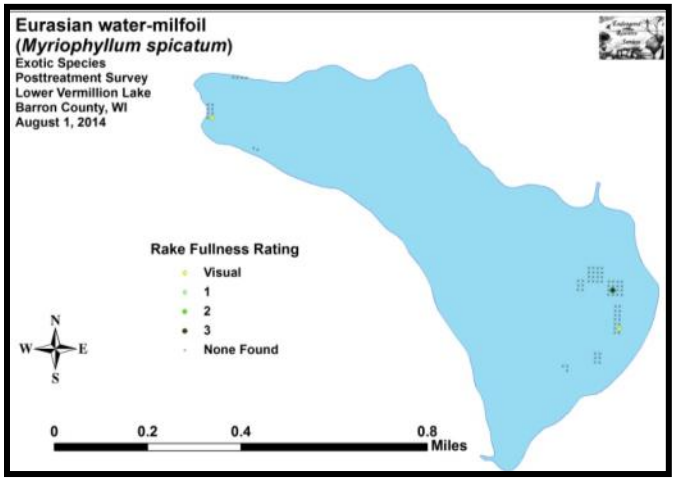
Eurasian water milfoil (*Myriophyllum spicatum*) Pre/Post Herbicide and Fall Bed Mapping Surveys Lower Vermillion Lake – WBIC: 2098200 Barron County, Wisconsin



2014 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 (Grant AIRR-108-12)


2014 EWM treatment areas

Survey Conducted by and Report Prepared by:
Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin
June 1, August 1, and October 11, 2014

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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). The lake reaches a maximum depth of 55 feet in the central basin and has an average depth of approximately 25ft (Busch et al 1967). Although limited historical data is available, Lower Vermillion appears to be mesotrophic and water clarity has been fair to good with summer Secchi readings ranging from 7-12ft (WDNR 2014). This clarity produced a littoral zone that reached approximately 12ft in the spring of 2014. Bottom substrates along the north, south, and southeastern shorelines are primarily rocky/sandy while most of the east bay and main basin are organic muck or sandy muck in nature.

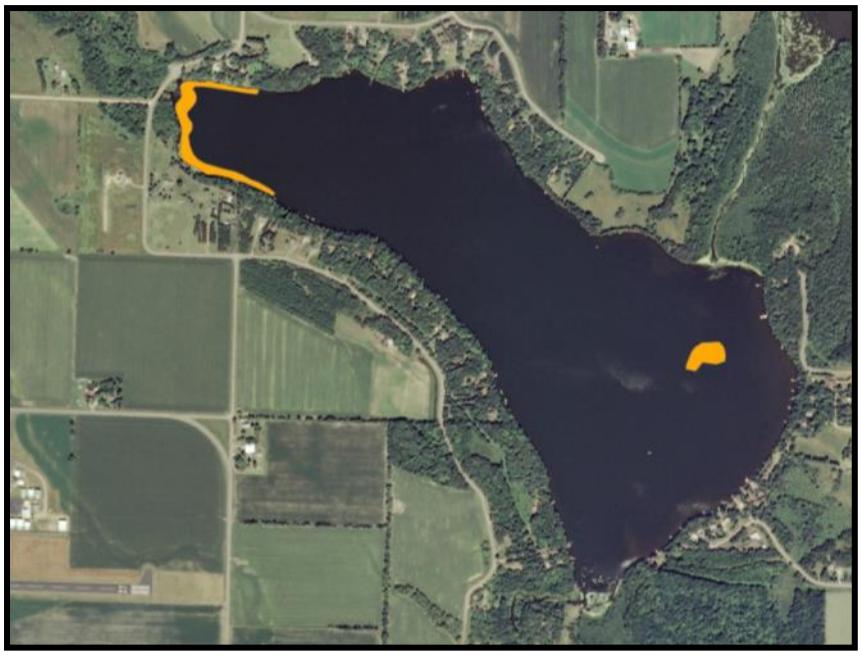


Figure 1: 2014 EWM Treatment Areas

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 2013 fall EWM bed mapping survey that found a few EWM towers in the eastern bay and scattered patches throughout the northwest bay near the boat landing, the VLA, under the direction of Lake Education and Planning Services LLC (LEAPS) and in accordance with the WDNR approved Vermillion Lakes Aquatic Plant Management Plan, decided to chemically treat two areas in 2014. Combined, they totaled 4.34 acres or 2.0% of the lake's total surface area (Figure 1).

On June 1st, we conducted a pretreatment survey to gather baseline data from the scheduled treatment areas and to allow LEAPS to finalize treatment plans. Following the June 6th herbicide application, we conducted an August 1st posttreatment survey to evaluate the effectiveness of the treatment. We also conducted an October 11th EWM bed mapping survey to determine where EWM control might be considered in 2015. This report is the summary analysis of these three field surveys.

METHODS:

Pre/Post Herbicide Survey:

LEAPS requested we use the same 75 survey points developed in 2013 for the 2014 surveys. Although the majority of these points fell outside the 2014 treatment areas as they were based on that year's treatment, they served as exploratory point to see if EWM had returned in the former beds. Despite this high number of points outside the treatment areas, the grid still met the WDNR pre/post protocol expectation of between 4 and 10 points/acre (Appendix I).

During the surveys, we located each of these points using a handheld mapping GPS unit (Garmin 76CSx) and used a rake to sample an approximately 2.5ft section of the bottom. All plants on the rake were assigned a rake fullness value of 1-3 as an estimation of abundance, and a total rake fullness for all species was also recorded (Figure 2). Visual sightings of EWM were noted if they occurred within 6ft of the point. In addition to plant data, we recorded the lake depth using a hand held sonar (Vexilar LPS-1) and the bottom substrate (bottom type) when we could see it or reliably determine it with the rake.

We entered all data collected into the standard WDNR APM spreadsheet (Appendix II). These data were then analyzed using the linked statistical summary sheet and the WDNR pre/post analysis worksheet (UWEX 2010). Pre/post treatment differences were determined to be significant at $p < .05$, moderately significant at $p < .01$, and highly significant at $p < .005$.

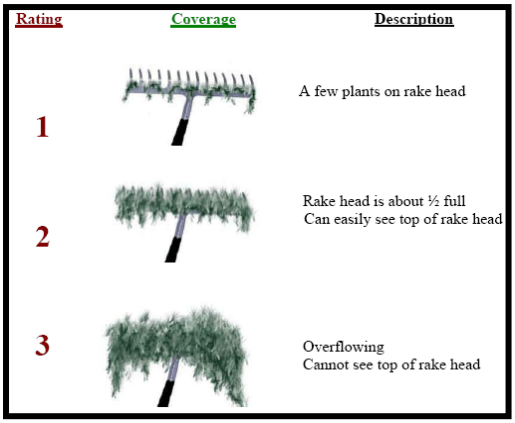


Figure 2: Rake Fullness Ratings

Fall Eurasian Water Milfoil Bed Mapping:

On October 11th, we searched the entire visible littoral zone of the lake and mapped all known beds of EWM. A "bed" was determined to be any area where we visually estimated that EWM made up >50% of the area's plants and was generally continuous with clearly defined borders. After we located a bed, we motored around the perimeter of the area, took GPS coordinates at regular intervals, and estimated the average rake fullness rating of EWM within the bed (Figure 2). Using the WDNR's Forestry Tool's Extension to ArcGIS 9.3.1, we plotted these coordinates to generate bed shapefiles and determine the acreage to the nearest hundredth of an acre. We also GPS marked individual EWM plants outside of the beds as they were few in number.

RESULTS AND DISCUSSION:

Finalization of Treatment Areas:

Initial expectations were to treat two beds totaling 3.14 acres with liquid (Bed A) or granular (Bed B) 2, 4-D (Navigate) at a concentration of 3-4 ppm (Table 1). Although the pretreatment survey did not find Eurasian water milfoil in the rake at any point, we noted EWM plants scattered throughout and just beyond the proposed treatment areas. Because of this, it was decided to expand the total area to be treated from 3.14 to 4.34 acres. This represented an acreage increase of 38% over initial expectations. The final treatment was conducted by Northern Aquatic Services (Dresser, WI) on June 6th (Figure 3) (Appendix I).

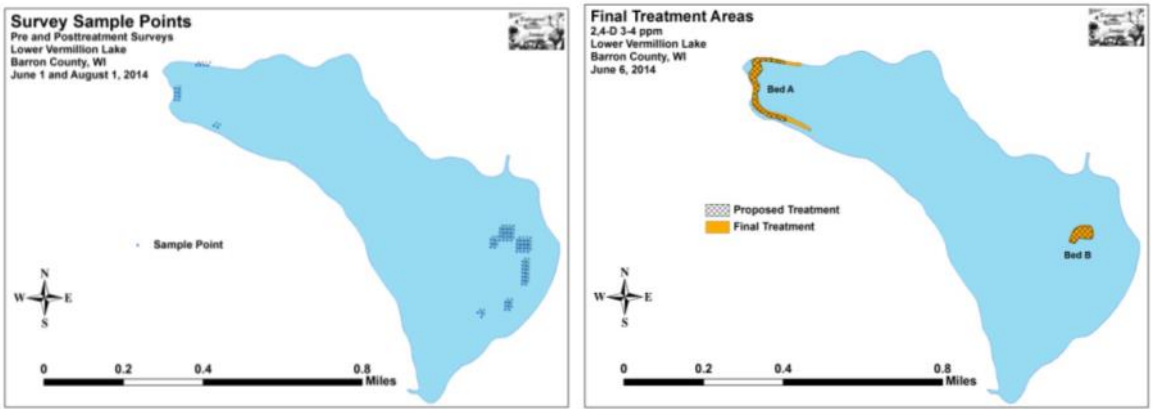


Figure 3: 2014 Survey Sample Points and Final Treatment Areas

Table 1: EWM Treatment Summary
Lower Vermillion Lake – June 6, 2014

Bed	Proposed Acreage	Final Acreage	Difference +/-
A	2.10	3.12	1.02
B	1.04	1.22	0.18
Total Acres	**3.14**	**4.34**	**+1.20**

EWM Pre/Post Herbicide Survey:

The survey area littoral zone extended from 11.5-12.0ft during both surveys. Mean and median depths for all plants were 7.5ft each during both surveys (Table 2). Most EWM was established over organic muck with a few low density patches occurring on sandy bottoms along the western shorelines (Figure 4) (Appendix III).

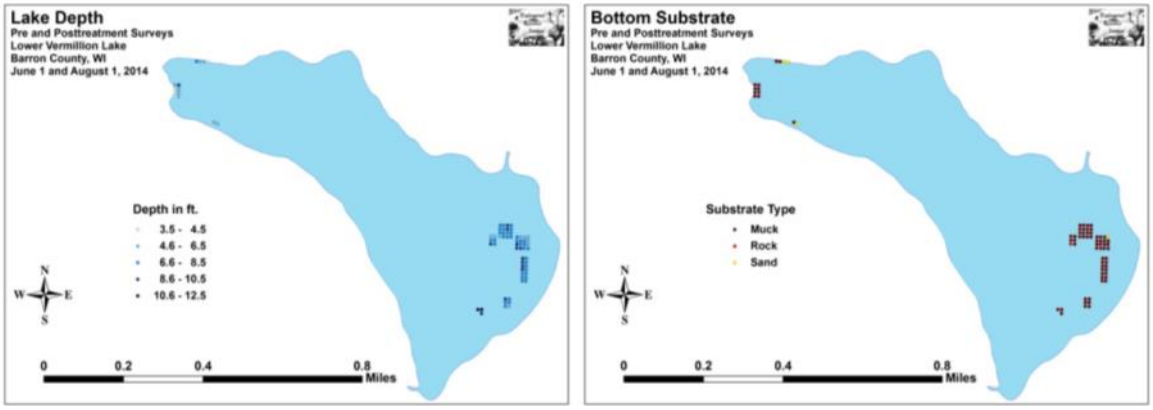


Figure 4: Treatment Area Depths and Bottom Substrate

Table 2: Pre/Post Survey Summary Statistics
Lower Vermillion Lake, Barron County
June 1 and August 1, 2014

Summary Statistics:	Pre	Post
Total number of points sampled	75	75
Total number of sites with vegetation	74	74
Total number of sites shallower than the maximum depth of plants	75	75
Frequency of occurrence at sites shallower than maximum depth of plants	100.0	98.7
Simpson Diversity Index	0.70	0.80
Floristic Quality Index	19.6	21.9
Mean Coefficient of Conservatism	5.9	5.9
Maximum depth of plants (ft)	11.5	12.0
Mean depth of plants (ft)	7.5	7.5
Median depth of plants (ft)	7.5	7.5
Average number of all species per site (shallower than max depth)	2.12	2.43
Average number of all species per site (veg. sites only)	2.12	2.46
Average number of native species per site (shallower than max depth)	2.12	2.41
Average number of native species per site (sites with native veg. only)	2.12	2.45
Species richness	11	15
Mean rake fullness (veg. sites only)	1.89	2.05

Initial diversity within the beds was moderate with a Simpson Index of 0.70. This value improved slightly to 0.80 posttreatment. The Floristic Quality Index, another measure of only native species, also showed a slight increase from 19.6 pretreatment to 21.9 posttreatment. Mean native species richness at sites with native vegetation was 2.12/site pretreatment and 2.45 species/site posttreatment (Figure 5). Total rake fullness also increased from 1.89 pretreatment to 2.05 posttreatment (Figure 6) (Appendix IV).

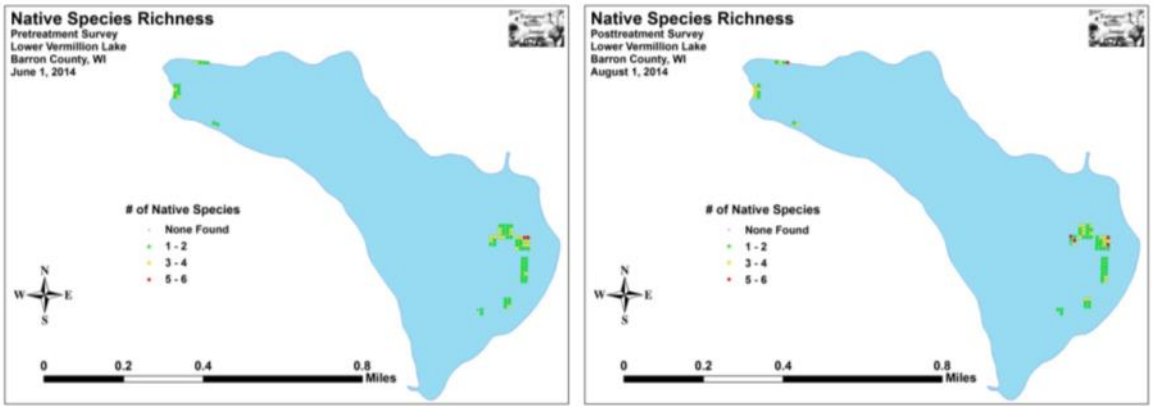


Figure 5: Pre/Post Native Species Richness

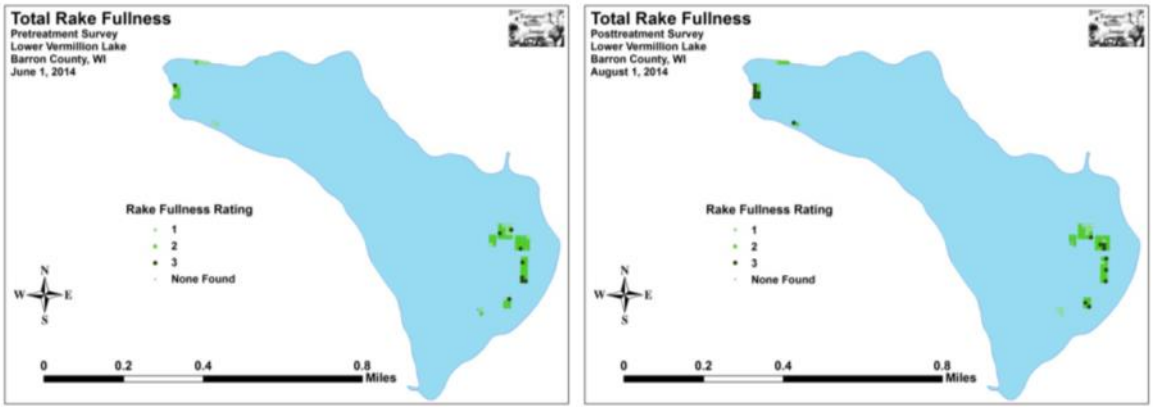


Figure 6: Pre/Post Total Rake Fullness

We didn't find EWM in the rake at any survey points during the pretreatment survey. Despite this, we did note plants as visuals at two points and also found them inter-point in both treatment areas. During the posttreatment survey, we located EWM at a single point in the eastern bay, and it rated a 3 as the point was within a small dense bed. We again recorded EWM as a visual at two points (Figure 7) (Appendix V). Our findings suggested there was no significant change in EWM within the treatment areas (Figure 8).

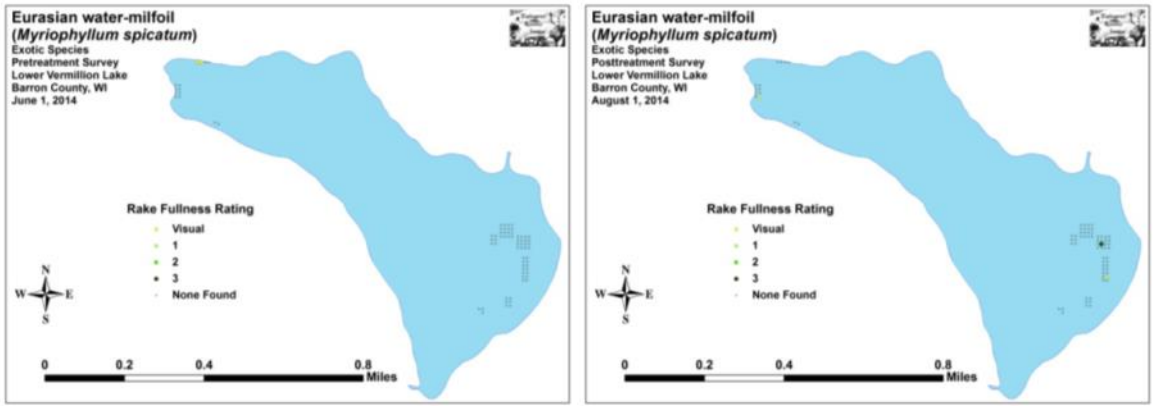
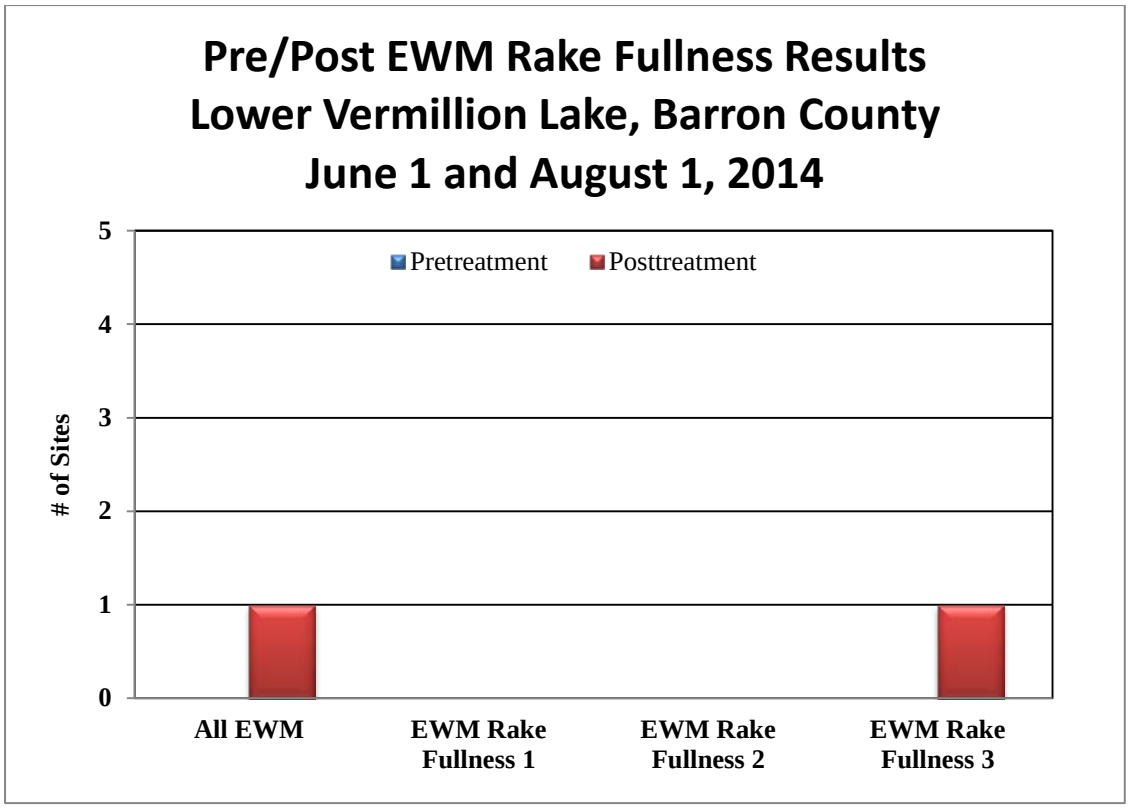


Figure 7: Pre/Post EWM Density and Distribution



Significant differences = * $p < .05$, ** $p < .01$, *** $p < .005$

Figure 8: Pre/Post Changes in EWM Rake Fullness

Coontail (*Ceratophyllum demersum*) and Flat-stem pondweed (*Potamogeton zosteriformis*), the two most common native species in both the pre and posttreatment surveys (Tables 3 and 4), showed no significant change posttreatment (Figures 9 and 10). White-stem pondweed (*Potamogeton praelongus*) was the only species that showed a significant decline posttreatment, and this likely had more to do with normal late-season senescence than the treatment as pondweeds are monocots and not generally affected by 2,4-D. Conversely, Clasping-leaf pondweed (*Potamogeton richardsonii*) demonstrated a highly significant increase; Small pondweed (*Potamogeton pusillus*) a moderately significant increase; and Wild celery (*Vallisneria americana*), Muskgrass (*Chara* sp.), Slender naiad (*Najas flexilis*), and filamentous algae significant increases posttreatment (Figure 11). These positive changes are all likely the product of normal growing season expansion (Maps for all native species from the pre and posttreatment surveys are available in Appendixes VI and VII).

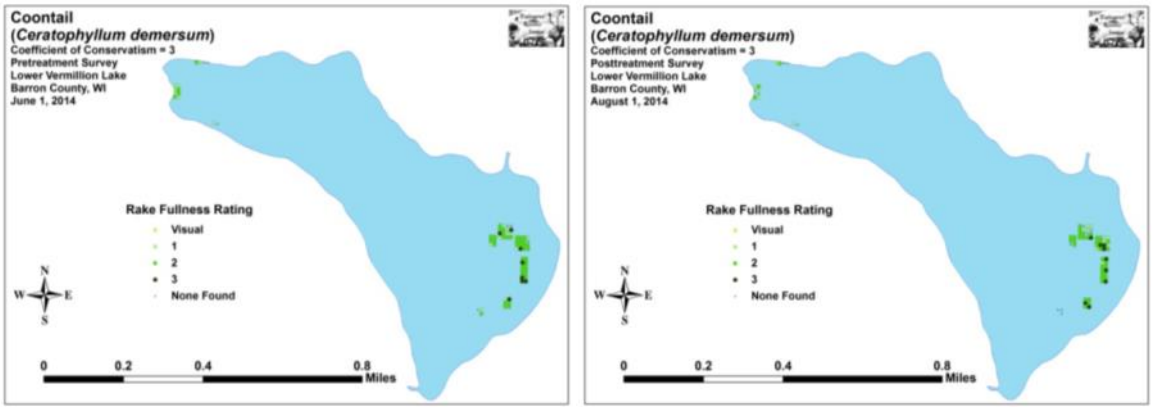


Figure 9: Pre/Post Coontail Density and Distribution

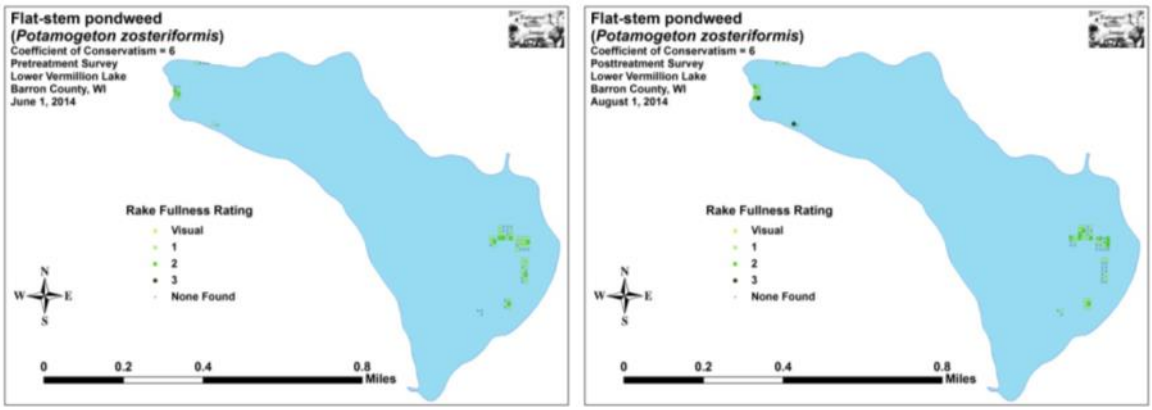
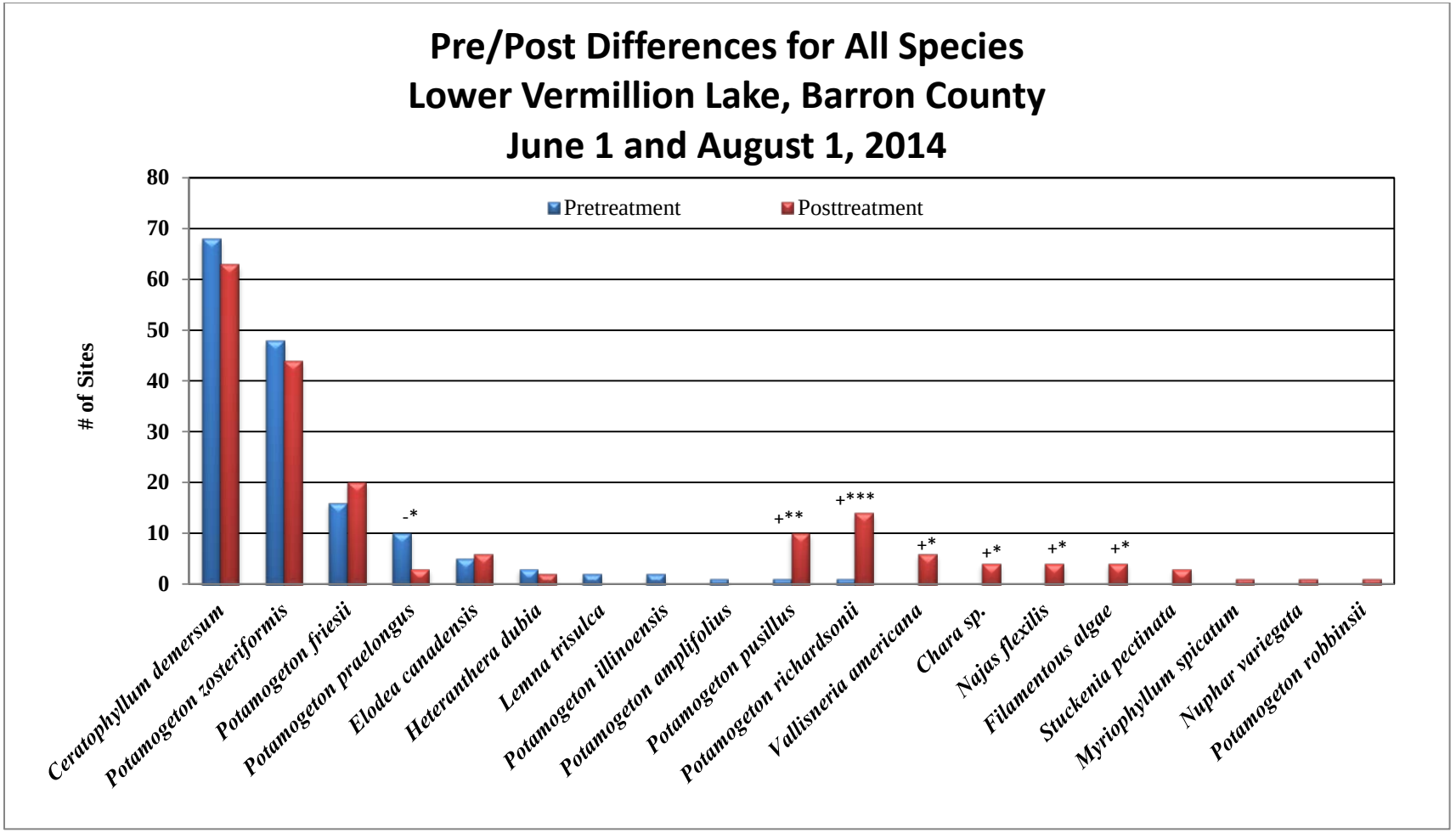


Figure 10: Pre/Post Flat-stem Pondweed Density and Distribution



Significant differences = * $p < .05$, ** $p < .01$, *** $p < .005$

Figure 11: Pre/Post Macrophyte Changes

Table 3: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Pretreatment Survey Lower Vermillion Lake, Barron County
June 1, 2014

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
Ceratophyllum demersum	Coontail	68	43.31	91.89	91.89	1.87	0
Potamogeton zosteriformis	Flat-stem pondweed	48	30.57	64.86	64.86	1.19	0
Potamogeton friesii	Fries' pondweed	16	10.19	21.62	21.62	1.13	0
Potamogeton praelongus	White-stem pondweed	10	6.37	13.51	13.51	1.00	0
Elodea canadensis	Common waterweed	5	3.18	6.76	6.76	1.80	0
Heteranthera dubia	Water star-grass	3	1.91	4.05	4.05	1.00	0
Lemna trisulca	Forked duckweed	2	1.27	2.70	2.70	1.00	0
Potamogeton illinoensis	Illinois pondweed	2	1.27	2.70	2.70	1.00	0
Potamogeton amplifolius	Large-leaf pondweed	1	0.64	1.35	1.35	1.00	0
Potamogeton pusillus	Small pondweed	1	0.64	1.35	1.35	1.00	0
Potamogeton richardsonii	Clasping-leaf pondweed	1	0.64	1.35	1.35	1.00	0
Myriophyllum spicatum	Eurasian water milfoil	**	**	**	**	**	2
Potamogeton crispus	Curly-leaf pondweed	***	***	***	***	***	***

** Visual Only
*** Inter-point Only

Table 4: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Posttreatment Survey Lower Vermillion Lake, Barron County
August 1, 2014

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
Ceratophyllum demersum	Coontail	63	34.62	85.14	84.00	1.89	0
Potamogeton zosteriformis	Flat-stem pondweed	44	24.18	59.46	58.67	1.36	0
Potamogeton friesii	Fries' pondweed	20	10.99	27.03	26.67	1.35	0
Potamogeton richardsonii	Clasping-leaf pondweed	14	7.69	18.92	18.67	1.21	0
Potamogeton pusillus	Small pondweed	10	5.49	13.51	13.33	1.10	0
Elodea canadensis	Common waterweed	6	3.30	8.11	8.00	2.50	0
Vallisneria americana	Wild celery	6	3.30	8.11	8.00	1.00	0
Chara sp.	Muskgrass	4	2.20	5.41	5.33	1.75	0
Najas flexilis	Slender naiad	4	2.20	5.41	5.33	1.00	0
	Filamentous algae	4	*	5.41	5.33	1.00	0
Potamogeton praelongus	White-stem pondweed	3	1.65	4.05	4.00	1.33	0
Stuckenia pectinata	Sago pondweed	3	1.65	4.05	4.00	1.33	0
Heteranthera dubia	Water star-grass	2	1.10	2.70	2.67	2.00	0
Myriophyllum spicatum	Eurasian water milfoil	1	0.55	1.35	1.33	3.00	2
Nuphar variegata	Spatterdock	1	0.55	1.35	1.33	3.00	0
Potamogeton robbinsii	Fern pondweed	1	0.55	1.35	1.33	1.00	0

* Excluded from Relative Frequency Analysis

Fall EWM Bed Mapping Survey:

On October 11th, 2014, we located and mapped a total of 8 beds on the lake ranging in size from 0.01 acre (Beds 1, 3, and 7) to 0.54 acres (Bed 5) (Figure 12) (Appendix VIII). In total, these beds covered 1.18 acres or 0.5% of the total lake surface. This represented a 0.47 acre (68.6%) increase over the 0.71 acre found in 2013, but was still much below the peak of 2.70 acres found in 2012 (Table 5).

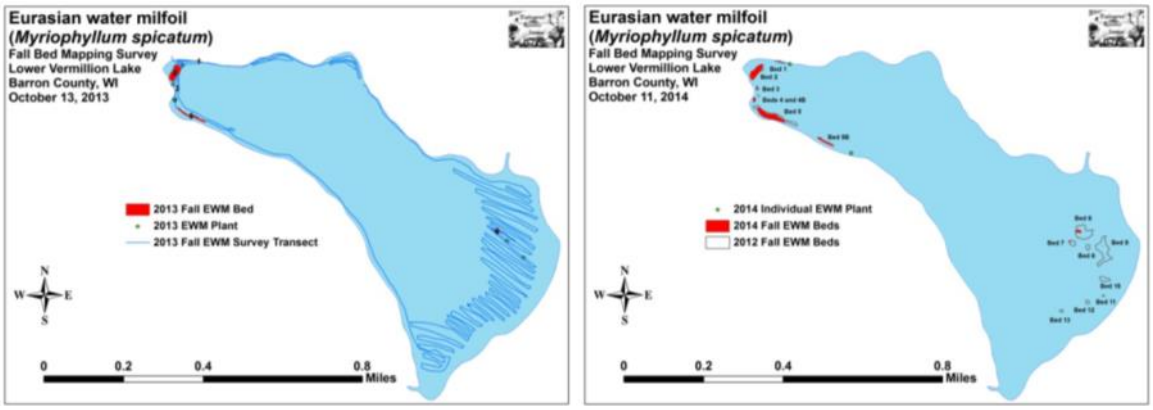


Figure 12: 2013 and 2014 Fall EWM Bed Maps

Descriptions of Past and Present EWM Beds:

Beds 1 and 5B – Both beds were more of a high density area (HDA) than a true bed as the EWM in them was somewhat scattered. Despite this, EWM plants were generally continuous, canopied and merging. They occurred in narrow strips along sharp drop-offs into 15ft+ of water which will likely again make treating these areas challenging.

Bed 2-3 – EWM plants were rapidly reestablishing throughout the treatment area, and many plants were prop-clipped as they were directly in front of the channel away from the public boat landing.

Beds 4 and 4B – We didn't see any plants in Bed 4, but Bed 4B contained scatted canopied plants mixed in with Spatterdock (*Nuphar variegata*).

Bed 5 – This was the worst we have ever seen this area as EWM formed a solid mat in many near shore areas. Plants were found from the shoreline to 8ft+ of water.

Beds 6 and 7 – Although EWM plants were greatly reduced from fall 2012, we found a few 10's of canopied clusters in 5-7ft of water on the western end of the formerly expansive beds. These beds were not visible at the surface in August, but, by October, they appeared to be fragmenting and growing rapidly.

Bed 9 – The single large tower found in August had almost doubled in size by October.

Beds 8, 10-13 – The only EWM seen in these beds was a single plant in Bed 10 that we rake removed in August. Other than that, we found these areas to be EWM free during all three surveys.

Table 5: Fall Eurasian Water Milfoil Bed Mapping Summary
Lower Vermillion Lake, Barron County
October 11, 2014

Bed Number	2014 Fall Bed Acreage	2013 Fall Bed Acreage	2012 Fall Bed Acreage	2011 Fall Bed Acreage	2014 Change in Acreage	Range and Estimated 2014 Mean Rake Fullness	2014 Bed Characteristics And Field Notes
1	0.01	0.02	0.02	0	-0.01	<1-1; most <1	Continuous scattered plants; more of a HDA
2	0.39	0.43	0.07	0.49	-0.04	<1-2; most 1	Plants regrowing, fragmenting, and merging
3	0.01	<0.01	0.03	0	0	1-2; most 2	A few merging towers
4	0	0	0.01	0	0	0	No EWM found
4B	0.04	0	0	0	0.04	<1-1; most <1	Continuous scattered plants; more of a HDA
5	0.54	0.22	0.70	0.35	0.32	<1-3; most 1	Continuous merging canopied plants
5B	0.13	0	0	0	0.13	<<1-1; most <1	Nearly continuous plants; more of a HDA
6	0.06	0.04	0.68	0	0.02	<1-3; most 3	Merging large canopied towers
7	0.01	0	0.10	0	0.01	<1-3; most 3	Merging large canopied towers
8	0	0	0.06	0	0	0	No EWM found
9	<0.01	0	0.80	0	<0.01	3	$10ft^2$ canopied group of towers.
10	0	0	0.14	0	0	0	No EWM found
11	0	0	0.01	0	0	0	No EWM found
12	0	0	0.05	0	0	0	No EWM found
13	0	0	0.03	0	0	0	No EWM found
Total	**1.18**	**0.71**	**2.70**	**0.84**	**0.47**		

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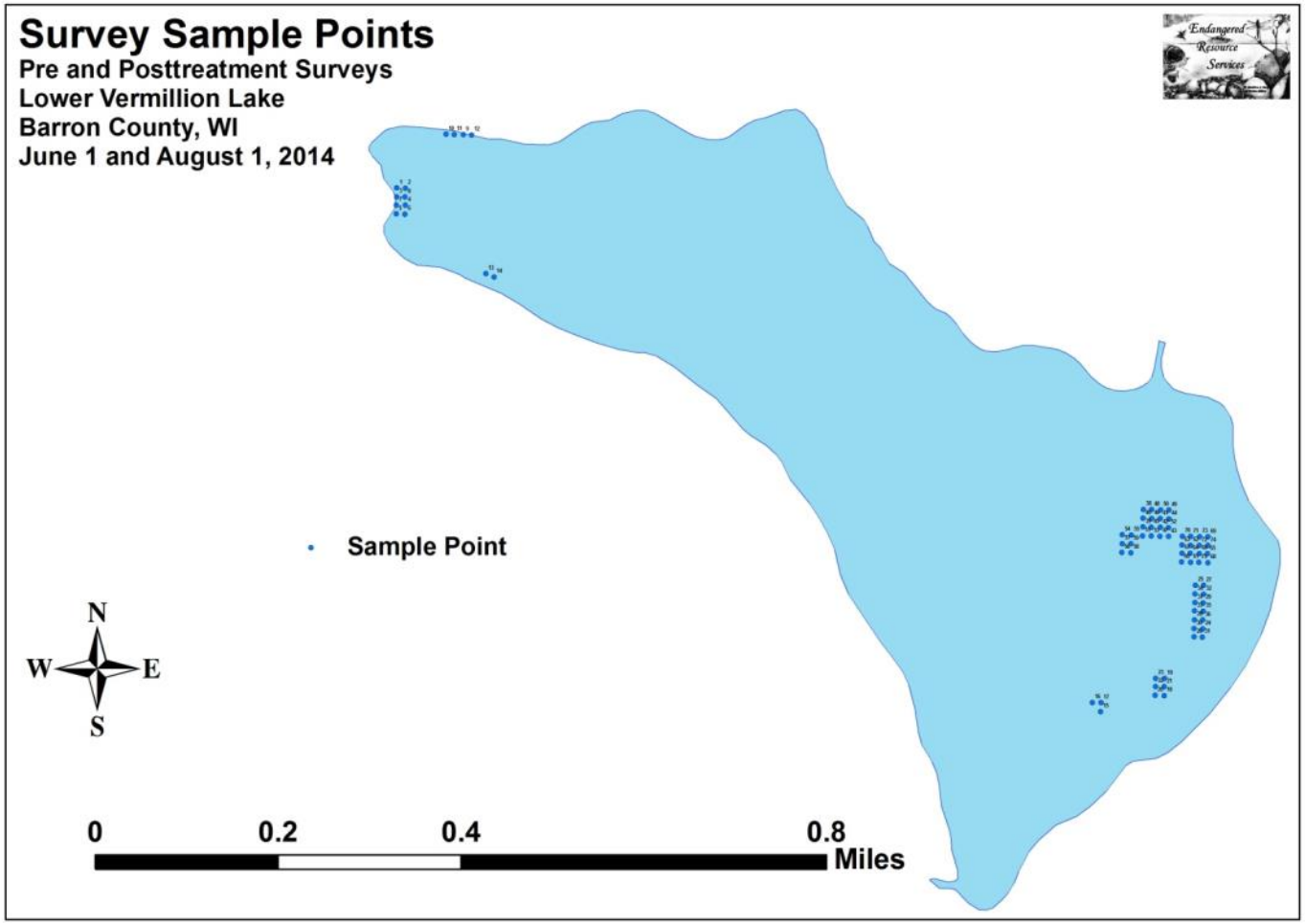
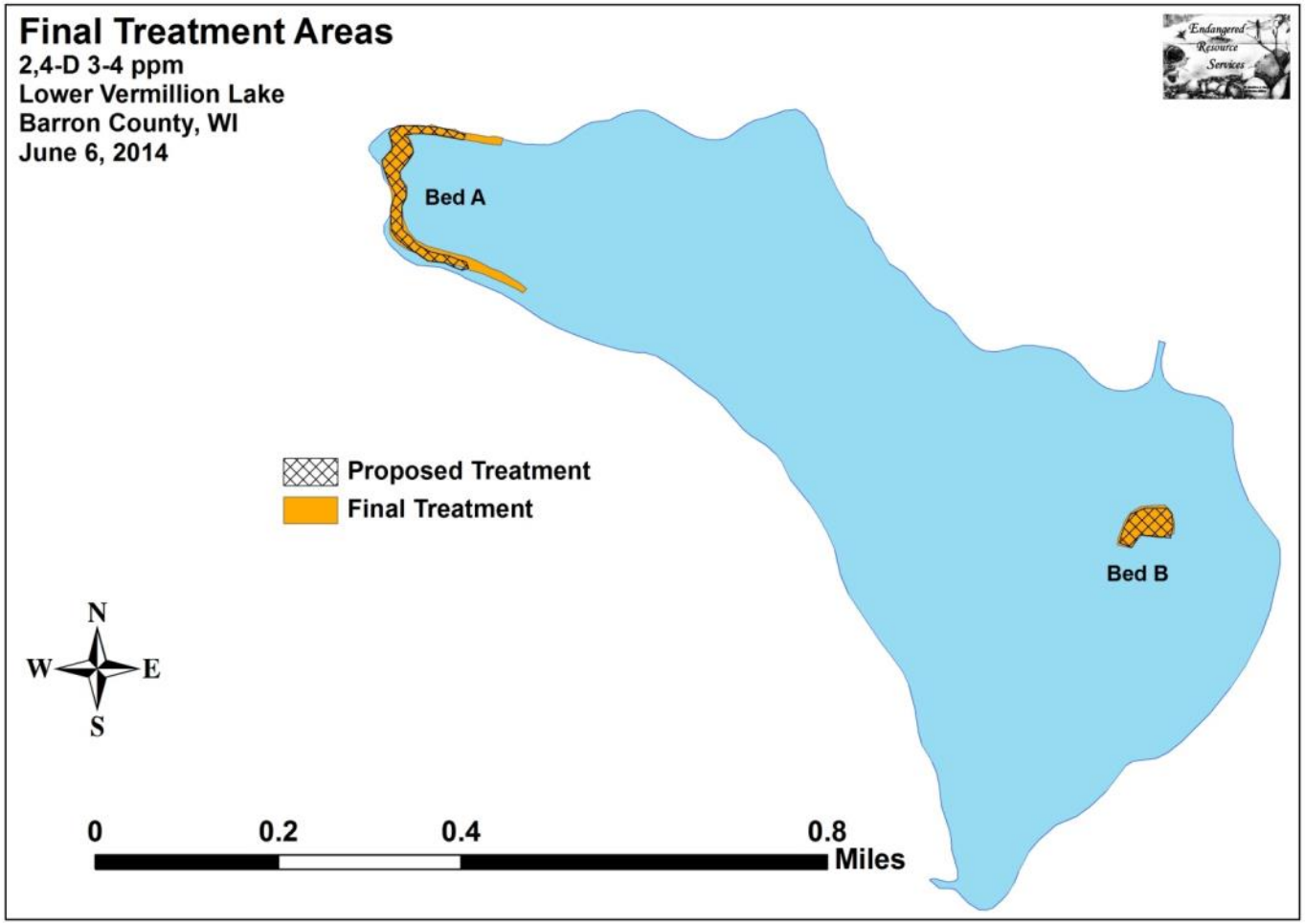
Appendix I: Survey Sample Points and EWM Treatment Areas


Survey Sample Points
Pre and Posttreatment Surveys
Lower Vermillion Lake
Barron County, WI
June 1 and August 1, 2014
Endangered Resource Services
Sample Point
N
W
E
S
0
0.2
0.4
0.8
Miles


Final Treatment Areas
2,4-D 3-4 ppm
Lower Vermillion Lake
Barron County, WI
June 6, 2014
Endangered Resource Services
Bed A
Bed B
Proposed Treatment
Final Treatment
N
W
E
S
0
0.2
0.4
0.8
Miles

Appendix II: Vegetative Survey Data Sheet

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																									
4																									
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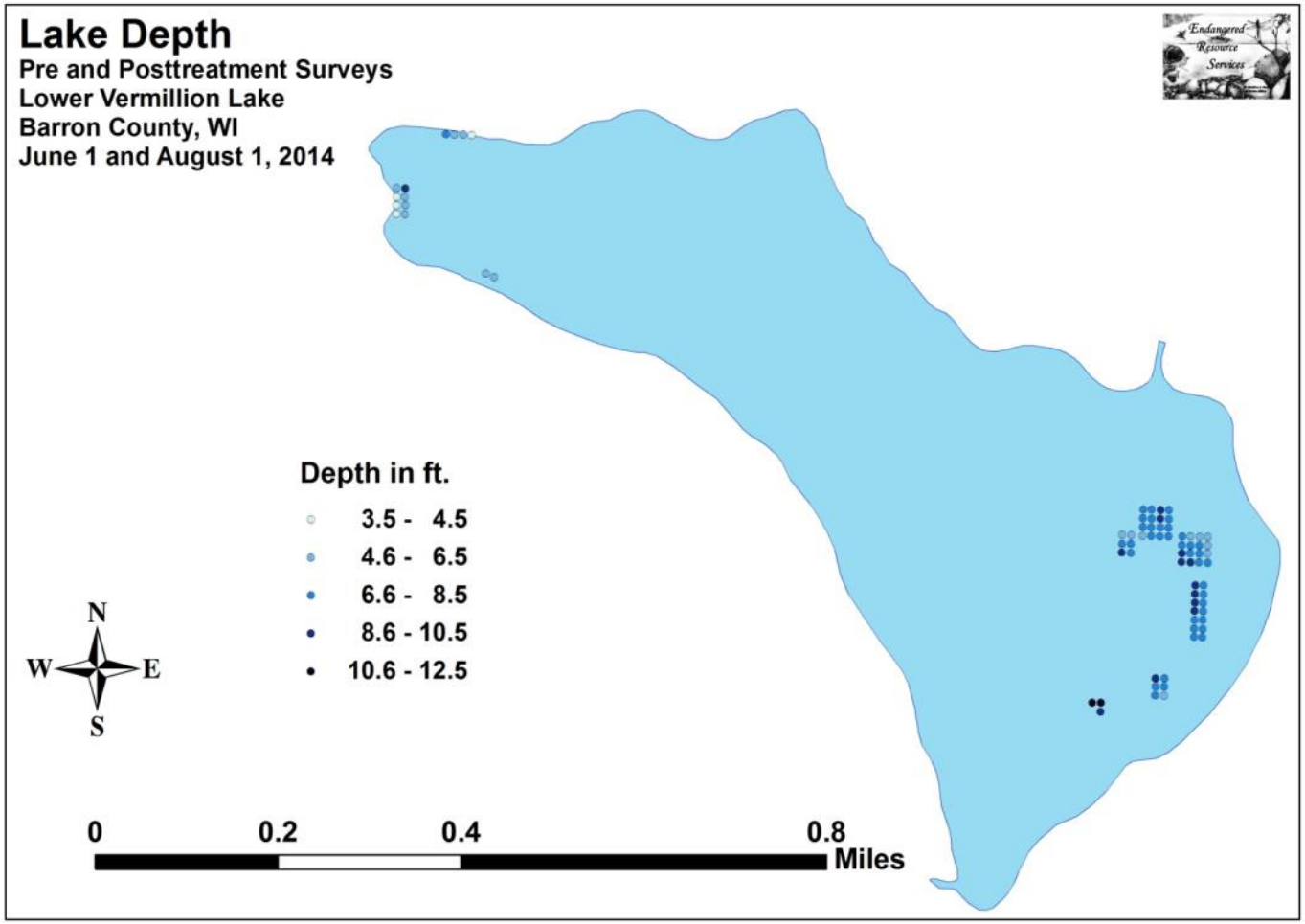
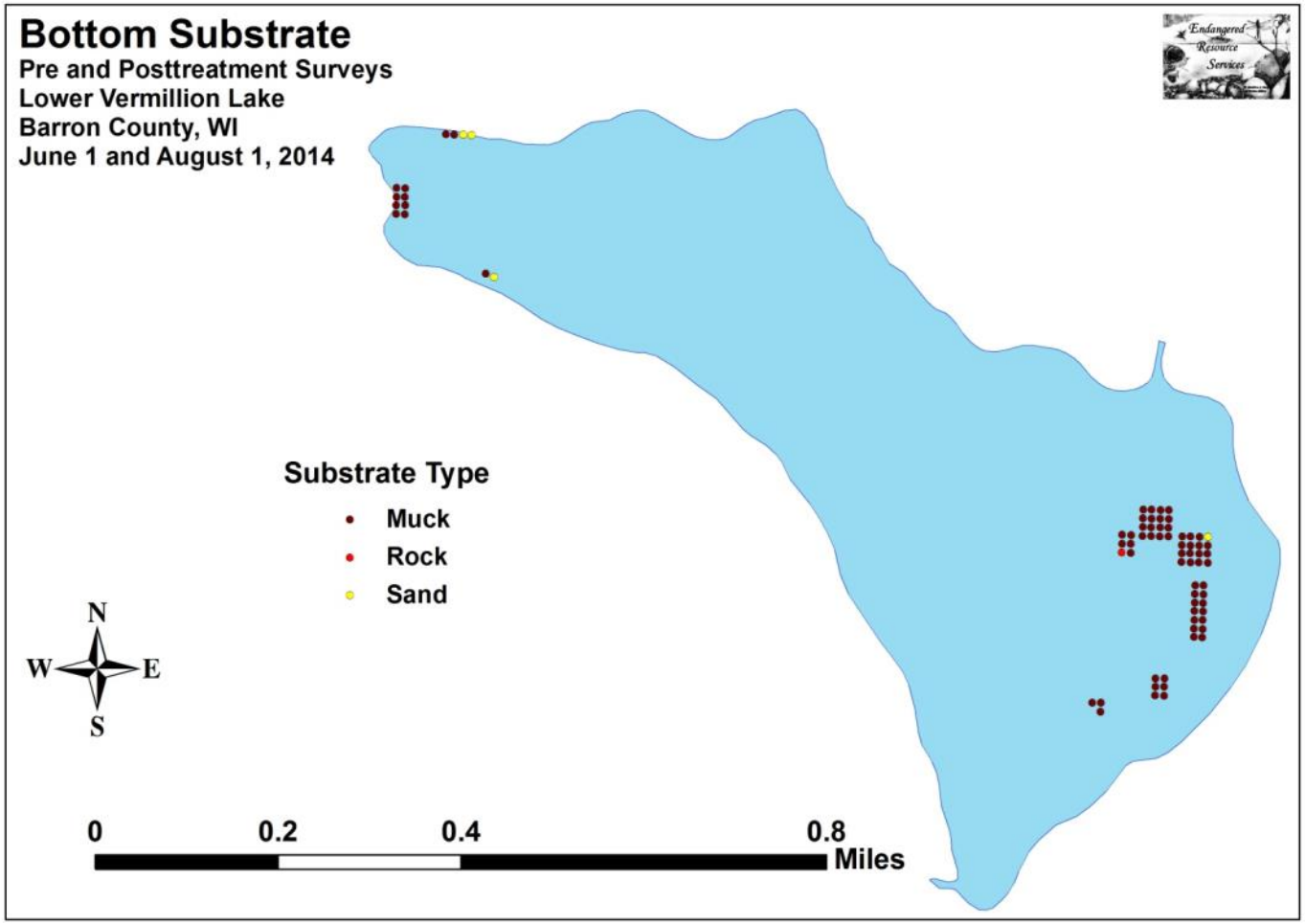
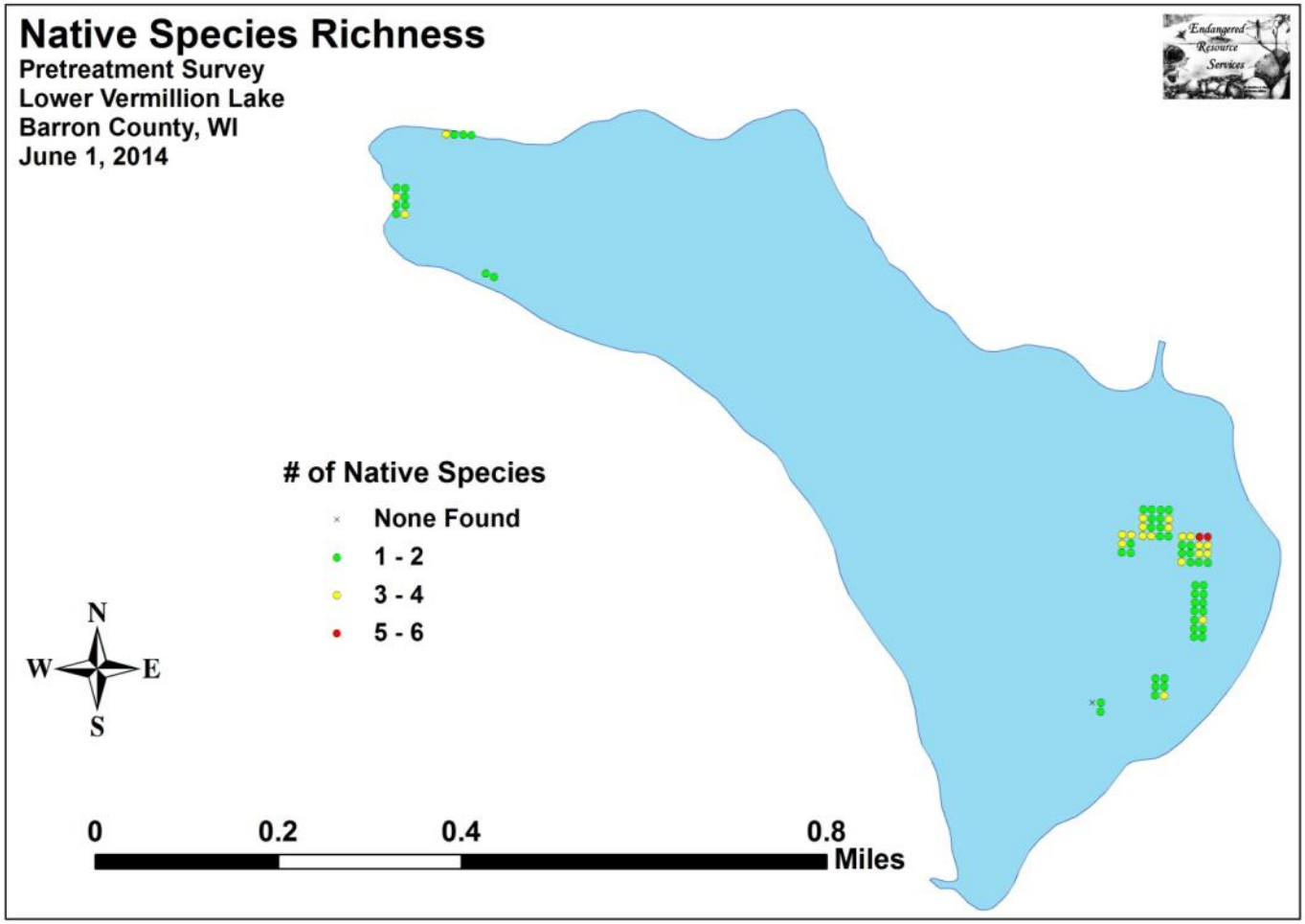
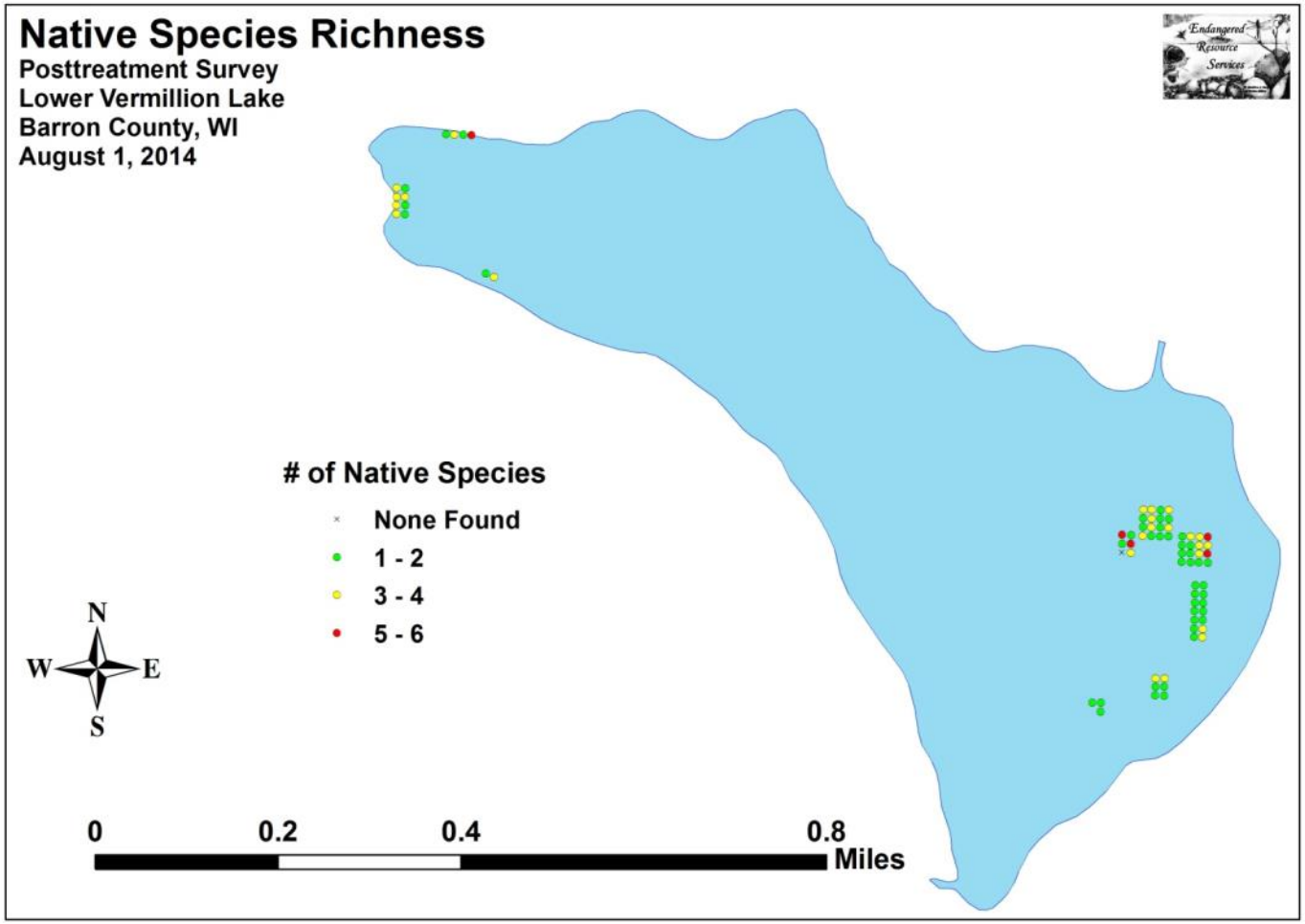
Appendix III: Pre/Post Habitat Variable Maps

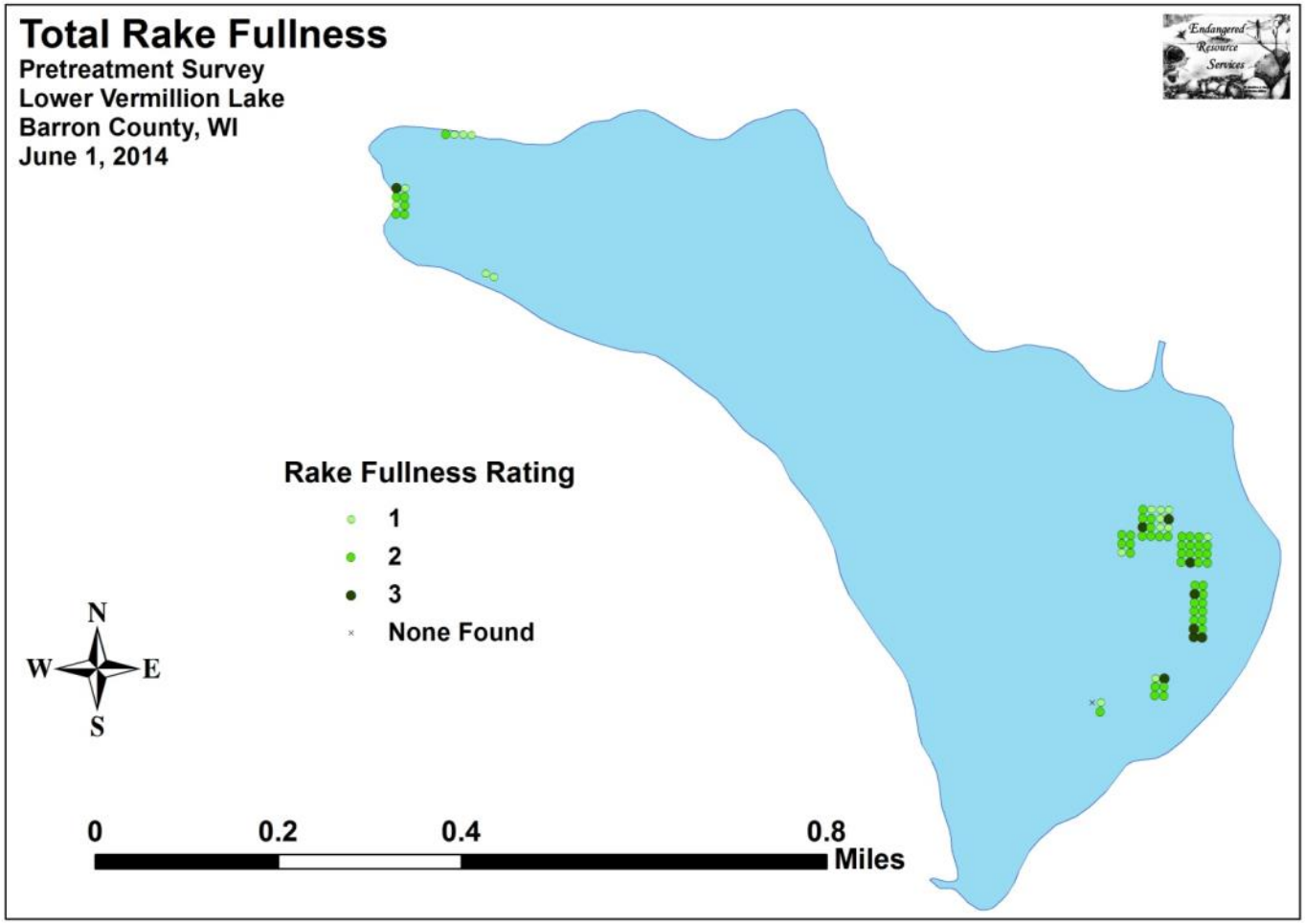

Lake Depth
Pre and Posttreatment Surveys
Lower Vermillion Lake
Barron County, WI
June 1 and August 1, 2014
Endangered Resource Services
Depth in ft.
3.5 - 4.5
4.6 - 6.5
6.6 - 8.5
8.6 - 10.5
10.6 - 12.5
N
W
E
S
0
0.2
0.4
0.8
Miles

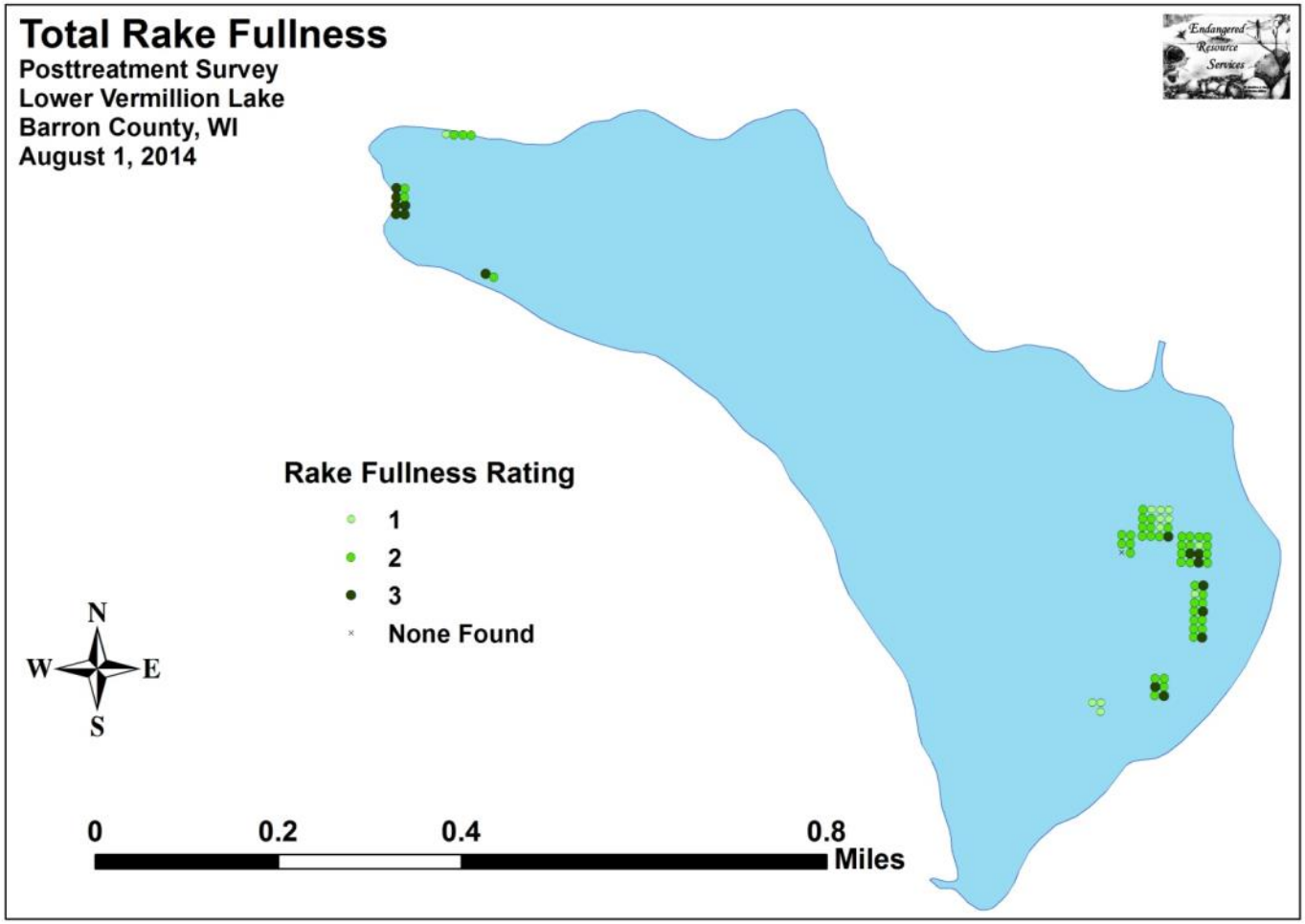

Bottom Substrate
Pre and Posttreatment Surveys
Lower Vermillion Lake
Barron County, WI
June 1 and August 1, 2014
Endangered Resource Services
Substrate Type
Muck
Rock
Sand
N
W
E
S
0
0.2
0.4
0.8
Miles

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

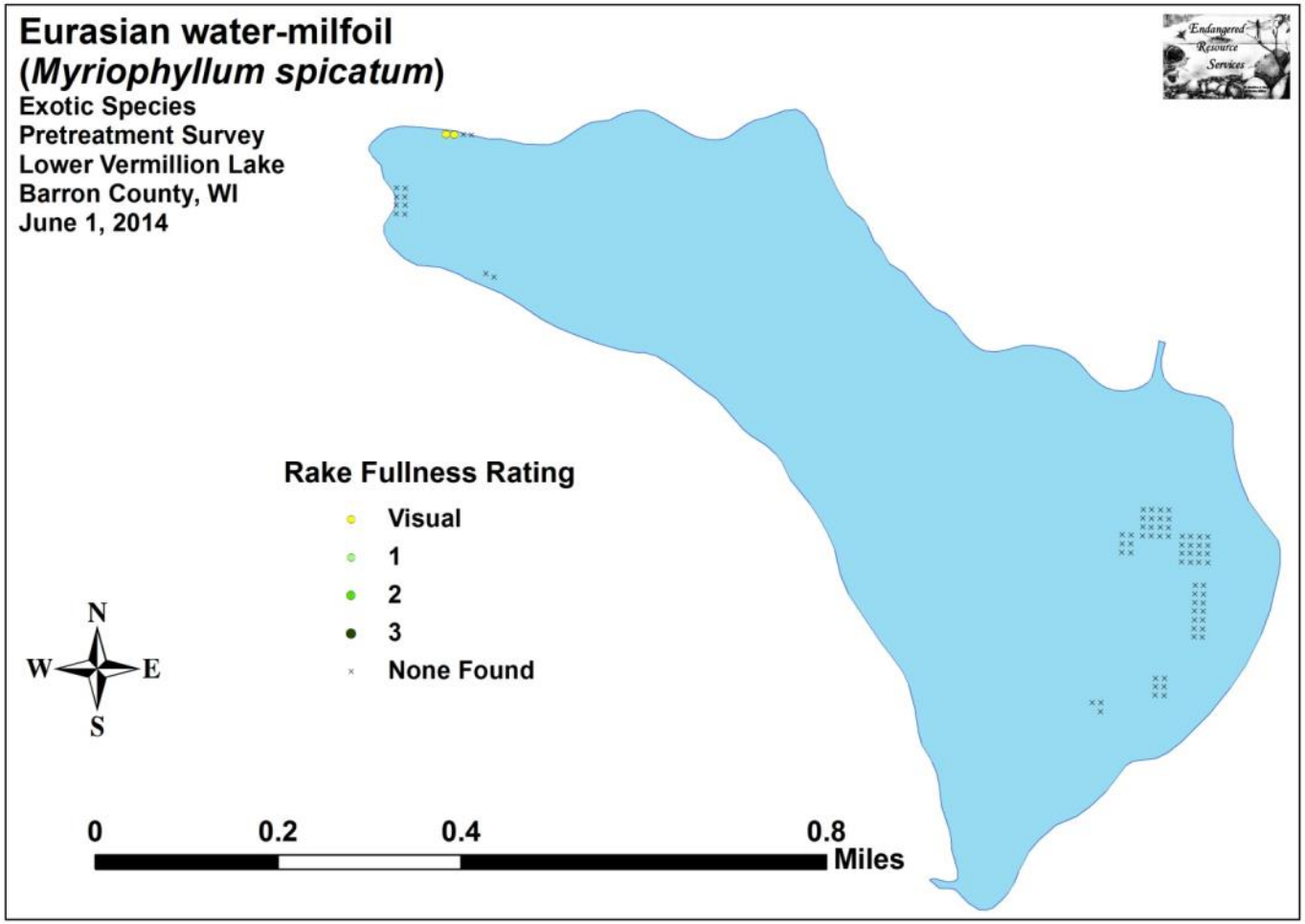

Native Species Richness
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 1, 2014
Endangered Resource Services
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
N
W
E
S
0
0.2
0.4
0.8
Miles

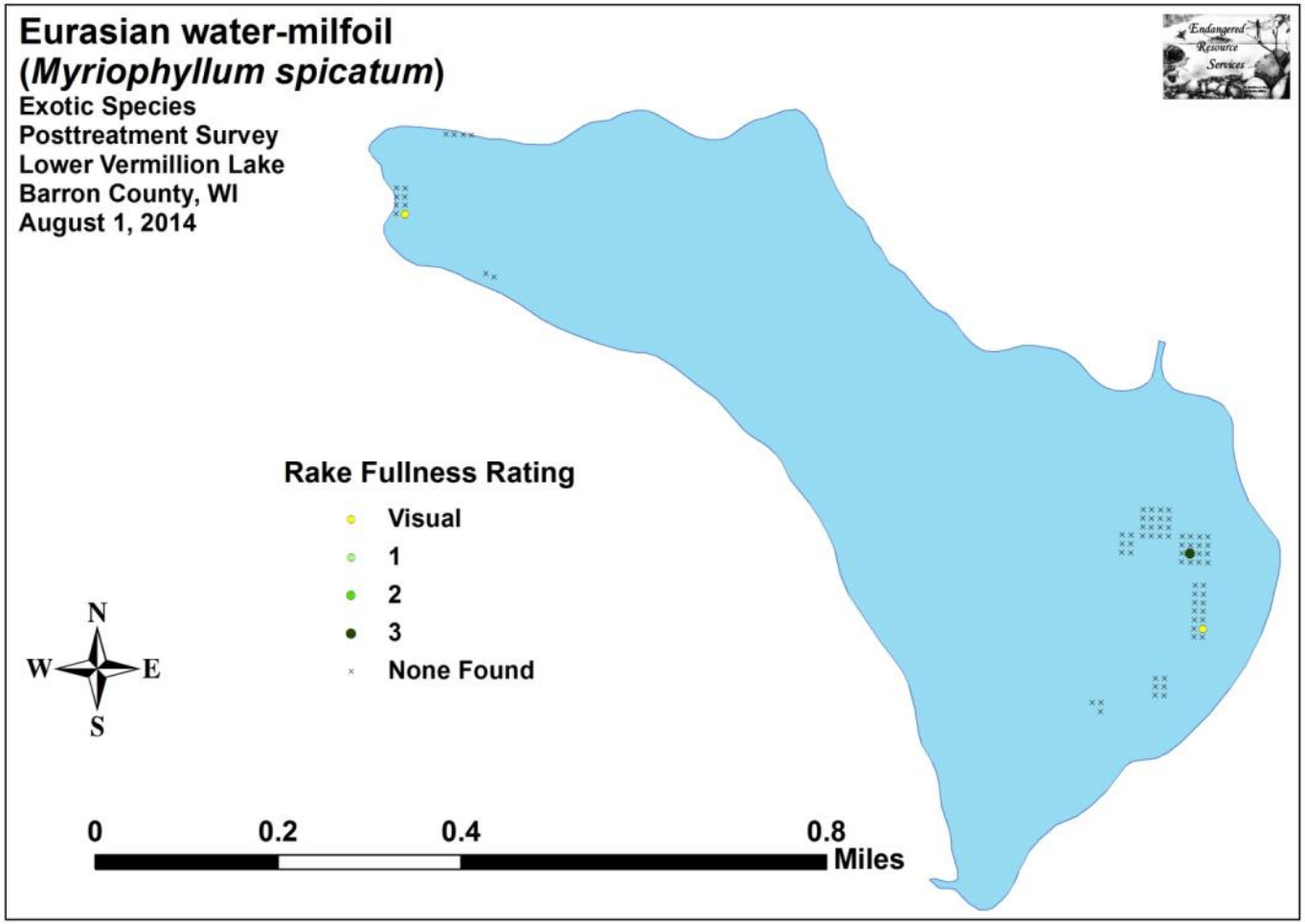

Native Species Richness
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
N
W
E
S
0
0.2
0.4
0.8
Miles


Total Rake Fullness
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 1, 2014
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

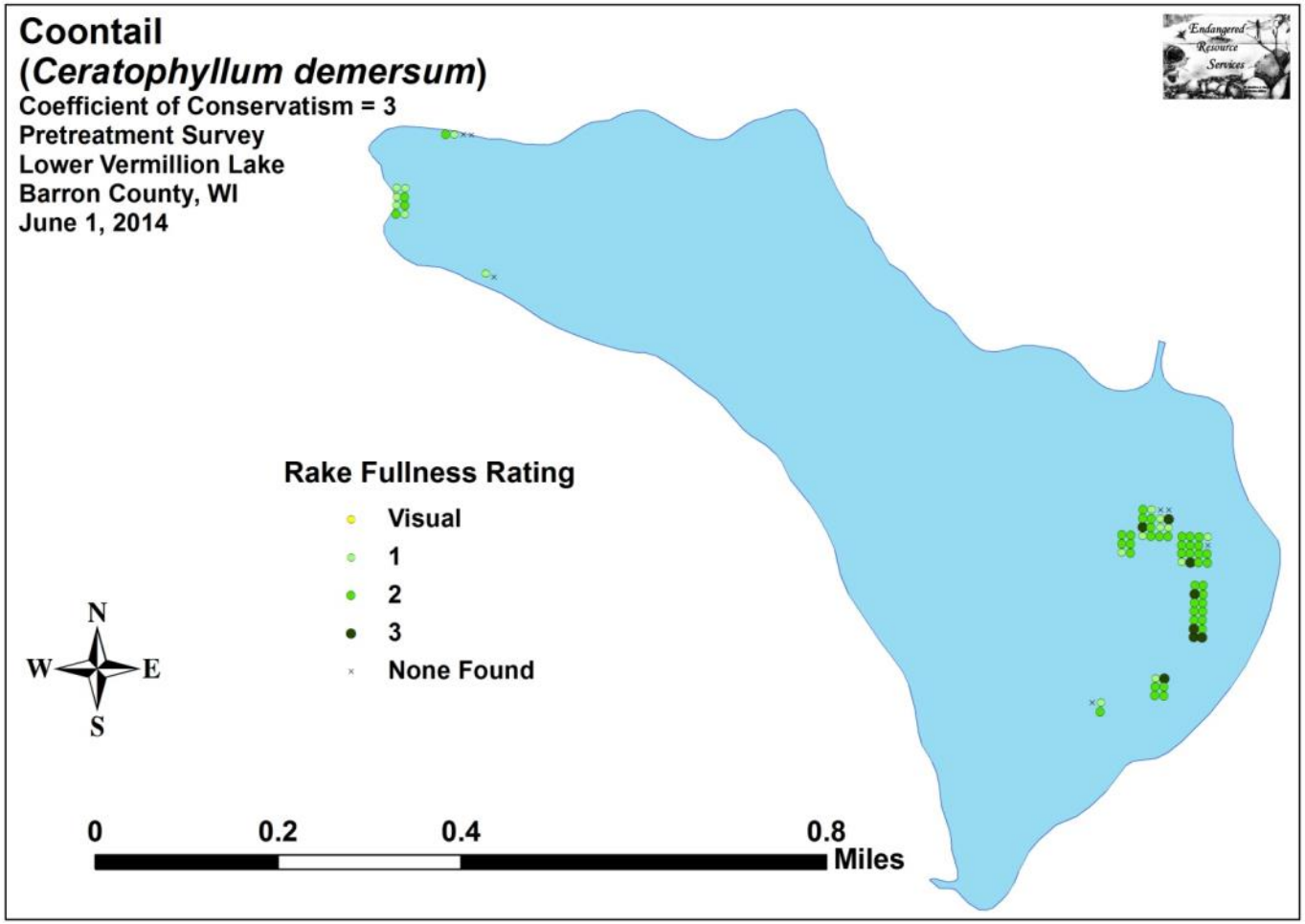

Total Rake Fullness
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

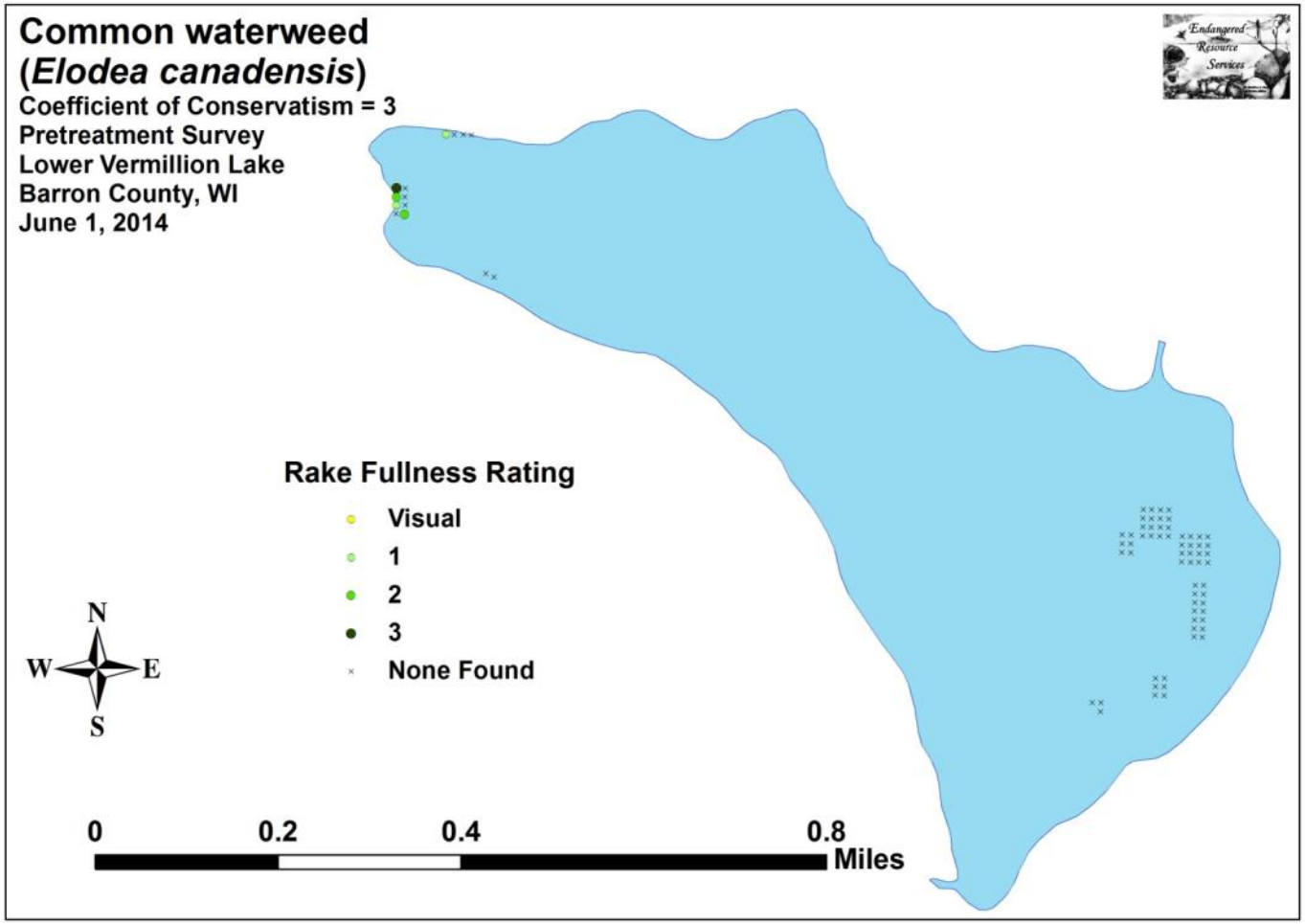
Appendix V: EWM Pre/Post Density and Distribution

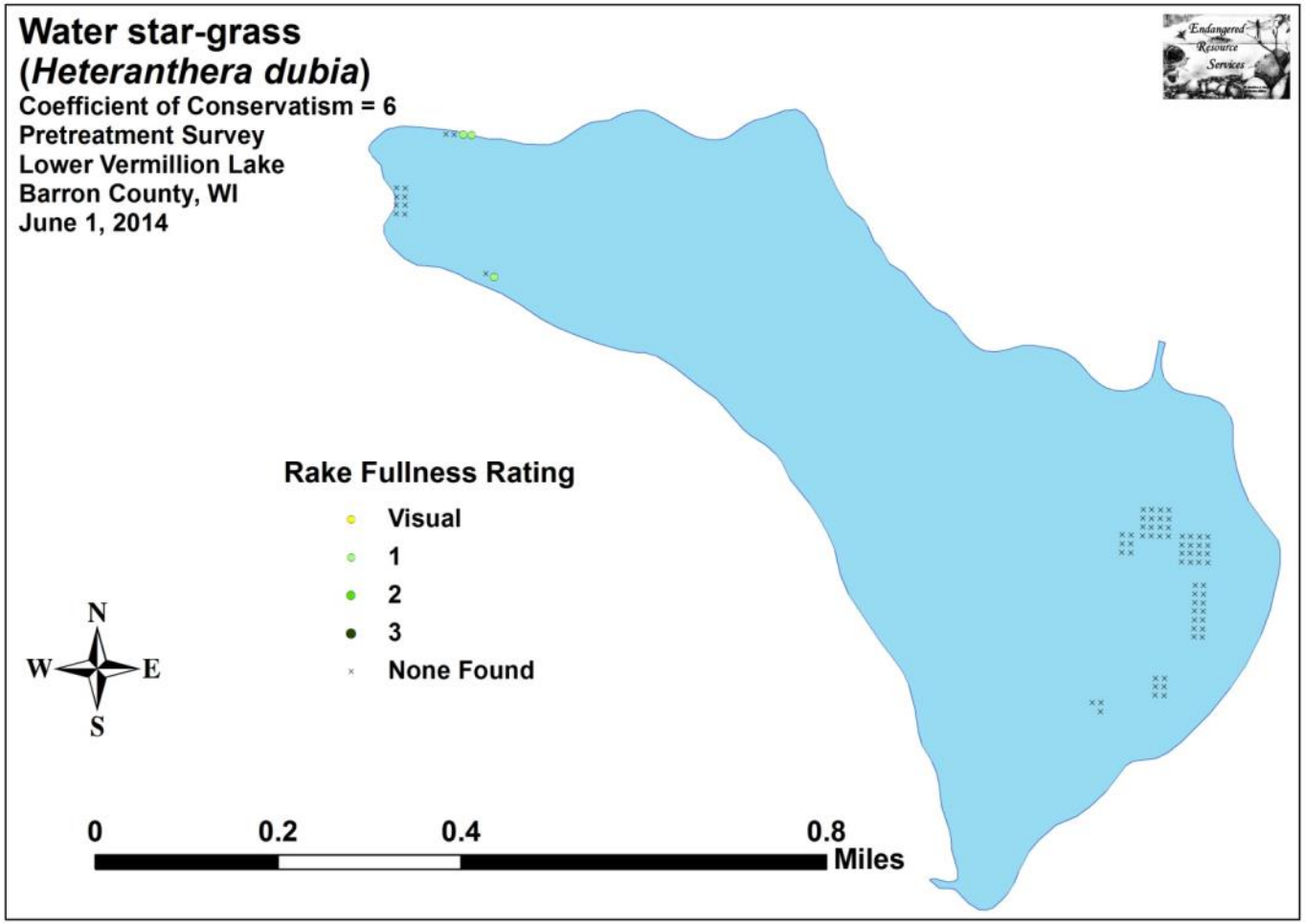

Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic Species
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

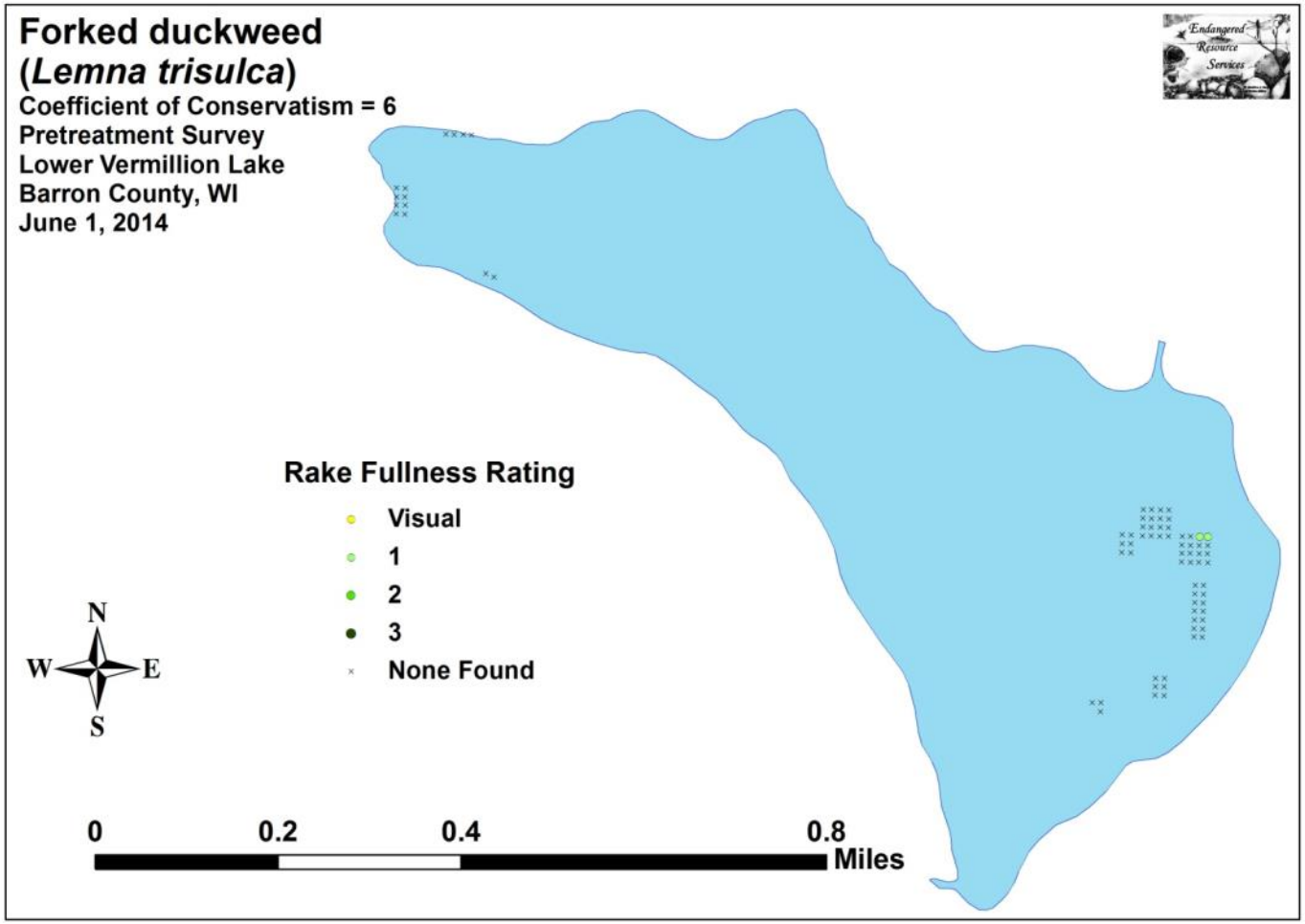

Eurasian water-milfoil
(Myriophyllum spicatum)
Exotic Species
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

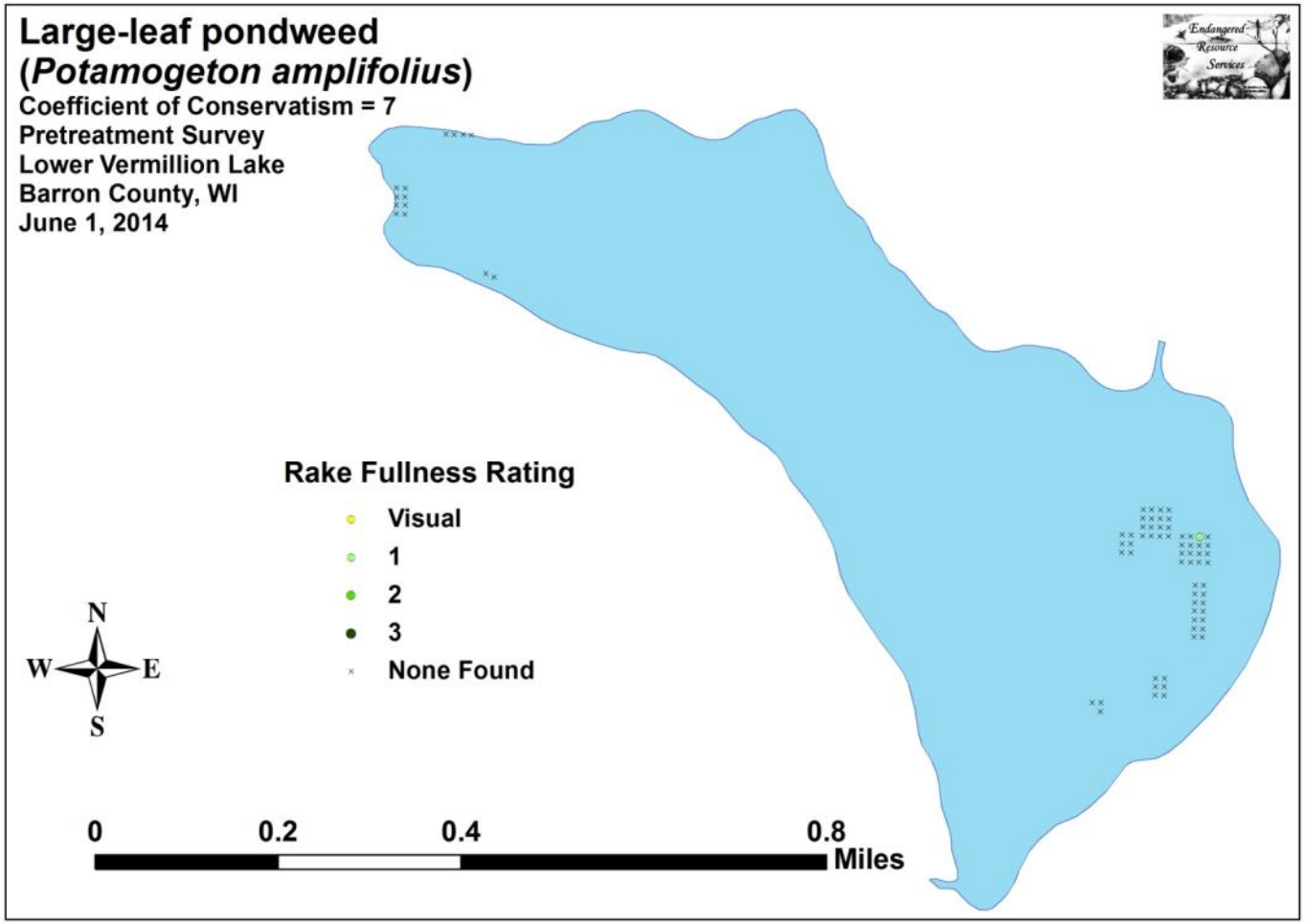
Appendix VI: Pretreatment Native Species Density and Distribution

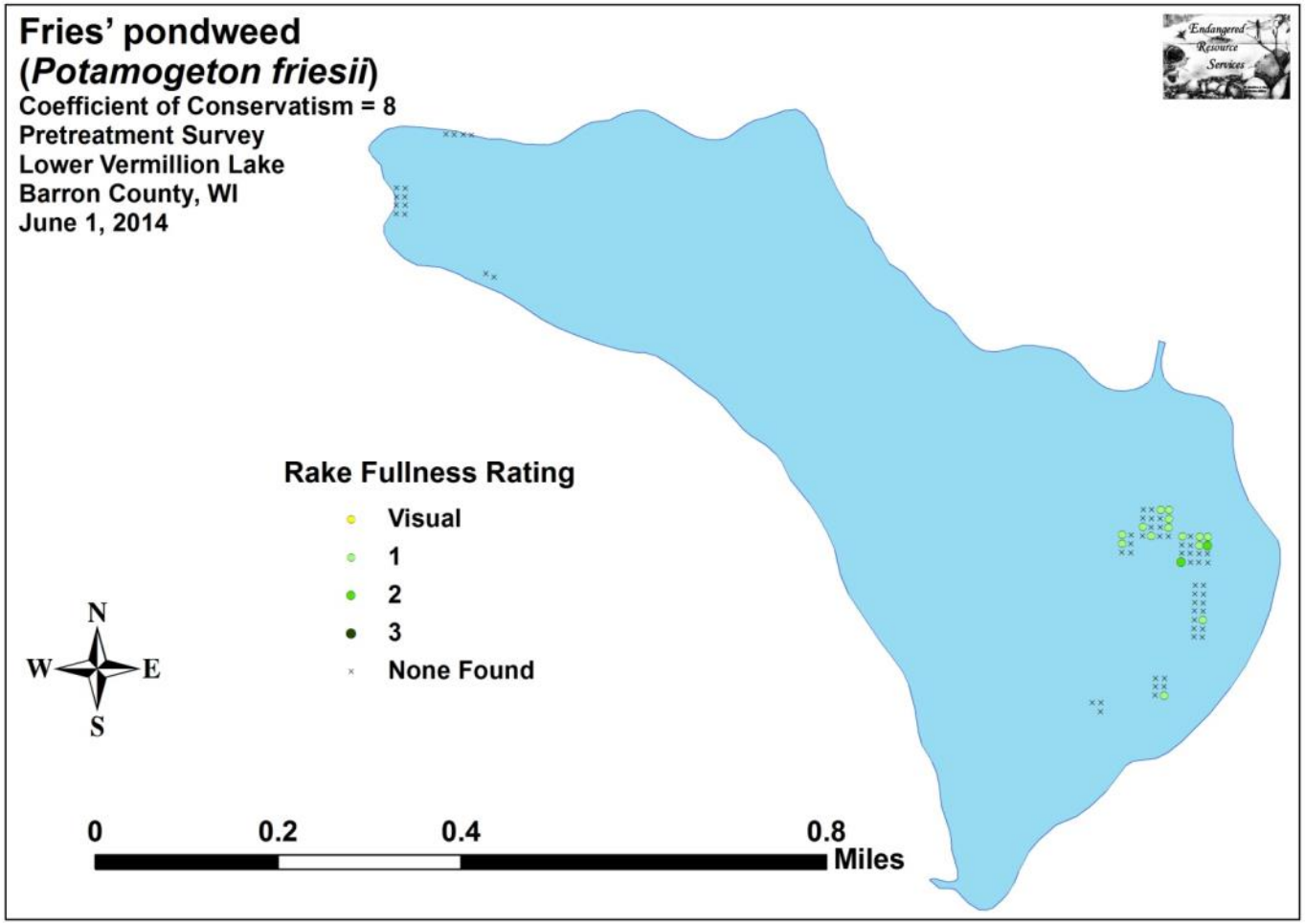

Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

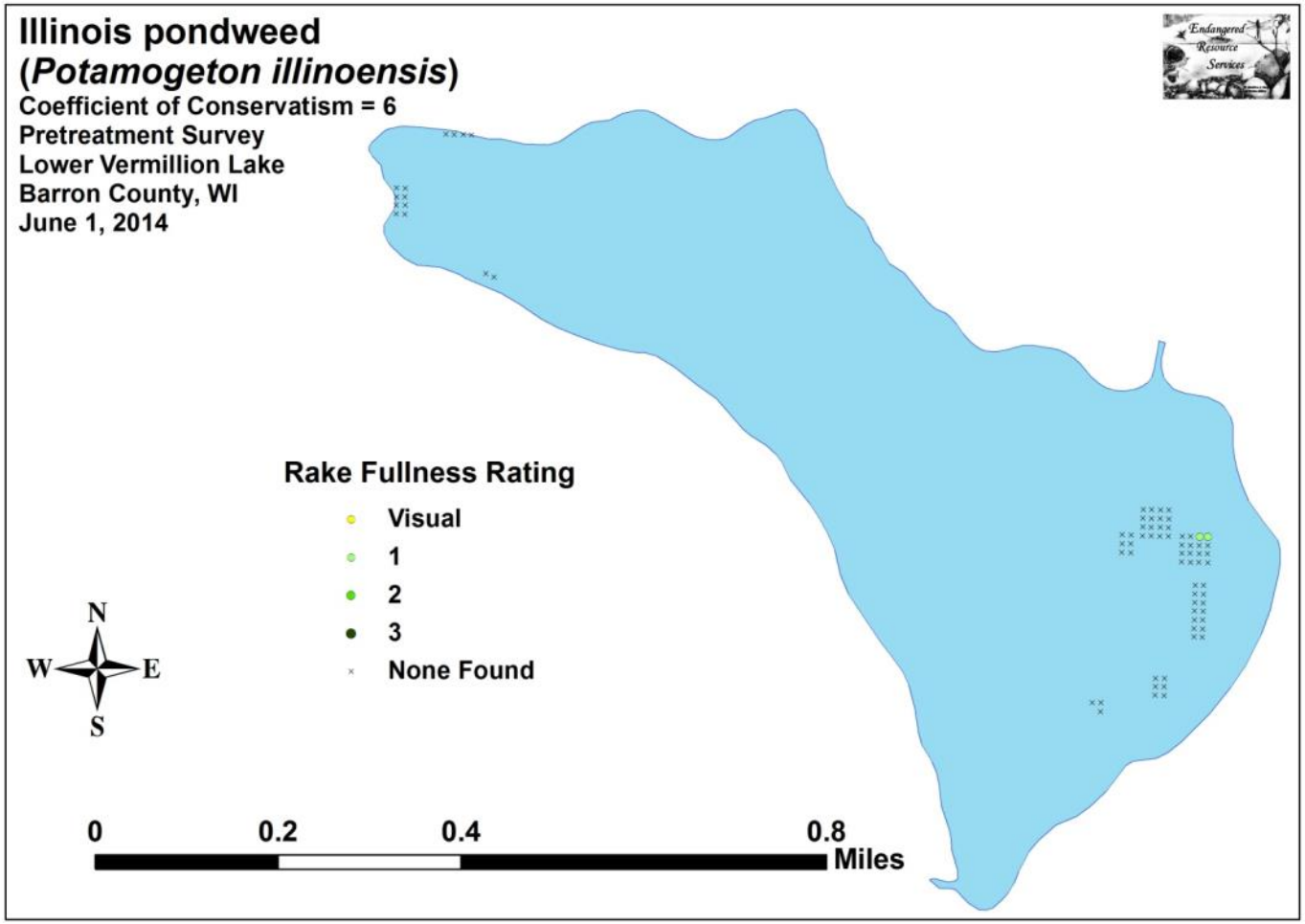

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

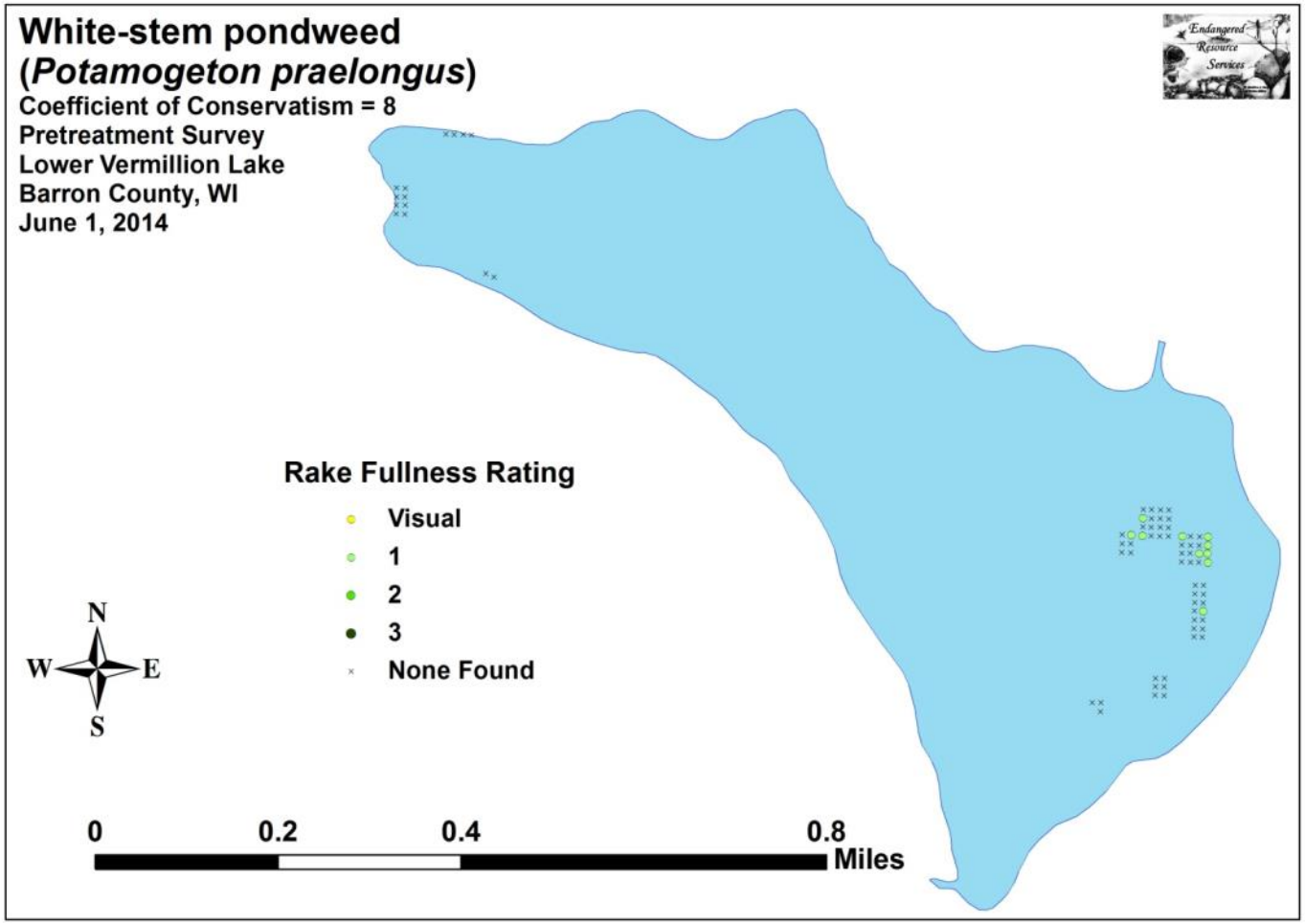

Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

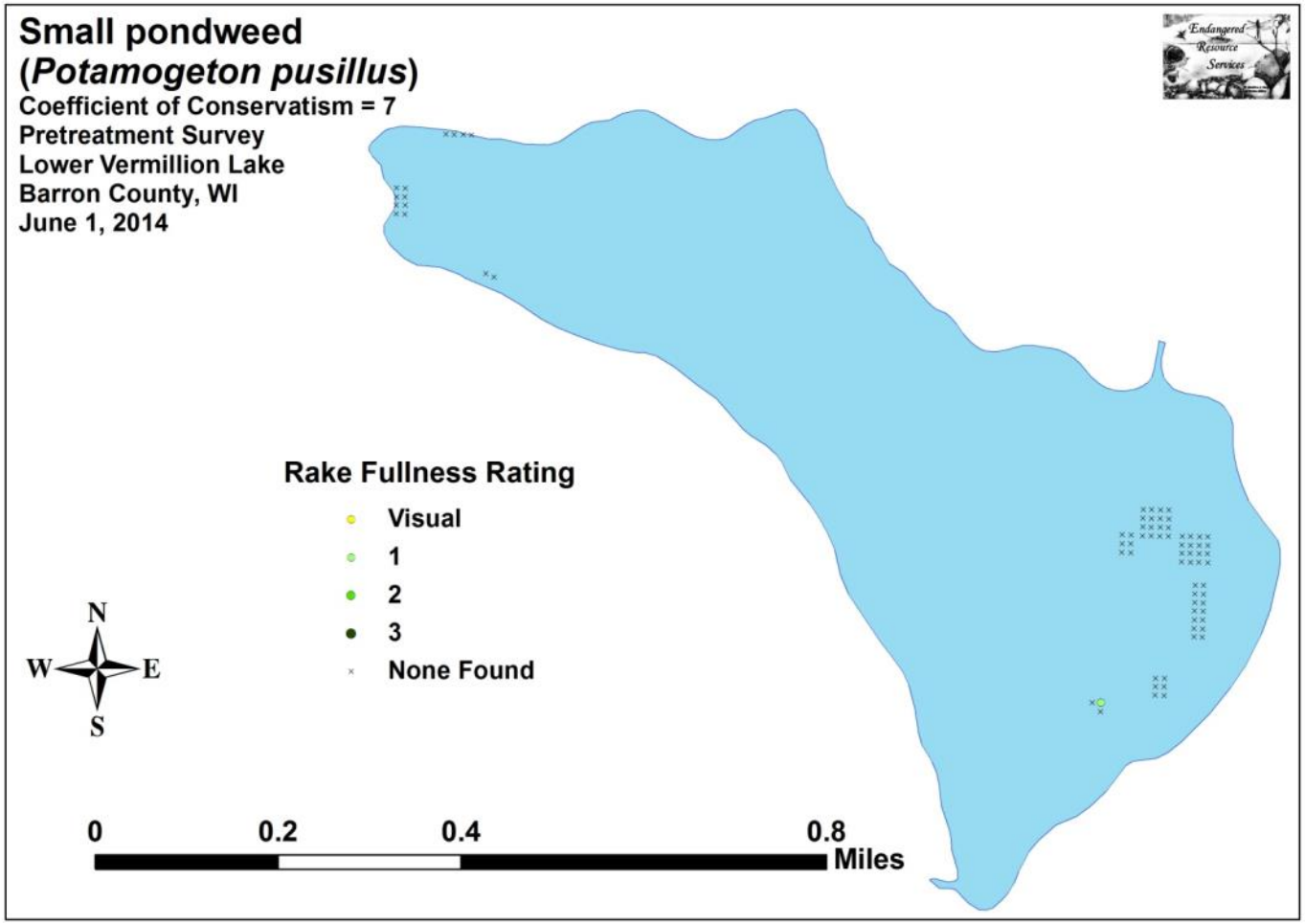

Forked duckweed
(Lemna trisulca)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

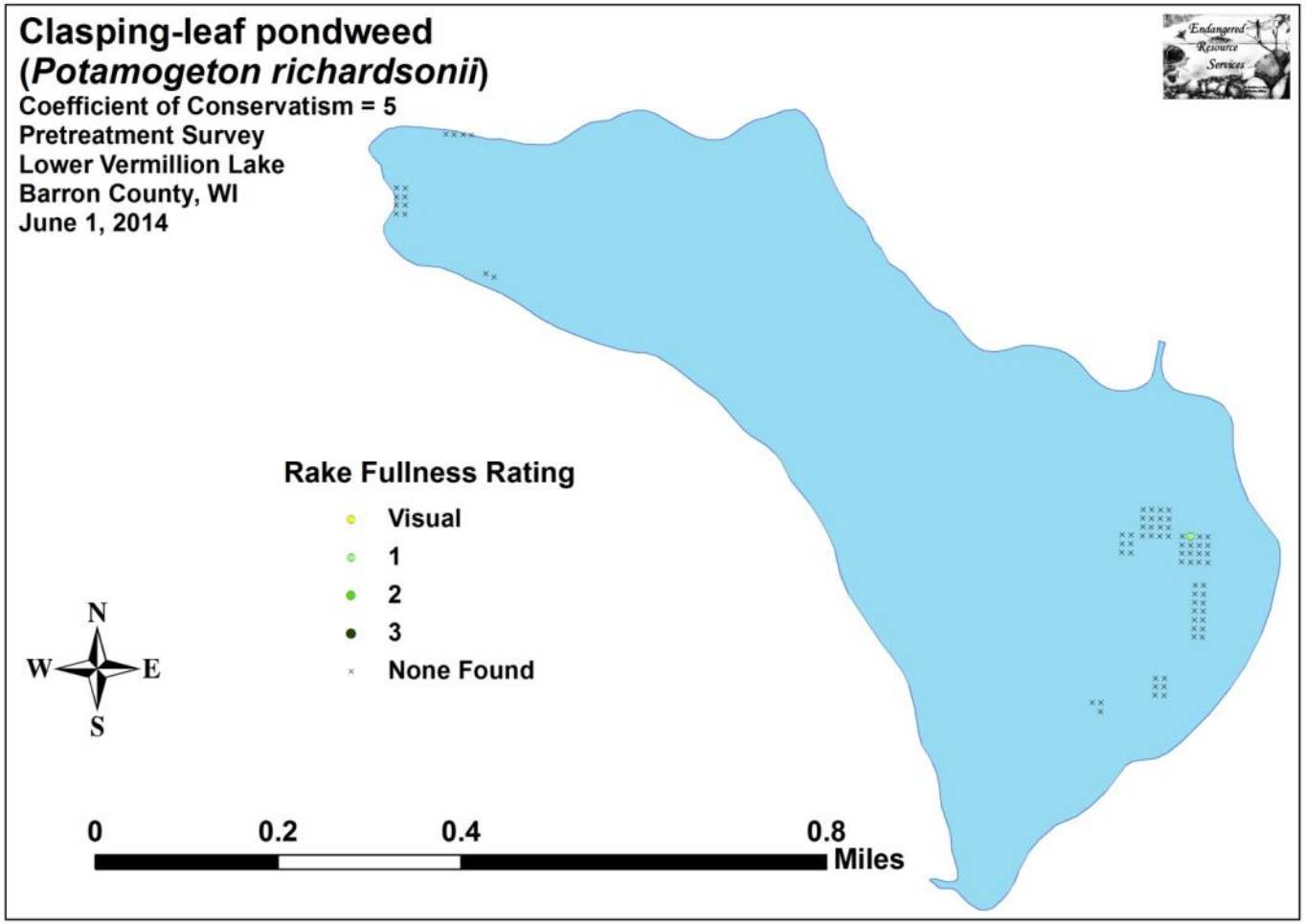

Large-leaf pondweed
(Potamogeton amplifolius)
Coefficient of Conservatism = 7
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

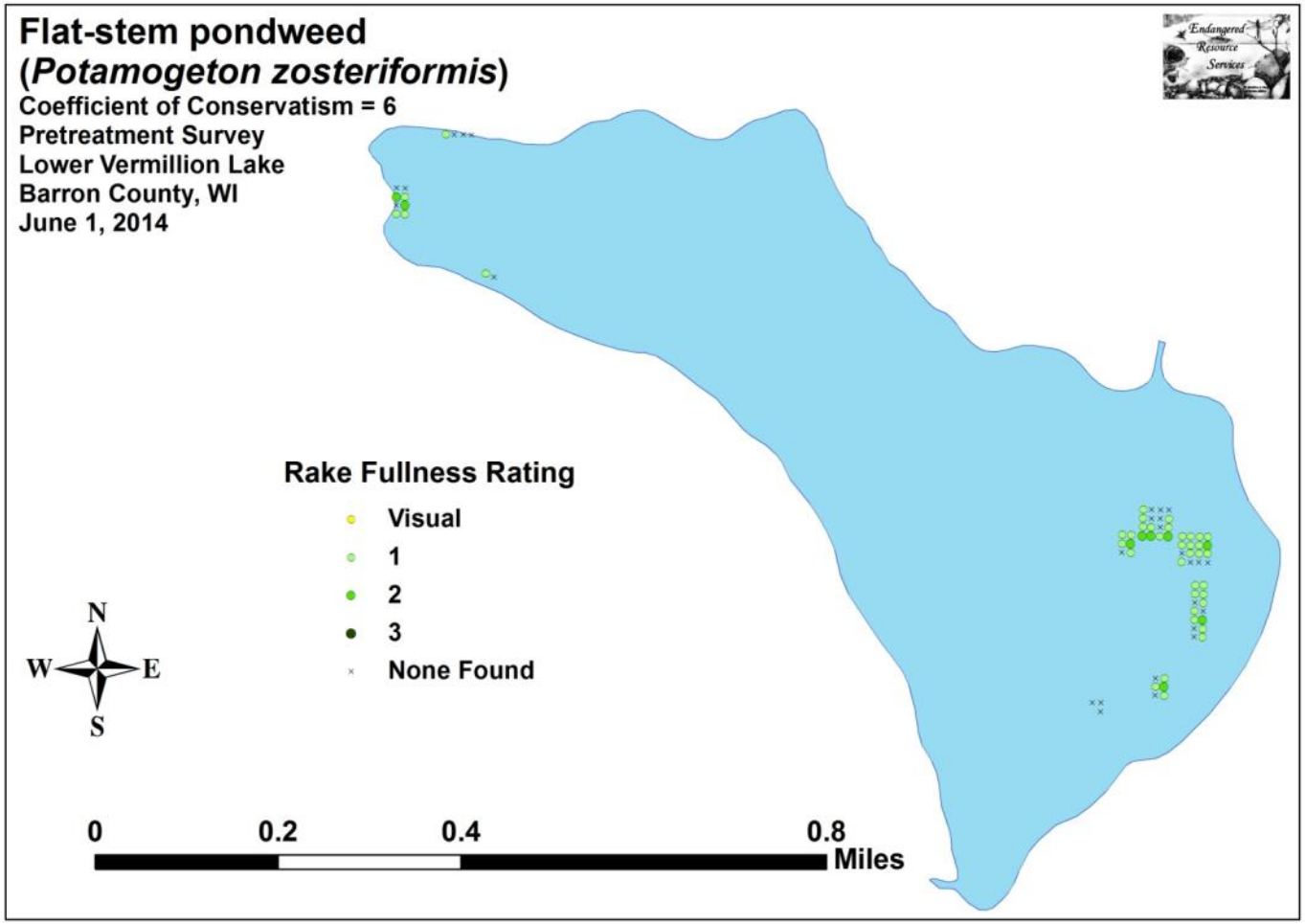

Fries' pondweed
(Potamogeton friesii)
Coefficient of Conservatism = 8
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles


Illinois pondweed
(Potamogeton illinoensis)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

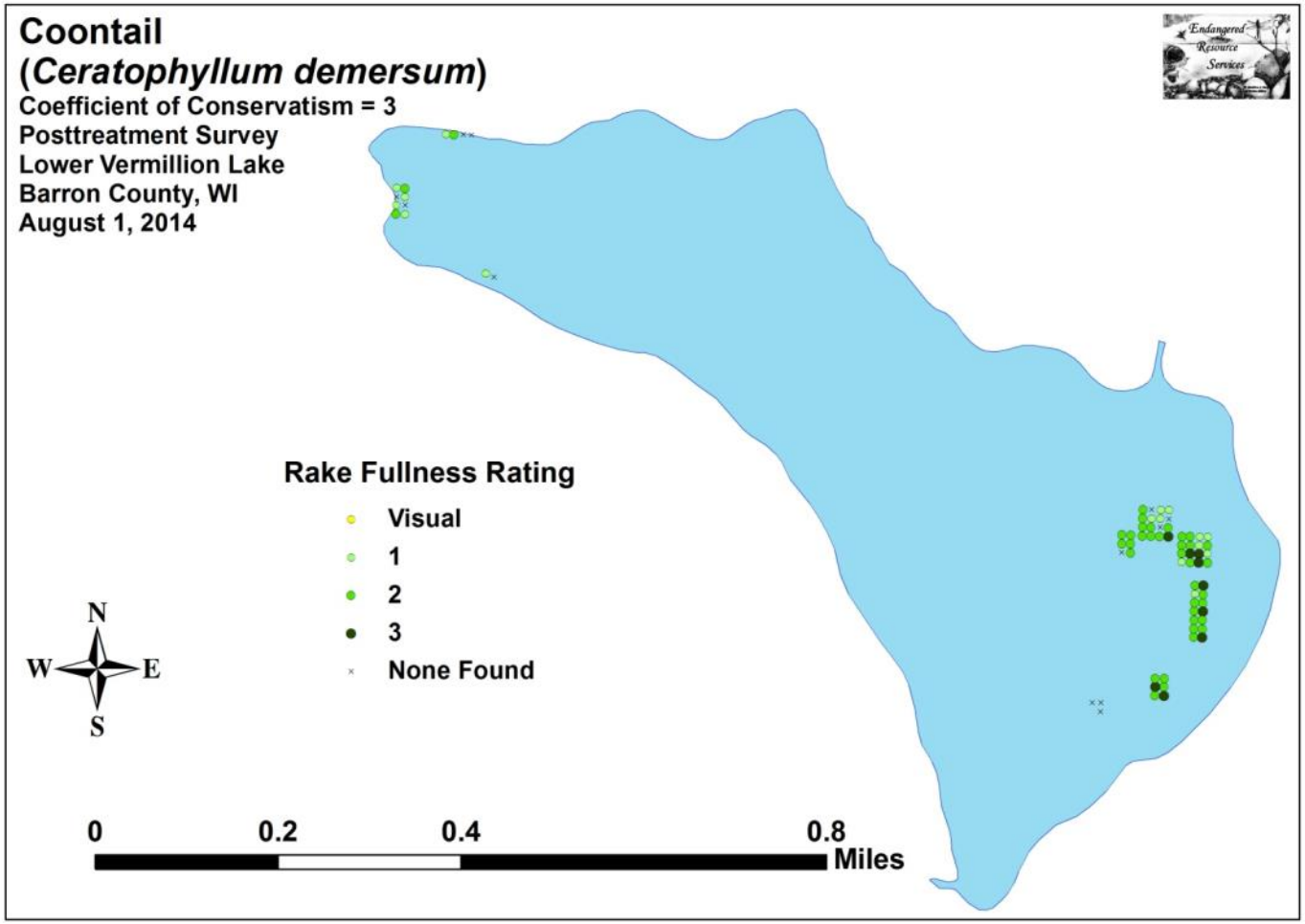

White-stem pondweed
(Potamogeton praelongus)
Coefficient of Conservatism = 8
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

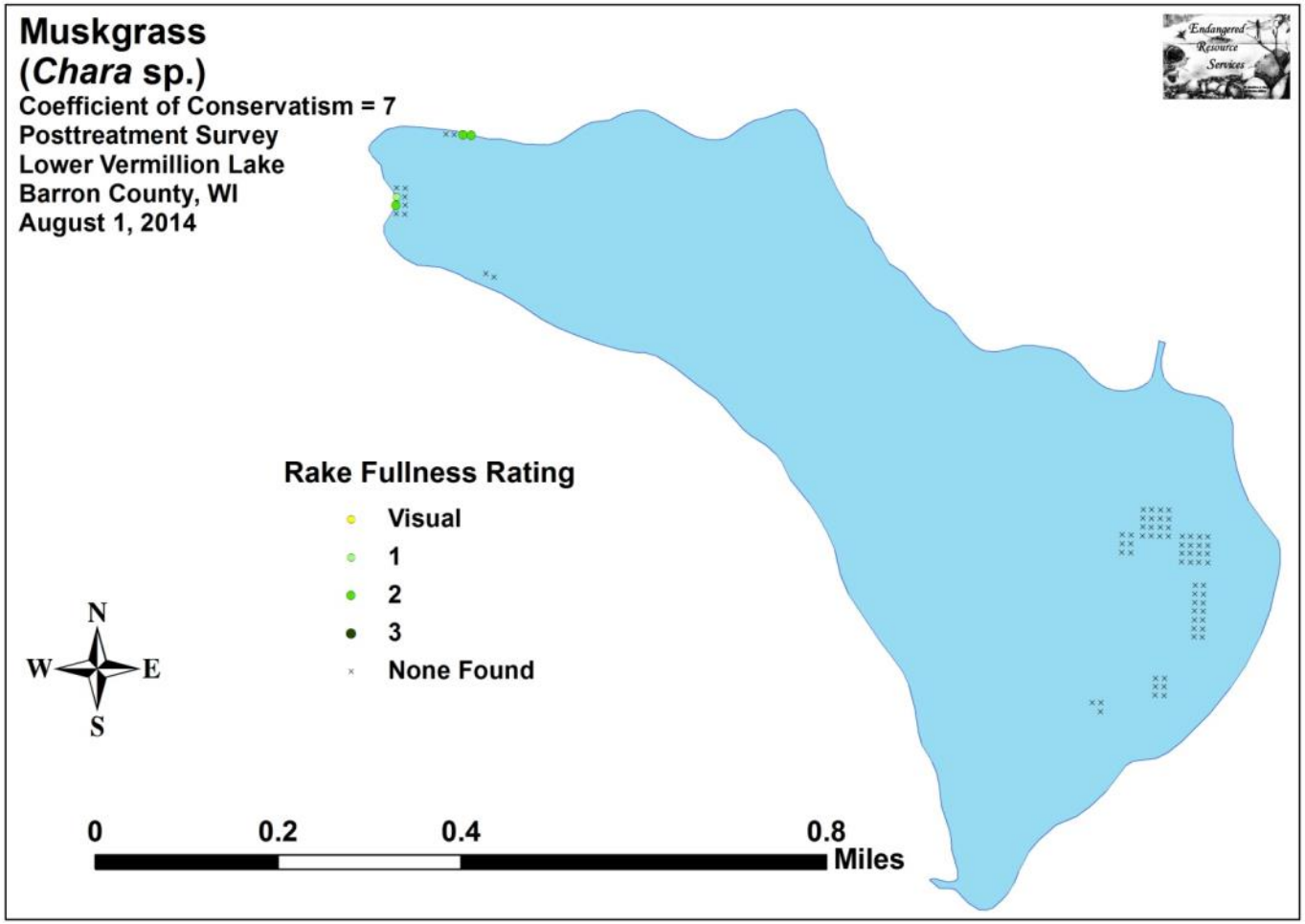

Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

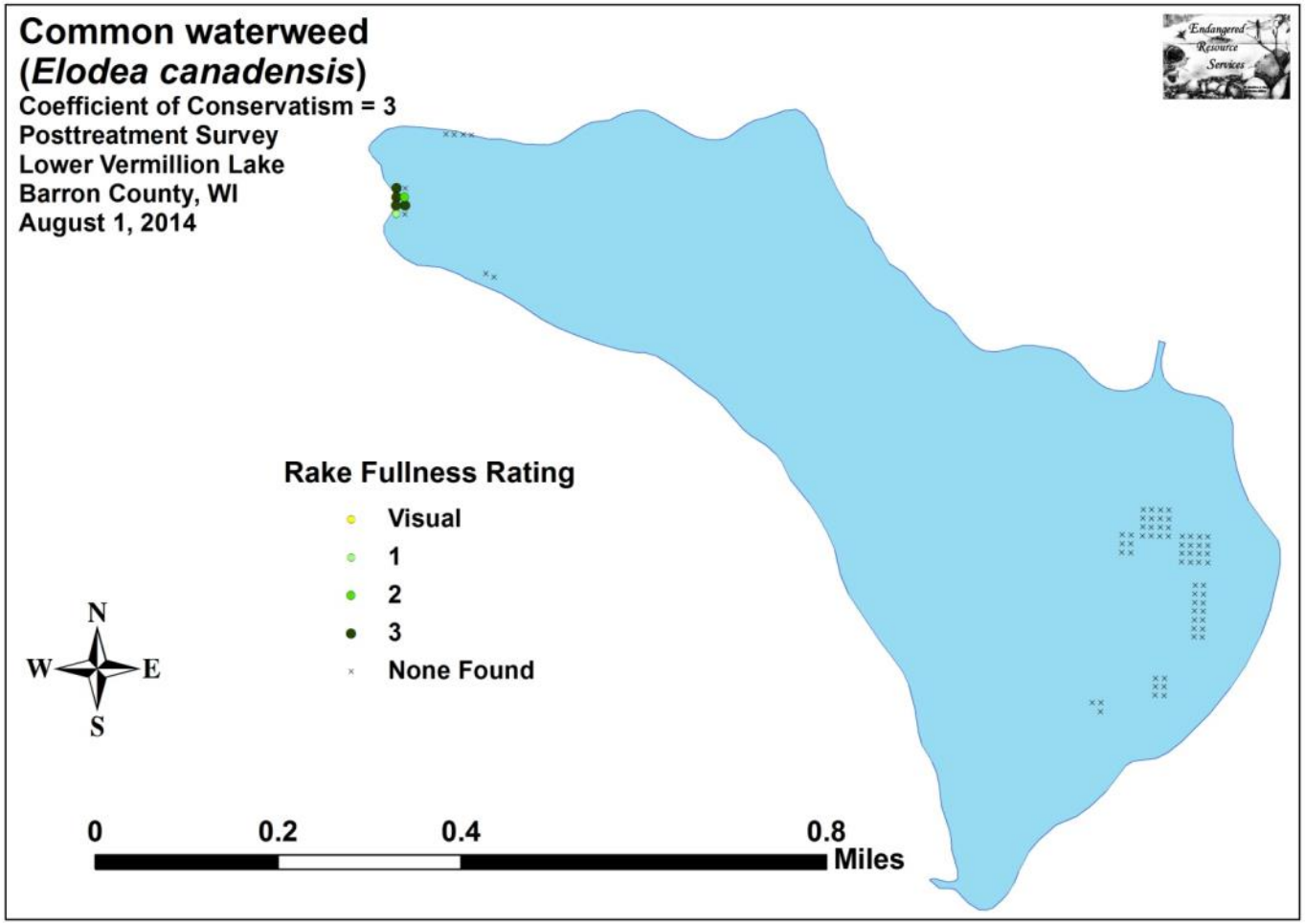

Clasping-leaf pondweed
(Potamogeton richardsonii)
Coefficient of Conservatism = 5
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

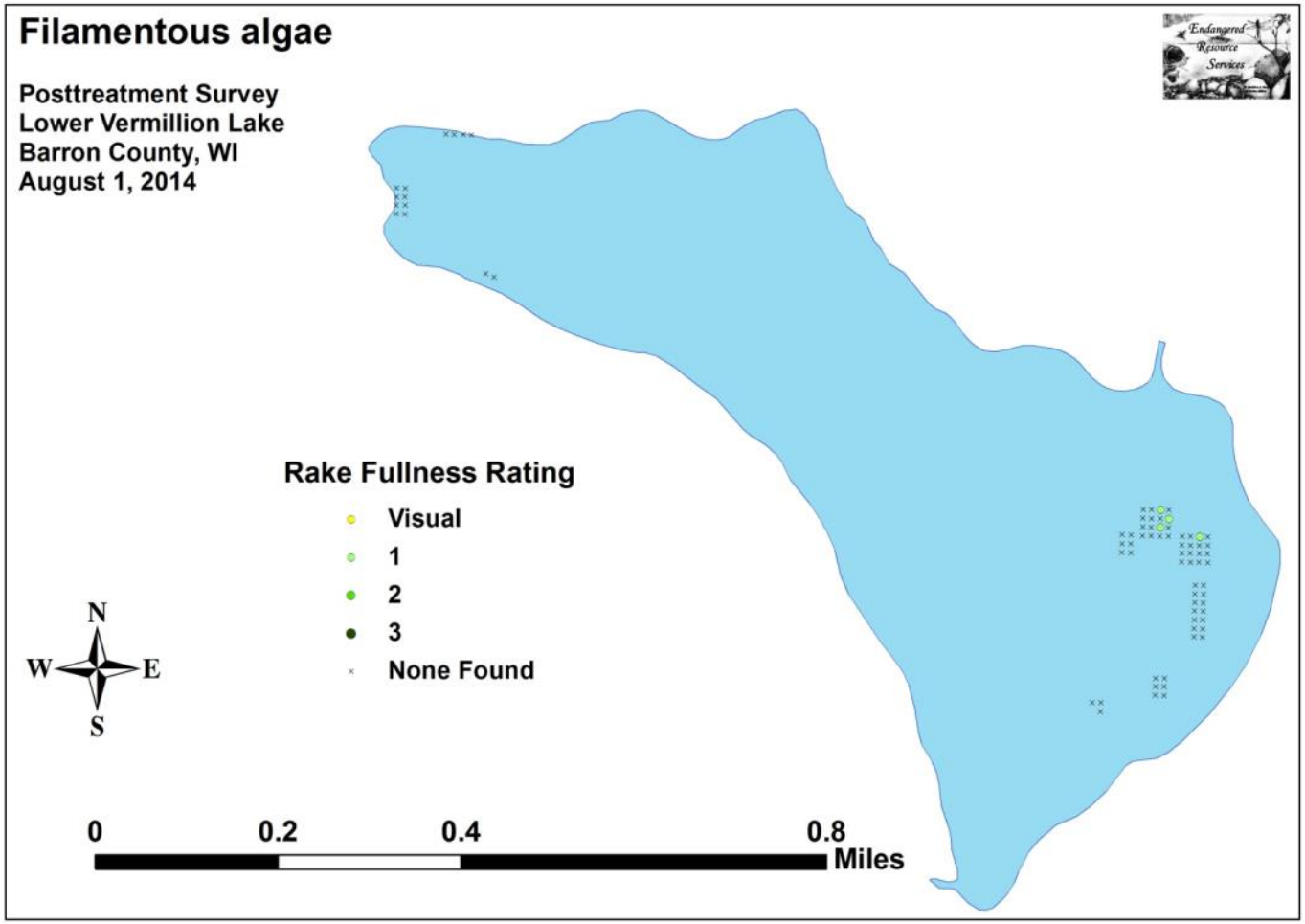

Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Pretreatment Survey
Lower Vermillion Lake
Barron County, WI
June 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

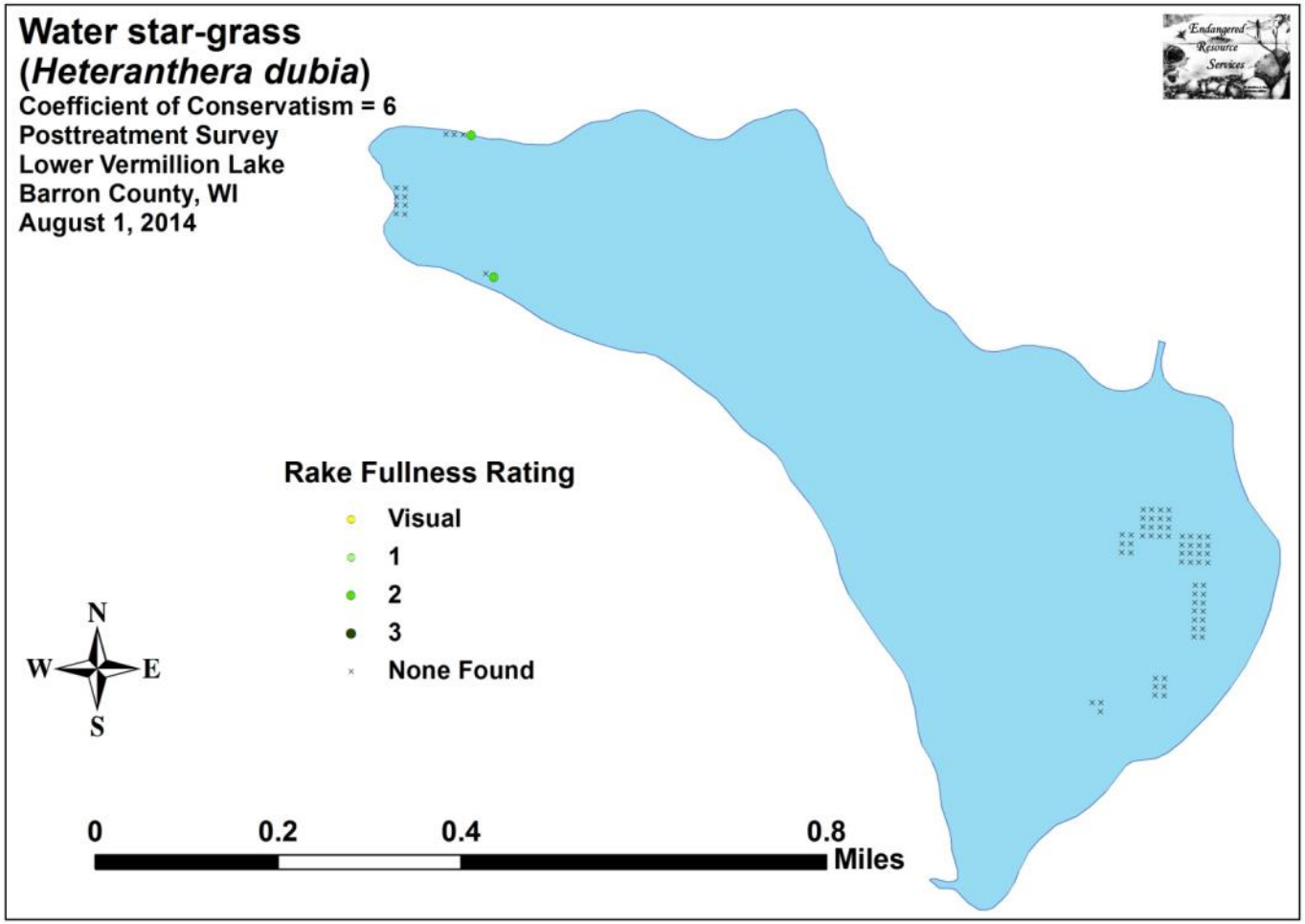
Appendix VII: Posttreatment Native Species Density and Distribution

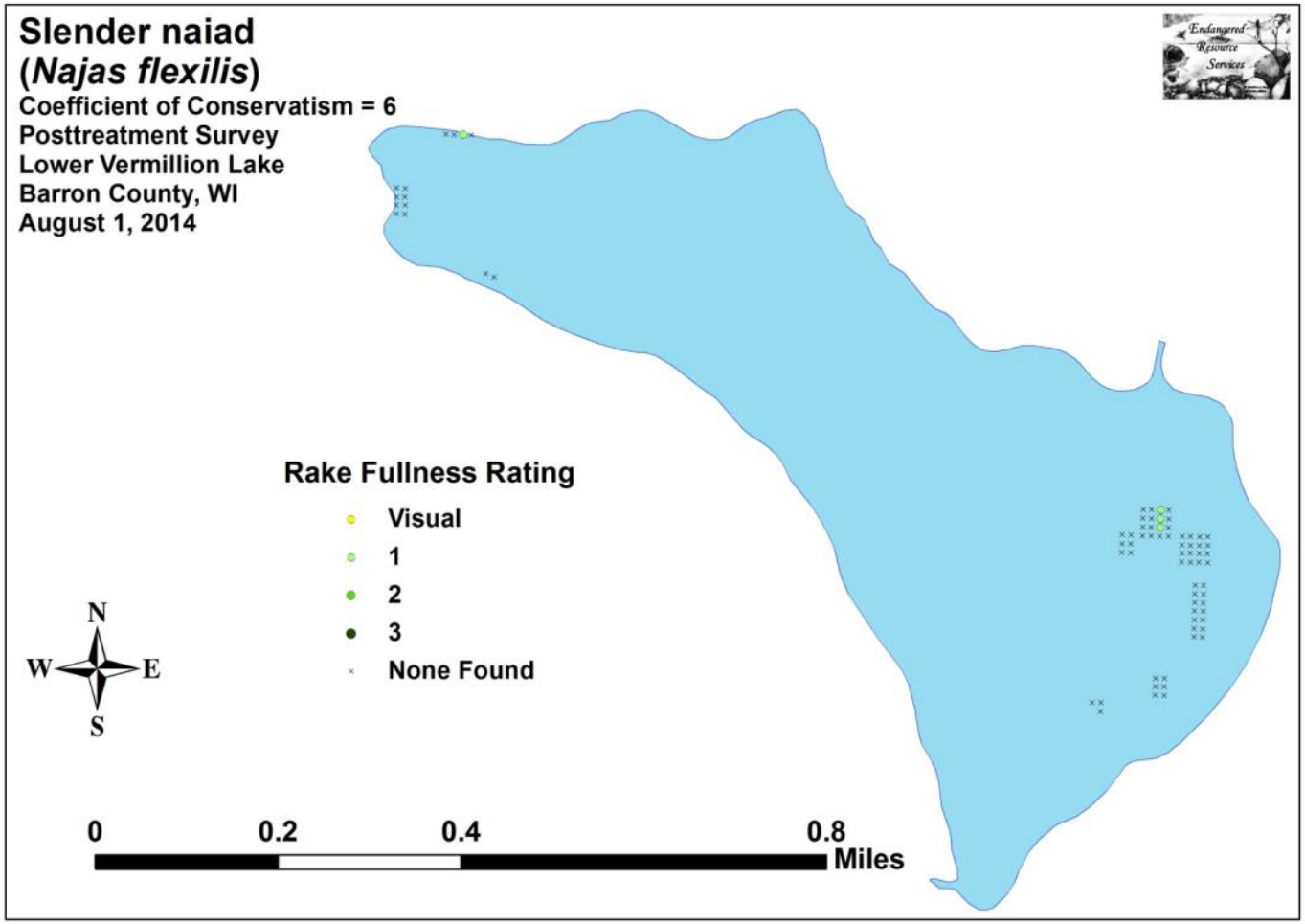

Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

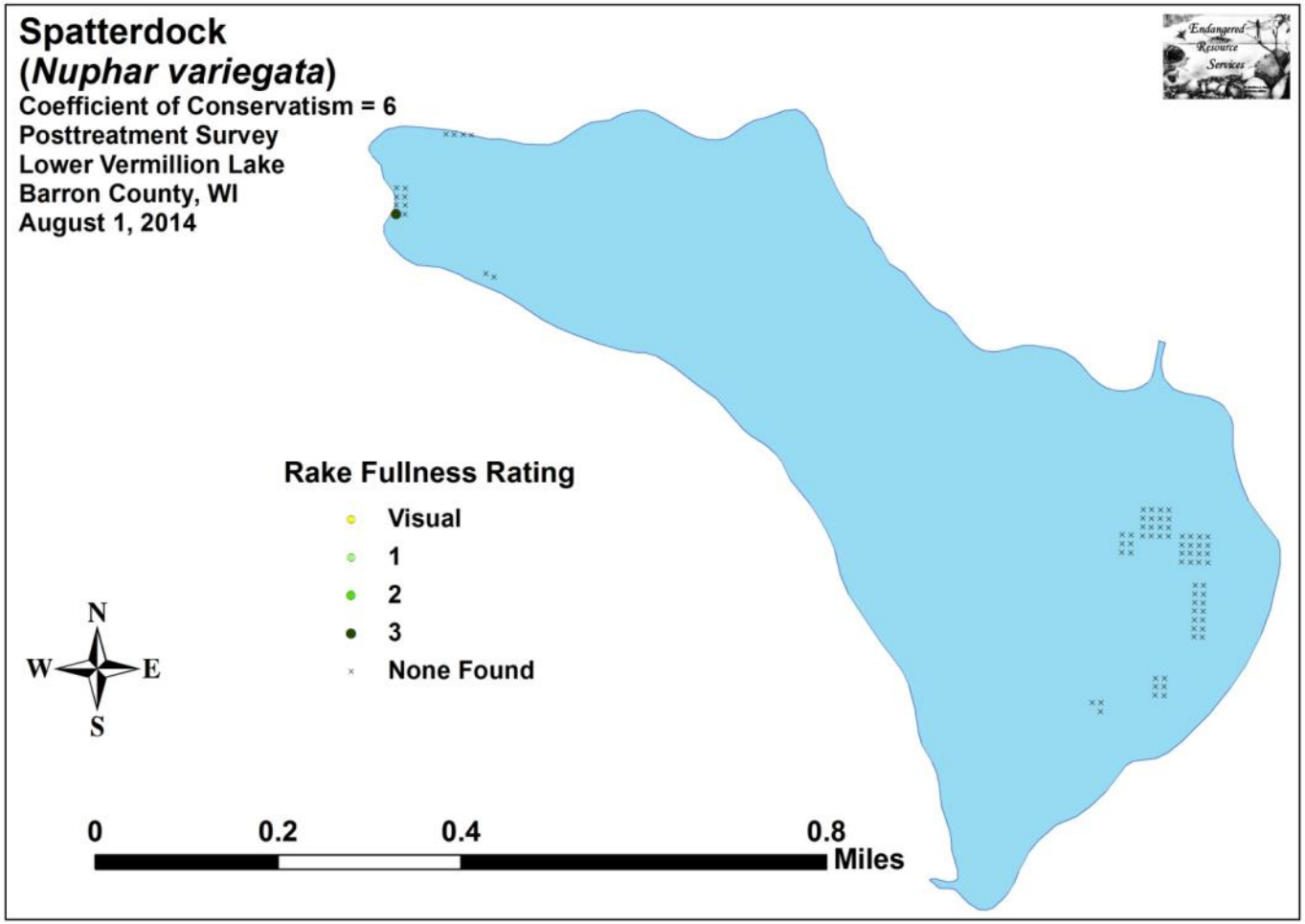

Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

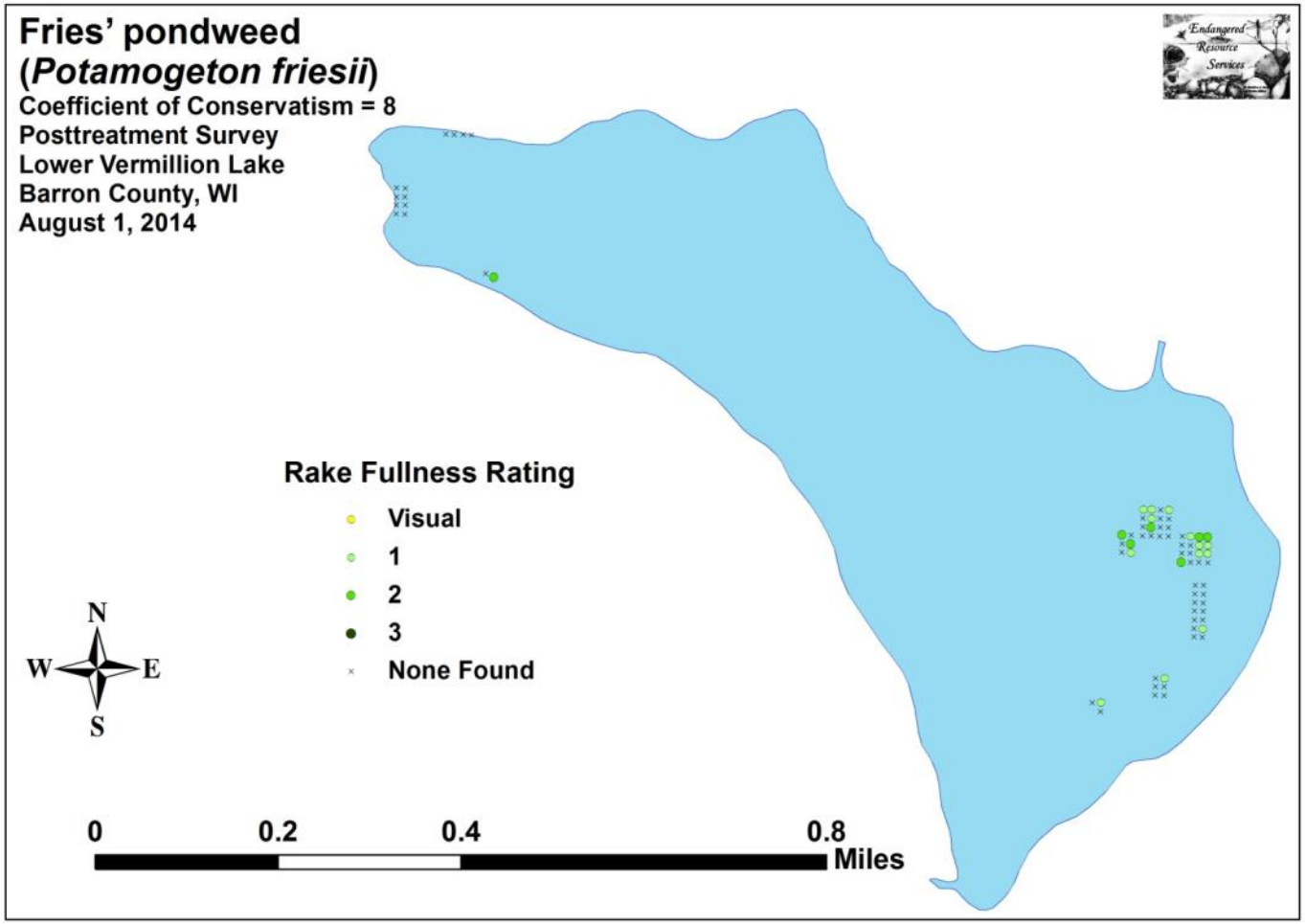

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

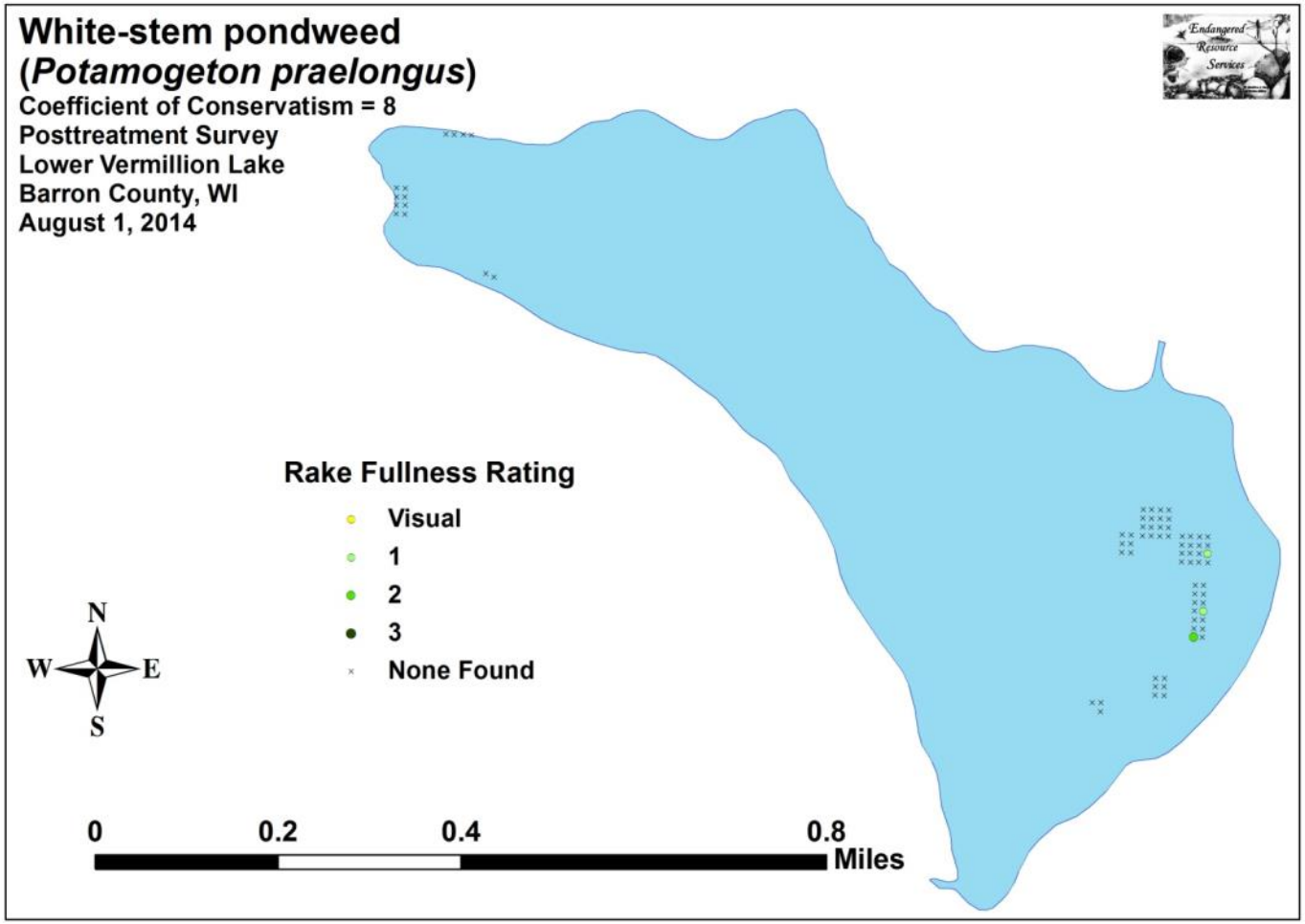

Filamentous algae
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

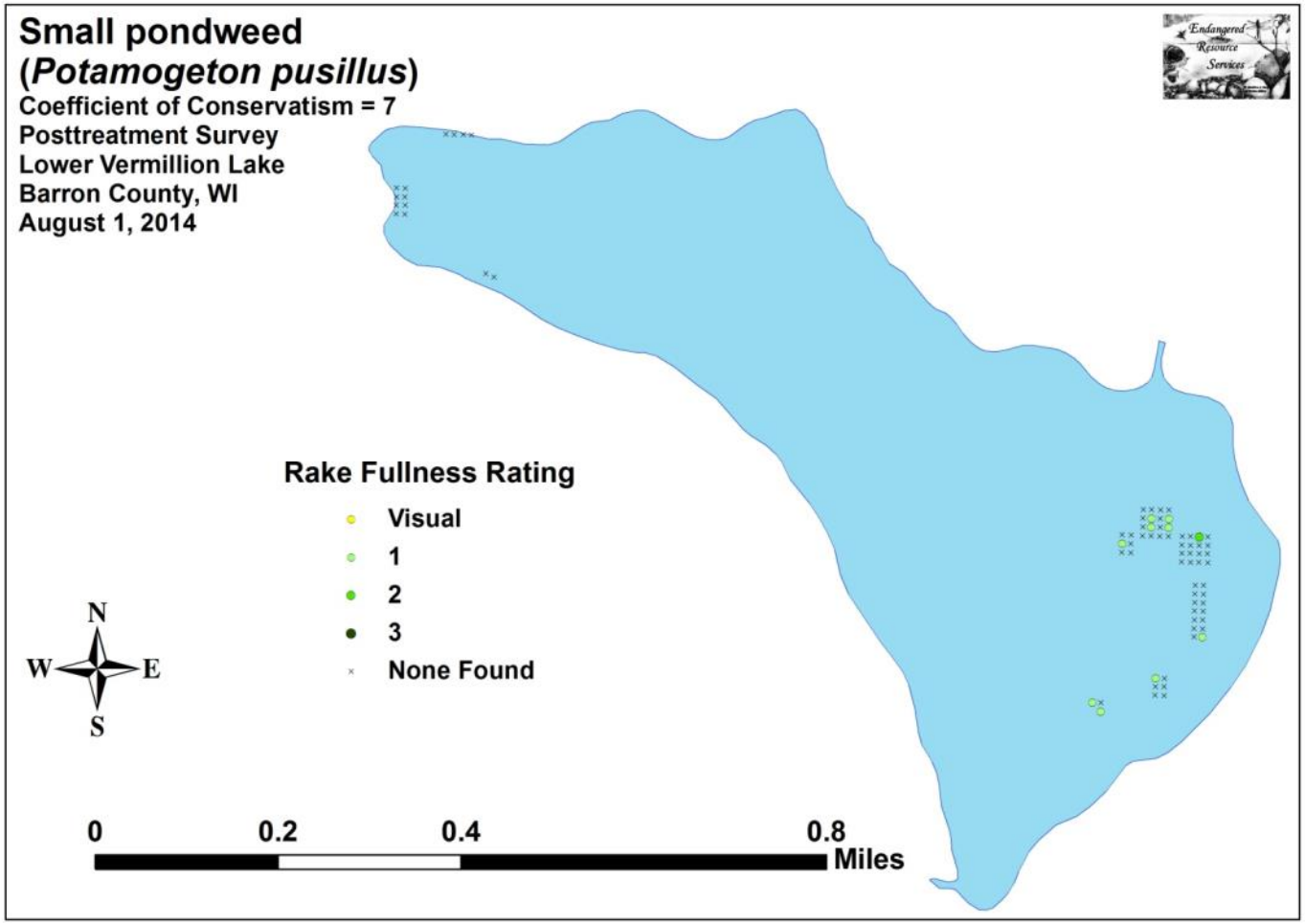

Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

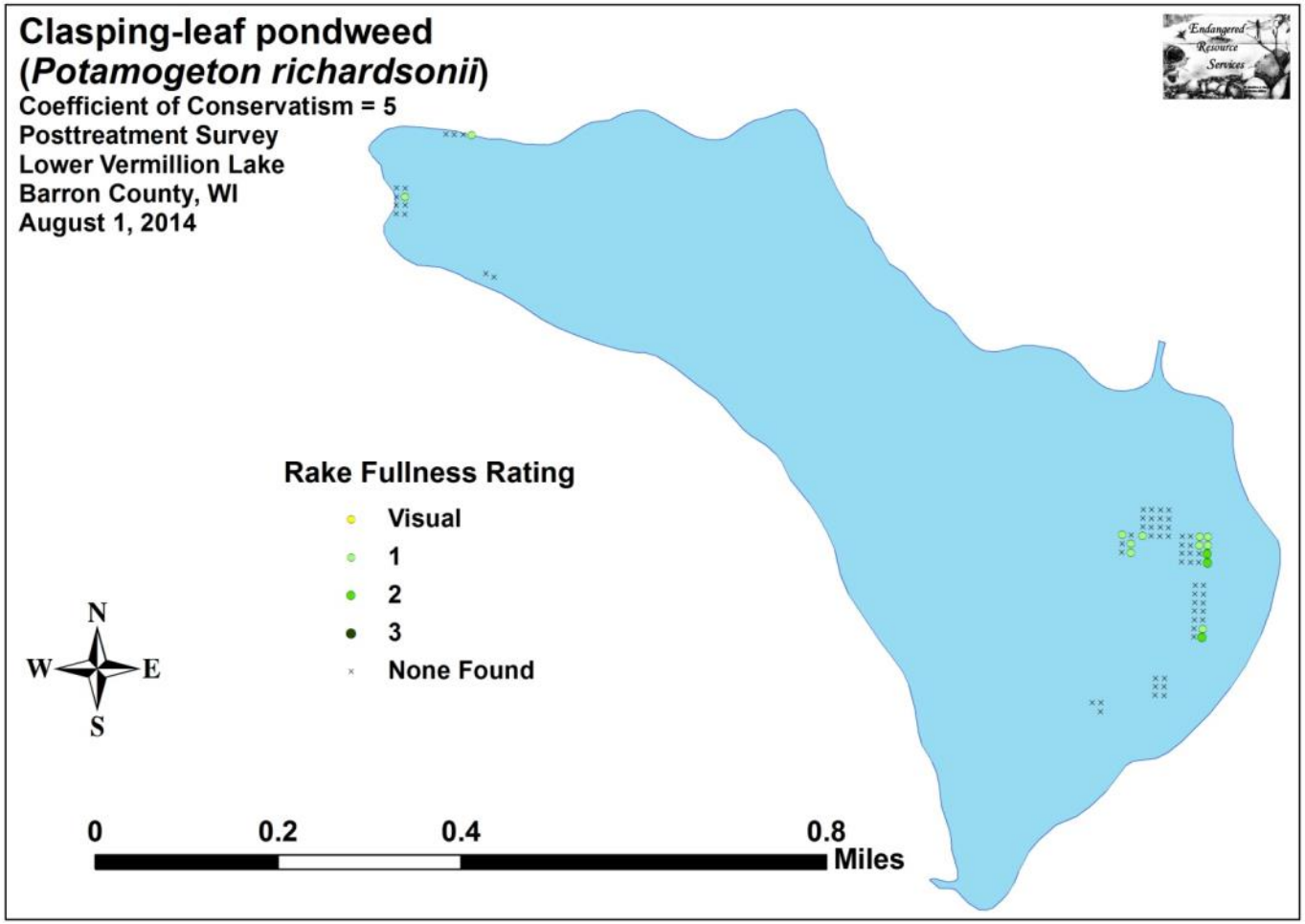

Slender naiad
(Najas flexilis)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

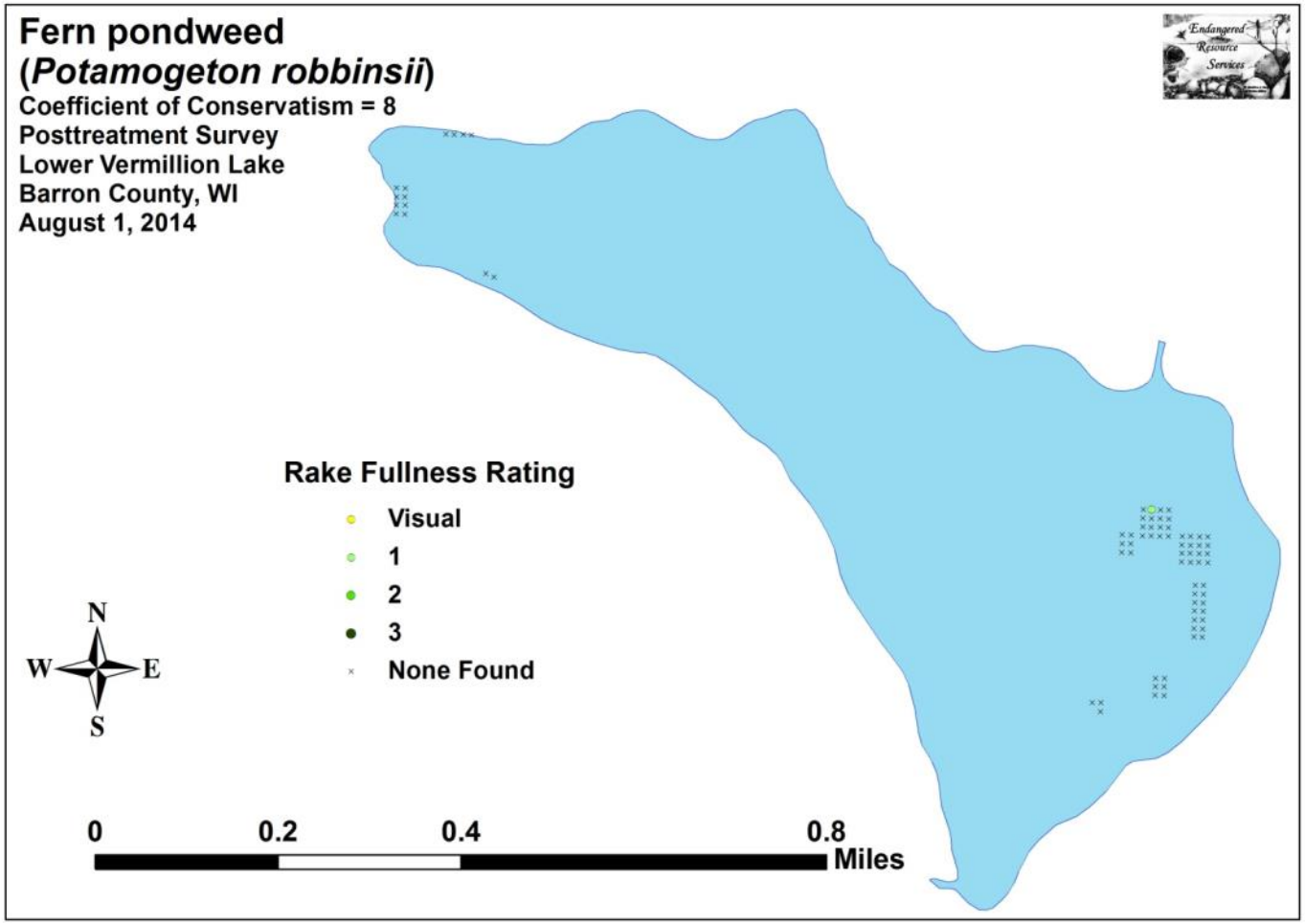

Spatterdock
(Nuphar variegata)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

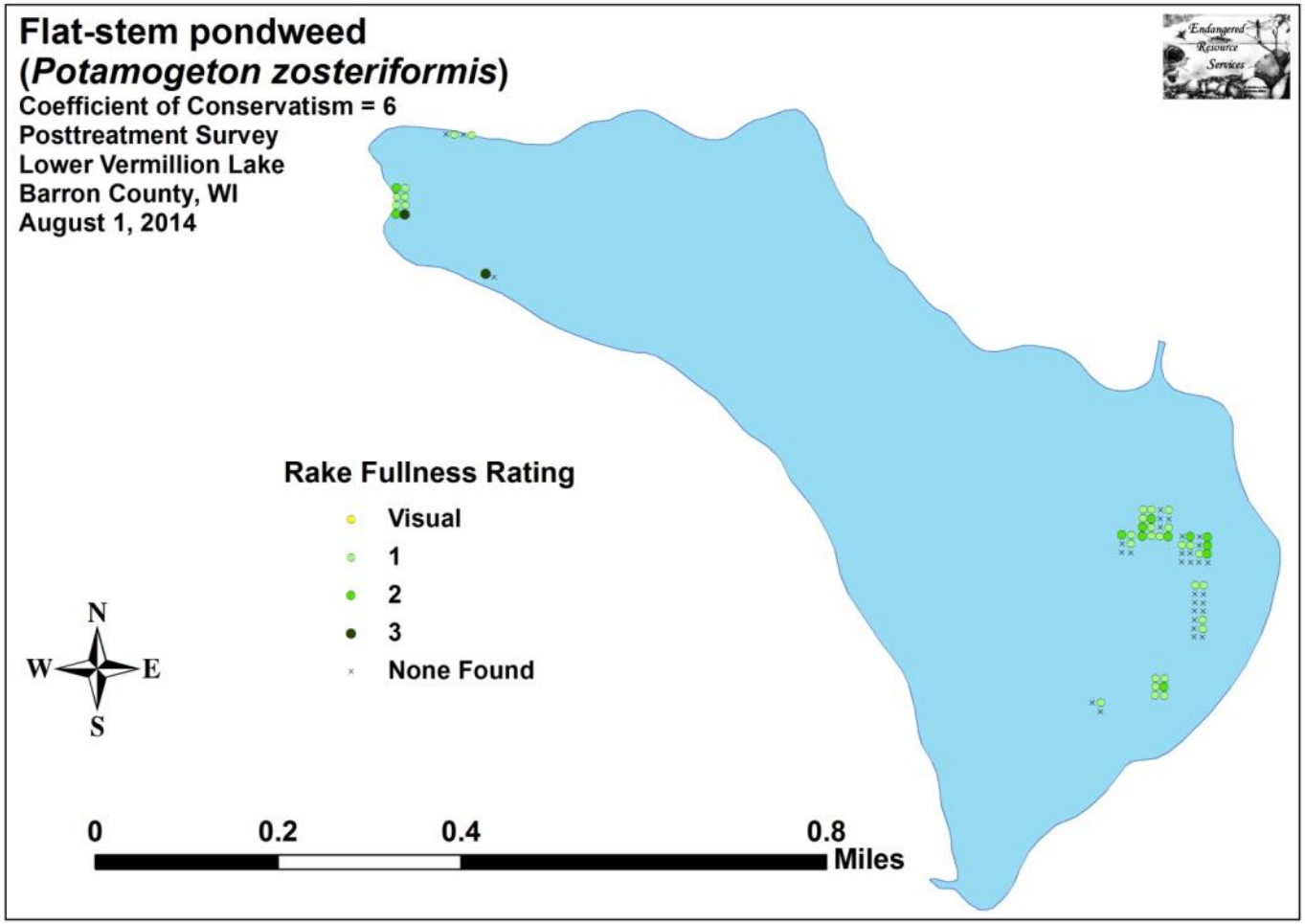

Fries' pondweed
(Potamogeton friesii)
Coefficient of Conservatism = 8
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

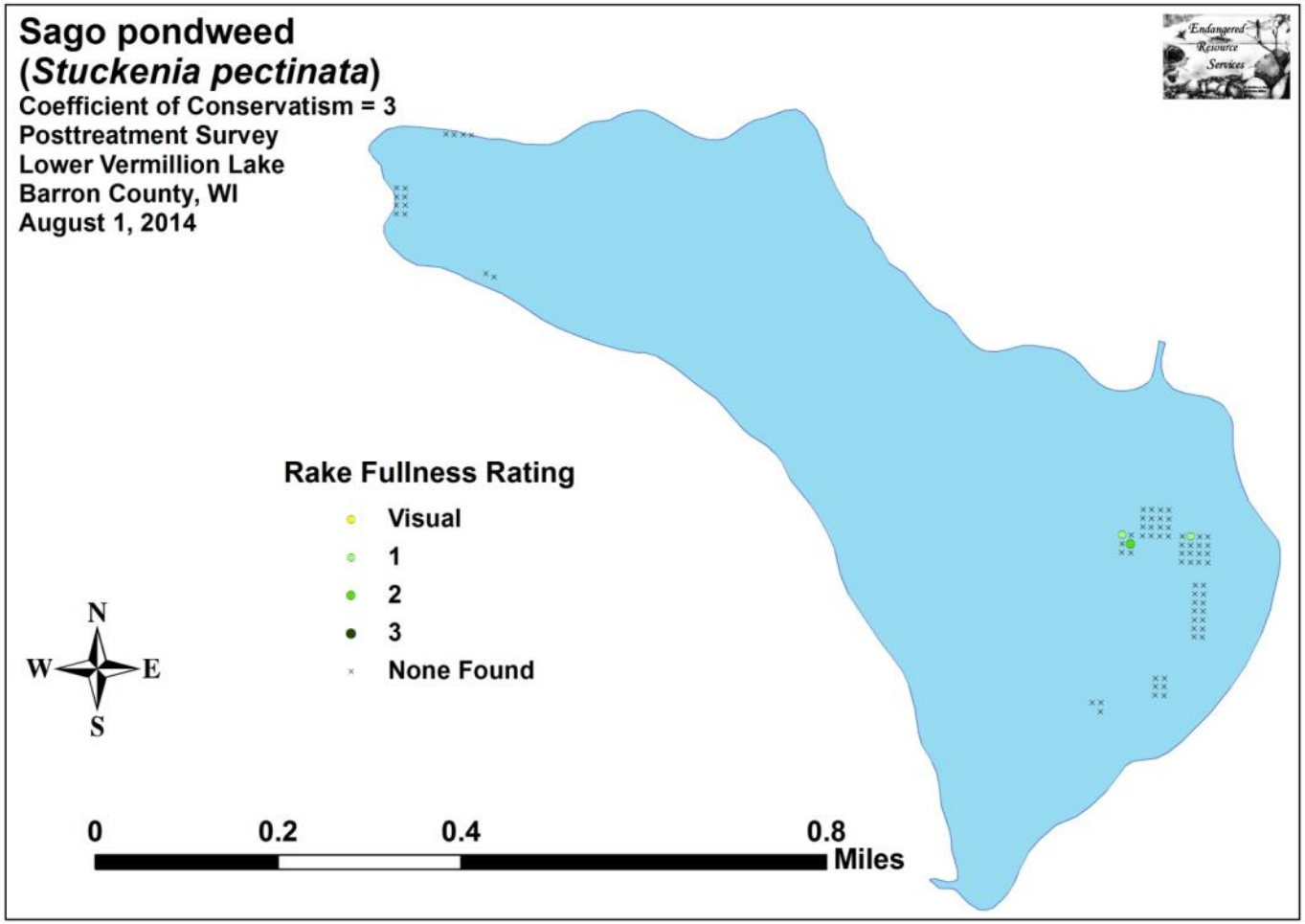

White-stem pondweed
(Potamogeton praelongus)
Coefficient of Conservatism = 8
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

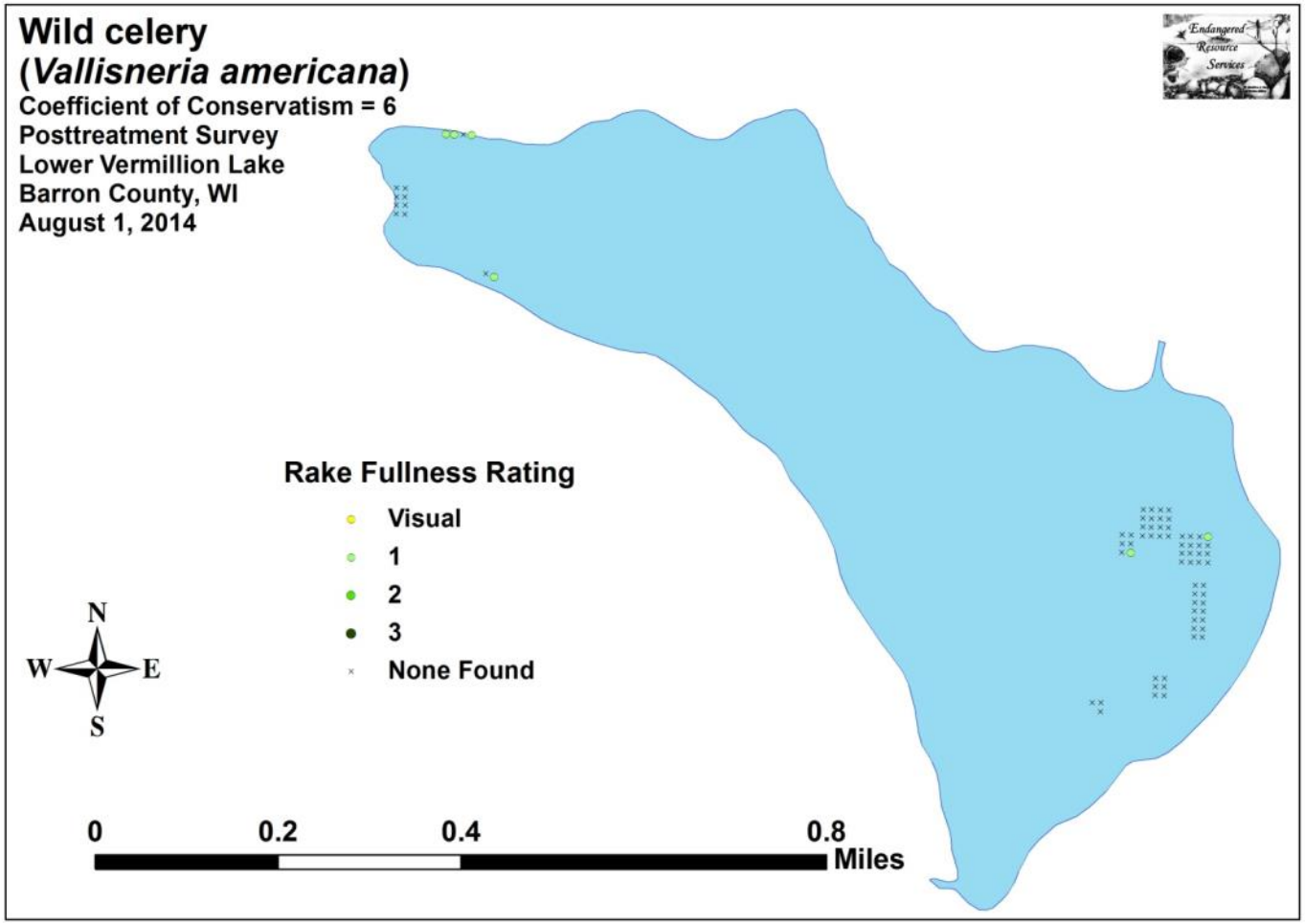

Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles


Clasping-leaf pondweed
(Potamogeton richardsonii)
Coefficient of Conservatism = 5
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

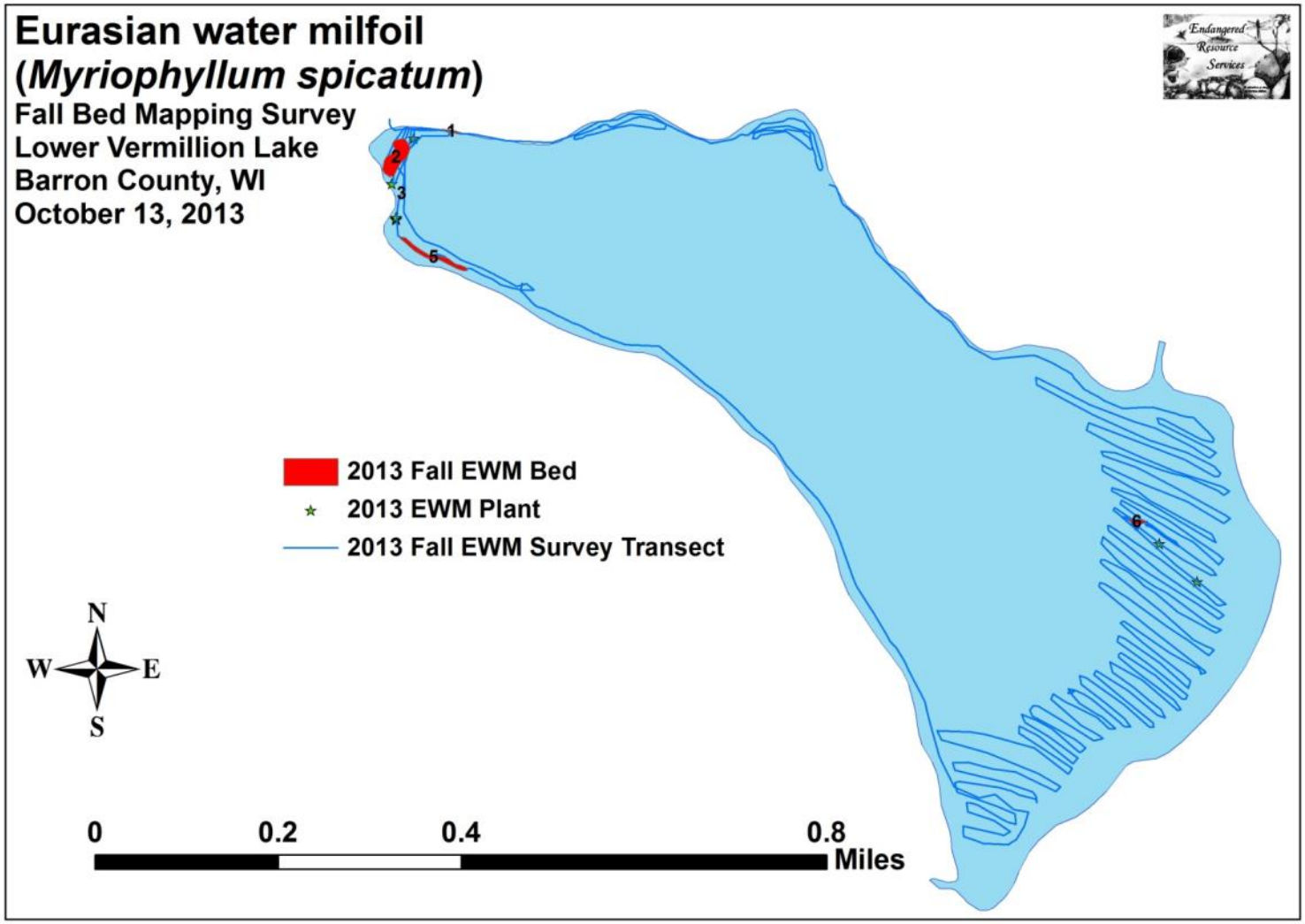

Fern pondweed
(Potamogeton robbinsii)
Coefficient of Conservatism = 8
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles

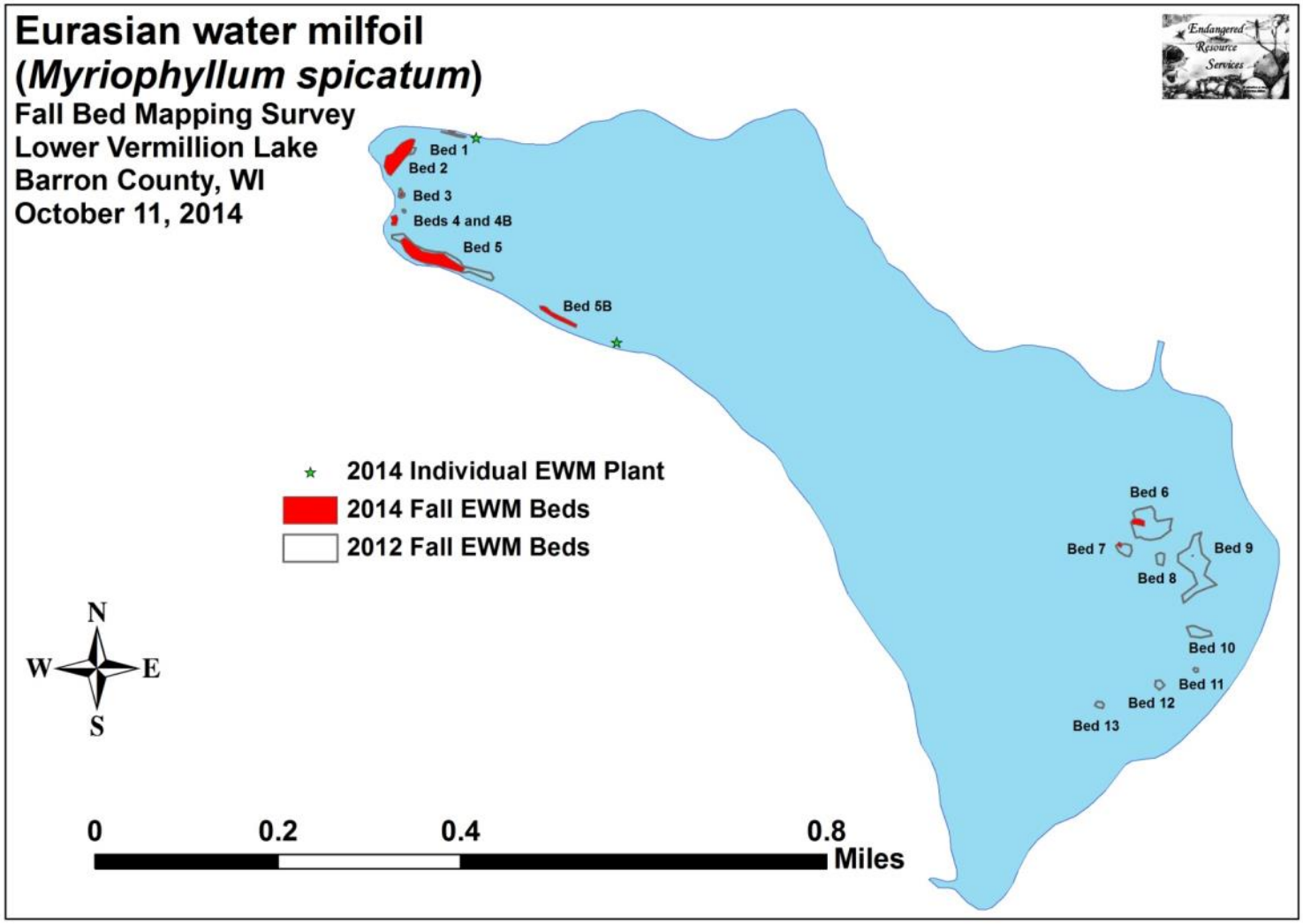

Flat-stem pondweed
(Potamogeton zosteriformis)
Coefficient of Conservatism = 6
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.2
0.4
0.8
Miles


Sago pondweed
(Stuckenia pectinata)
Coefficient of Conservatism = 3
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
Endangered Resource Services
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
Posttreatment Survey
Lower Vermillion Lake
Barron County, WI
August 1, 2014
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 VIII: Fall 2013 and 2014 EWM Bed Maps


Eurasian water milfoil
(Myriophyllum spicatum)
Fall Bed Mapping Survey
Lower Vermillion Lake
Barron County, WI
October 13, 2013
Endangered Resource Services
1
2
3
5
6
2013 Fall EWM Bed
2013 EWM Plant
2013 Fall EWM Survey Transect
N
W
E
S
0
0.2
0.4
0.8
Miles


Eurasian water milfoil
(Myriophyllum spicatum)
Fall Bed Mapping Survey
Lower Vermillion Lake
Barron County, WI
October 11, 2014
Endangered Resource Services
Bed 1
Bed 2
Bed 3
Beds 4 and 4B
Bed 5
Bed 5B
Bed 6
Bed 7
Bed 8
Bed 9
Bed 10
Bed 11
Bed 12
Bed 13
2014 Individual EWM Plant
2014 Fall EWM Beds
2012 Fall EWM Beds
N
W
E
S
0
0.2
0.4
0.8
Miles