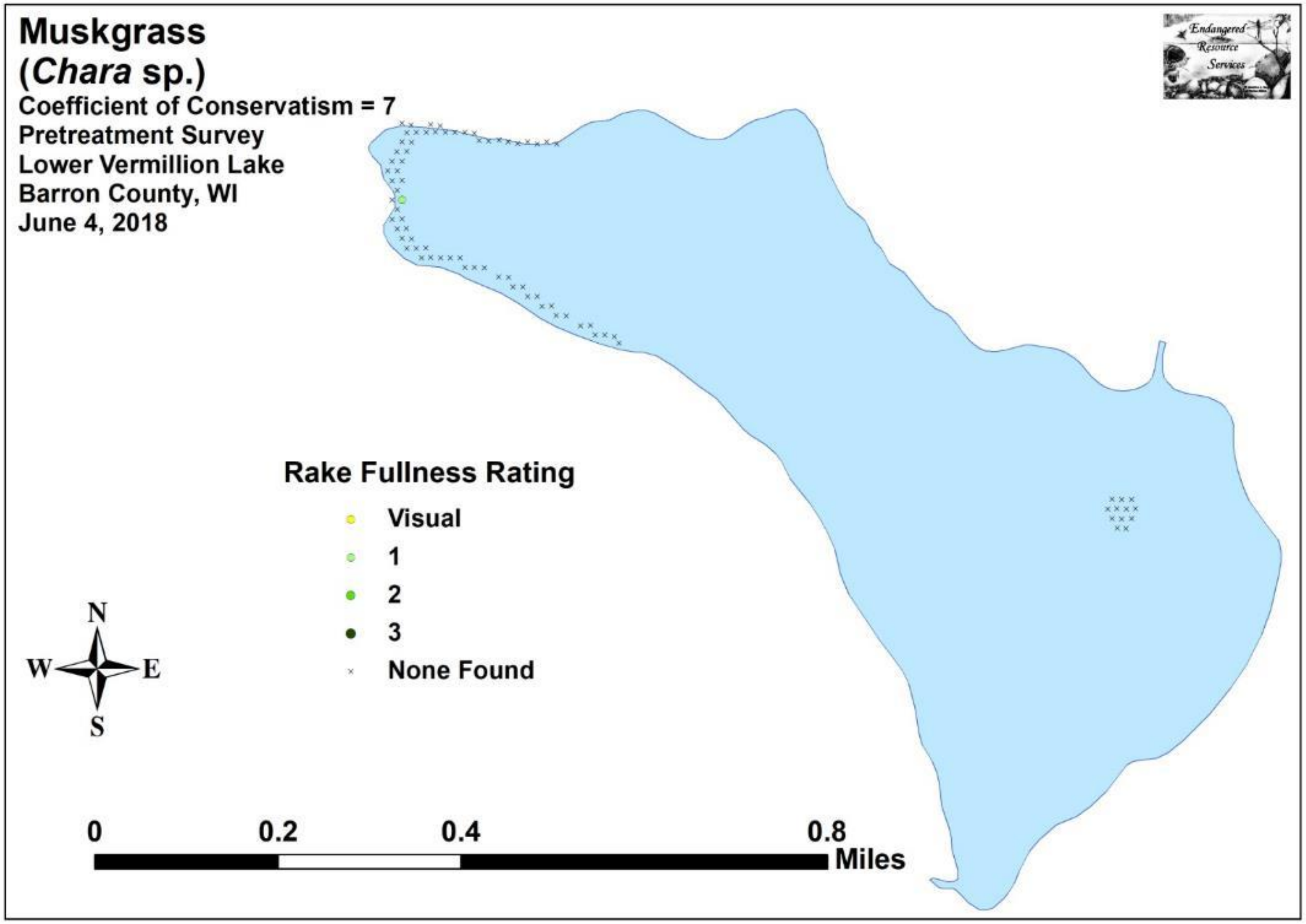

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

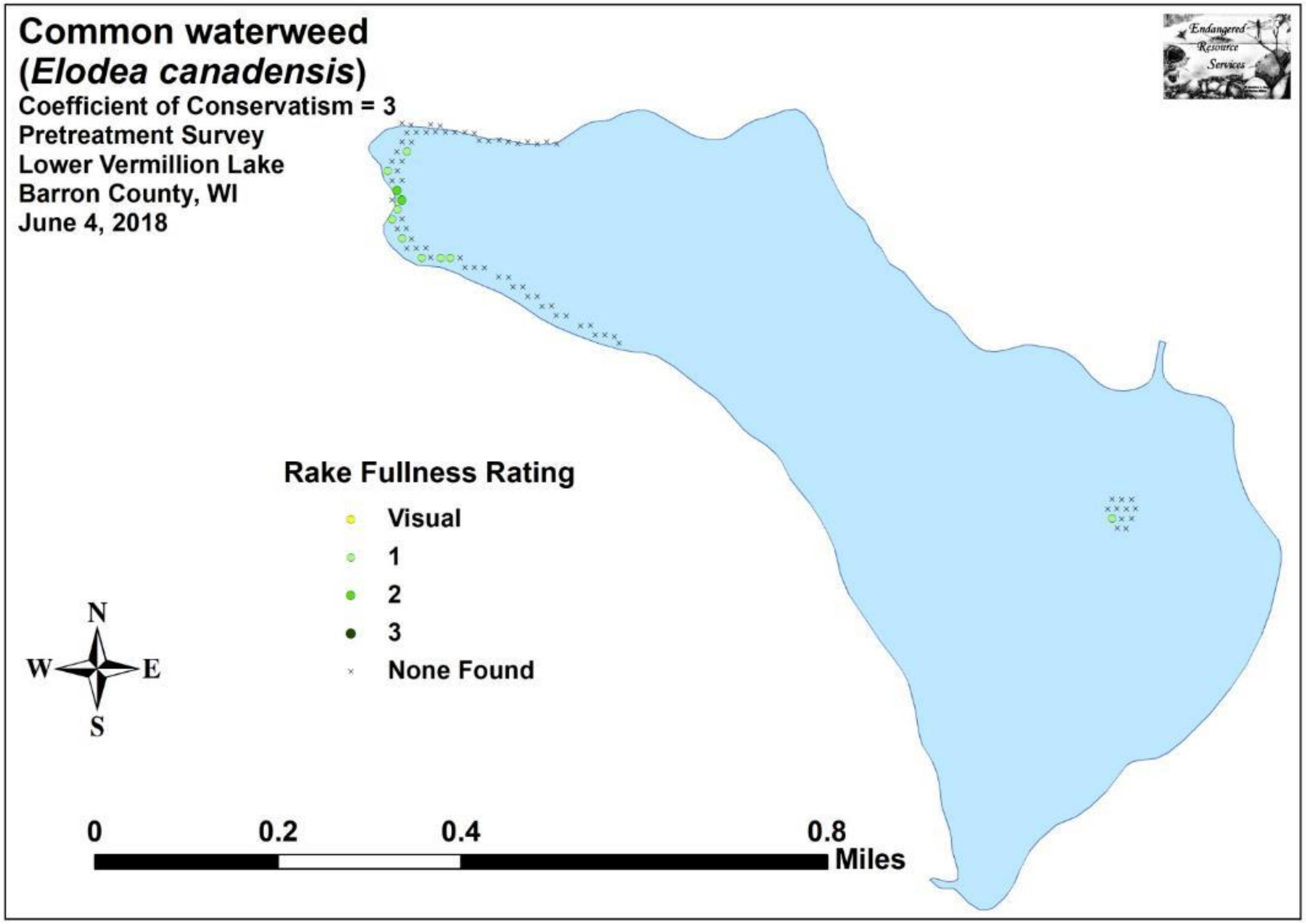

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

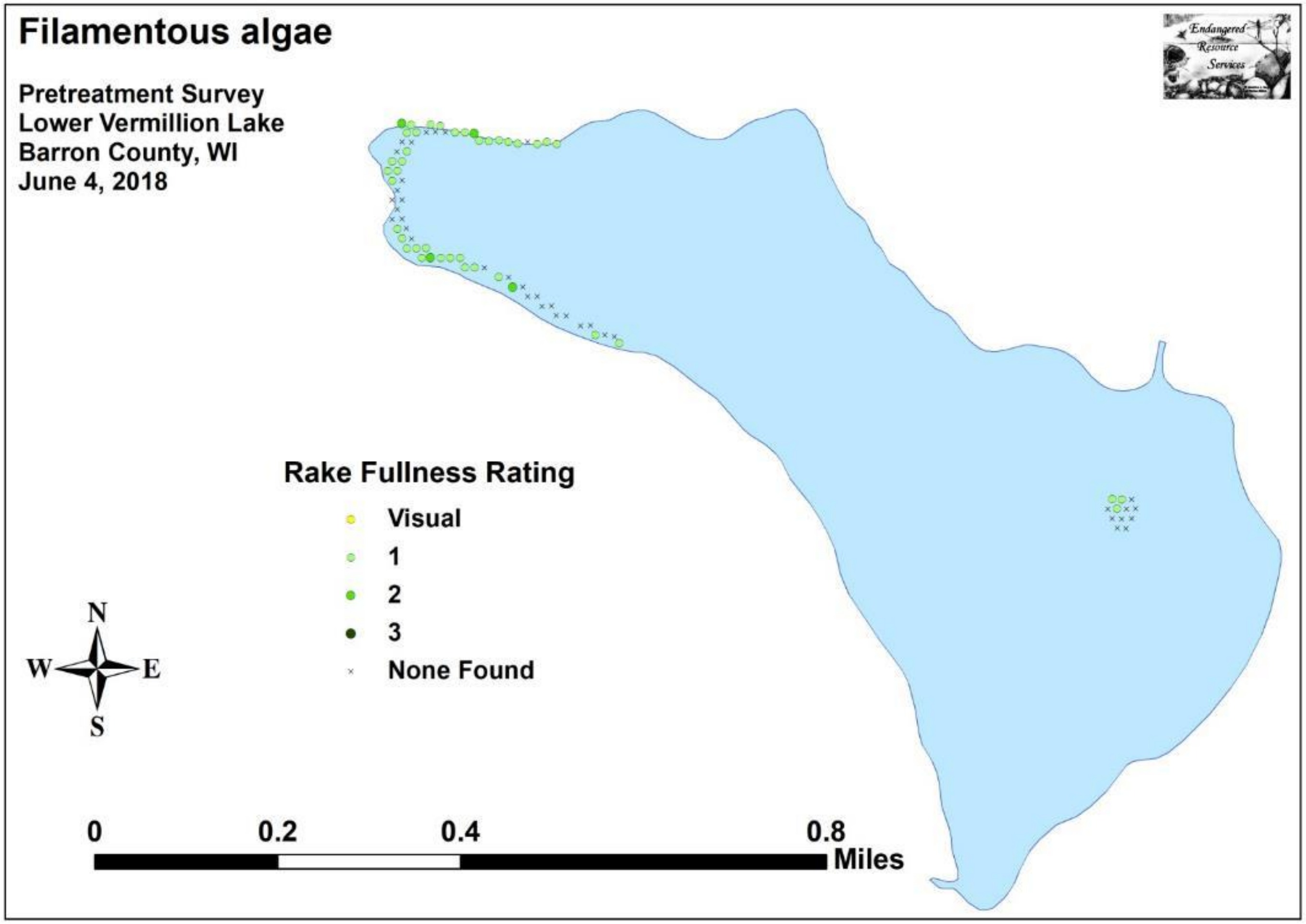
Appendix VI: Pretreatment Native Species Density and Distribution

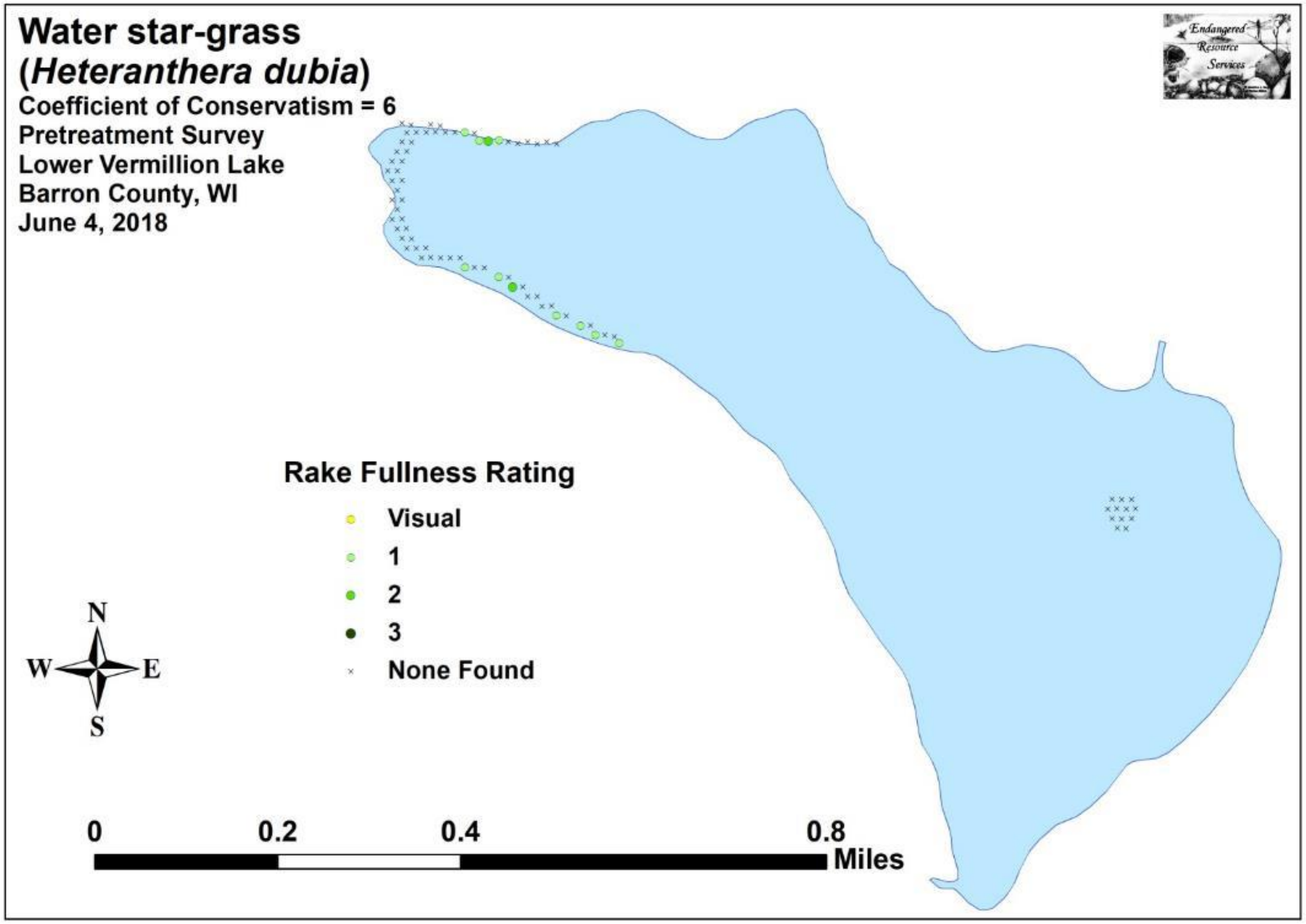

Aquatic moss
Bryophyte
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

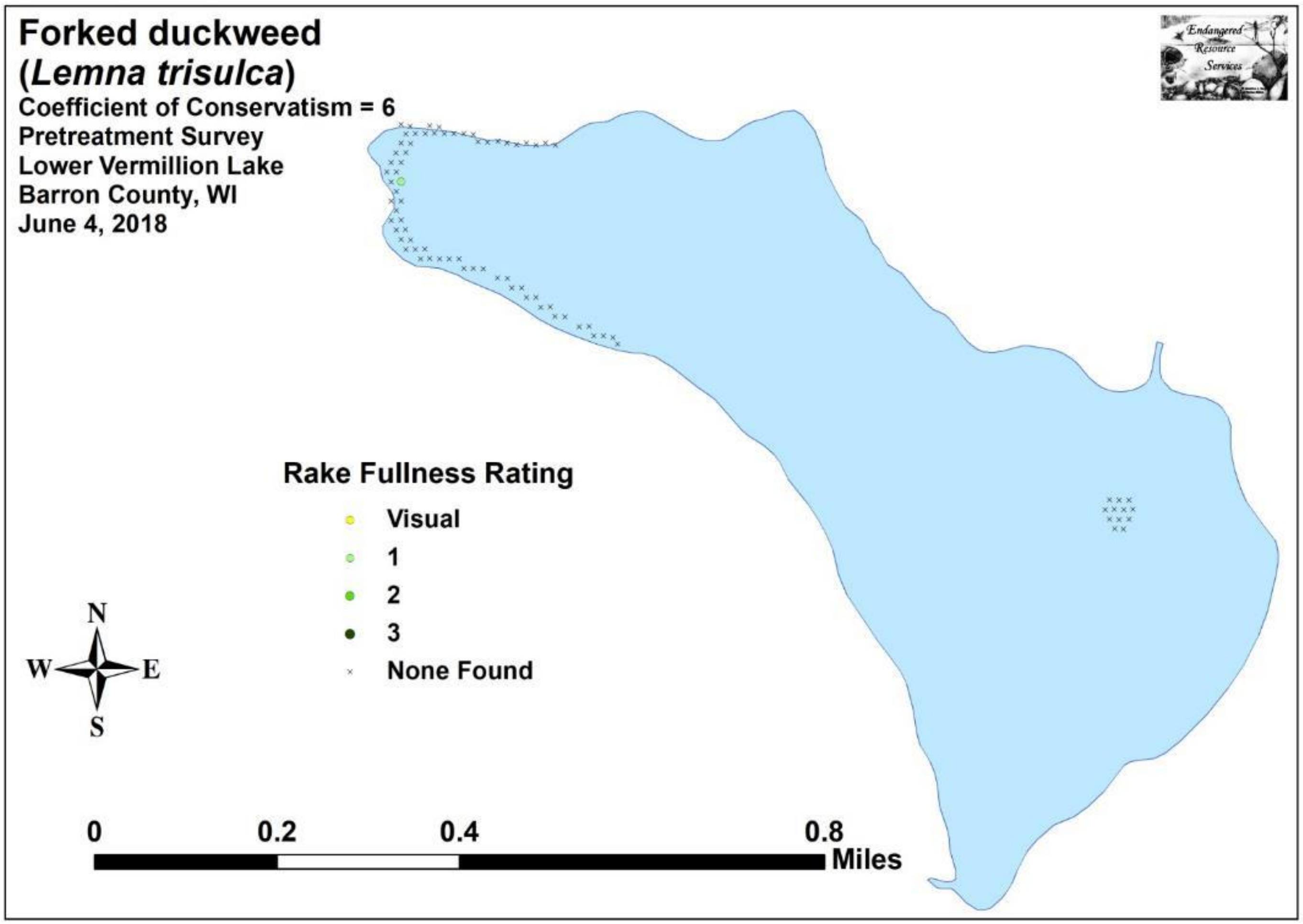

Coontail
(*Ceratophyllum demersum*)
Coefficient of Conservatism = 3
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

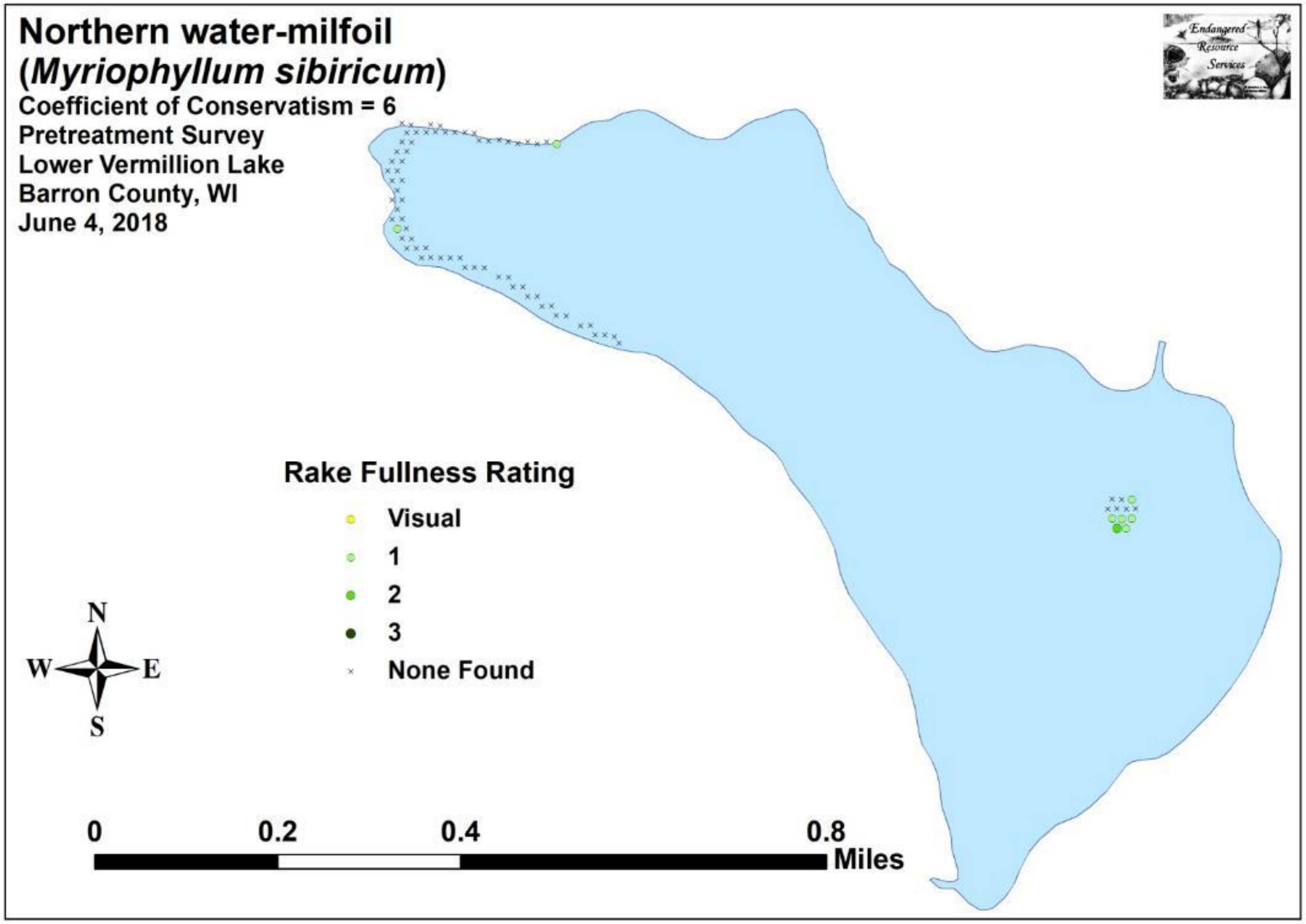

Muskgrass
(*Chara* sp.)
Coefficient of Conservatism = 7
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

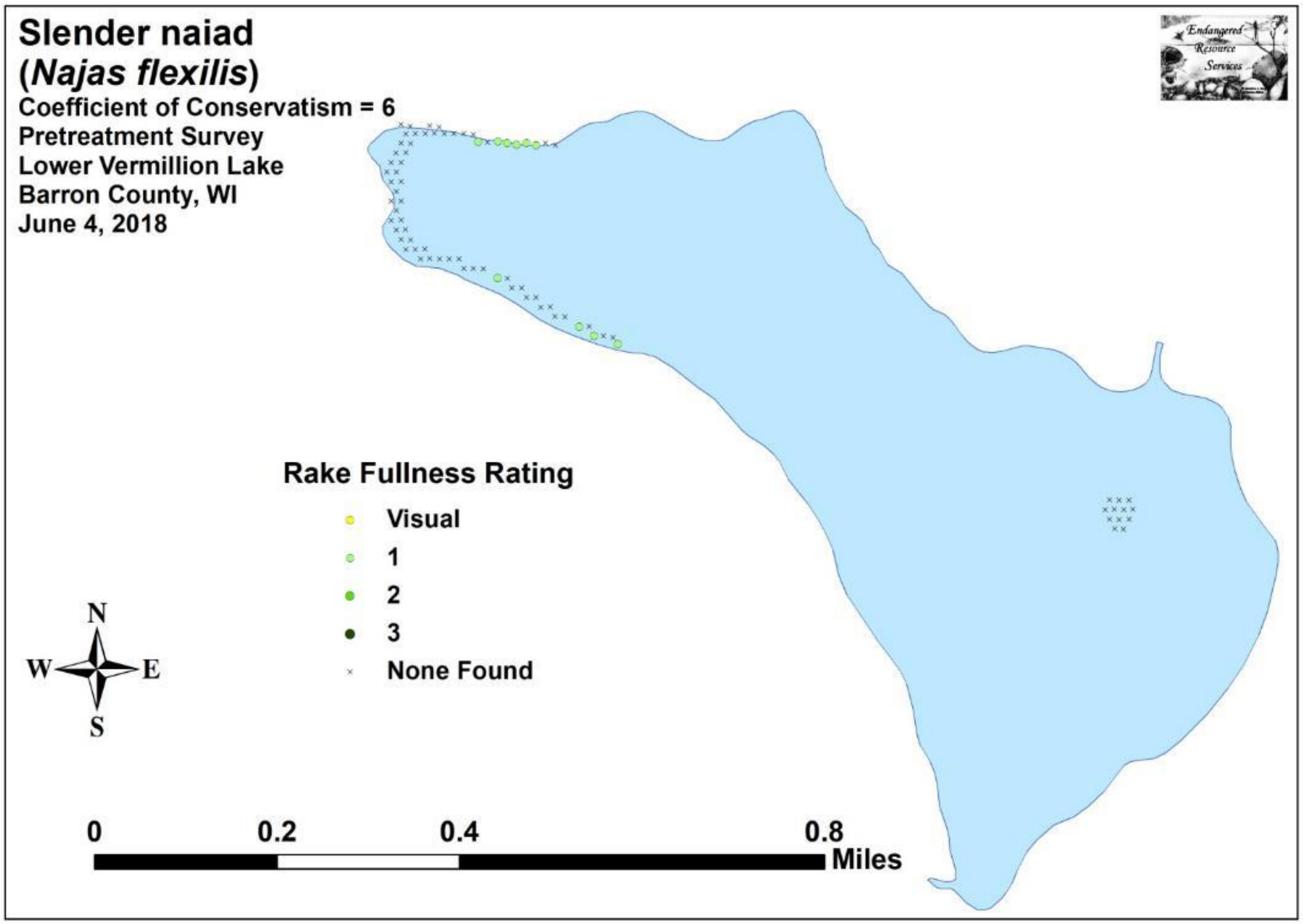

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

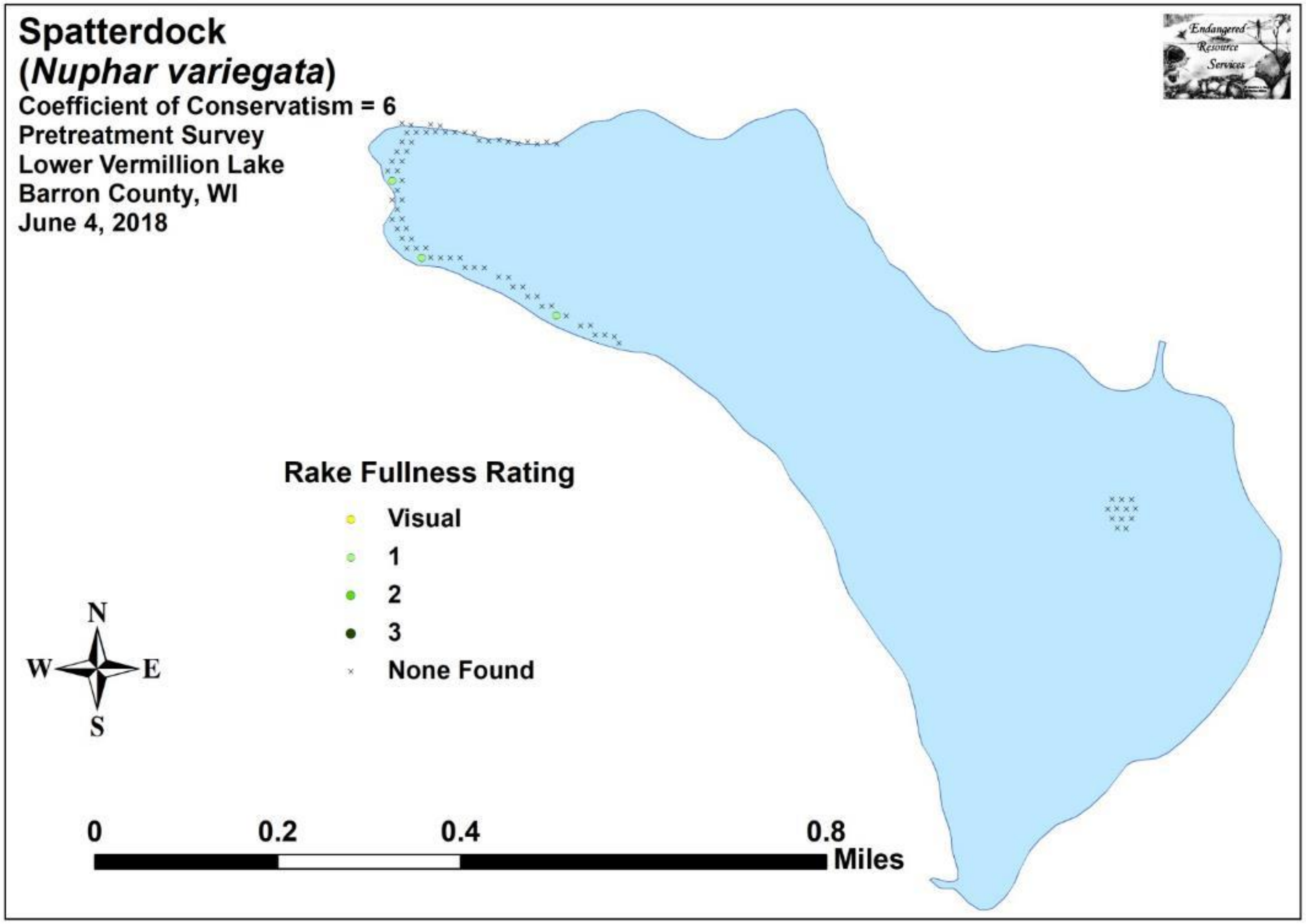

Filamentous algae
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

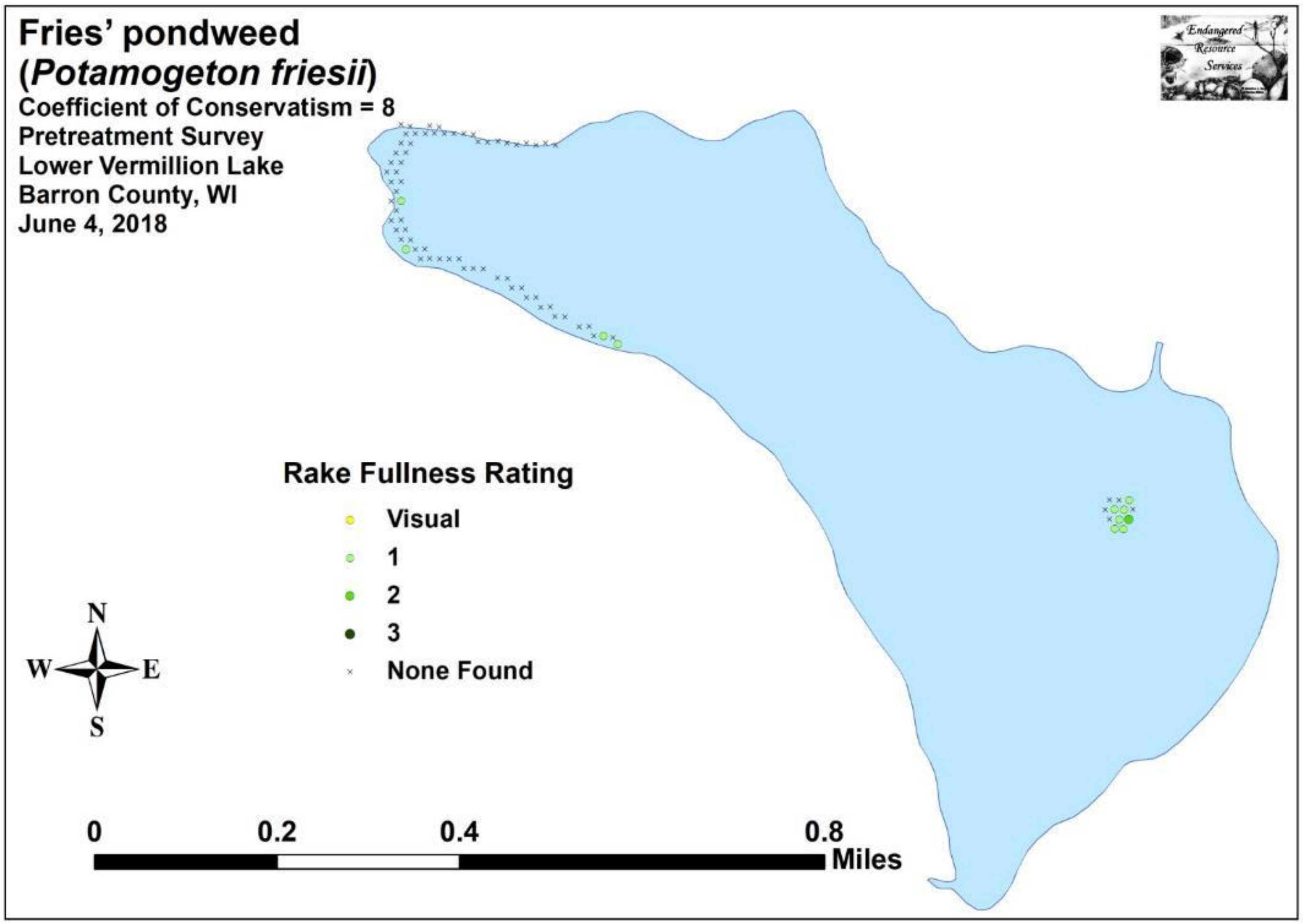

Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

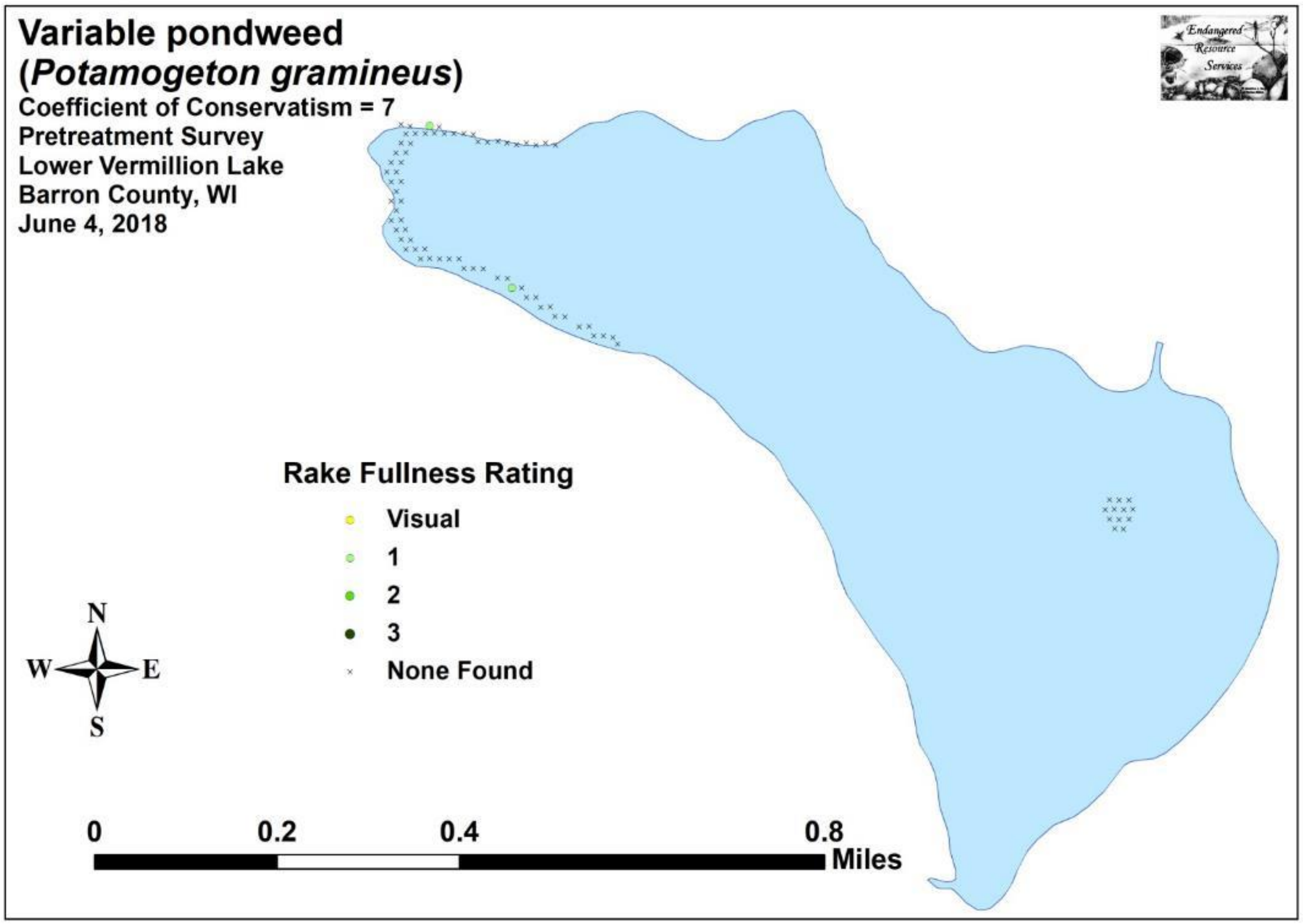

Forked duckweed
(*Lemna trisulca*)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

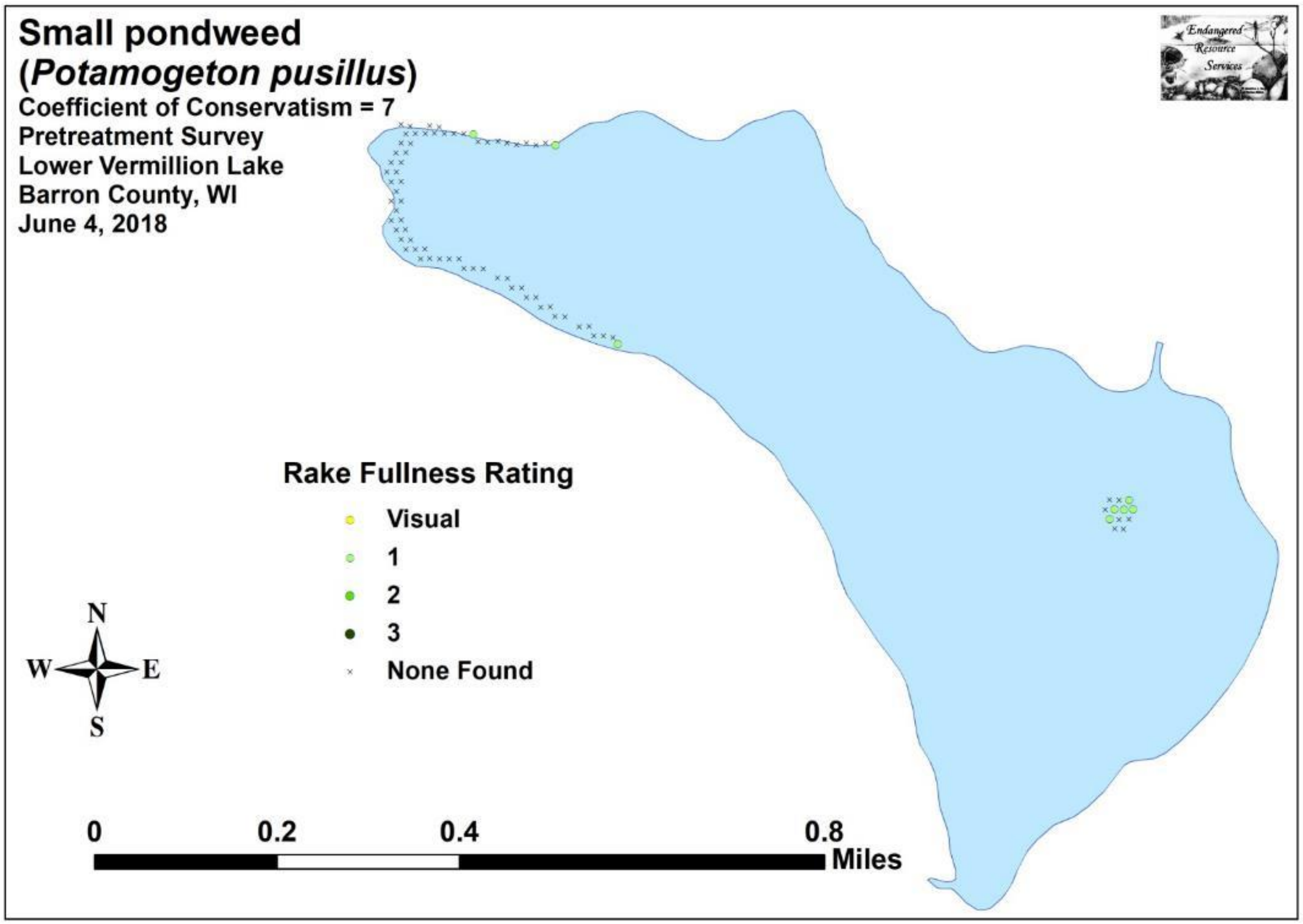

Northern water-milfoil
(*Myriophyllum sibiricum*)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

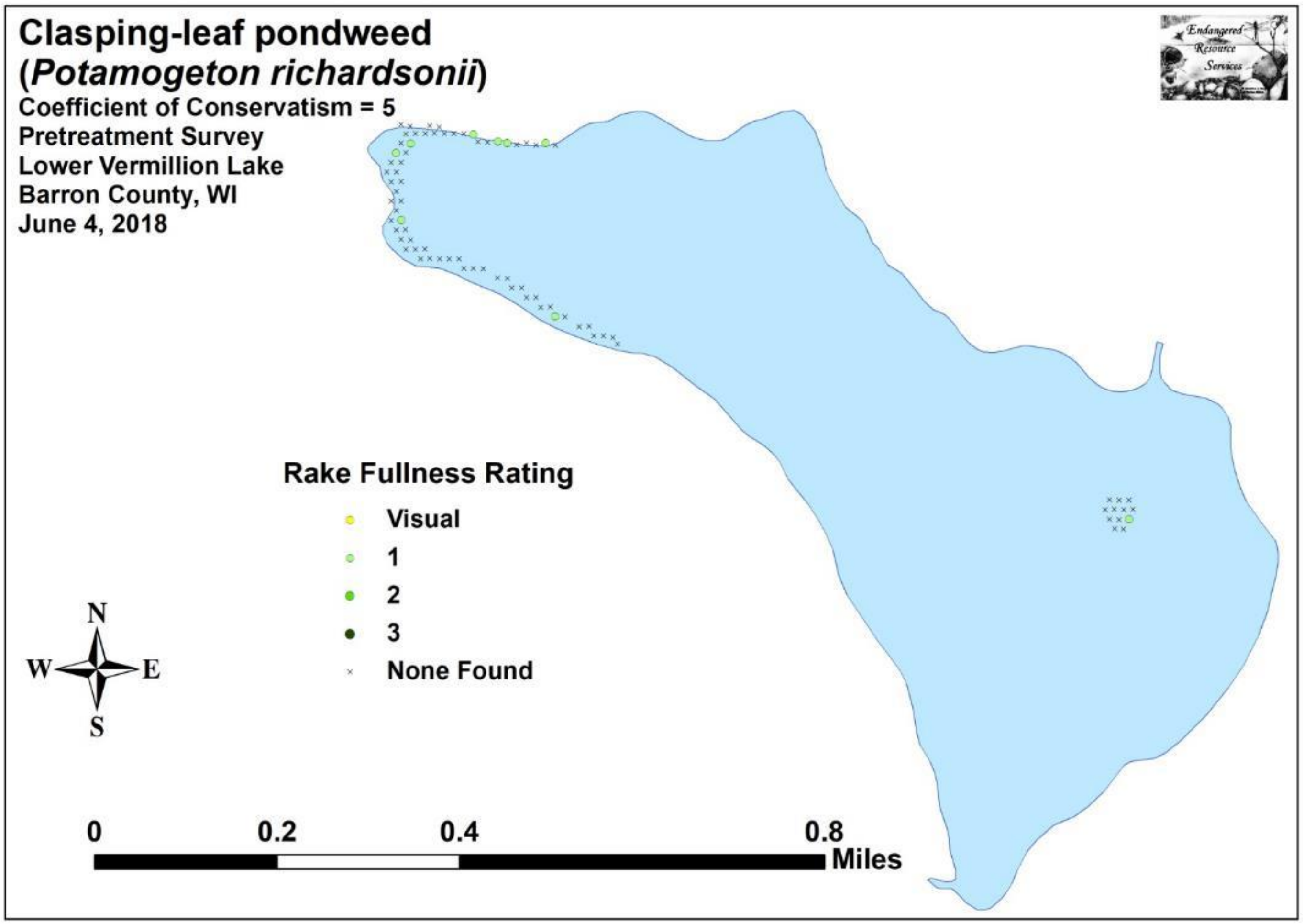

Slender naiad
(*Najas flexilis*)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

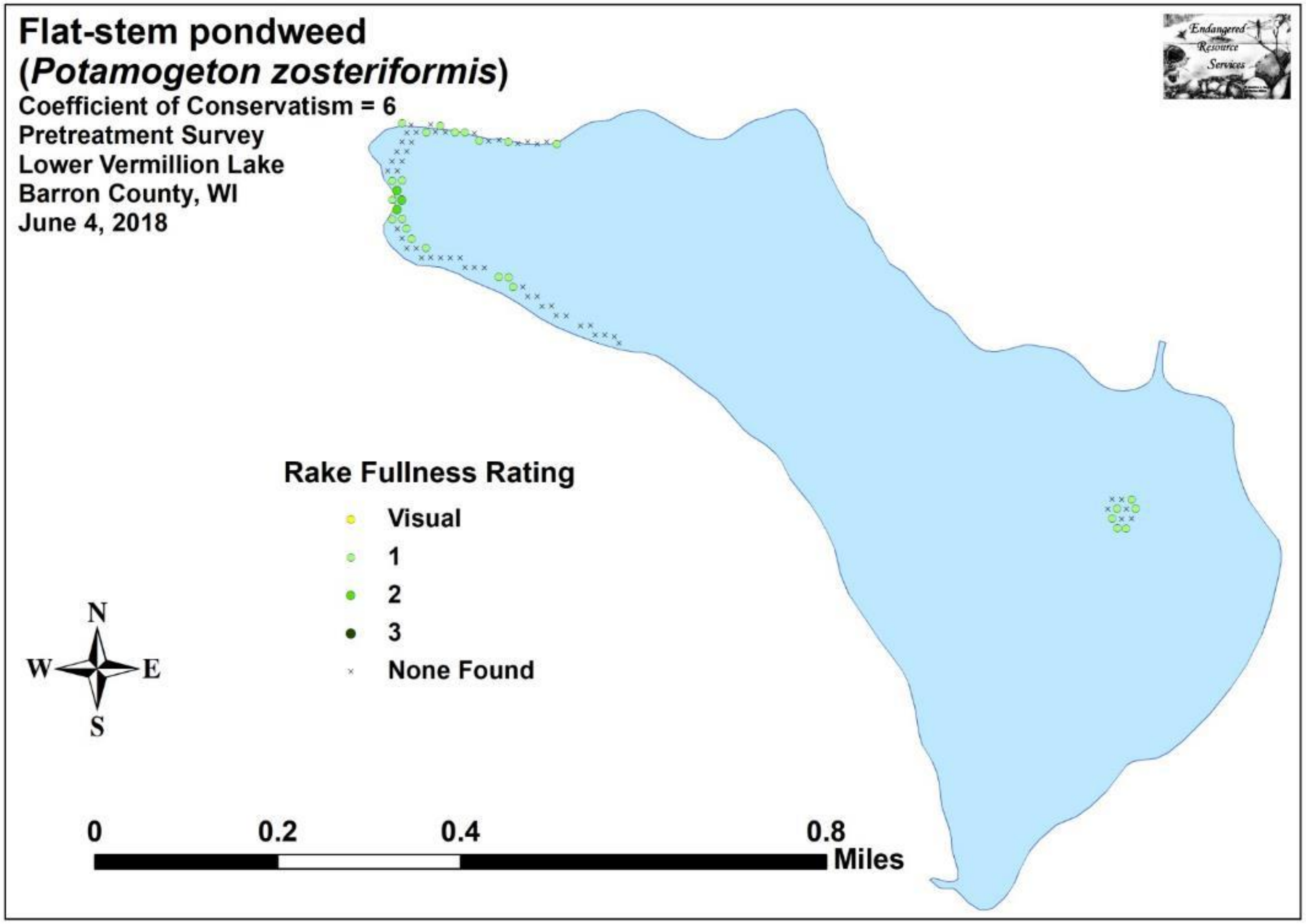

Spatterdock
(Nuphar variegata)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

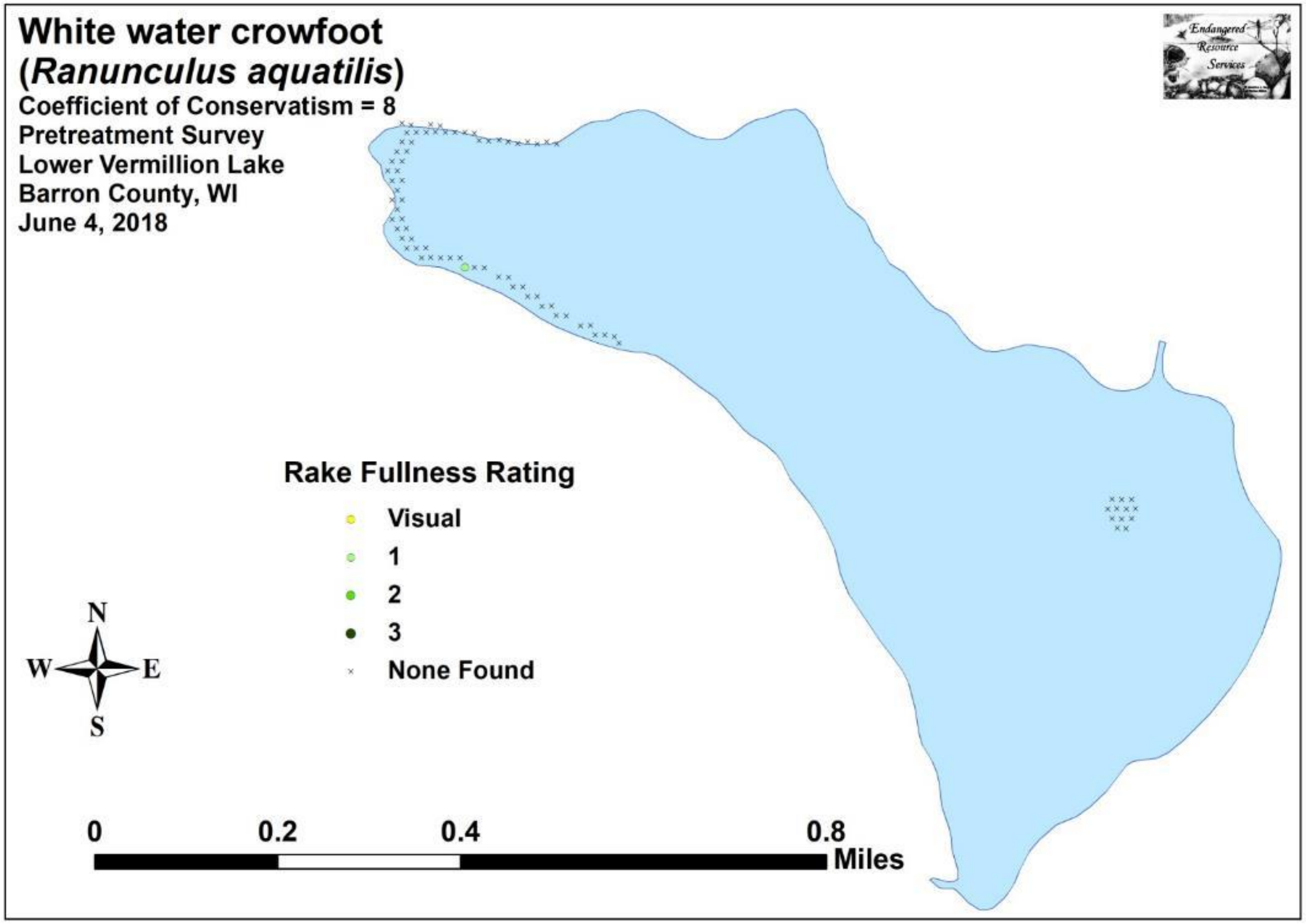

Fries' pondweed
(Potamogeton friesii)
Coefficient of Conservatism = 8
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

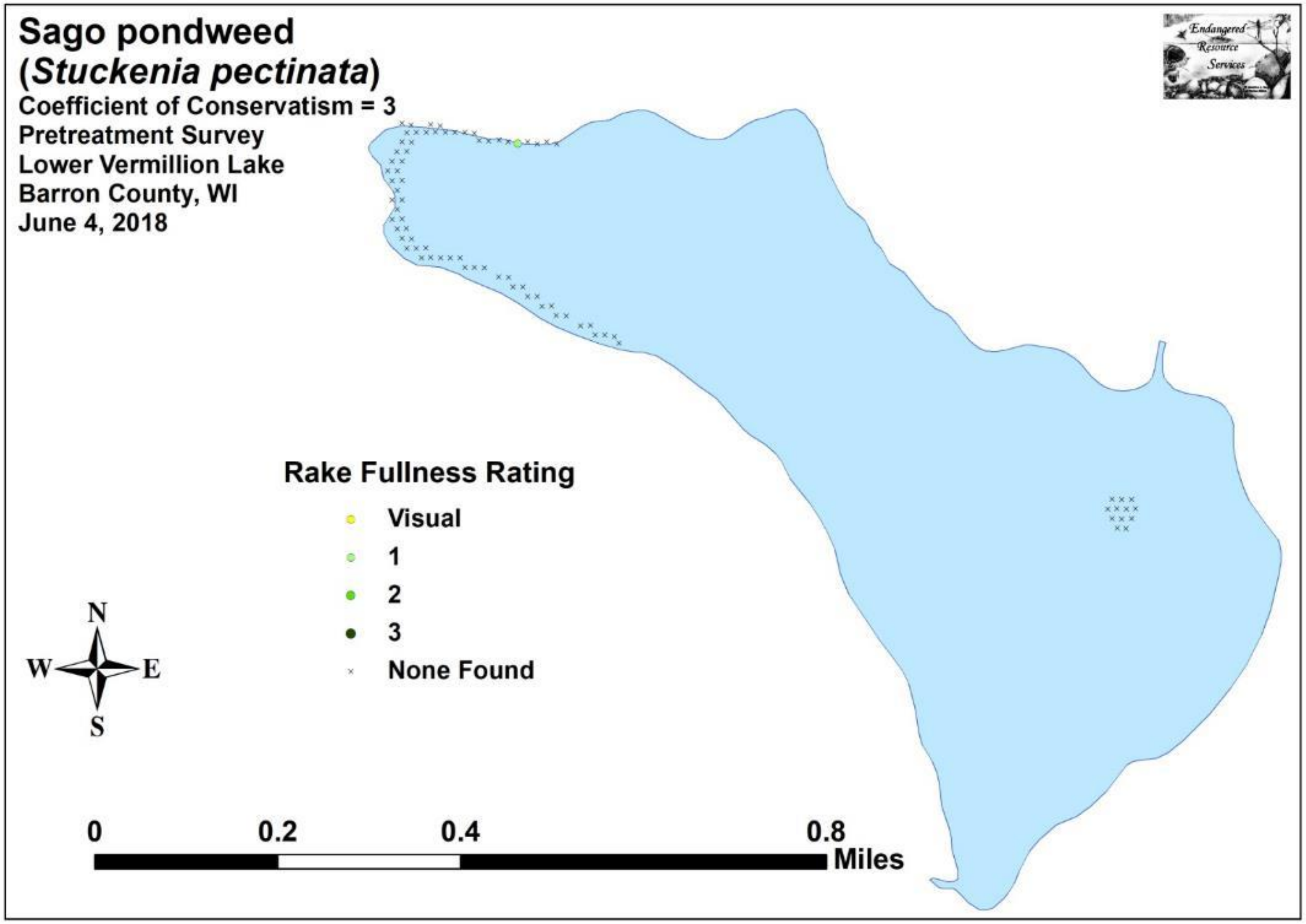

Variable pondweed
(Potamogeton gramineus)
Coefficient of Conservatism = 7
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

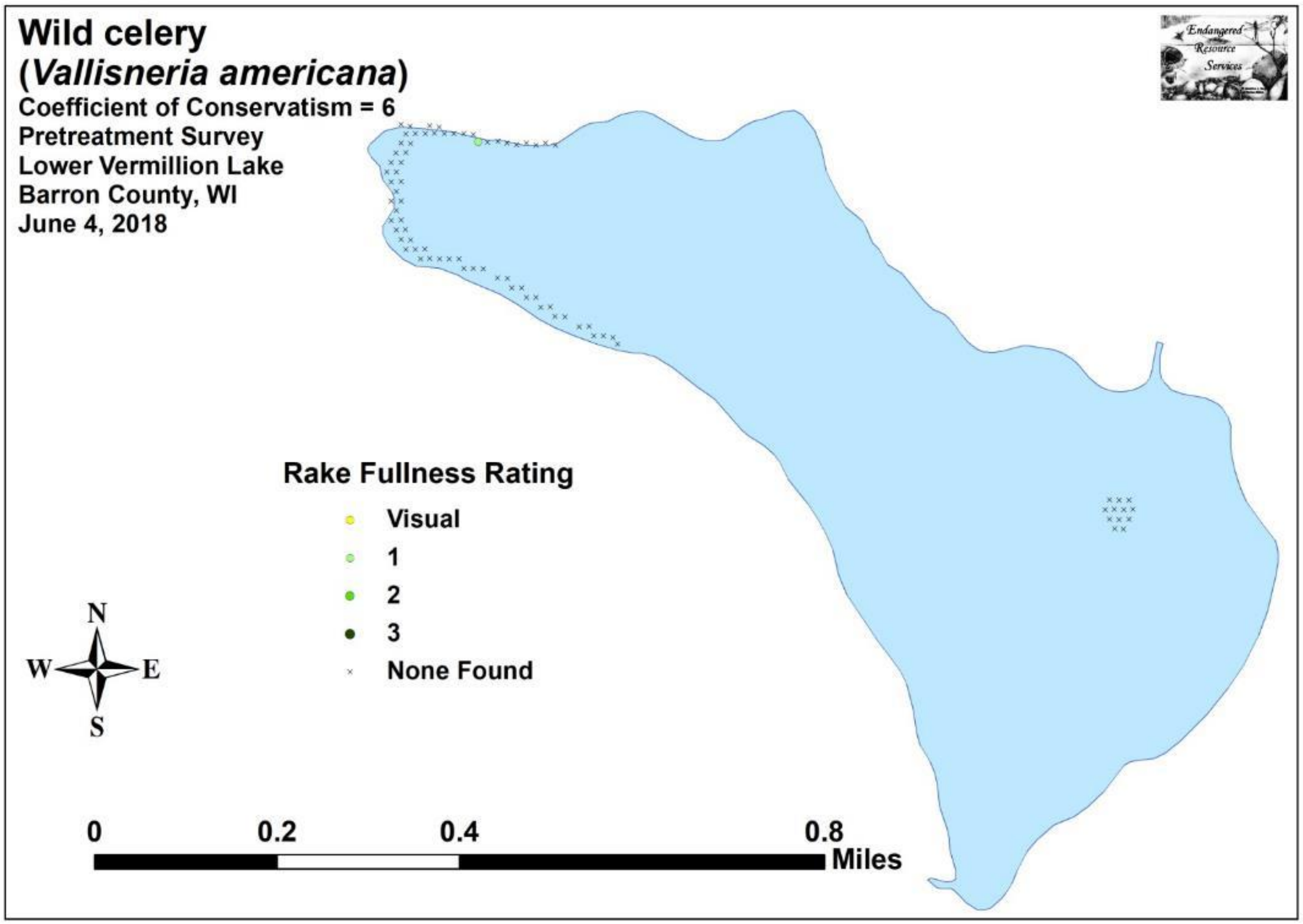

Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles


Clasping-leaf pondweed
(Potamogeton richardsonii)
Coefficient of Conservatism = 5
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

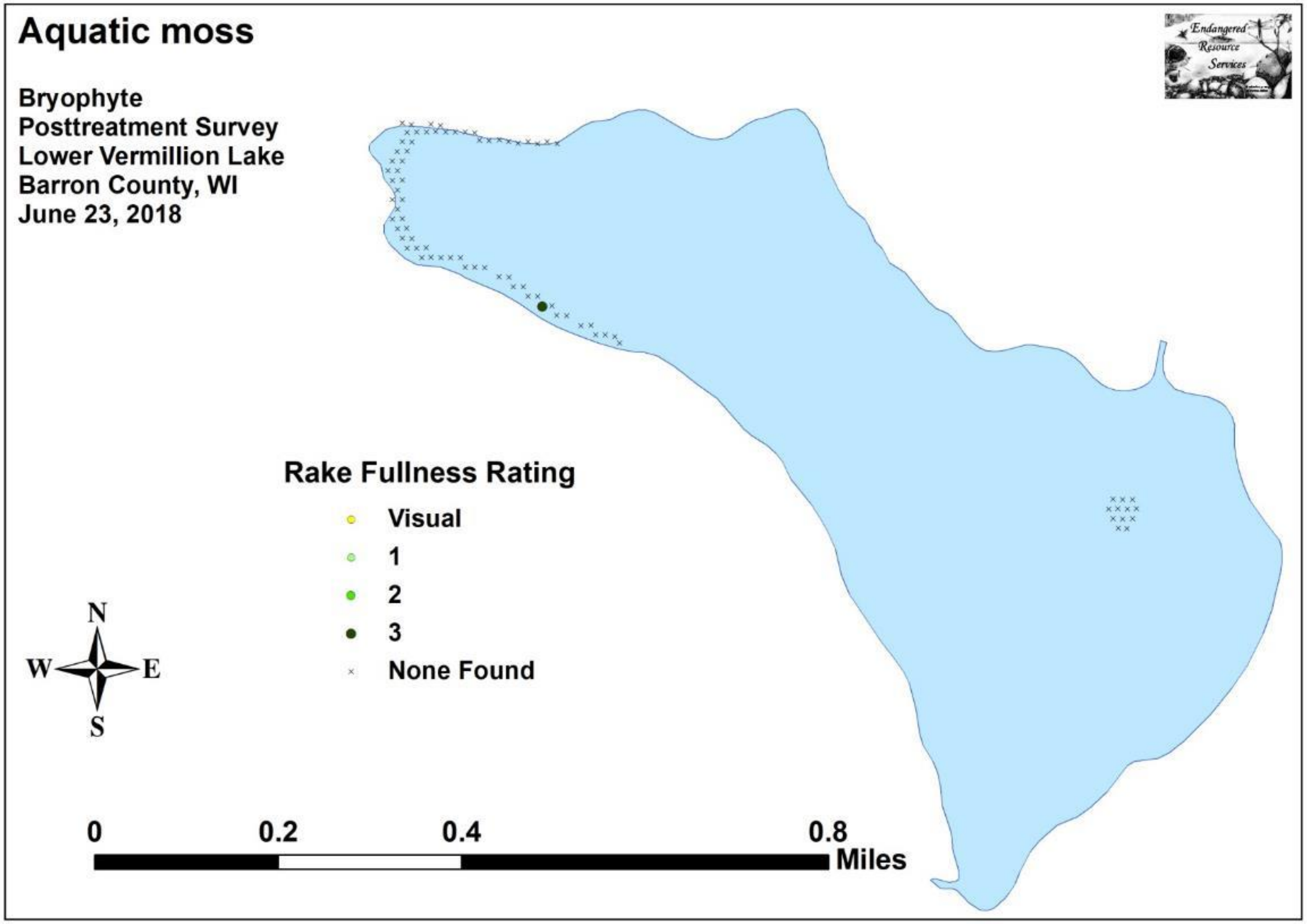

Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

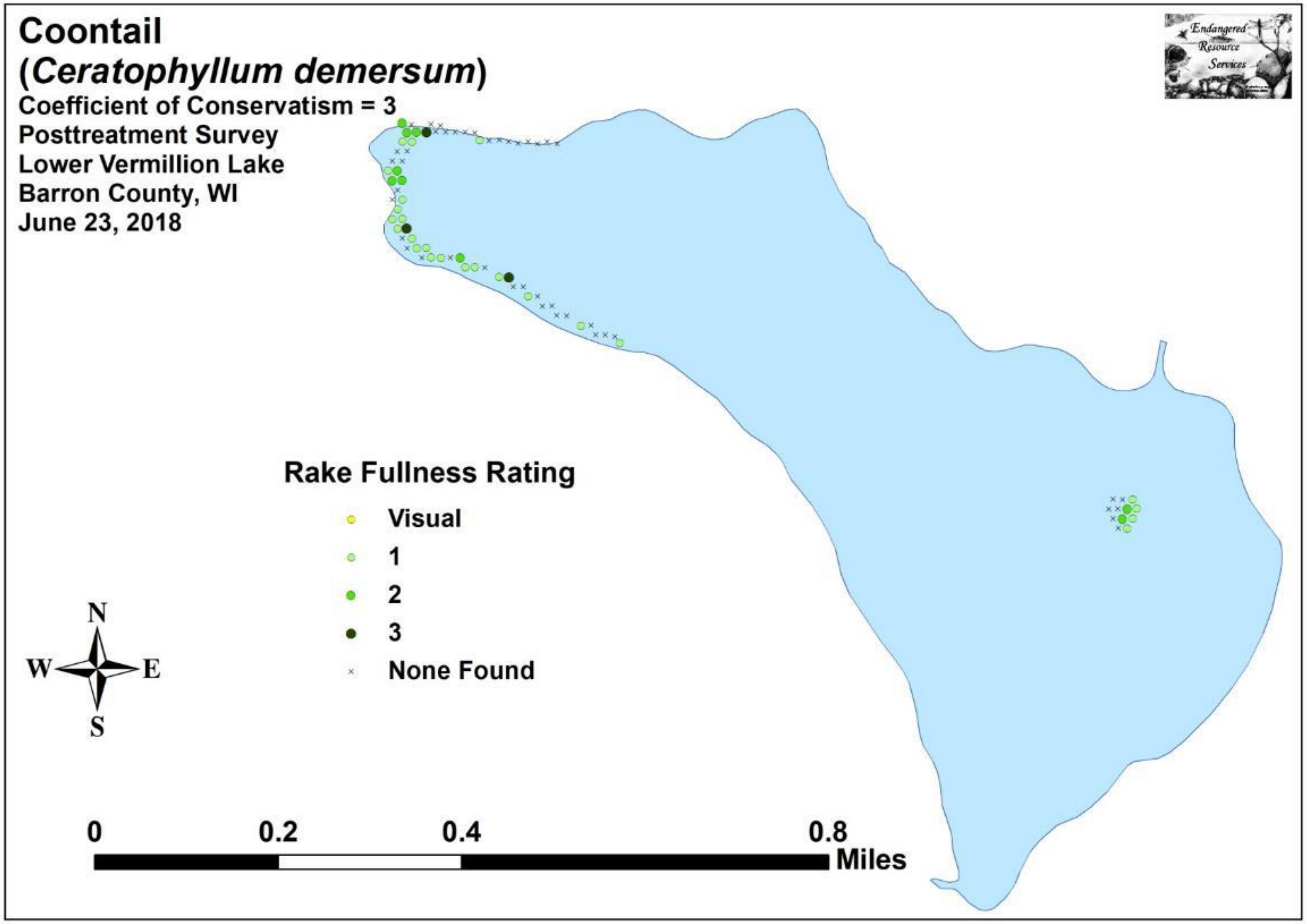

White water crowfoot
(Ranunculus aquatilis)
Coefficient of Conservatism = 8
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles


Sago pondweed
(Stuckenia pectinata)
Coefficient of Conservatism = 3
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

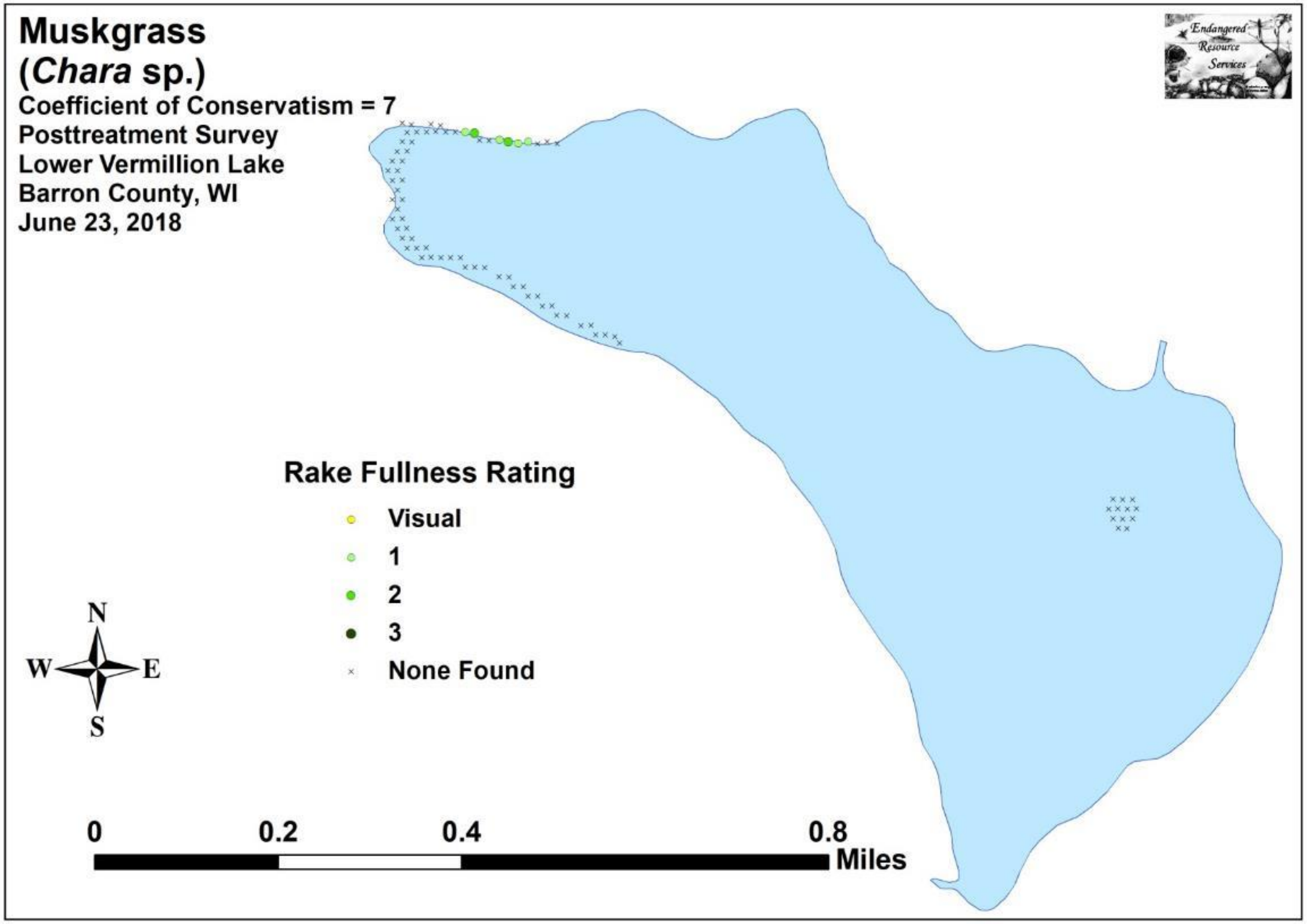

Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 4, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

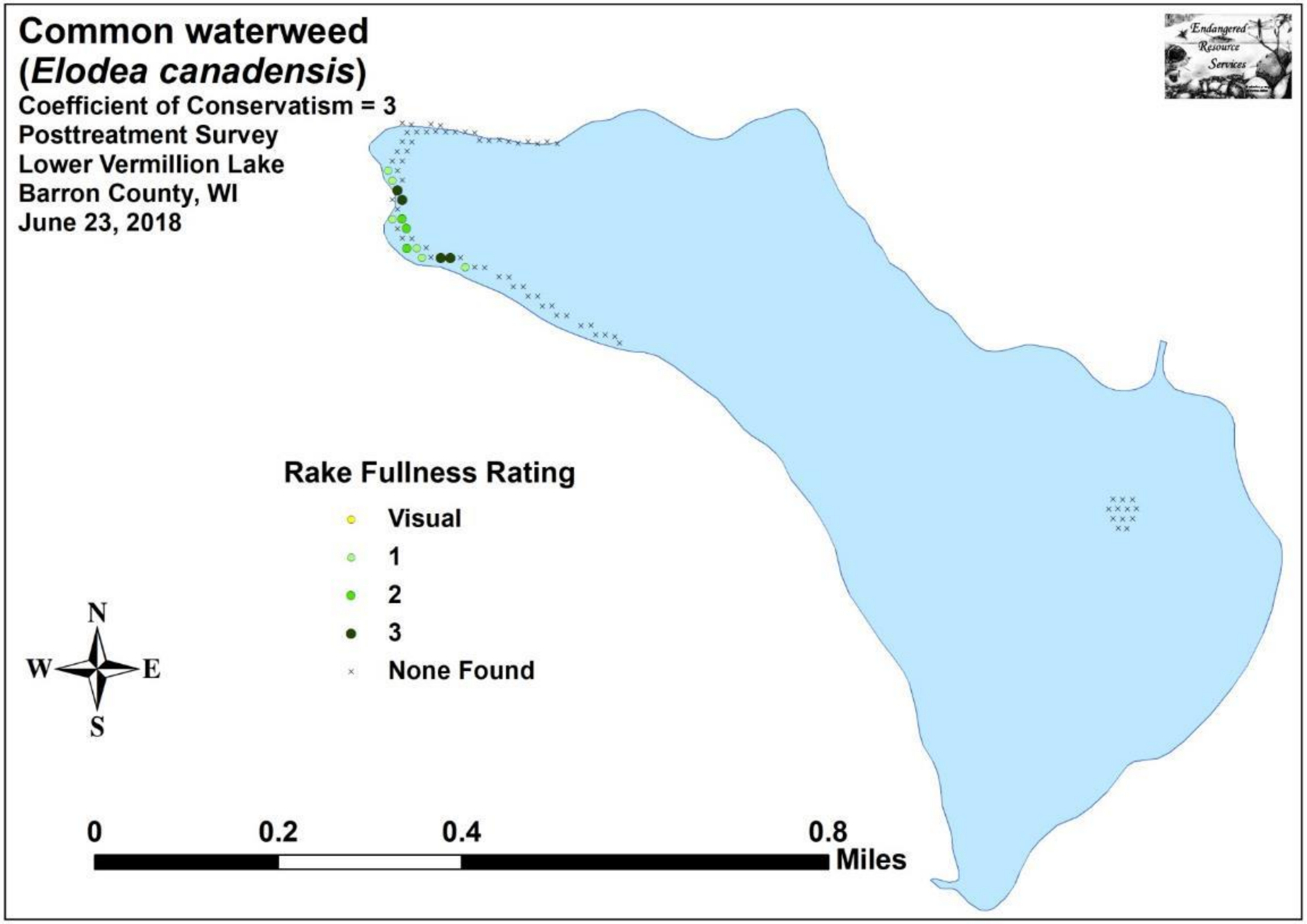
Appendix VII: Posttreatment Native Species Density and Distribution

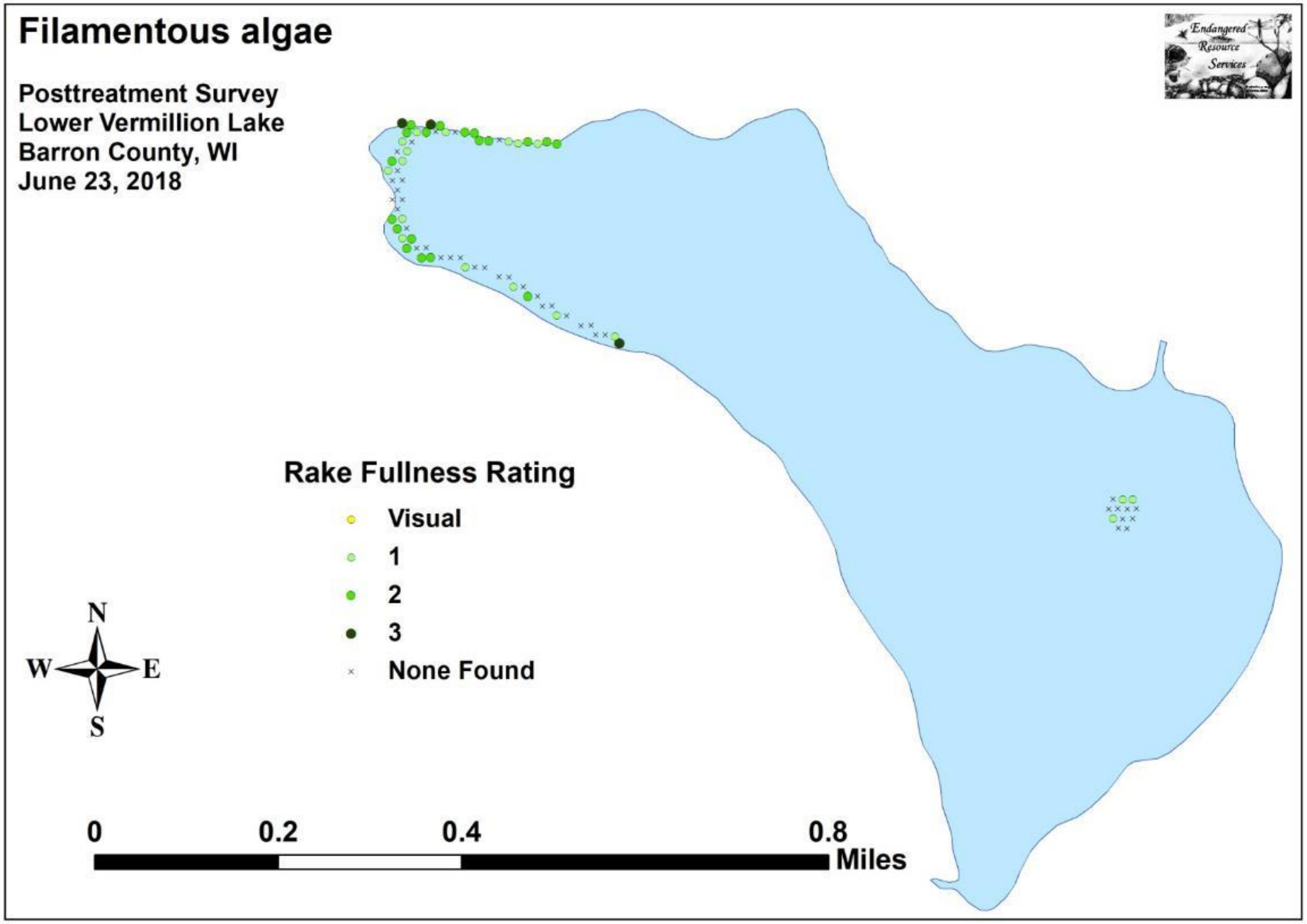

Aquatic moss
Bryophyte
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

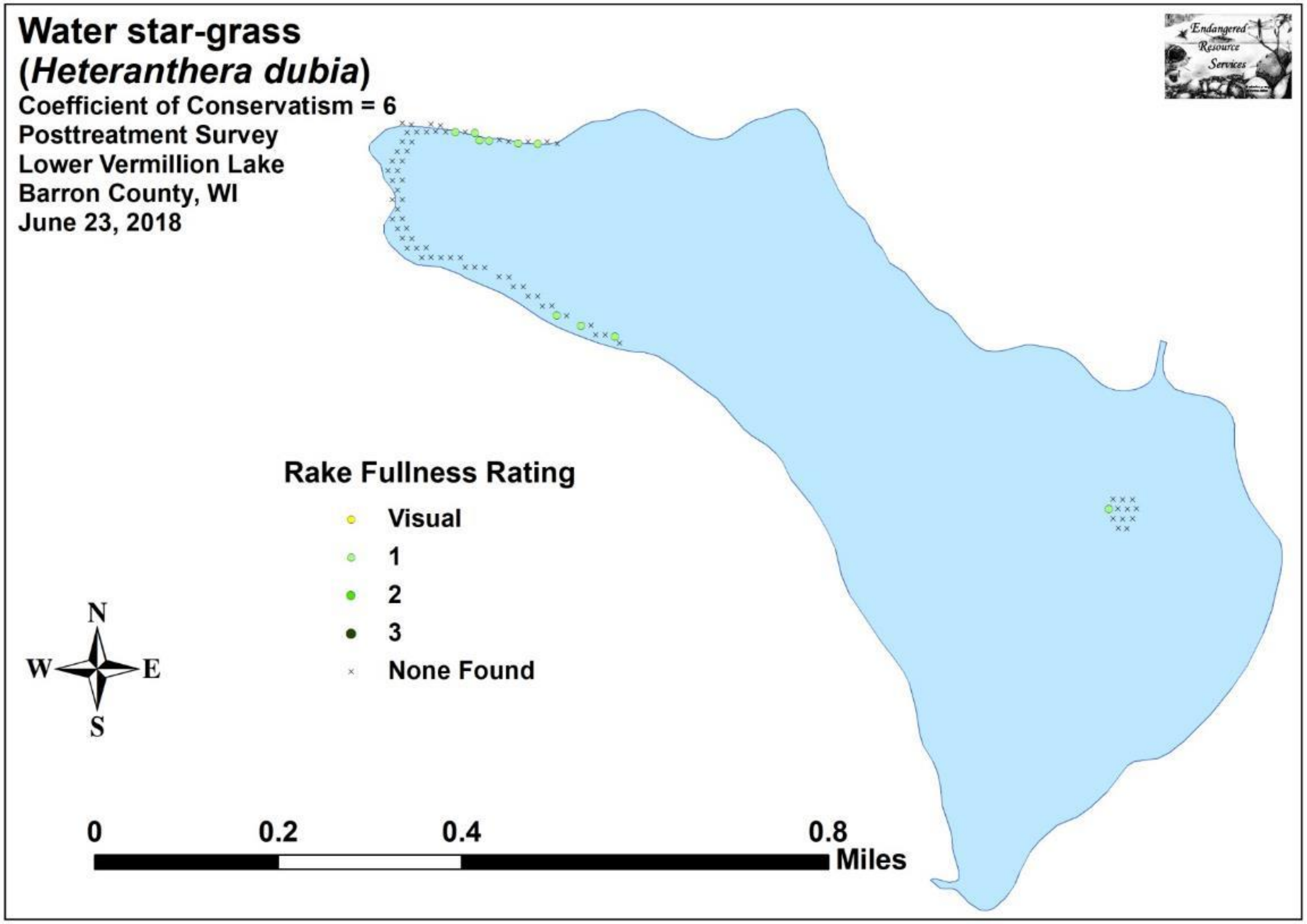


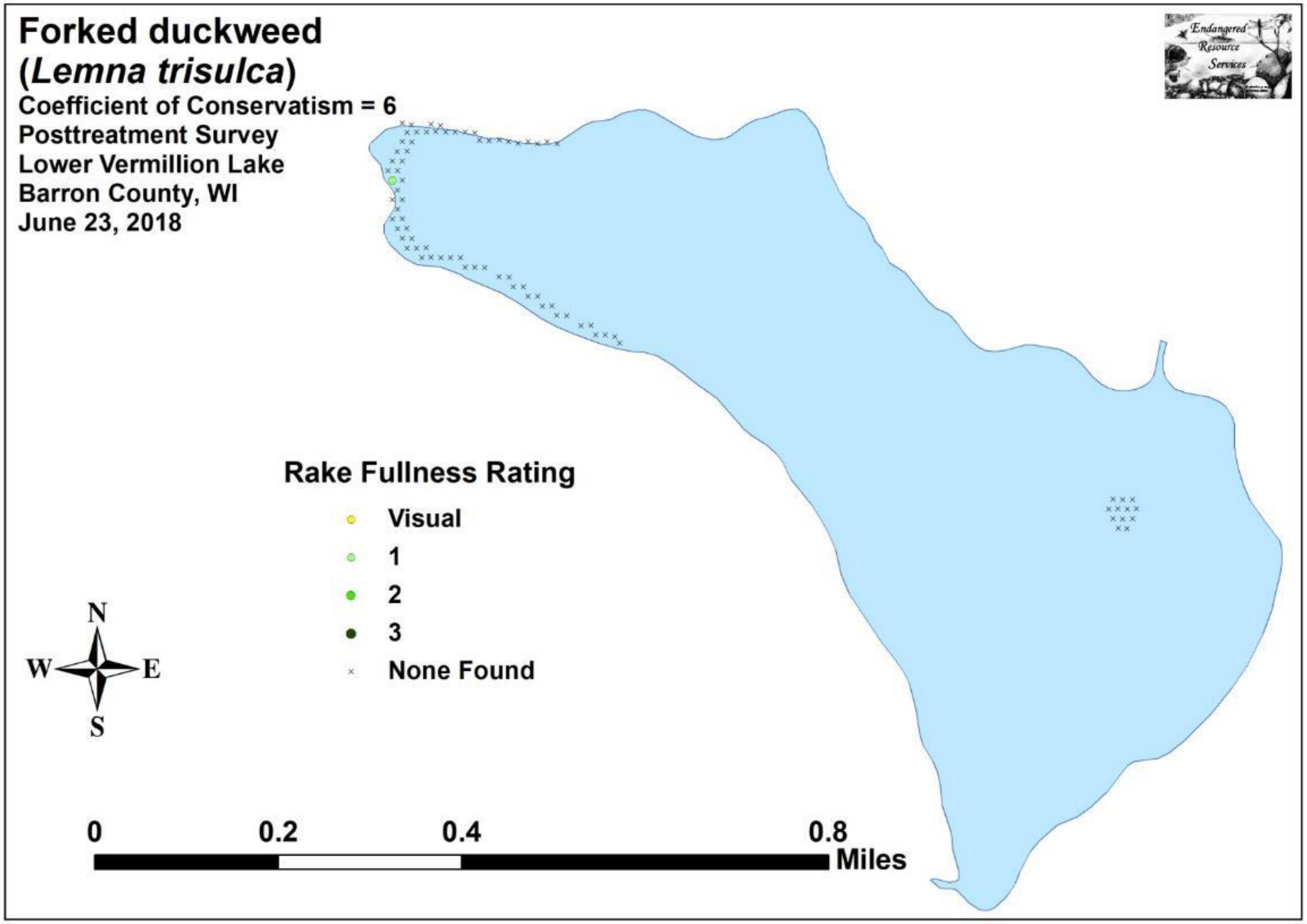
Coontail
(*Ceratophyllum demersum*)
Coefficient of Conservatism = 3
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

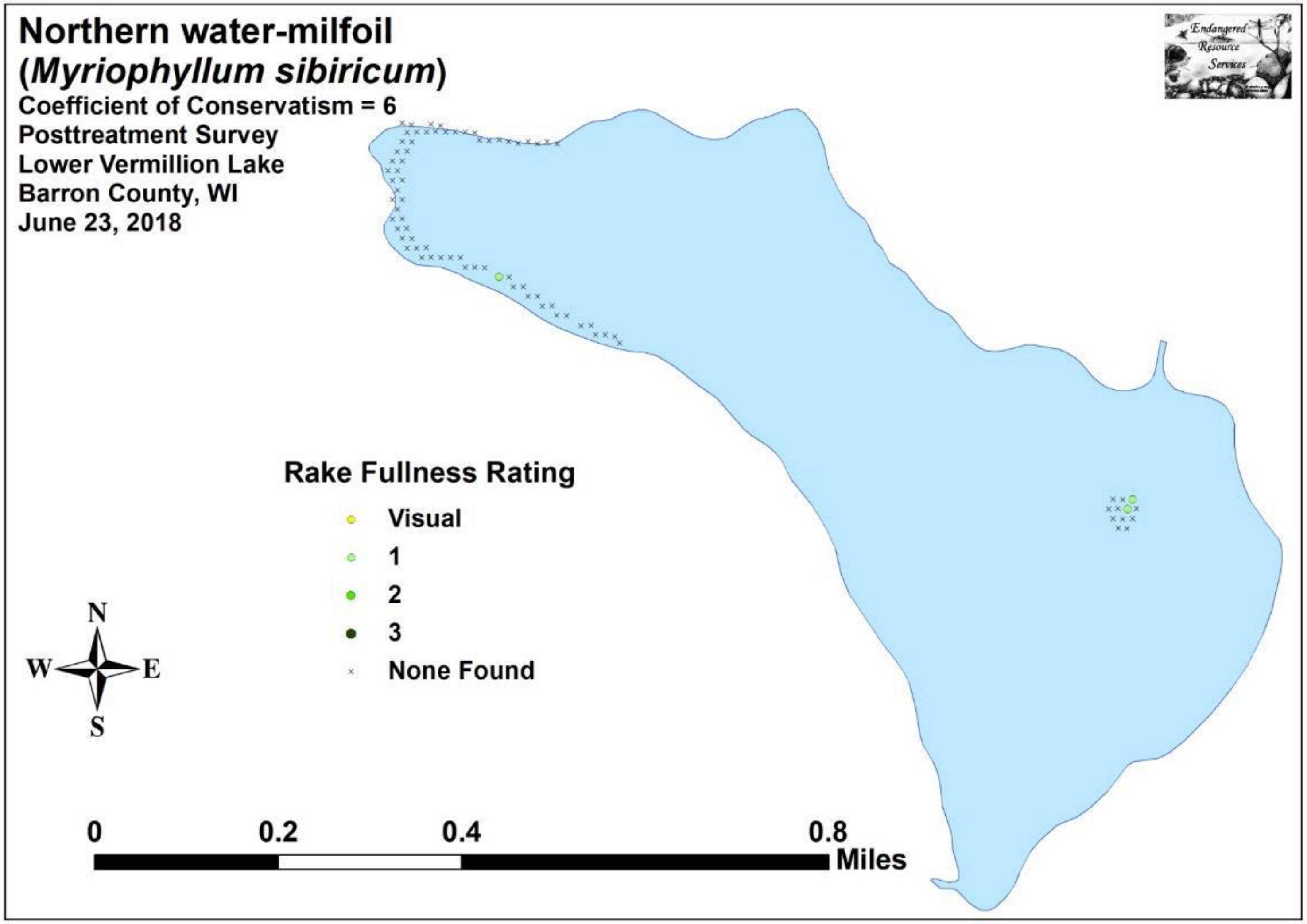

Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

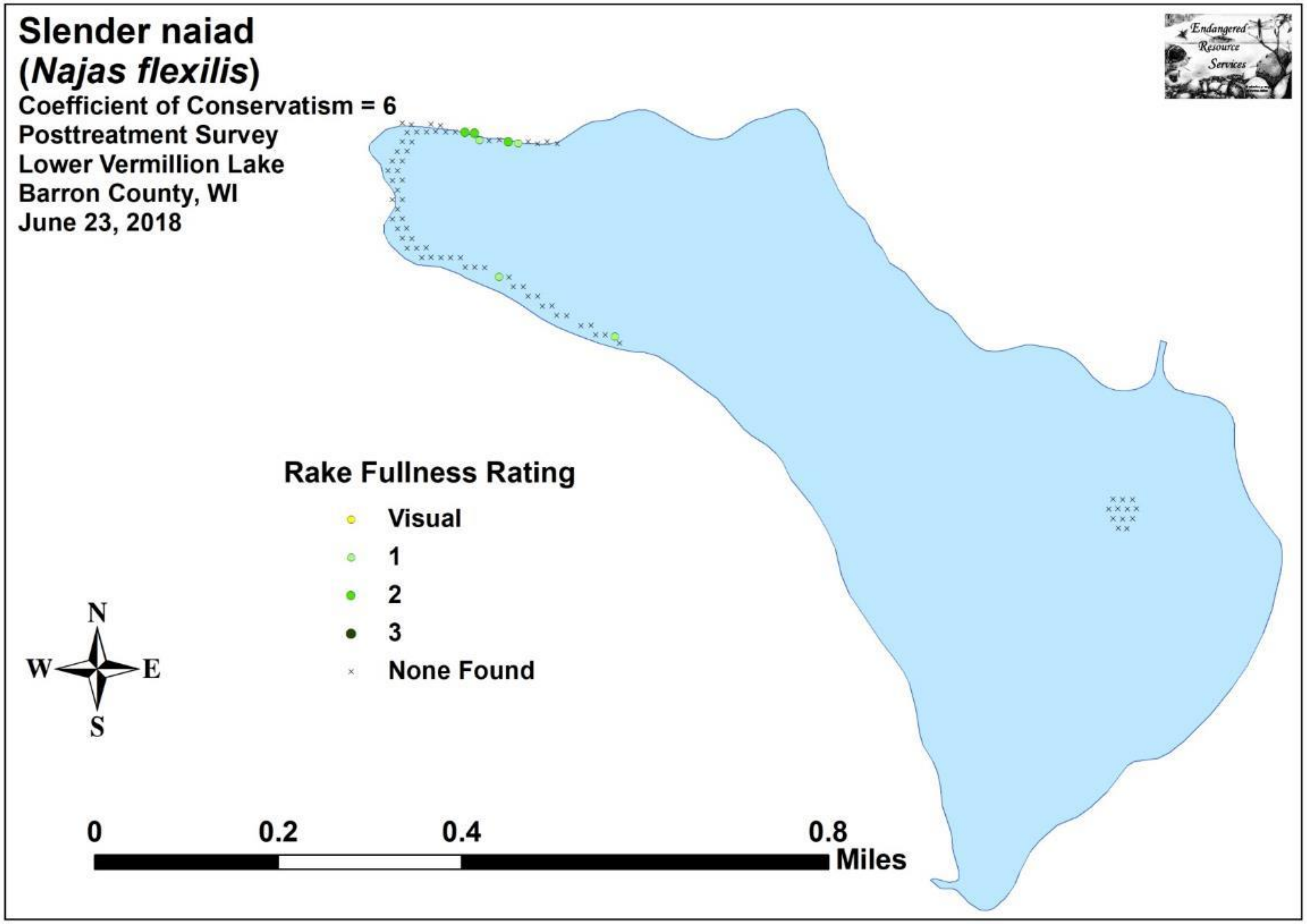

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

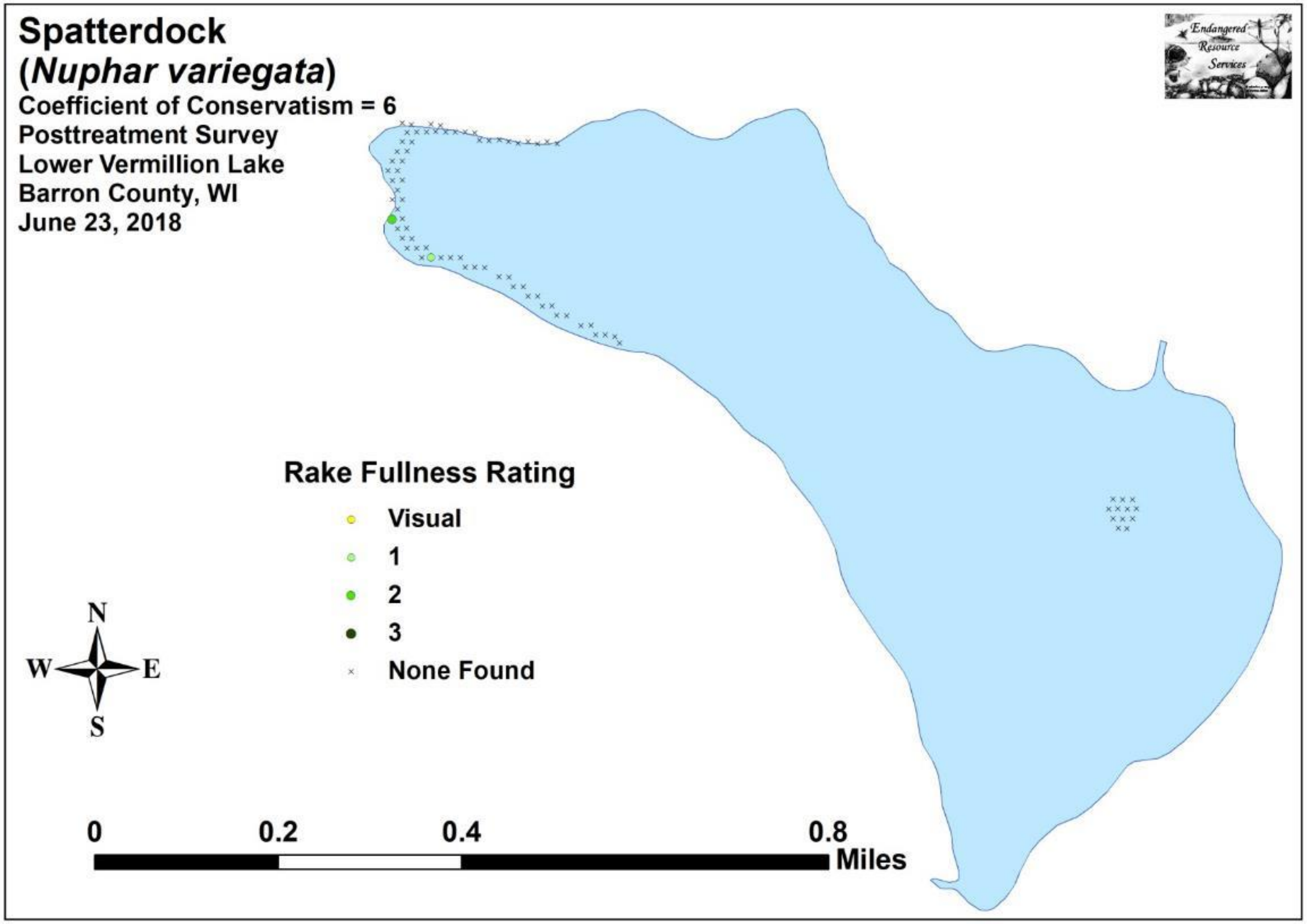

Filamentous algae
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles


Water star-grass
(*Heteranthera dubia*)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

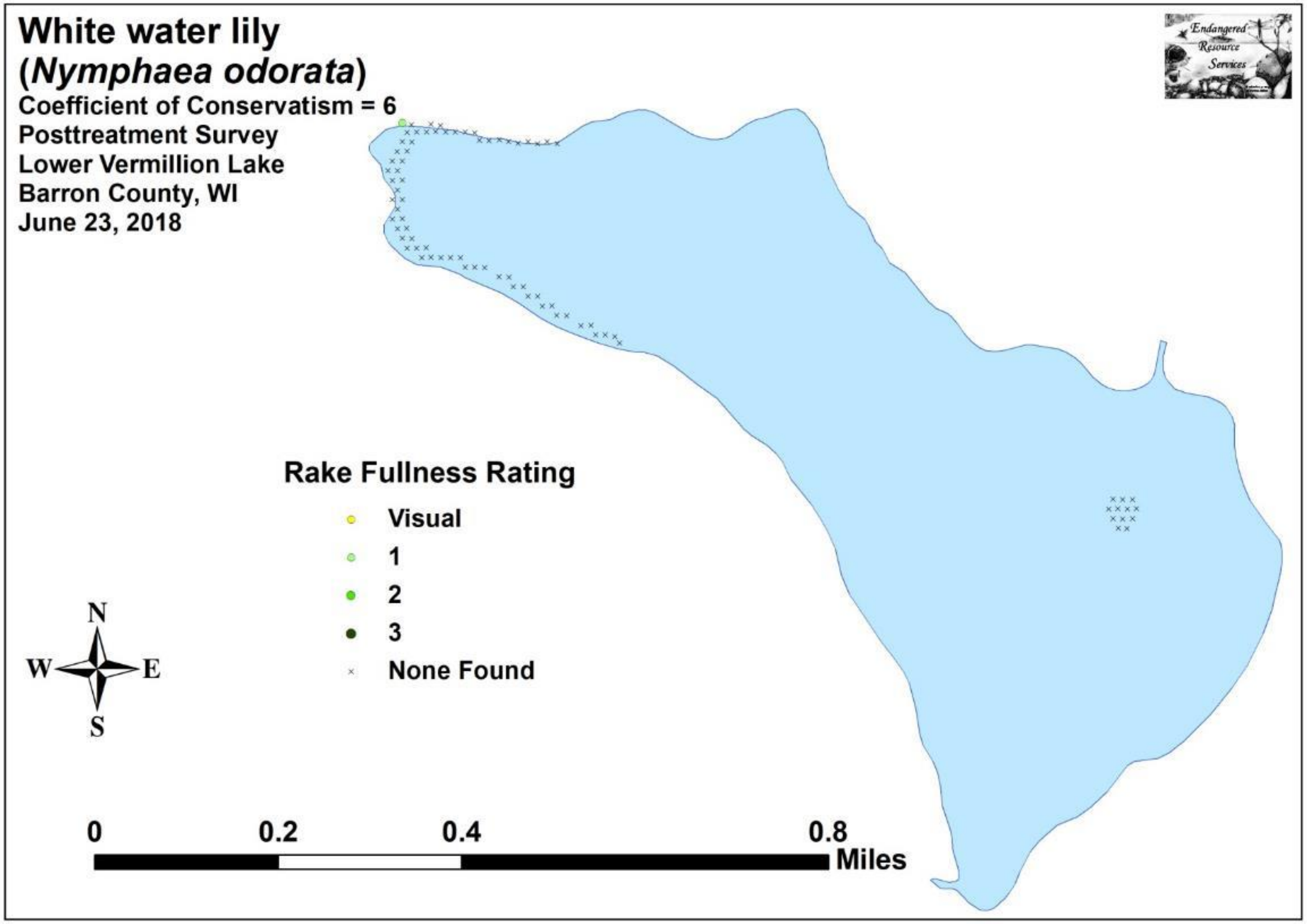

Forked duckweed
(Lemna trisulca)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

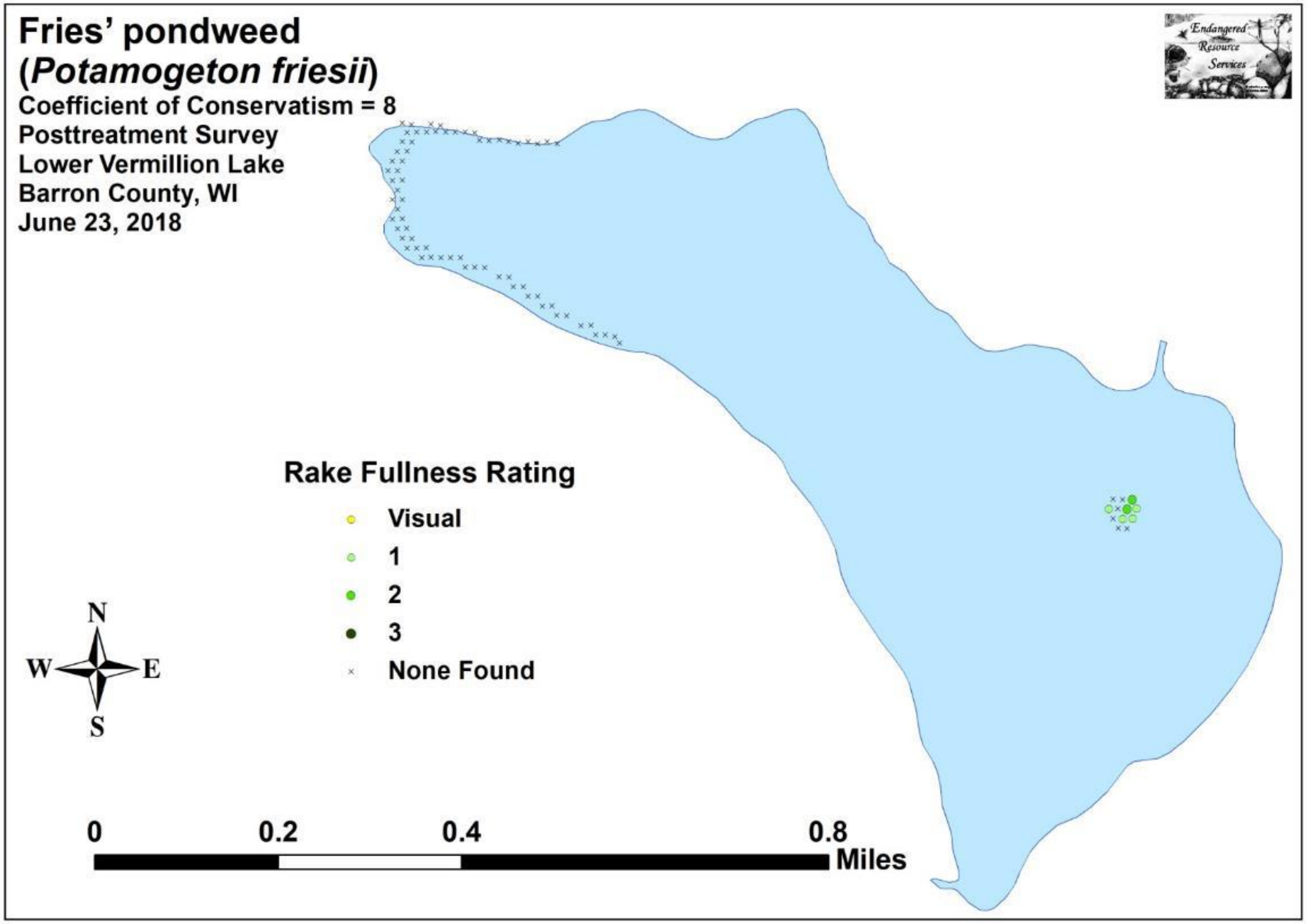

Northern water-milfoil
(*Myriophyllum sibiricum*)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

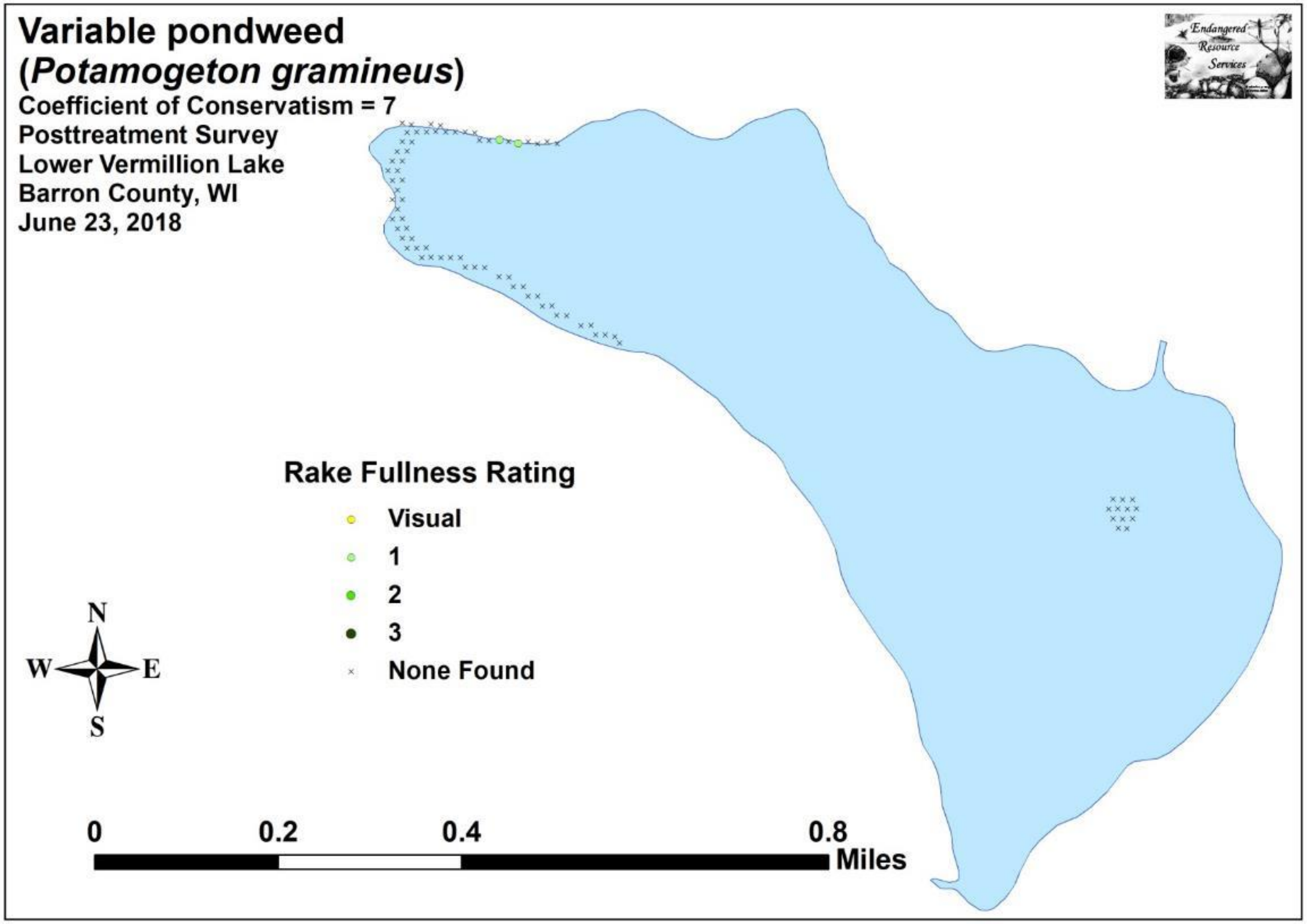

Slender naiad
(Najas flexilis)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles



Spatterdock
(*Nuphar variegata*)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles


White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles


Fries' pondweed
(Potamogeton friesii)
Coefficient of Conservatism = 8
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles


Variable pondweed
(Potamogeton gramineus)
Coefficient of Conservatism = 7
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
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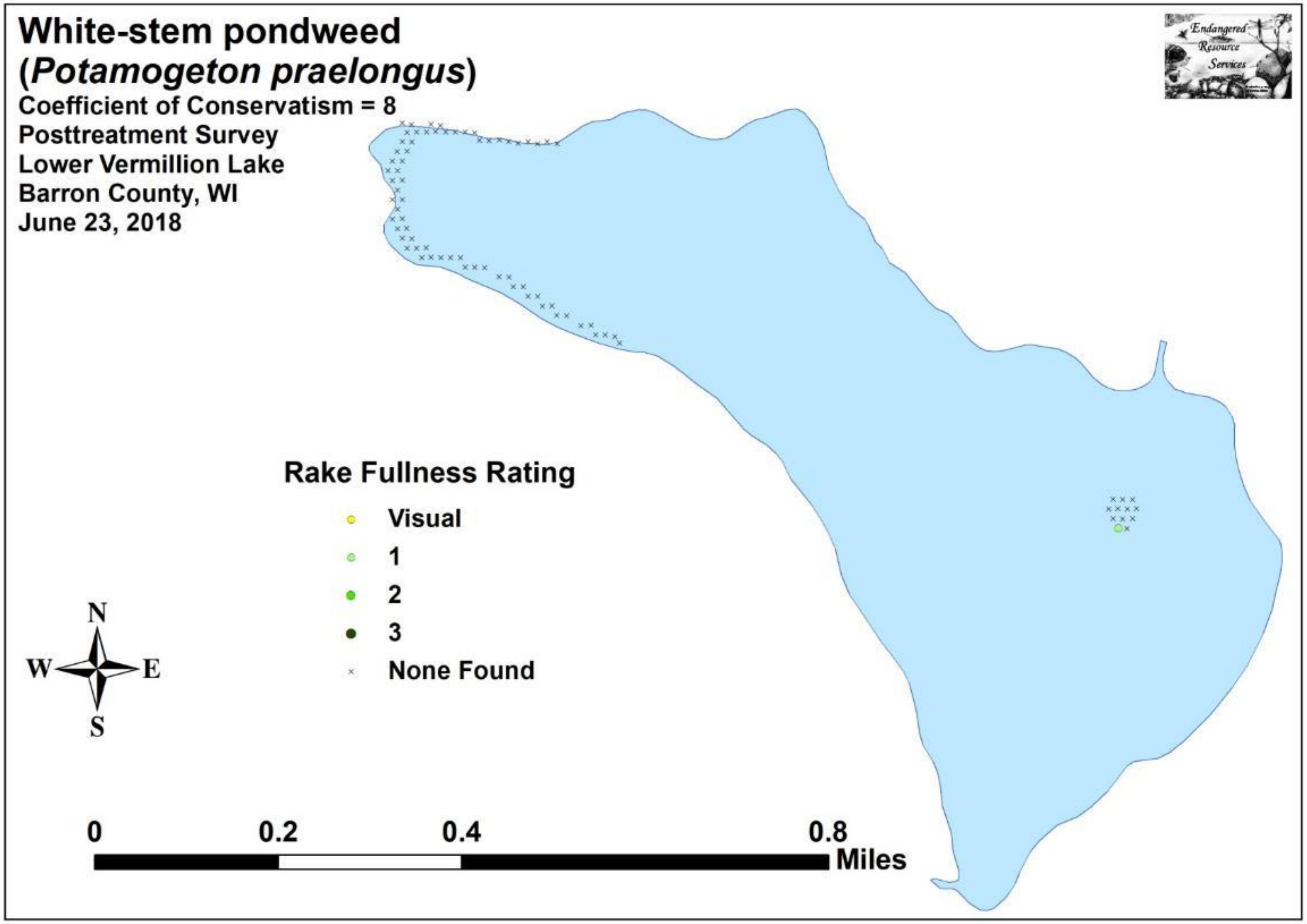
0
0.2
0.4
0.8
Miles


White-stem pondweed
(*Potamogeton praelongus*)
Coefficient of Conservatism = 8
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
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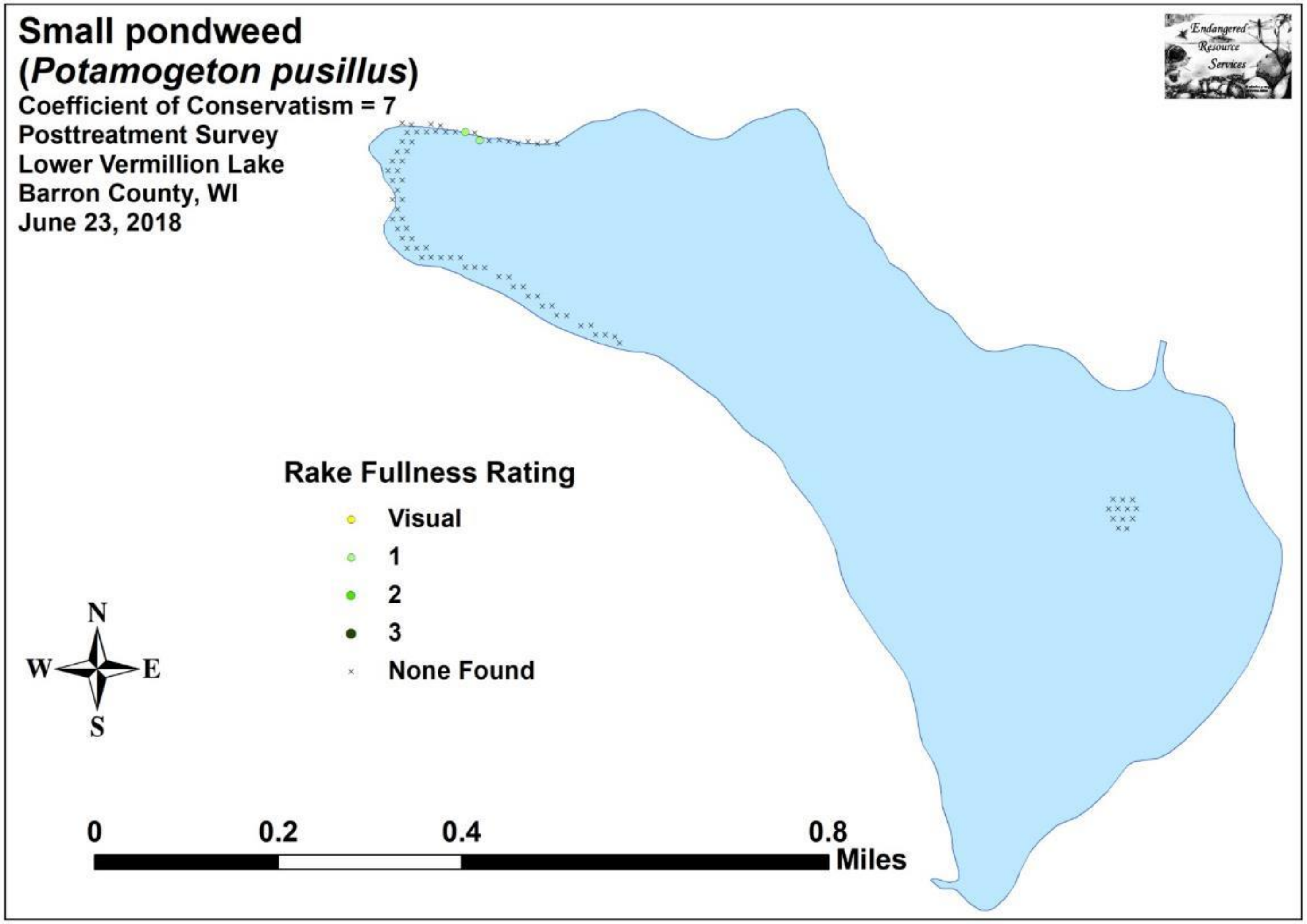
0.8
Miles


Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
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None Found
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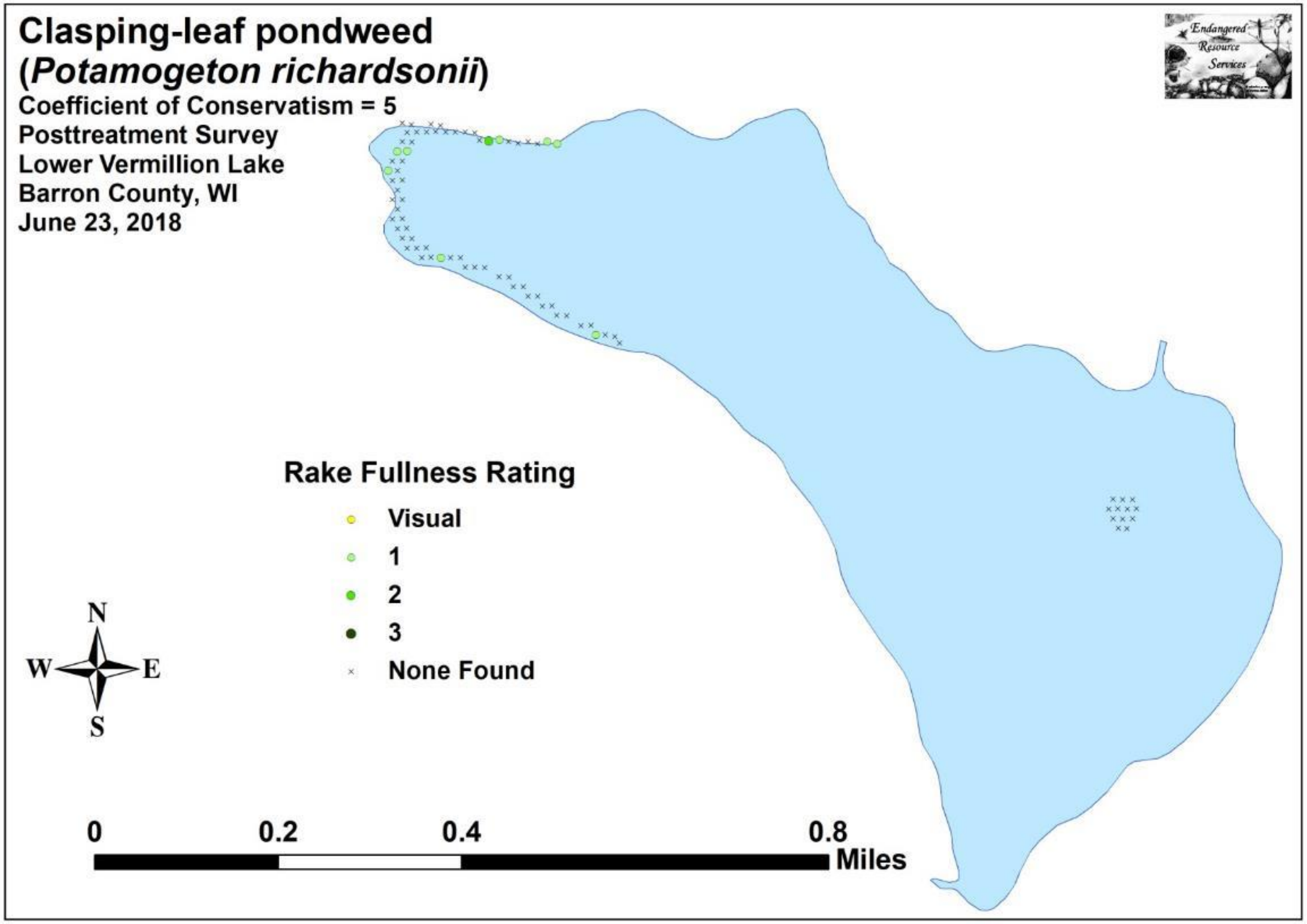
0.2
0.4
0.8
Miles


Clasping-leaf pondweed
(Potamogeton richardsonii)
Coefficient of Conservatism = 5
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
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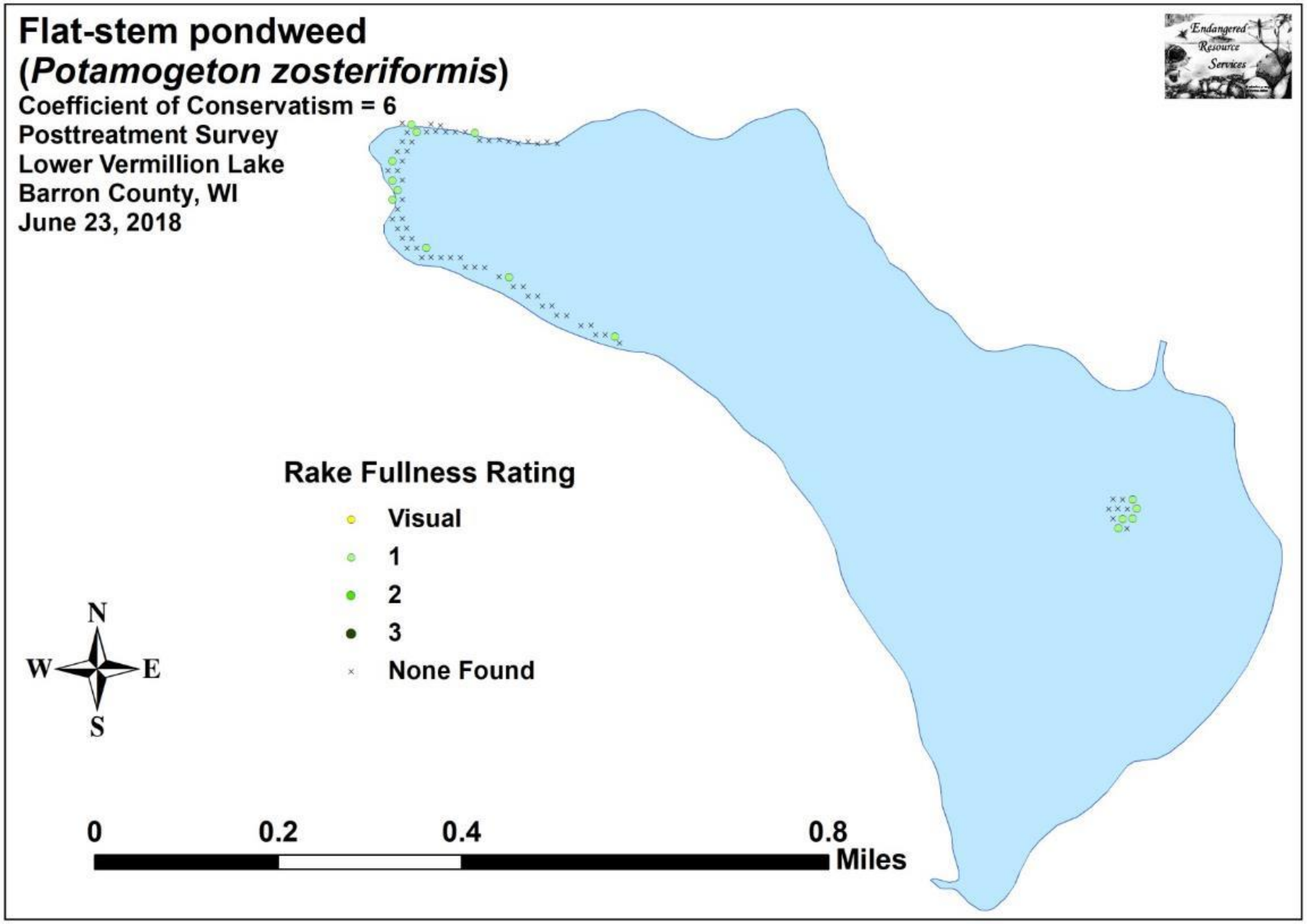
0.2
0.4
0.8
Miles



Flat-stem pondweed
(*Potamogeton zosteriformis*)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
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3
None Found
N
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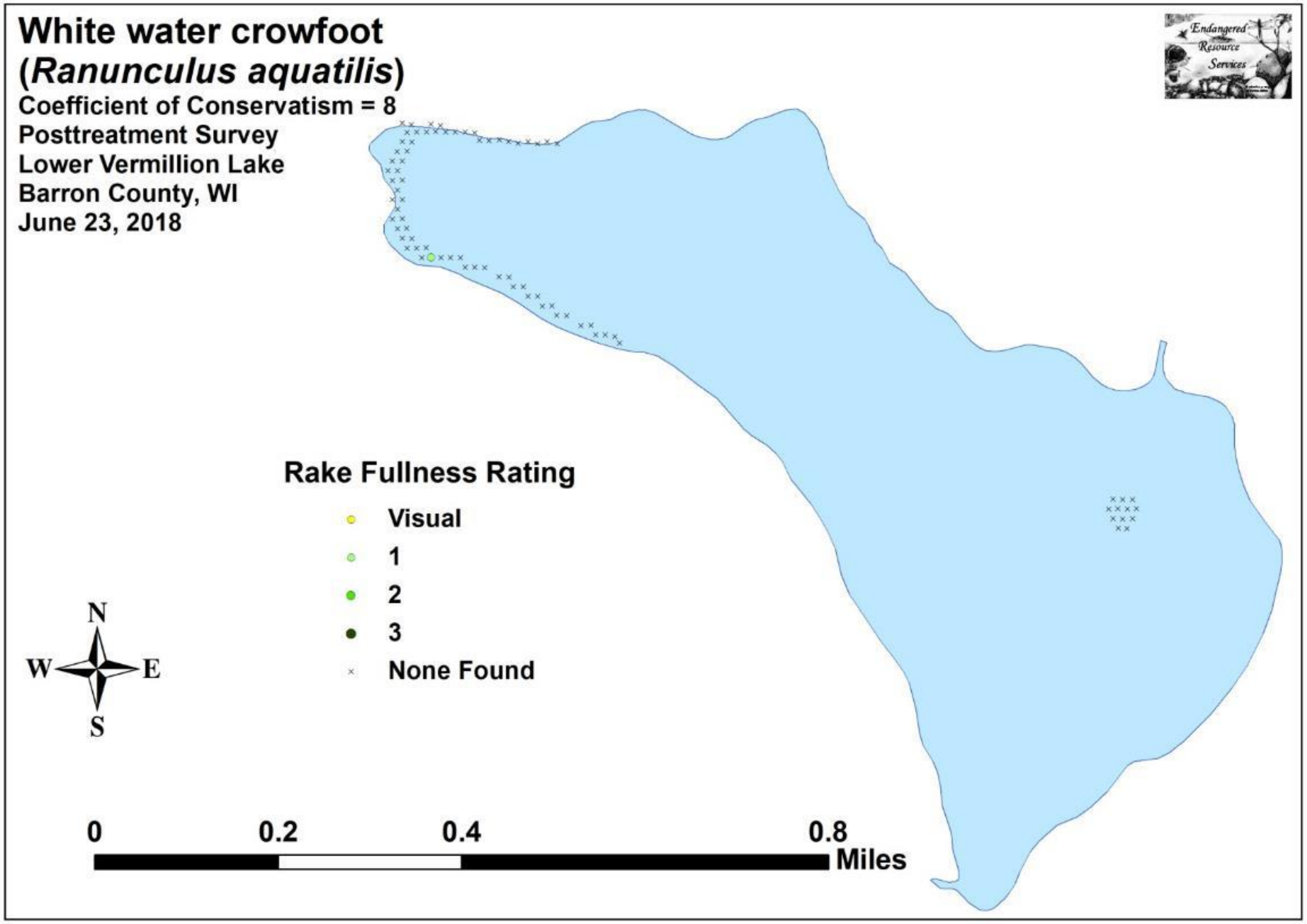
0.2
0.4
0.8
Miles


White water crowfoot
(Ranunculus aquatilis)
Coefficient of Conservatism = 8
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
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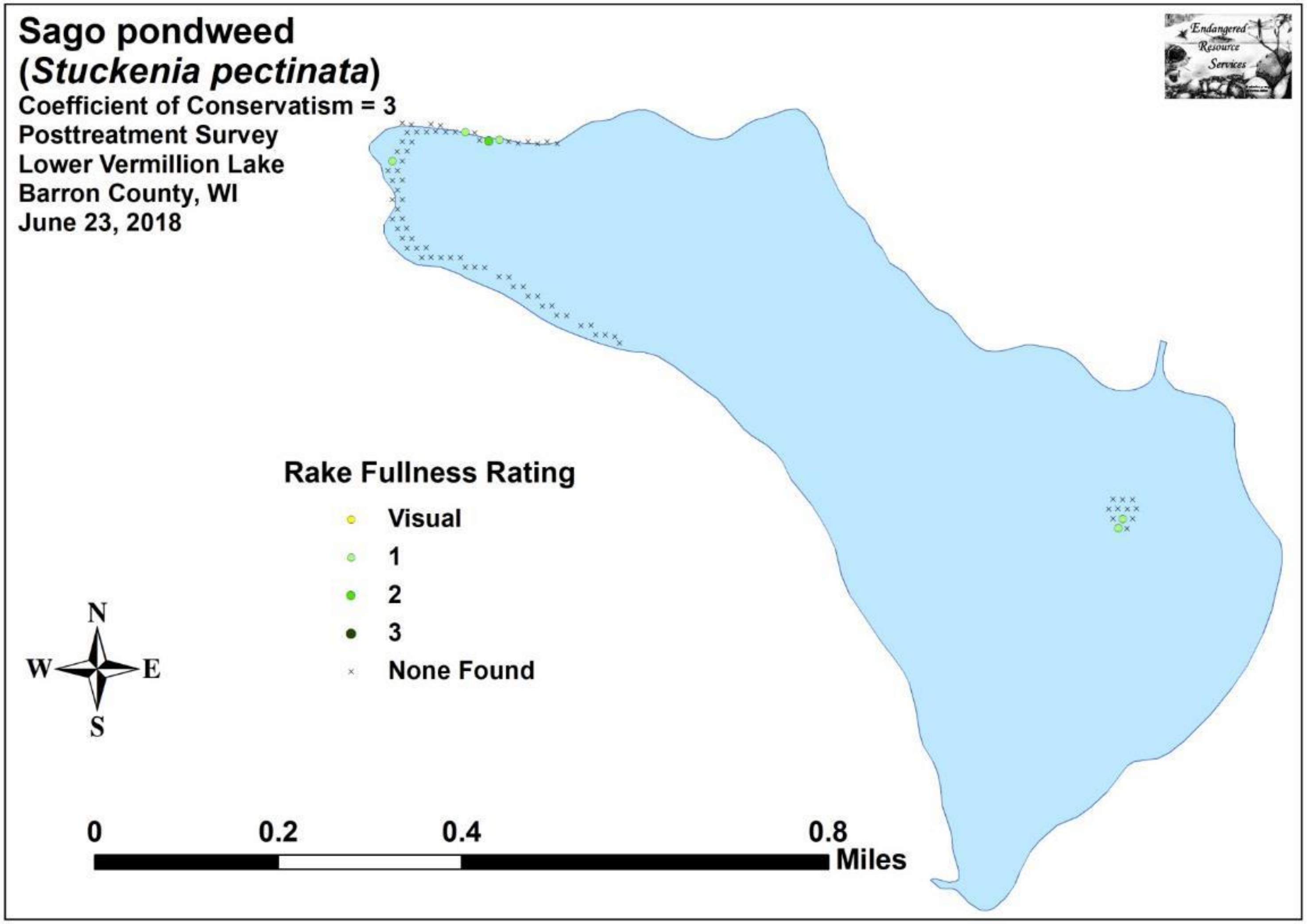
0.2
0.4
0.8
Miles


Sago pondweed
(Stuckenia pectinata)
Coefficient of Conservatism = 3
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
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None Found
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0.2
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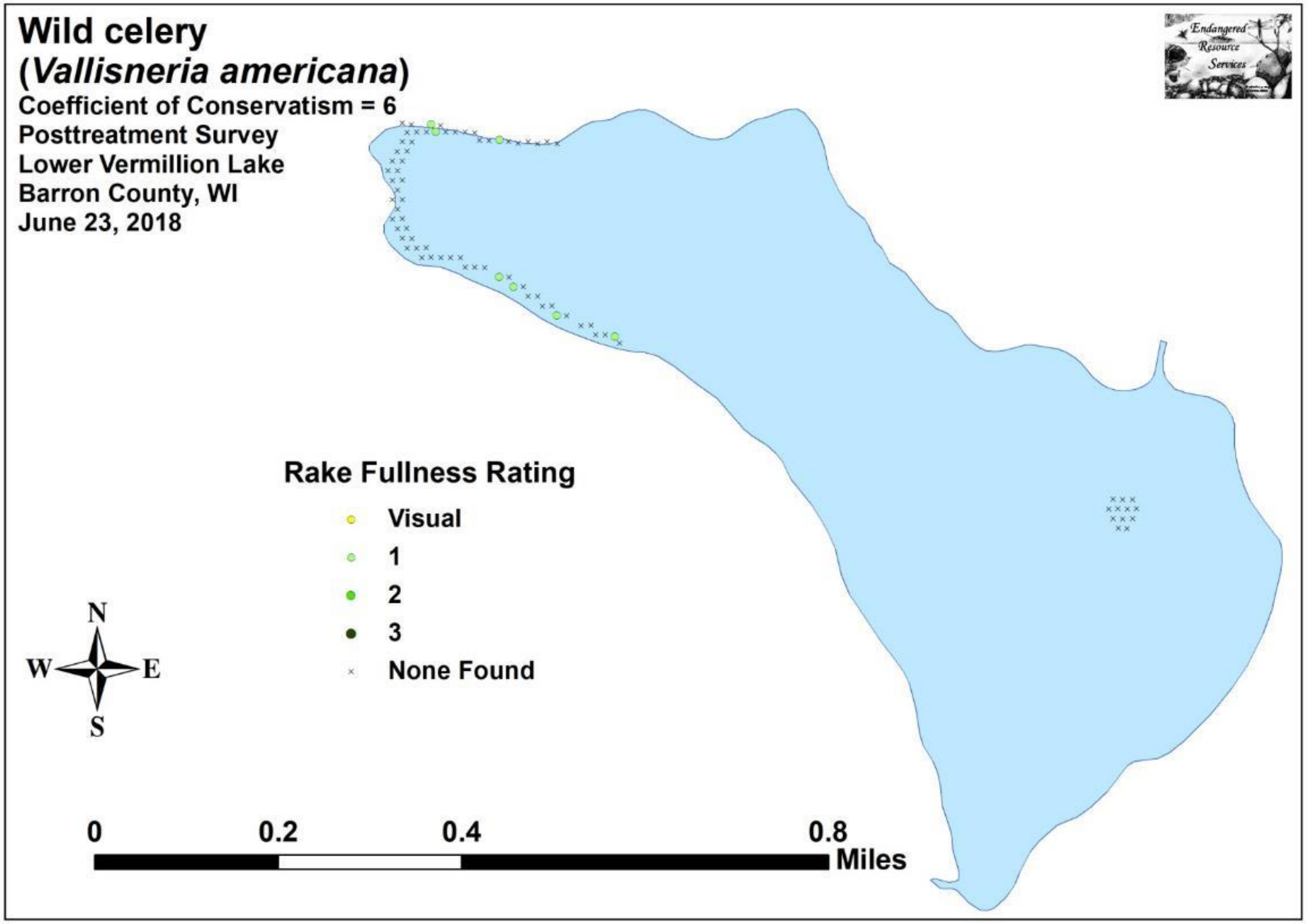
0.8
Miles


Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
June 23, 2018
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles