Eurasian water milfoil (*Myriophyllum spicatum*) Pre/Post Herbicide and Fall Bed Mapping Surveys Echo Lake – WBIC: 2630200 Barron County, Wisconsin

EWM (Berg 2007)

2013 EWM Treatment Areas

Project Initiated by:

Echo Lake Association, Short Elliott Hendrickson Inc. and the Wisconsin Department of Natural Resources

EWM Removed from Echo Lake During the Fall 2013 Bed Mapping Survey

Survey Conducted by and Report Prepared by:

Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin

June 10, July 20, and October 6, 2013

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INTRODUCTION:

Echo Lake (WBIC 2630200) is a 172 acre stratified seepage lake in west-central Barron County, Wisconsin in the Town of Almena (T34N R14W S07 NE NE). The lake reaches a maximum depth of 41ft in the southeast corner of the central basin and has an average depth of 20ft (Busch et al. 1967). Echo Lake is mesotrophic bordering on oligotrophic in nature and water clarity is good to very good with 2013 summer Secchi readings averaging 12ft (WDR 2013). Bottom substrate is variable with sandy muck bottoms in most bays and rock/sand bars along most points and around the lake's islands.

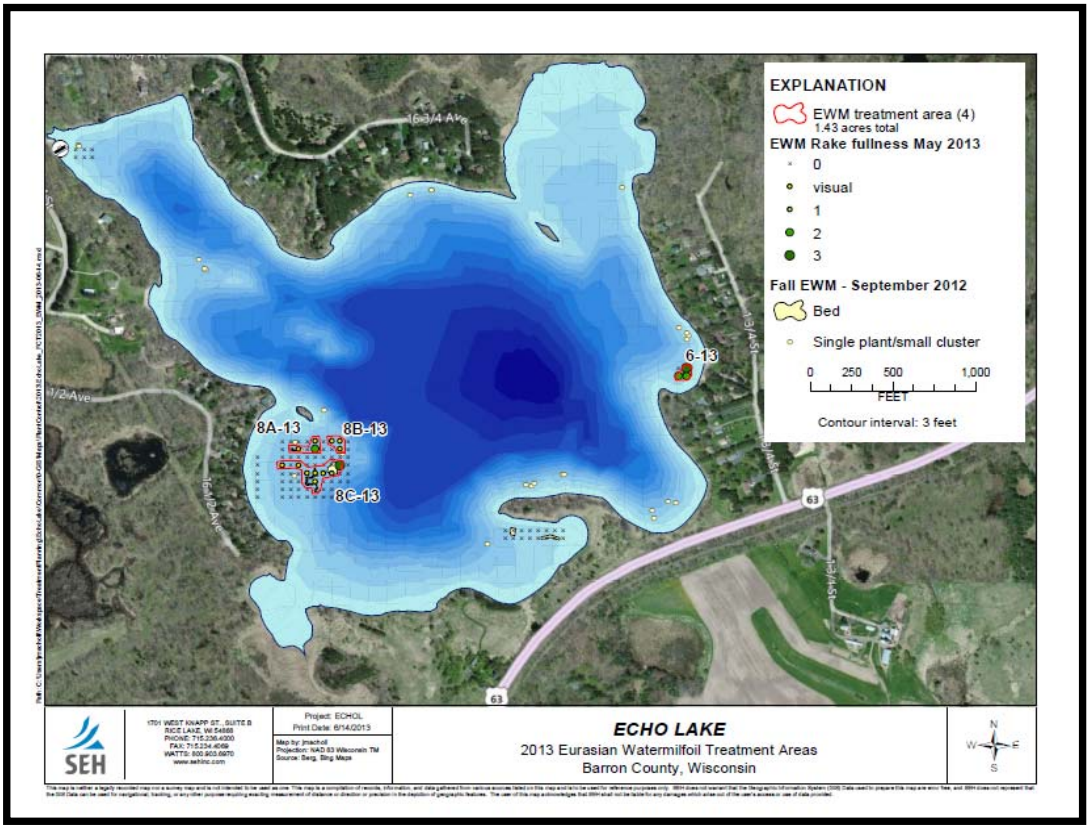


Figure 1: Proposed 2013 Spring EWM Treatment Areas

Eurasian water milfoil (*Myriophyllum spicatum*) (EWM), was discovered in Echo Lake in 2006, and the Echo Lake Association (ELA) has been actively managing this invasive exotic species since 2008. Following the 2012 fall EWM bed mapping survey that found low numbers of EWM plants scattered throughout the lake, the ELA, under the direction of Short Elliott Hendrickson Inc. (SEH), decided to chemically treat four areas in 2013. All combined, they totaled 1.43 acres or 0.8% of the lake's surface area (Figure 1).

On June 10th, we conducted a pretreatment survey to gather baseline data from the scheduled treatment areas and to allow SEH biologists to finalize treatment plans. Following the June 26th herbicide application, we conducted a July 20th posttreatment survey to evaluate the effectiveness of the treatment. We also conducted an October 6th EWM bed mapping survey to determine where EWM control might be considered in 2014. This report is the summary analysis of these three field surveys.

METHODS:

Pre/Post Herbicide Survey:

SEH biologists created pre/post survey points based on the size and shape of the proposed treatment areas with additional "exploratory" survey points scattered throughout the lake in areas that have supported EWM beds in the past. Of the 100 points they generated, approximately 24 fell within the four treatment areas. This was well over the 4-10 pts/acre required by WDNR protocol (Appendix I).

During the surveys, we located each point 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 $p < .005$.

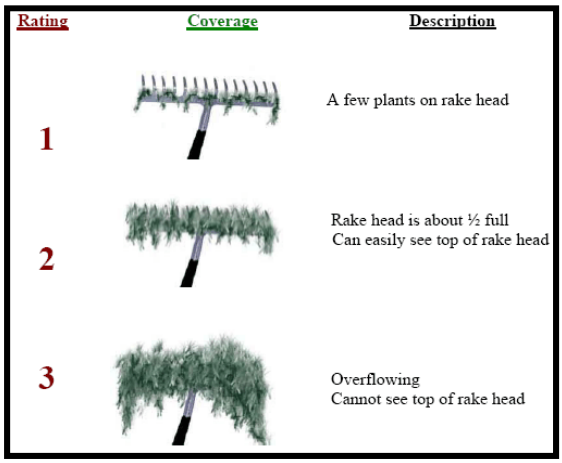


Figure 2: Rake Fullness Ratings

Fall Eurasian Water Milfoil Bed Mapping:

On October 6th, 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. Using the WDNR's Forestry Tool's Extension to ArcGIS 9.3.1, we used 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 generally few in number, and, if possible, rake removed them.

RESULTS AND DISCUSSION:

Finalization of Treatment Areas:

Initial expectations were to treat four beds totaling 1.43 acres with granular 2, 4-D (Navigate) at a concentration of 3ppm (Table 1). Following the pretreatment survey where we found EWM at or inter-point in each of these areas, it was determined to maintain the treatment as initially planned. The final treatment was conducted by Lake Management, Inc. on June 26th (Figure 3) (Appendix I).

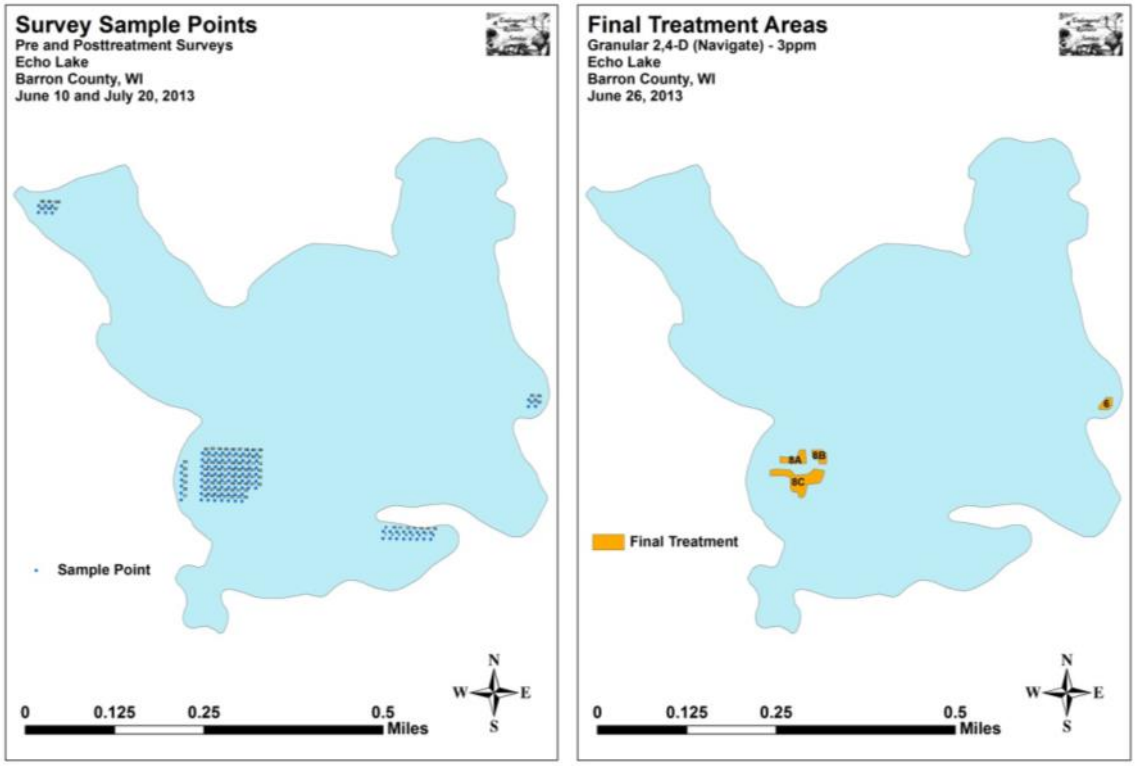


Figure 3: 2013 Survey Sample Points and Final Treatment Areas

Table 1: Spring EWM Treatment Summary
Echo Lake – June 26, 2013

Bed Number	Proposed Acreage	Final Acreage	Difference +/-
6	0.15	0.15	0
8A	0.26	0.26	0
8B	0.19	0.19	0
8C	0.83	0.83	0
Total Acres	**1.43**	**1.43**	**0.00**

EWM Pre/Post Herbicide Survey:

The treatment area littoral zone extended to a maximum of 14.5ft during the pretreatment survey and 15.0ft during the posttreatment survey. Mean and median depths for all plants were 6.3ft and 6.0ft respectively for both the pre and posttreatment surveys (Table 2). Most EWM was established over organic and sandy muck (Figure 4) (Appendix III).

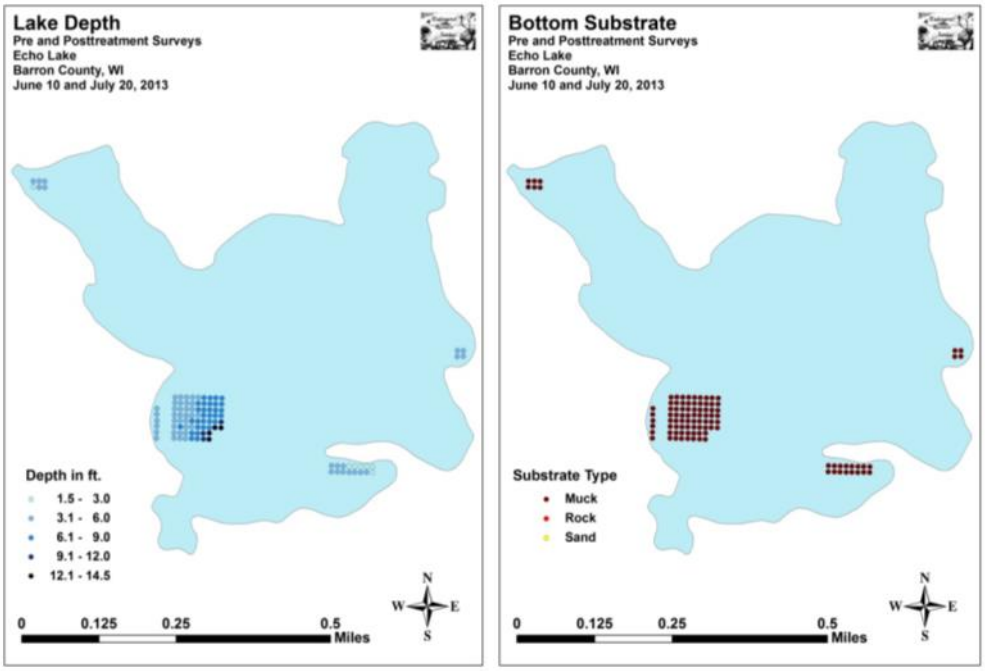


Figure 4: Treatment Area Depths and Bottom Substrate

Table 2: Pre/Post Survey Summary Statistics
Echo Lake, Barron County
June 10 and July 20, 2013

Summary Statistics:	Pre	Post
Total number of points sampled	100	100
Total number of sites with vegetation	99	97
Total number of sites shallower than the maximum depth of plants	100	100
Frequency of occurrence at sites shallower than maximum depth of plants	99.0	97.0
Simpson Diversity Index	0.72	0.78
Floristic Quality Index	21.5	26.9
Maximum depth of plants (ft)	14.5	15.0
Mean depth of plants (ft)	6.3	6.3
Median depth of plants (ft)	6.0	6.0
Average number of all species per site (shallower than max depth)	2.19	2.29
Average number of all species per site (veg. sites only)	2.21	2.36
Average number of native species per site (shallower than max depth)	2.13	2.29
Average number of native species per site (native veg. sites only)	2.15	2.36
Species richness	11	15
Mean rake fullness (veg. sites only)	2.30	2.09

Initial diversity within the beds was moderate with a Simpson Diversity Index of 0.72. This value increased slightly to 0.78 posttreatment. The Floristic Quality Index, a measure of only native plants, also increased from 21.5 to 26.9. Mean native species richness at sites with native vegetation was 2.15/site pretreatment, and this also increased to 2.36/site posttreatment (Figure 5). Total rake fullness declined from a moderately high 2.30 pretreatment to a moderate 2.09 posttreatment (Figure 6) (Appendix IV).

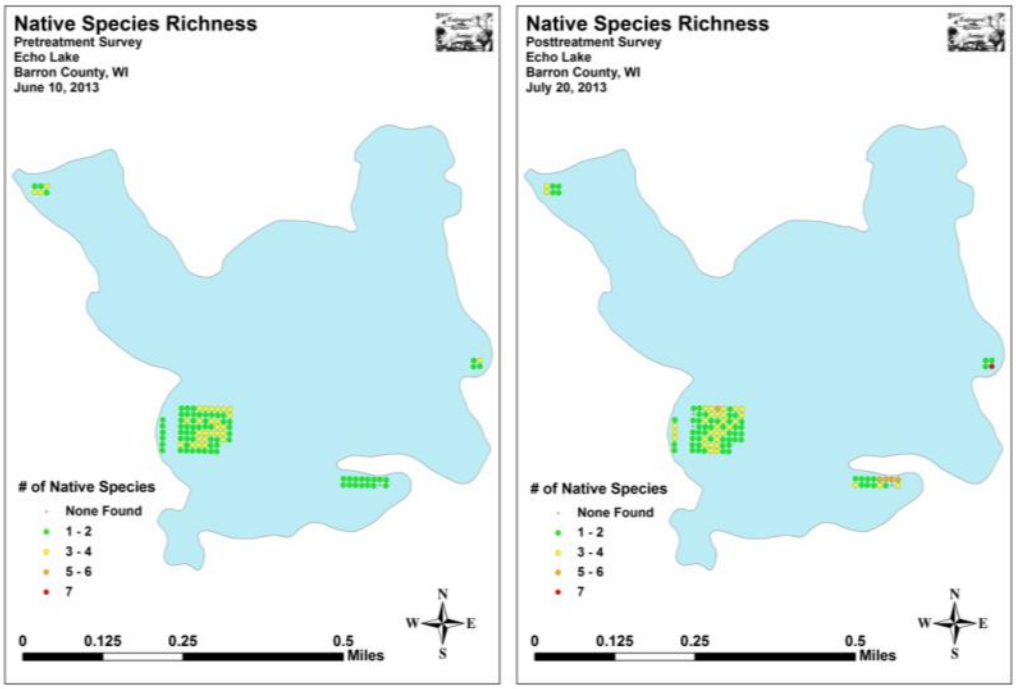


Figure 5: Pre/Post Native Species Richness

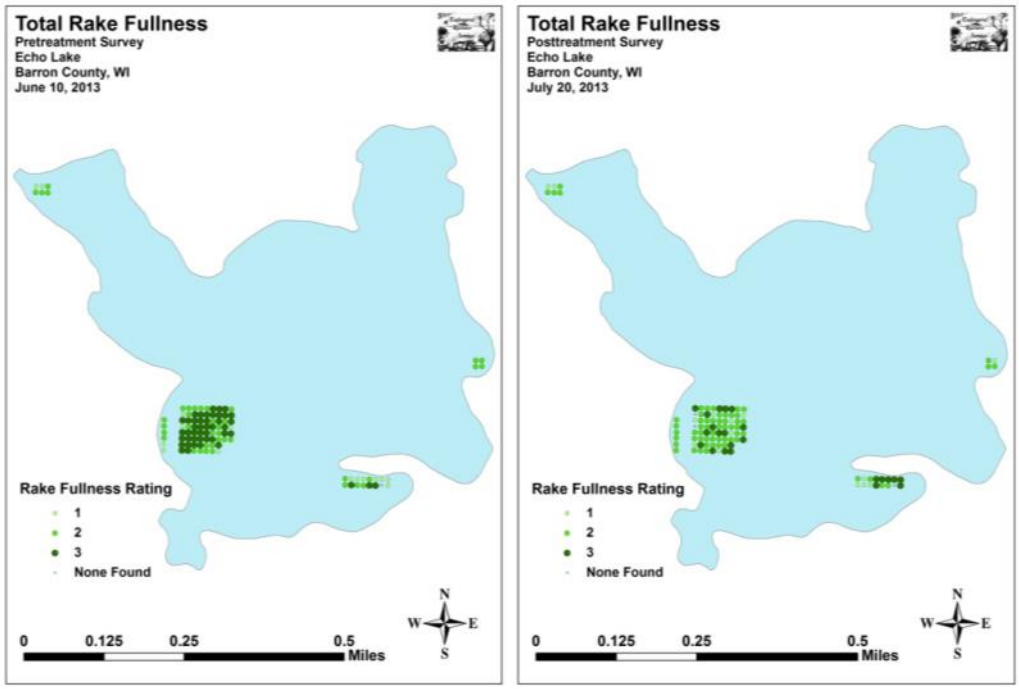


Figure 6: Pre/Post Total Rake Fullness

We found EWM at only six sites during the pretreatment survey. Of these, one had a fullness rating of 3, three had a rating of 2, and two were represented by a single stem. This resulted in a mean rake fullness value for EWM at all sites of 1.83. We also recorded EWM as a visual at eleven points. During the posttreatment survey, we didn't find EWM in the rake anywhere, but it was a visual at a single site (Figure 7) (Appendix V). These results suggested a significant reduction in overall EWM (Figure 8).

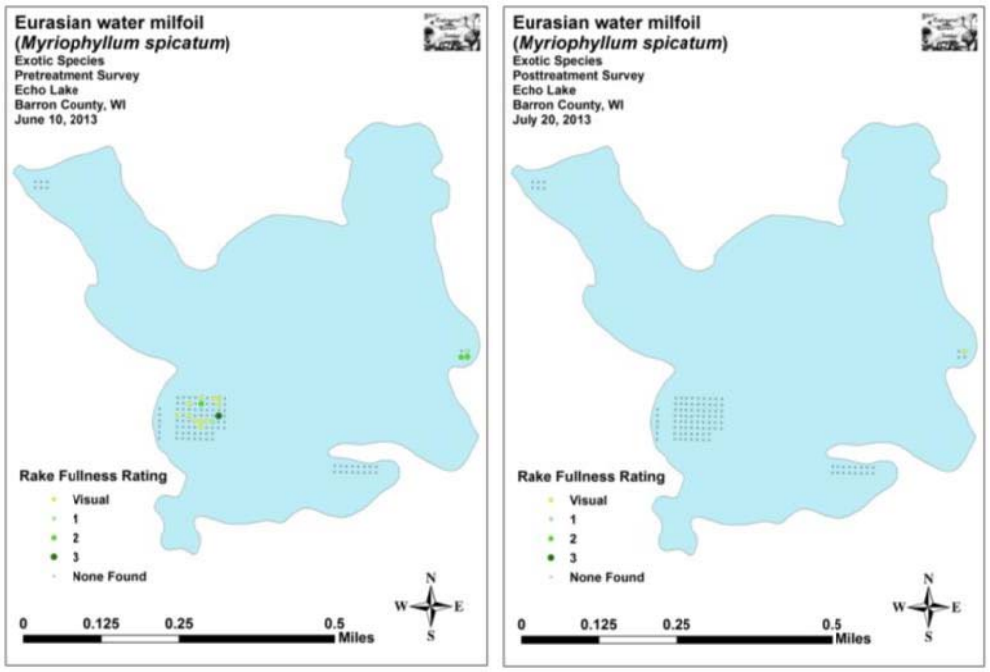
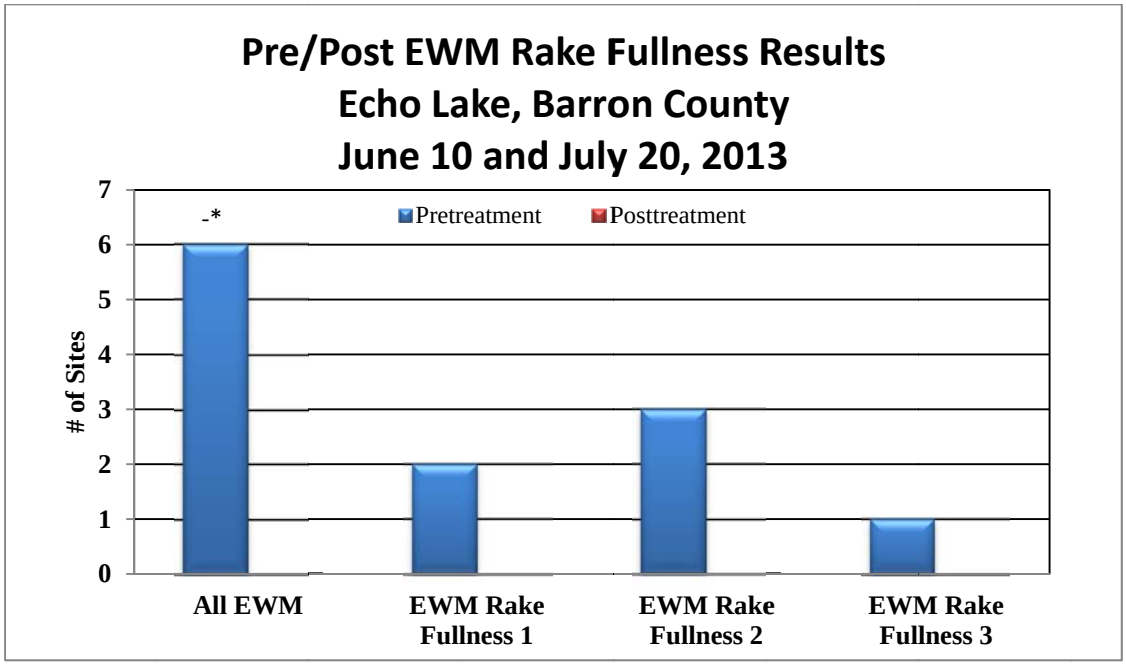


Figure 7: Pre/Post EWM Density and Distribution



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

Figure 8: Pre/Post Changes in EWM Rake Fullness

Fern pondweed (*Potamogeton robbinsii*) and Common waterweed (*Elodea canadensis*) (Figures 9 and 10) were the most common native species in both the pre and posttreatment surveys (Tables 3 and 4) and neither showed a significant change (Figure 11). In fact, no species other than EWM was significantly reduced. Conversely, Vasey's pondweed (*Potamogeton vaseyi*) and Northern naiad (*Najas gracillima*) showed moderately significant increases posttreatment; and Nitella (*Nitella* sp.) showed a significant increase. Maps for all native species from the pre and posttreatment surveys are available in Appendixes VI and VII.

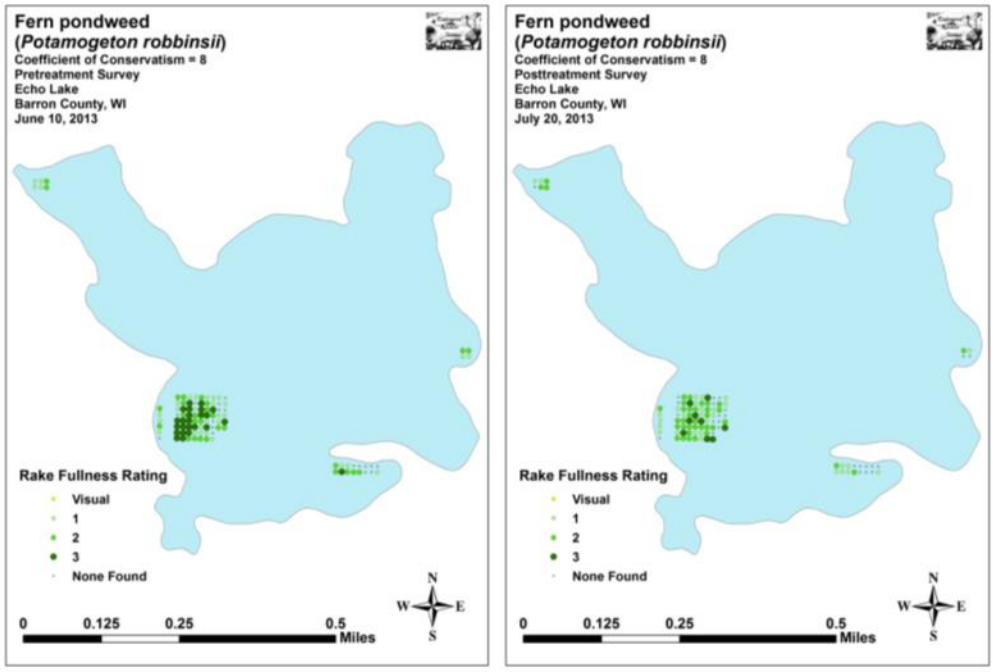


Figure 9: Pre/Post Fern Pondweed Density and Distribution

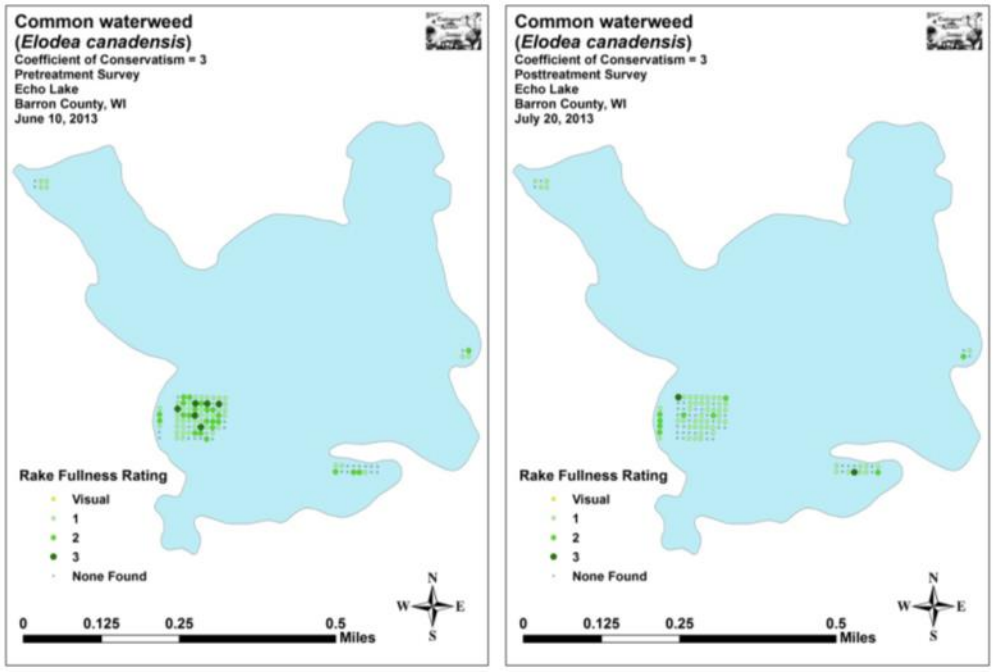
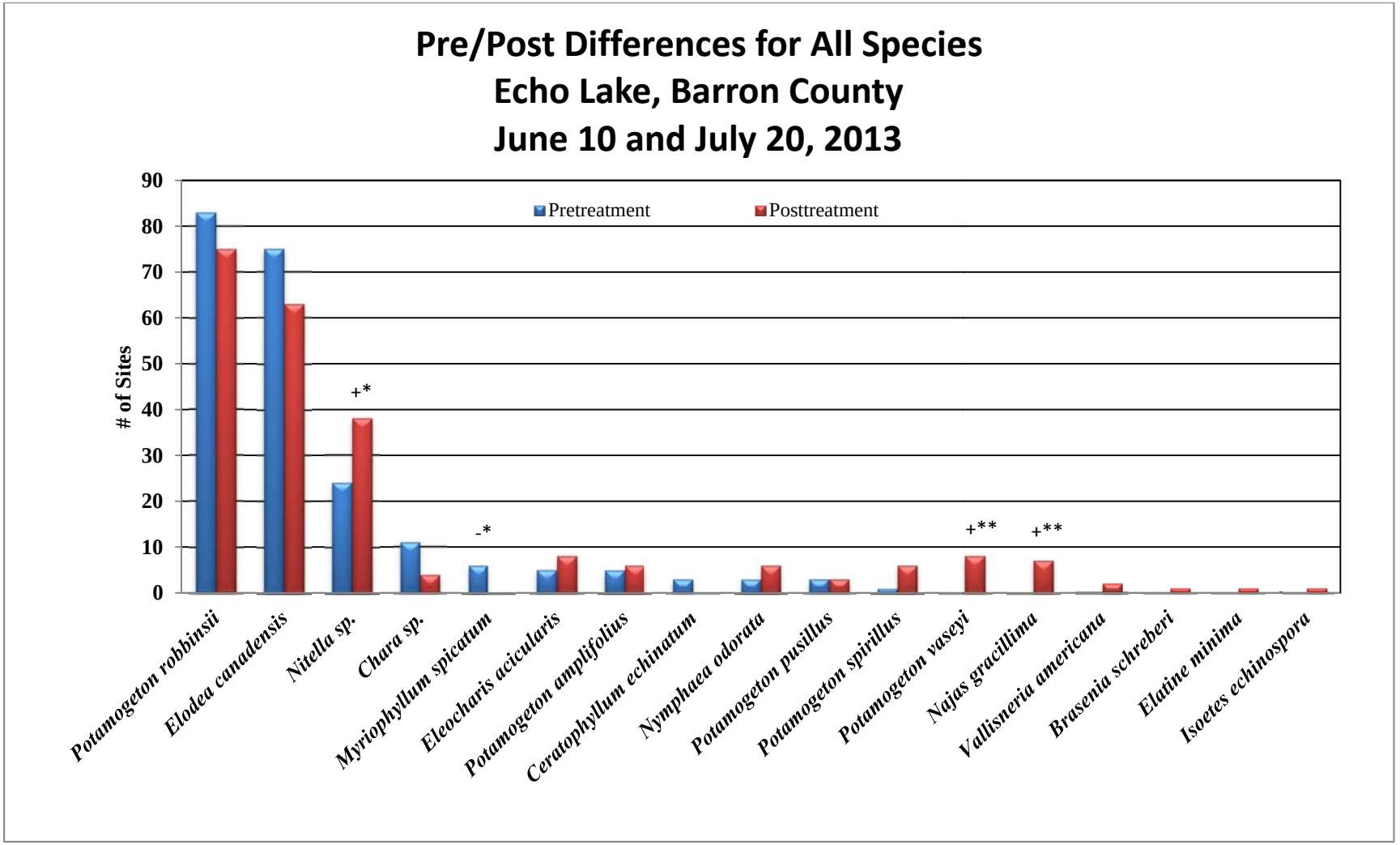


Figure 10: Pre/Post Common Waterweed Density and Distribution



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 Echo Lake, Barron County
June 10, 2013

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
Potamogeton robbinsii	Fern pondweed	83	83.84	83.00	37.90	1.92	0
Elodea canadensis	Common waterweed	75	75.76	75.00	34.25	1.47	0
Nitella sp.	Nitella	24	24.24	24.00	10.96	2.33	0
Chara sp.	Muskgrass	11	11.11	11.00	5.02	1.55	0
Myriophyllum spicatum	Eurasian water milfoil	6	6.06	6.00	2.74	1.83	11
Eleocharis acicularis	Needle spikerush	5	5.05	5.00	2.28	1.80	0
Potamogeton amplifolius	Large-leaf pondweed	5	5.05	5.00	2.28	1.00	0
Ceratophyllum echinatum	Spiny hornwort	3	3.03	3.00	1.37	1.00	0
Nymphaea odorata	White water lily	3	3.03	3.00	1.37	1.00	0
Potamogeton pusillus	Small pondweed	3	3.03	3.00	1.37	1.33	0
Potamogeton spirillus	Spiral-fruited pondweed	1	1.01	1.00	0.46	2.00	0

Table 4: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Posttreatment Survey Echo Lake, Barron County
July 20, 2013

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
Potamogeton robbinsii	Fern pondweed	75	32.75	77.32	75.00	1.73	0
Elodea canadensis	Common waterweed	63	27.51	64.95	63.00	1.21	0
Nitella sp.	Nitella	38	16.59	39.18	38.00	1.53	0
Eleocharis acicularis	Needle spikerush	8	3.49	8.25	8.00	2.00	0
Potamogeton vaseyi	Vasey's pondweed	8	3.49	8.25	8.00	1.25	0
Najas gracillima	Northern naiad	7	3.06	7.22	7.00	1.00	0
Nymphaea odorata	White water lily	6	2.62	6.19	6.00	2.50	0
Potamogeton amplifolius	Large-leaf pondweed	6	2.62	6.19	6.00	1.00	0
Potamogeton spirillus	Spiral-fruited pondweed	6	2.62	6.19	6.00	1.17	0
Chara sp.	Muskgrass	4	1.75	4.12	4.00	1.25	0
Potamogeton pusillus	Small pondweed	3	1.31	3.09	3.00	1.00	0
Vallisneria americana	Wild celery	2	0.87	2.06	2.00	1.00	0
Brasenia schreberi	Watershield	1	0.44	1.03	1.00	3.00	0
Elatine minima	Waterwort	1	0.44	1.03	1.00	1.00	0
Isoetes echinospora	Spiny spored-quillwort	1	0.44	1.03	1.00	1.00	0
Myriophyllum spicatum	Eurasian water milfoil	**	**	**	**	**	1

** Visual Only

Fall EWM Bed Mapping Survey:

On October 6th, 2013, we located and mapped two small EWM beds totaling just 0.04 acre (Figure 12) (Appendix VIII). Each bed appeared to contain 50-100 plants and was near canopy, but plants occurred at very low densities.

Compared to 2012 when we found five beds totaling 0.21 acres, 2013 would seem to show a reduction in EWM on the lake (-0.17 acres) (Table 5). Unfortunately, while we only found 35 additional EWM plants outside of the mapped beds in 2012 and were able to rake remove all of them, in 2013, we located 209 additional plants outside these two small beds and could not remove them all. Most of these plants were found in 5-9ft of water and were scattered throughout this lake within this zone. Comparing the location of these plants to our first bed mapping survey in the spring of 2010, we noted that EWM seems to be recolonizing, albeit at very low densities, many of these areas.

In fall 2012, we recommended continued rake removal throughout the 2013 growing season. Although we rake removed numbers of plants on each of our three trips to the lake, it is our understanding that there was no additional volunteer pulling in 2013 (D. Blumer, pers. comm). Without a consistent effort in this regards, it is likely that additional herbicide applications will be needed in the future to maintain EWM at the lake's current low levels. Additionally, as EWM was so widely distributed but occurred at such low densities in fall 2013, we believe using a shoreline survey before establishing treatment areas and pre/post points in the spring of 2014 is an idea worth considering.

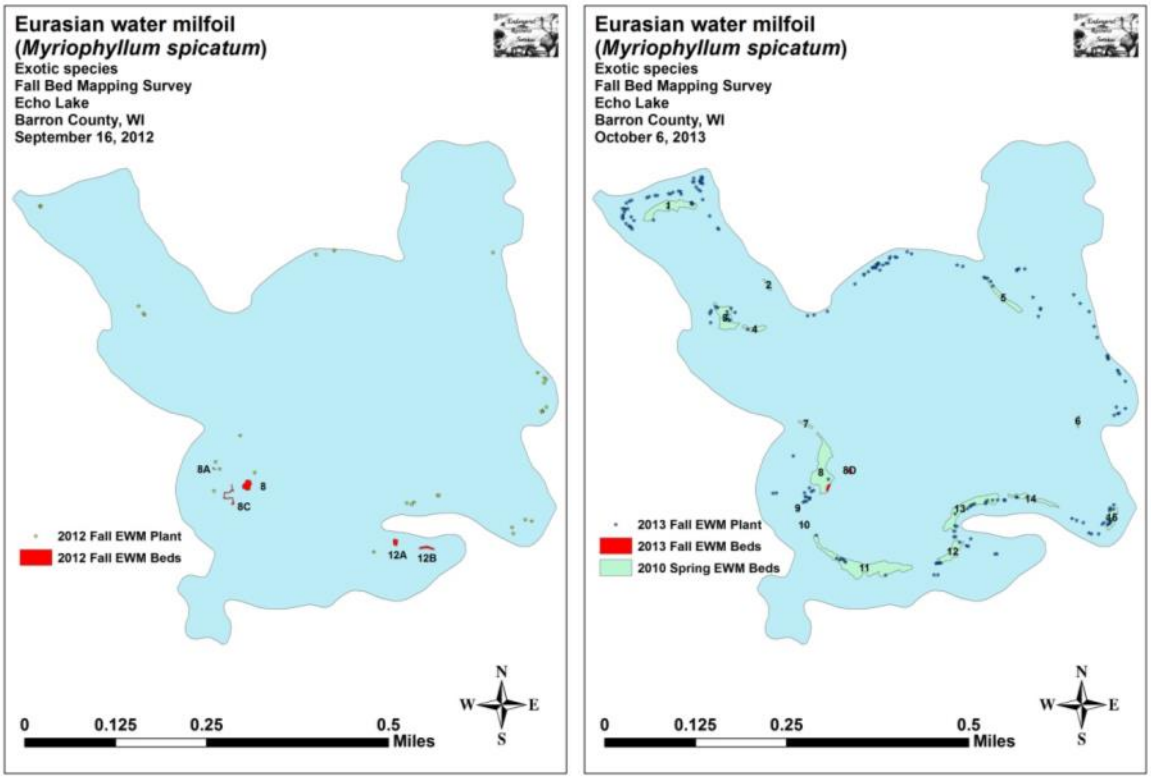


Figure 12: 2012 and 2013 Fall EWM Bed Maps

Table 5: Fall Eurasian Water Milfoil Bed Mapping Summary
Echo Lake, Barron County
October 6, 2013

Bed Number	2012 Fall Bed Acreage	2012 Fall Bed Acreage	2011 Fall Bed Acreage	2013 Change in Acreage	Estimated 2013 Mean Rake Fullness	Years Treated	2013 Bed Characteristics And Field Notes
1	0	0	0	0	<1-1	2010	Low density but noticeable increase
2	0	0	0	0	0	2010	No plants found
3	0	0	0	0	<<1	2010	Low density; rake removed all
4	0	0	0	0	<<1	2010	Low density; rake removed all
5	0	0	0	0	<1-1	2010	Low density; rake removed most
6	0	0	0	0	0	2010, 2013	No plants found; scattered inshore
7	0	0	0	0	0	2010	No plants found
8	0.02	0.09	0	-007	<1-1	2010, 2011, 2013	Bed at the edge of deep water
8A	0	<0.01	0	-<0.01	<<<1	2013	Low density; rake removed most
8B	0	0	0	0	0	2012, 2013	Low density; rake removed most
8C	0	0.05	0	-0.05	<1-1	2013	Low density; rake removed most
8D	0.02	0	0	0.02	<1-1	None	New bed on rock hump in 6ft
9	0	0	0	0	<<1	2010, 2011	Low density; rake removed all
10	0	0	0	0	<<1	2010	Low density; rake removed all
11	0	0	0	0	<<<1	2010, 2011, 2012	Few plants found in deep water
12	0	0	0	0	<1-1	2010	Low density but spreading
12A	0	0.03	0	-0.03	<<<1	None	Very low density; rake removed
12B	0	0.04	0	-0.04	<<<1	None	Very low density; rake removed
13	0	0	0	0	<1-1	2010	Low density but spreading
14	0	0	0	0	<1-1	2010	Low density but spreading
15	0	0	0	0	<1-1	2010	Low density but spreading
Total	**0.04**	**0.21**	**0.00**	**-0.17**			

Descriptions of Current and Former EWM Beds:

Bed 1 – The area near the boat landing showed a noticeable uptick in EWM compared to fall 2012 and earlier in the summer of 2013. Despite this, we recommend resurveying this area in spring 2014 as past experience suggests that many of these plants may winter kill. Although we raked many out, we were not able to get to all of them.

Bed 2 – We found no plants in this area during any of our three trips to the lake in 2013.

Beds 3 and 4 – We rake removed all plants found in these areas. Large-leaf pondweed (*Potamogeton amplifolius*) and Water-thread pondweed (*Potamogeton diversifolius*) continue to be common in this area.

North-central shoreline to Bed 5 – This area again has a few widely scattered plants, and we rake removed most of them. However, we anecdotally believe that they are increasing with many of them being clusters rather than single stems as in the past. Because of this, we feel this area deserves another look in spring 2014.

Eastern Shoreline/Bed 6 – There were no plants in the former bed, but we did find clusters of plants around several docks scattered along the entire eastern shoreline. We rake removed every plant we found, but this area also deserves to be looked at early in 2014.

Bed 7 – We did not find any plants in this area during 2013.

Beds 8 and 8D – These beds continue to be challenging to treat as Bed 8 is on the outer edge of EWM's preferred zone of growth adjacent to deep water, and the newly discovered Bed 8D is surrounded by deeper water on a small 6ft rocky hump.

Beds 8A, 8B, 8C, 9 and 10 - This area continued to have scattered plants throughout and we rake removed everything we found.

Bed 11 – We found a few plants popping up in this formerly large bed. Most plants were in 8ft+ making it difficult to successfully rake remove them.

Beds 12A and 12B – These beds seemed to have winter killed as we didn't see much in this area at any time in 2013 despite having many 1ft tall "sprouts" during the 2012 fall survey.

Beds 12-15 – We removed a handful of plants in each of these areas on each of our visits, but there was more there than we could get to during the fall survey. Although not beds at this time, EWM appears to be expanding in all of these areas, and the depth that they occur at (most 8ft+) makes rake removal challenging.

LITERATURE CITED

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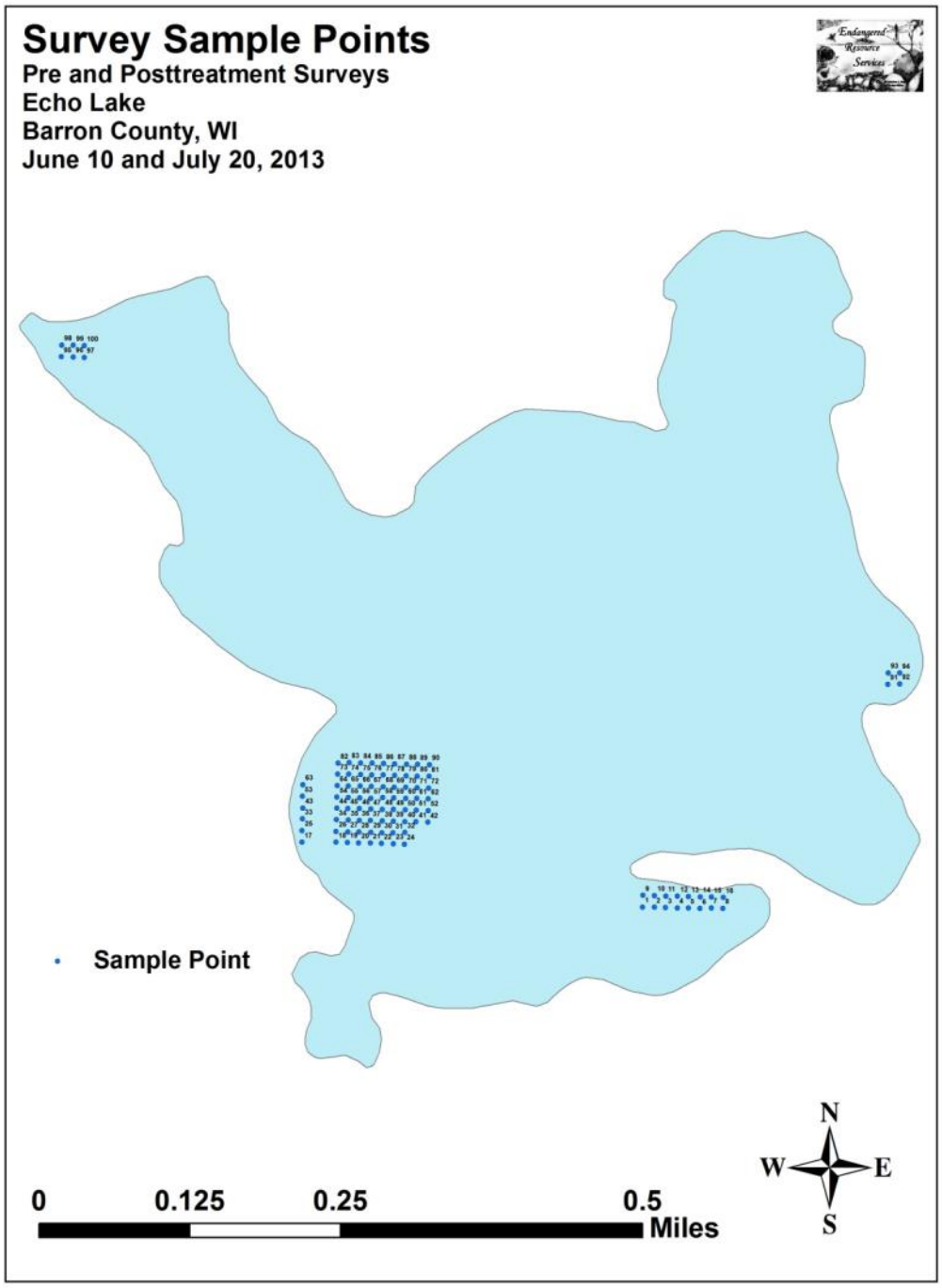
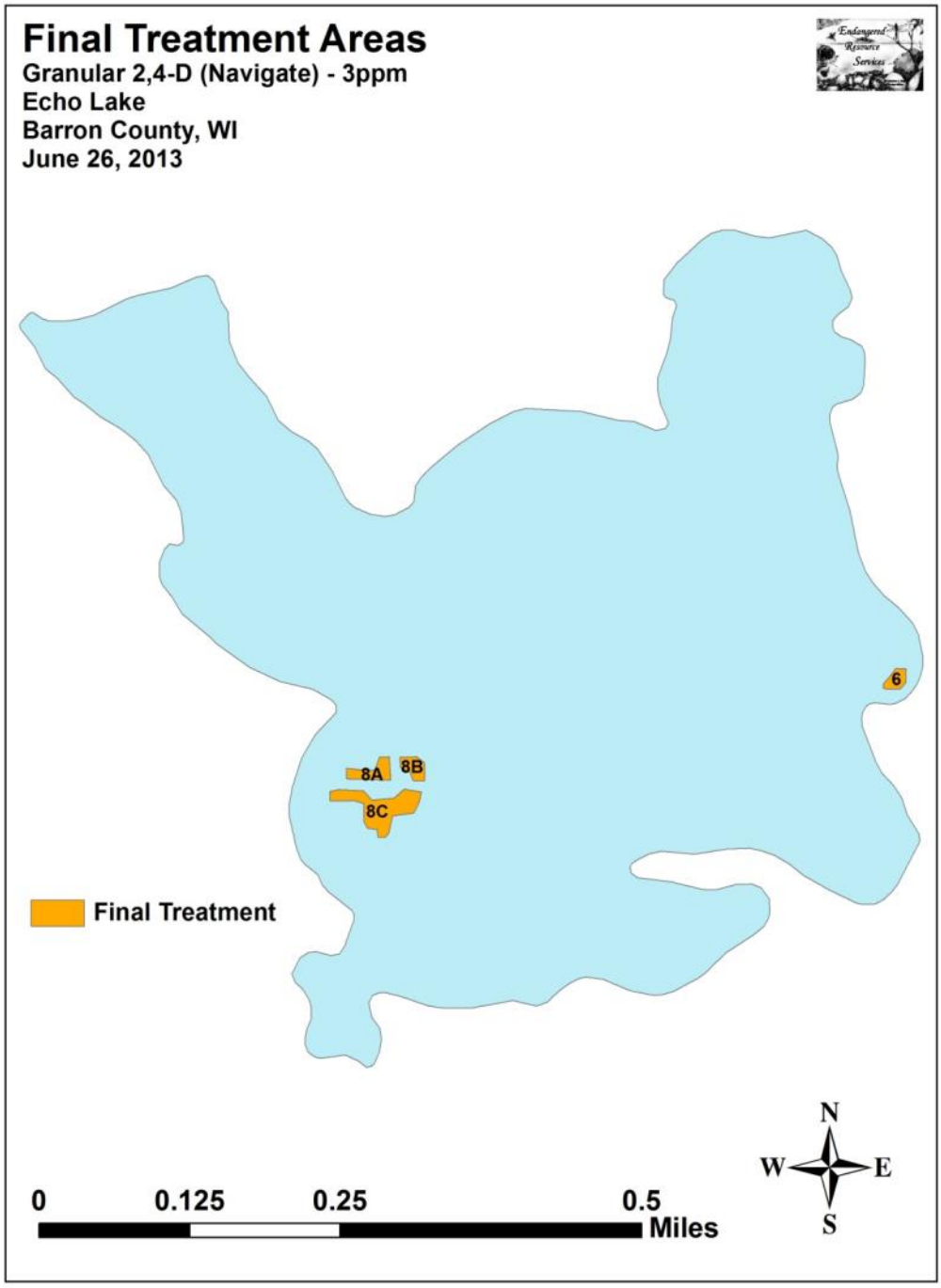
UWEX Lakes Program. [online]. 2010. Aquatic Plant Management in Wisconsin. Available from http://www.uwsp.edu/cnr/uwexlakes/ecology/APMguide.asp (2013, November).

WDNR. [online]. 2013. Echo Lake - Citizen Lake Water Quality Monitoring Database. Available from http://dnr.wi.gov/lakes/CLMN/Station.aspx?id=033210 (2013, November).

Appendix I: Survey Sample Points and EWM Treatment Areas


Survey Sample Points
Pre and Posttreatment Surveys
Echo Lake
Barron County, WI
June 10 and July 20, 2013
Sample Point
N
W
E
S
0
0.125
0.25
0.5
Miles


Final Treatment Areas
Granular 2,4-D (Navigate) - 3ppm
Echo Lake
Barron County, WI
June 26, 2013
6
8A
8B
8C
Final Treatment
N
W
E
S
0
0.125
0.25
0.5
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																									
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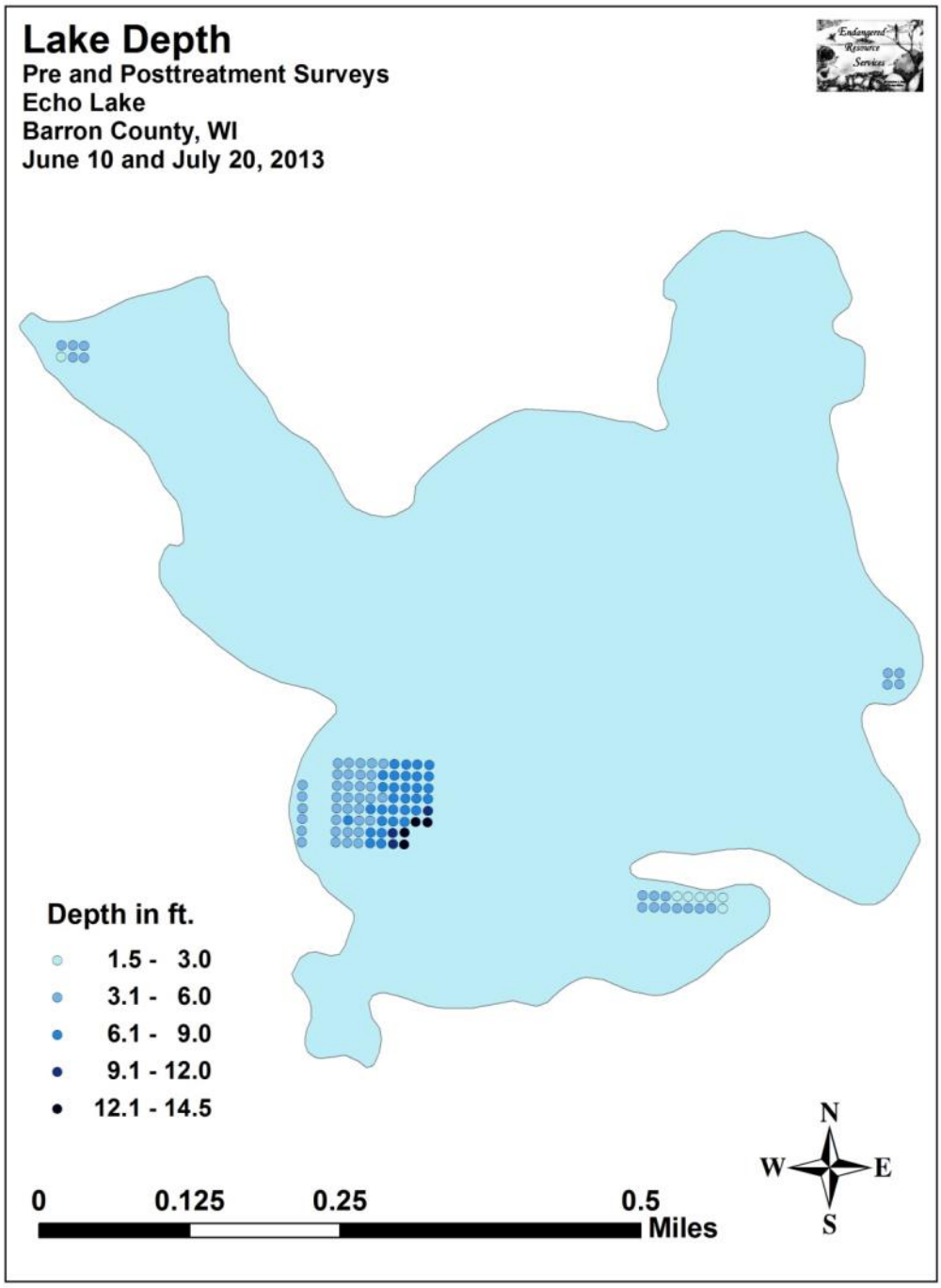
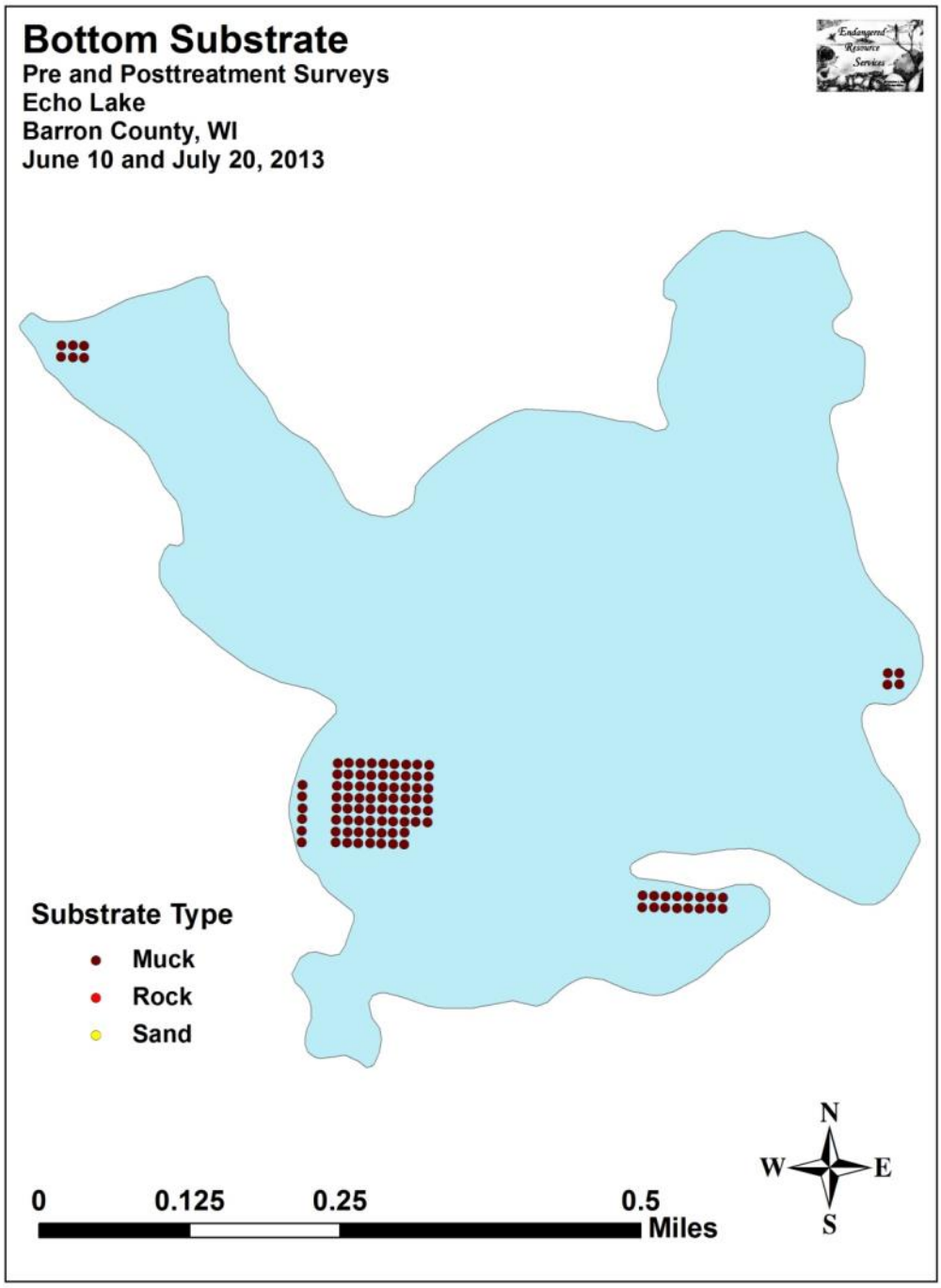
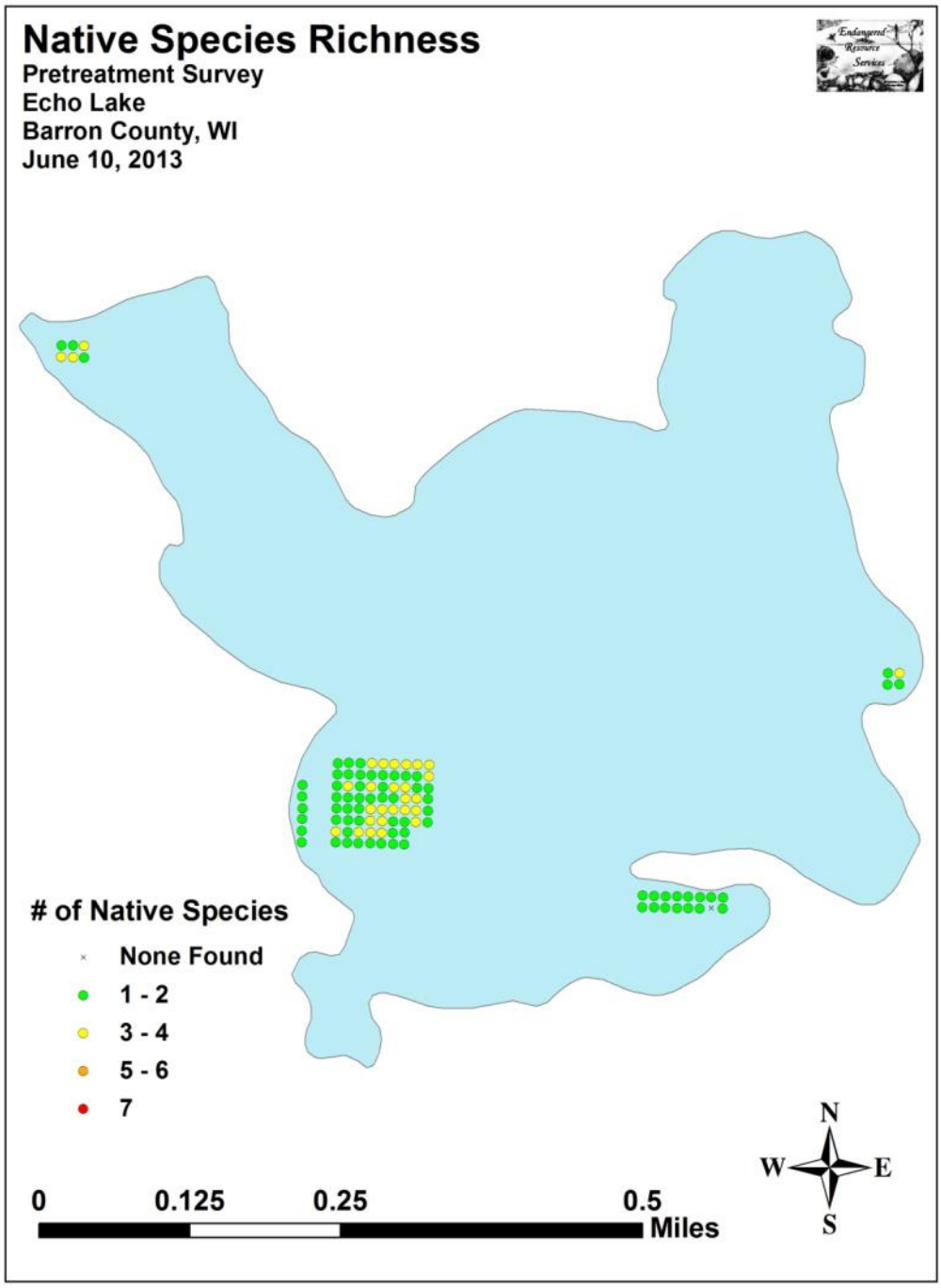
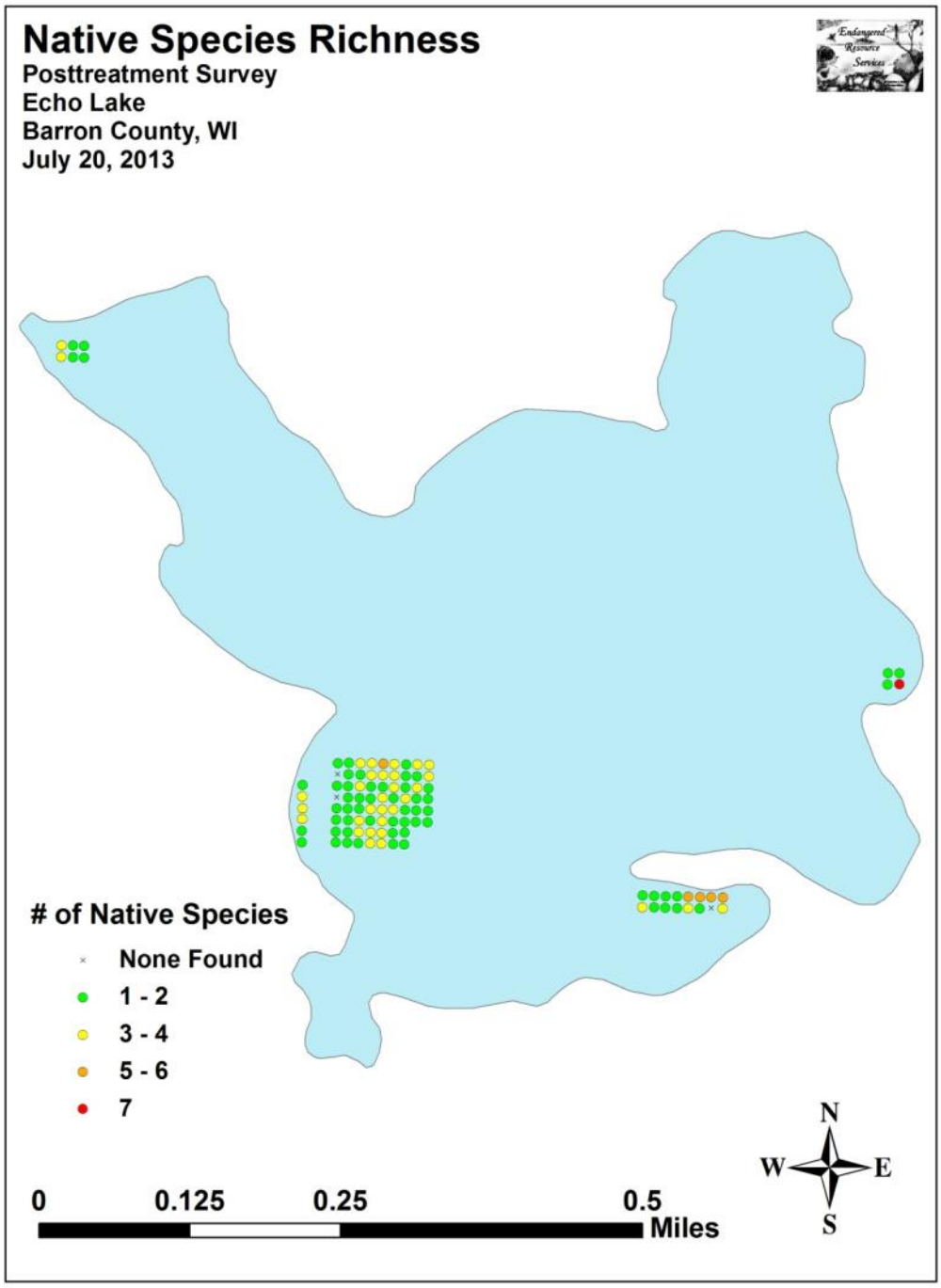
Appendix III: Pre/Post Habitat Variable Maps

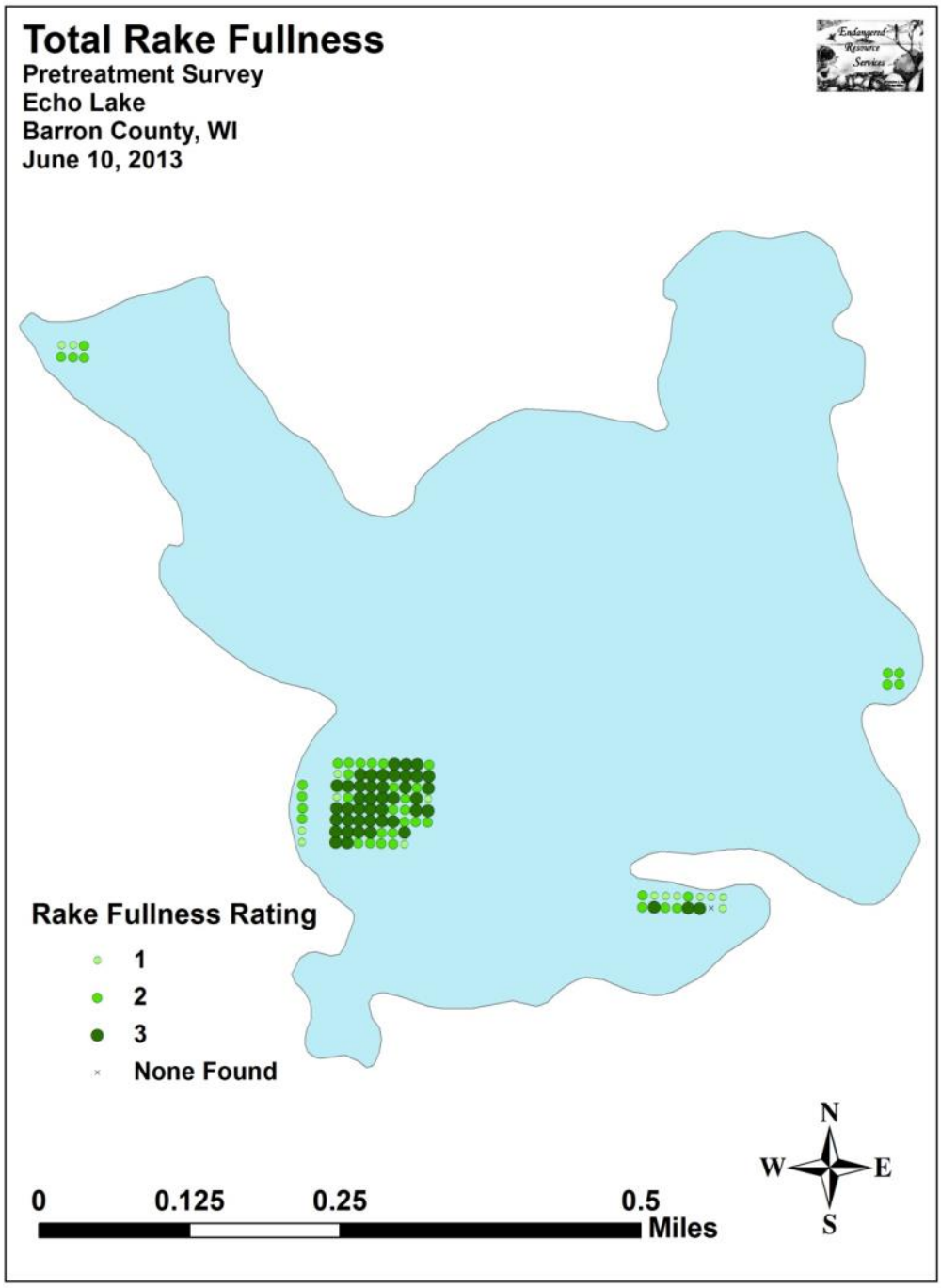

Lake Depth
Pre and Posttreatment Surveys
Echo Lake
Barron County, WI
June 10 and July 20, 2013
Depth in ft.
1.5 - 3.0
3.1 - 6.0
6.1 - 9.0
9.1 - 12.0
12.1 - 14.5
0
0.125
0.25
0.5
Miles
N
W
E
S

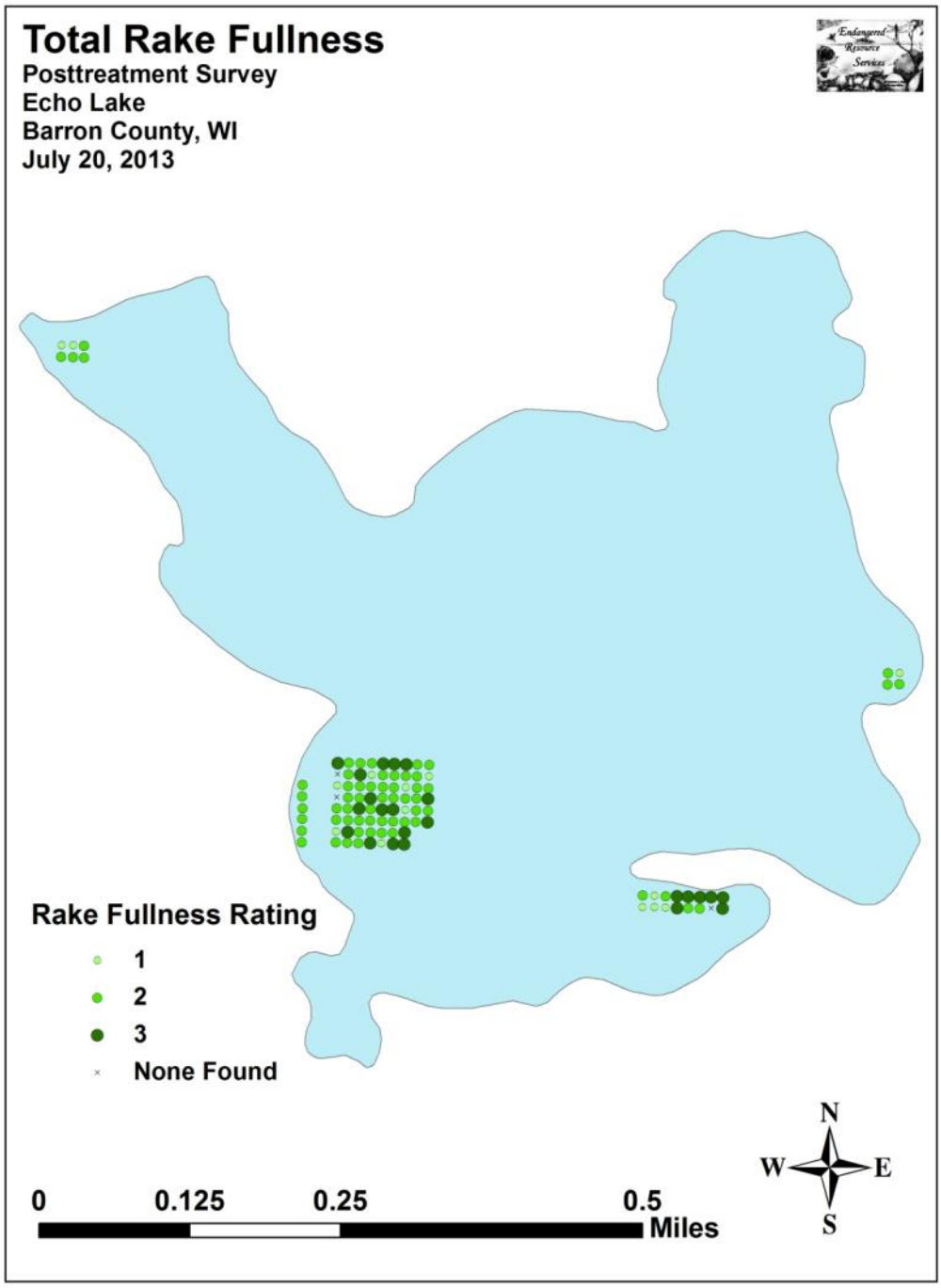

Bottom Substrate
Pre and Posttreatment Surveys
Echo Lake
Barron County, WI
June 10 and July 20, 2013
Substrate Type
Muck
Rock
Sand
N
W
E
S
0
0.125
0.25
0.5
Miles

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

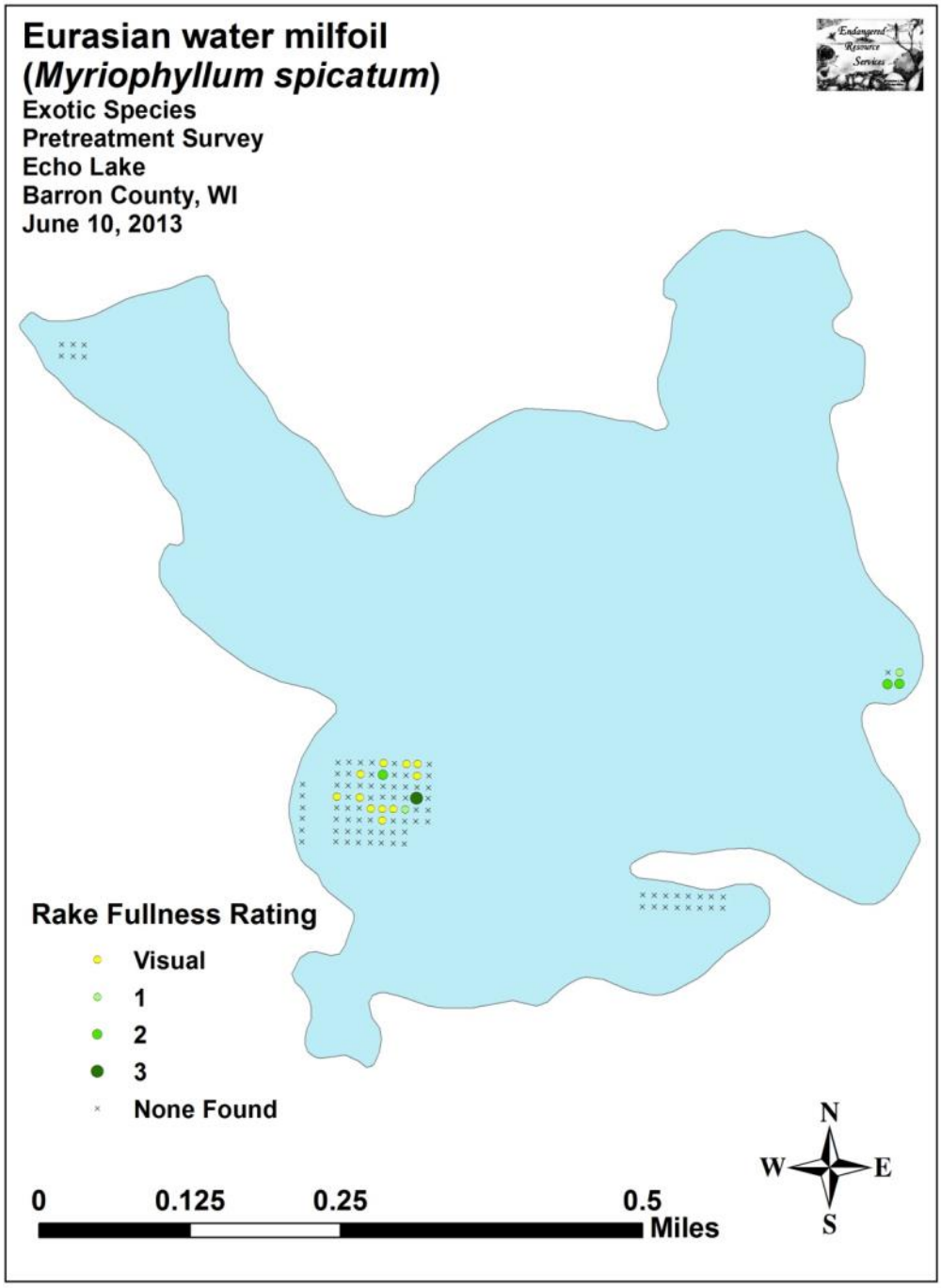

Native Species Richness
Pretreatment Survey
Echo Lake
Barron County, WI
June 10, 2013
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
7
0
0.125
0.25
0.5
Miles
N
W
E
S

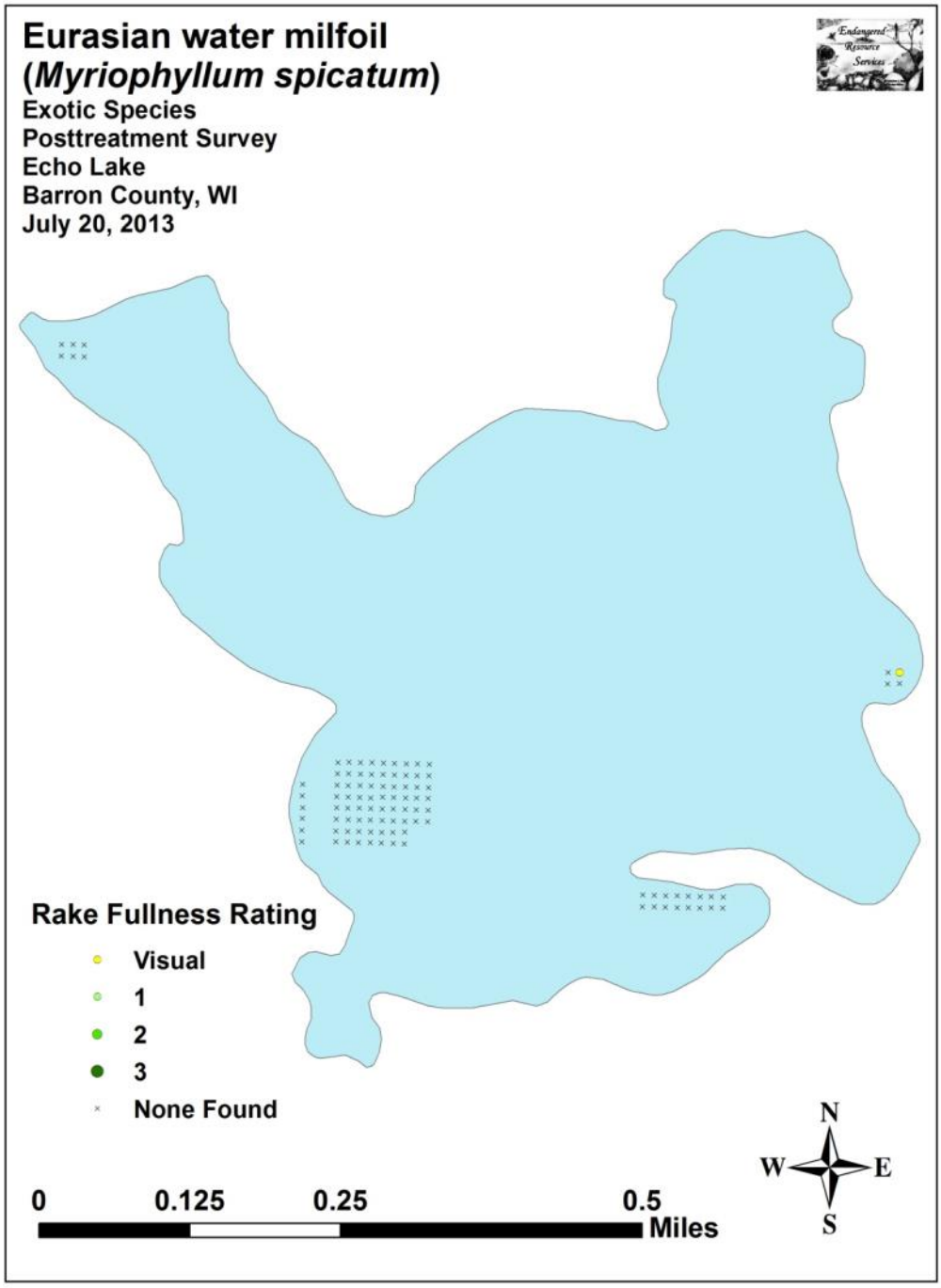

Native Species Richness
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
7
0
0.125
0.25
0.5
Miles
N
W
E
S


Total Rake Fullness
Pretreatment Survey
Echo Lake
Barron County, WI
June 10, 2013
Rake Fullness Rating
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

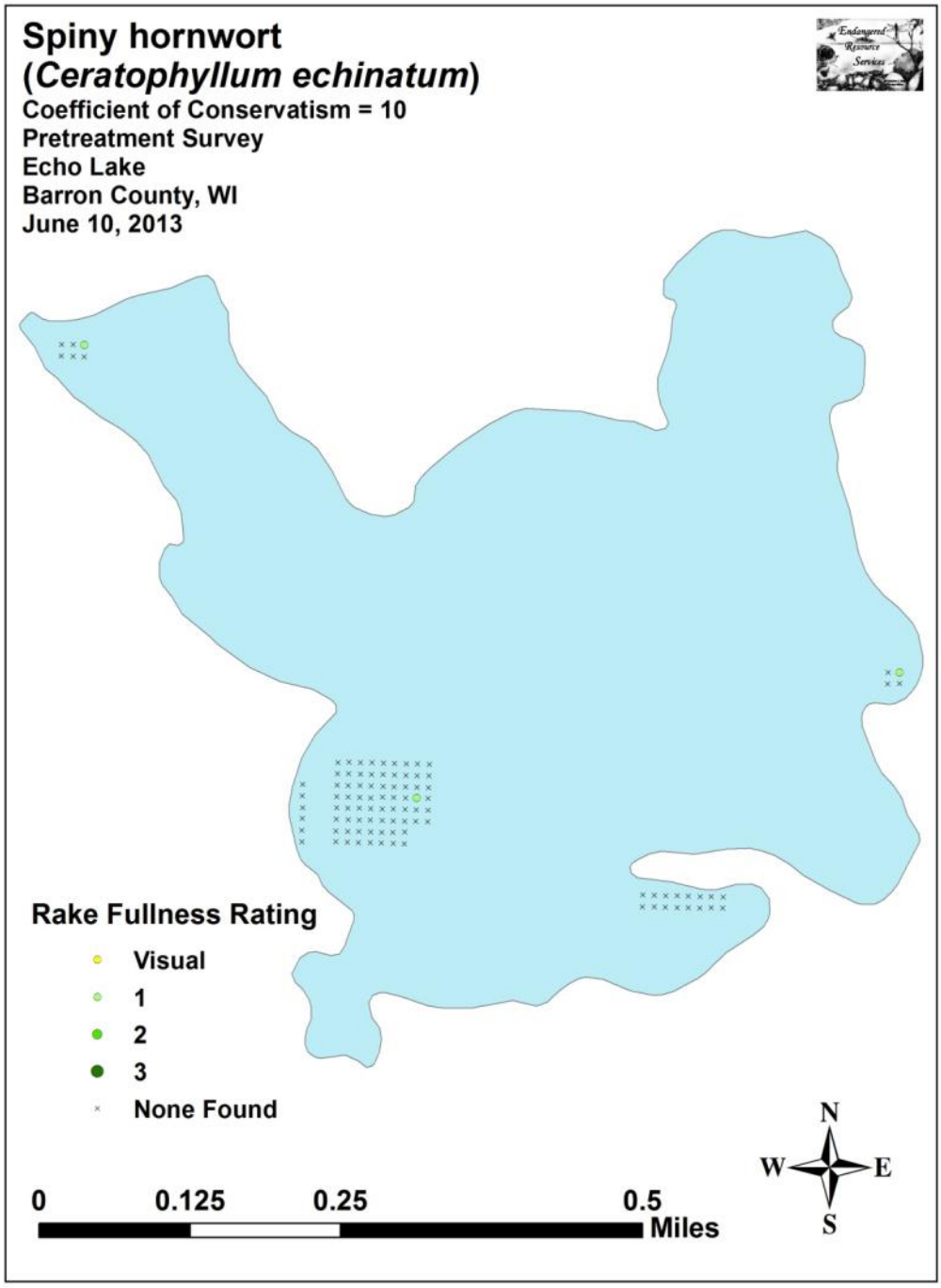

Total Rake Fullness
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

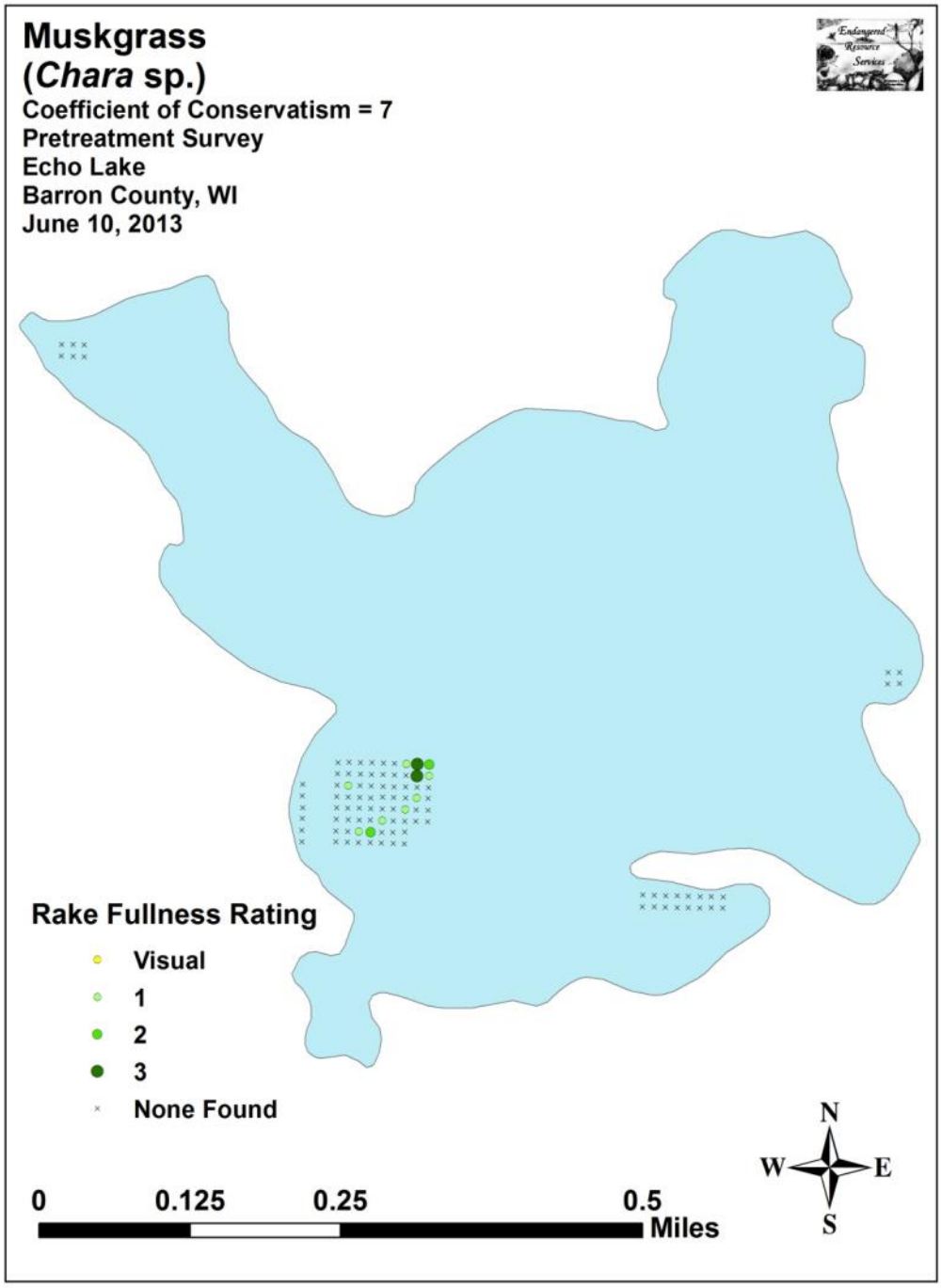
Appendix V: EWM Pre/Post Density and Distribution

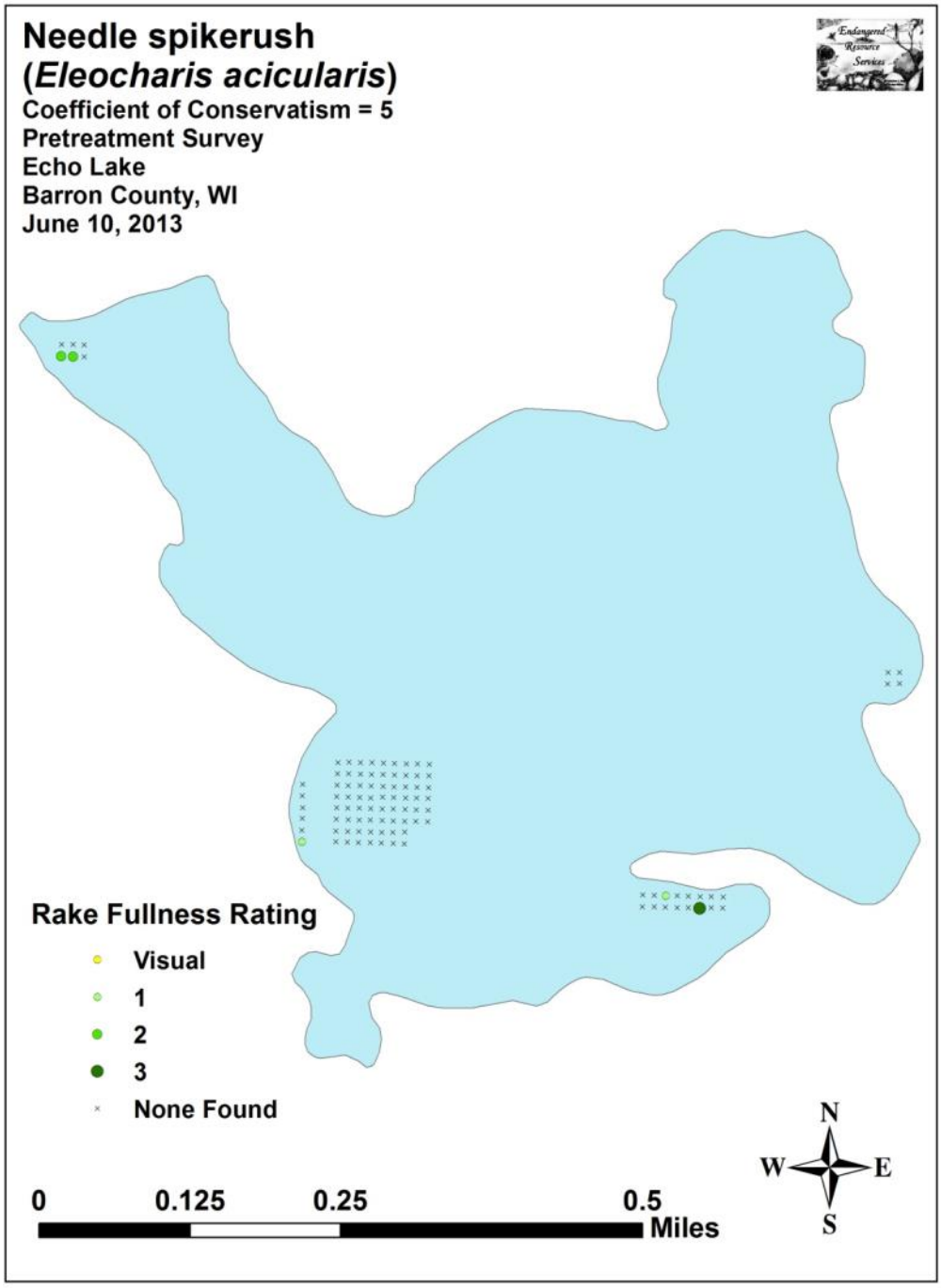

Eurasian water milfoil
(Myriophyllum spicatum)
Exotic Species
Pretreatment Survey
Echo Lake
Barron County, WI
June 10, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

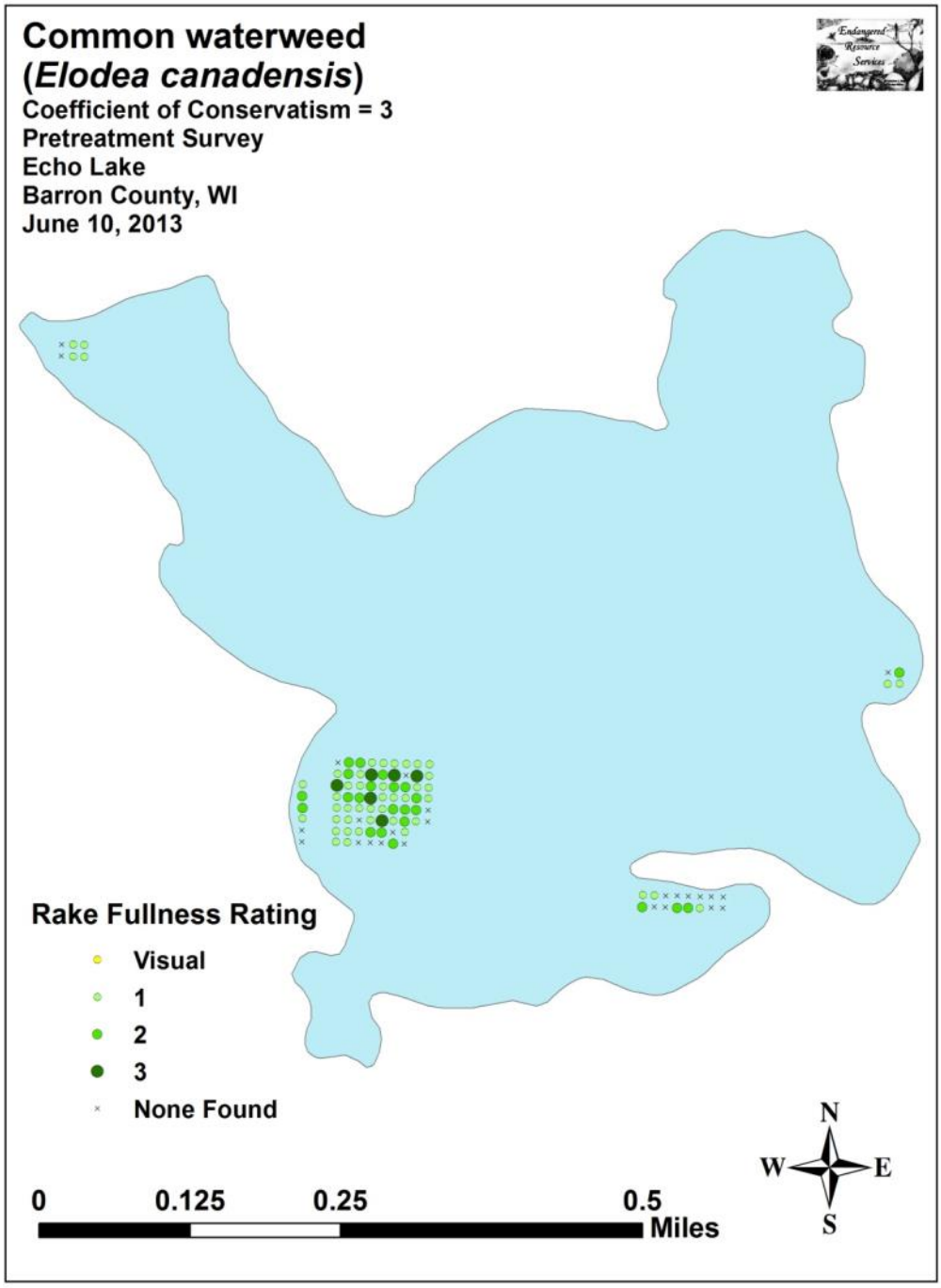

Eurasian water milfoil
(Myriophyllum spicatum)
Exotic Species
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

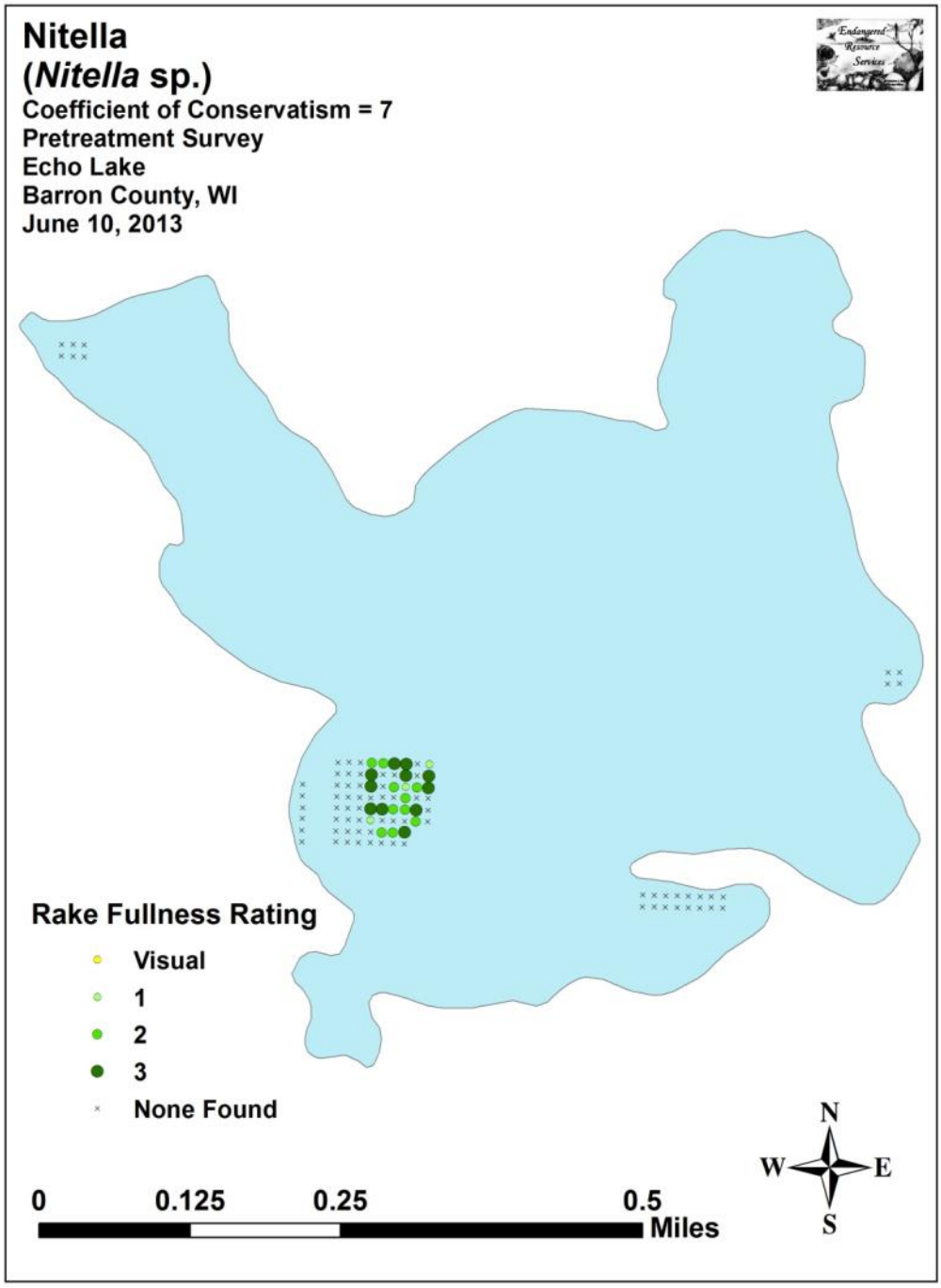
Appendix VI: Pretreatment Native Species Density and Distribution

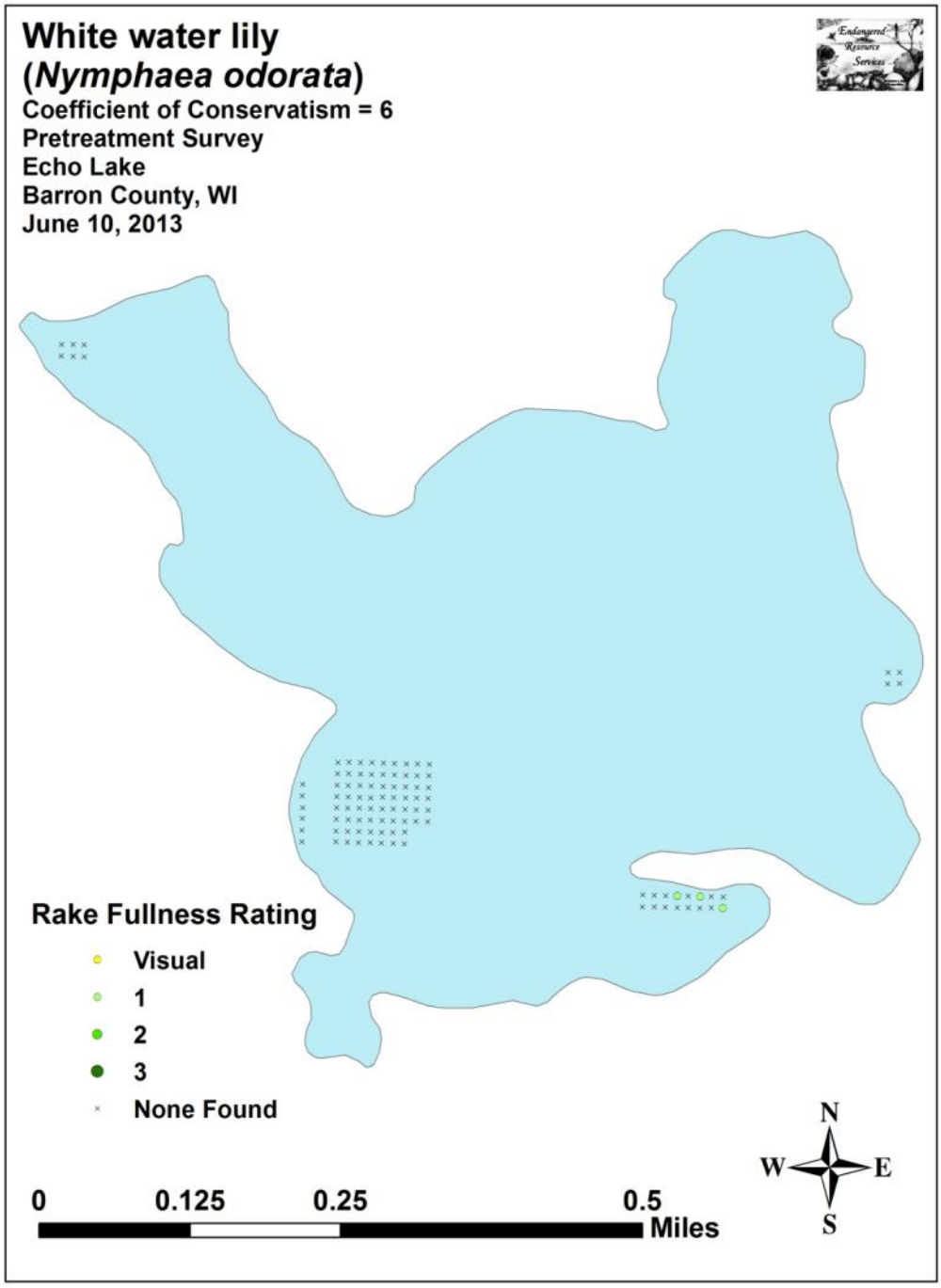

Spiny hornwort
(Ceratophyllum echinatum)
Coefficient of Conservatism = 10
Pretreatment Survey
Echo Lake
Barron County, WI
June 10, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

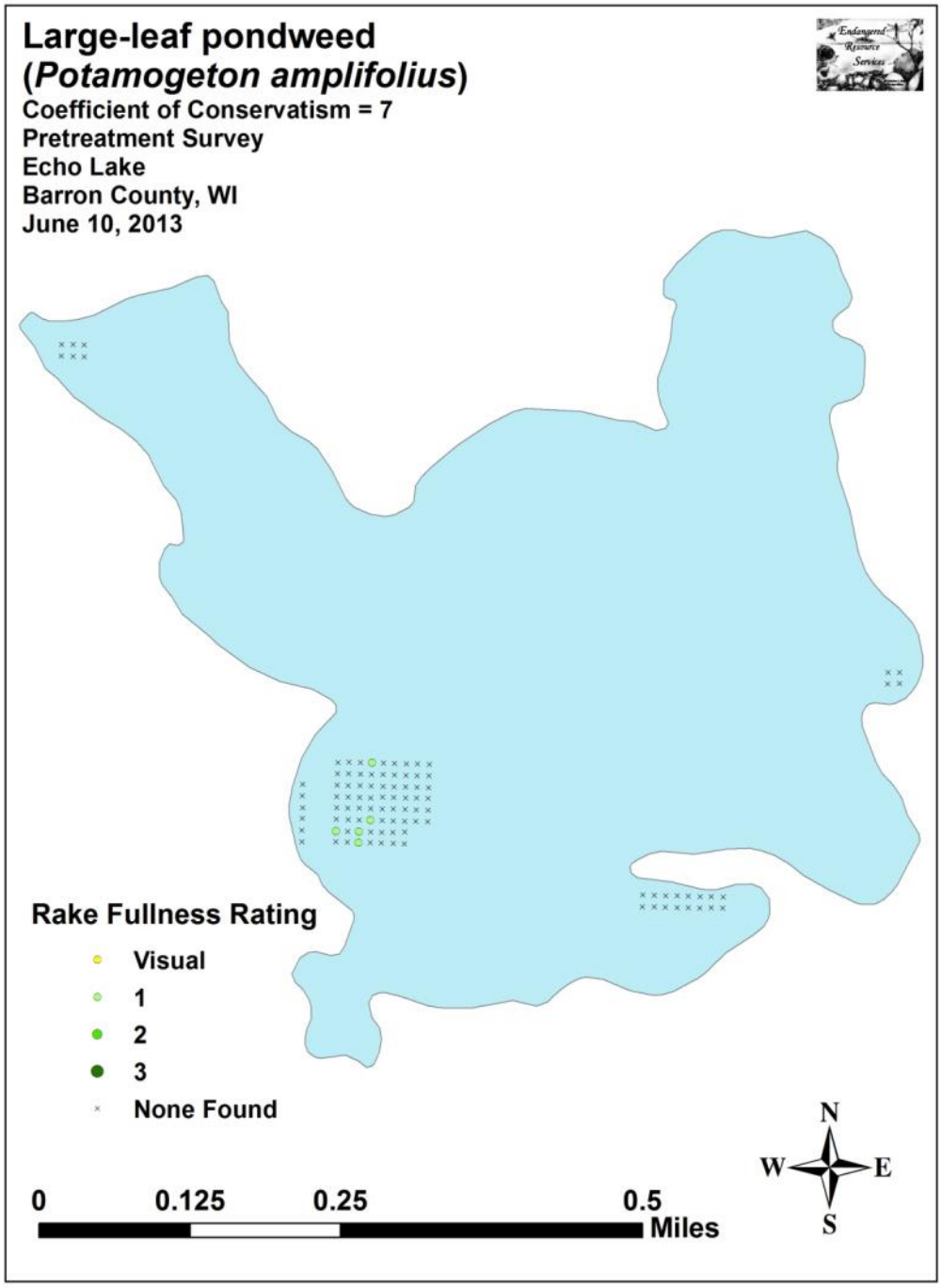

Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Pretreatment Survey
Echo Lake
Barron County, WI
June 10, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

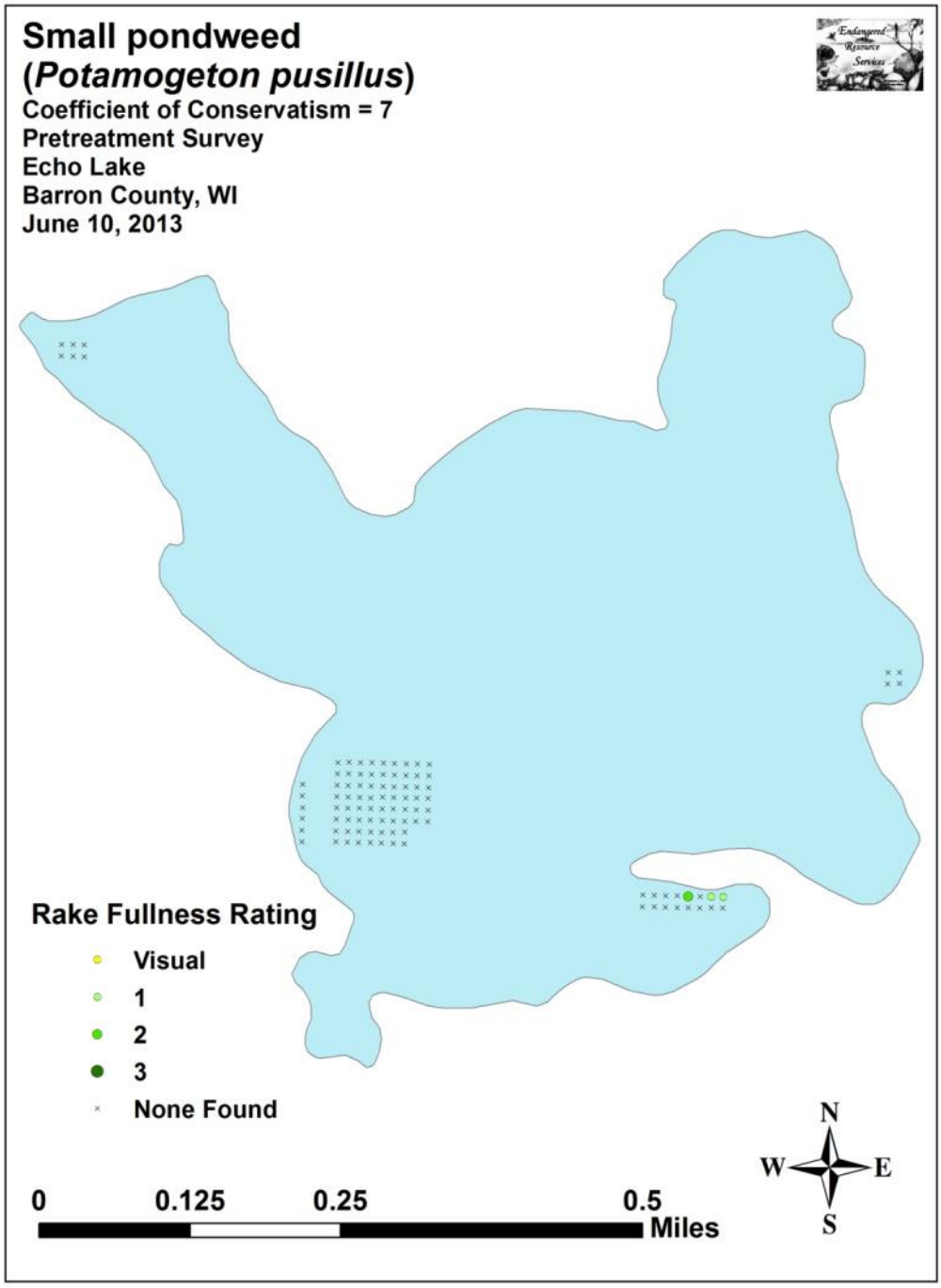

Needle spikerush
(Eleocharis acicularis)
Coefficient of Conservatism = 5
Pretreatment Survey
Echo Lake
Barron County, WI
June 10, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

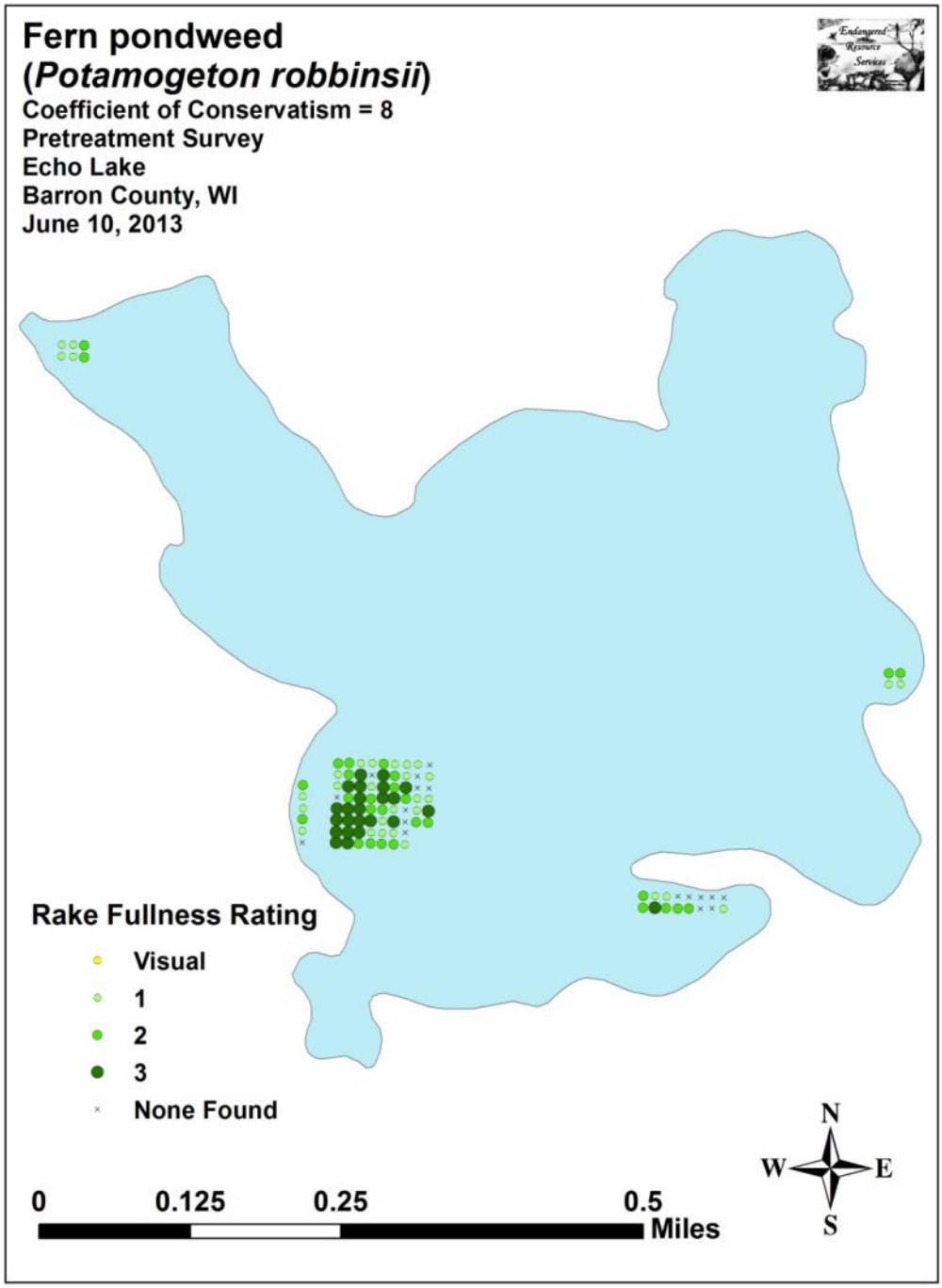

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Pretreatment Survey
Echo Lake
Barron County, WI
June 10, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

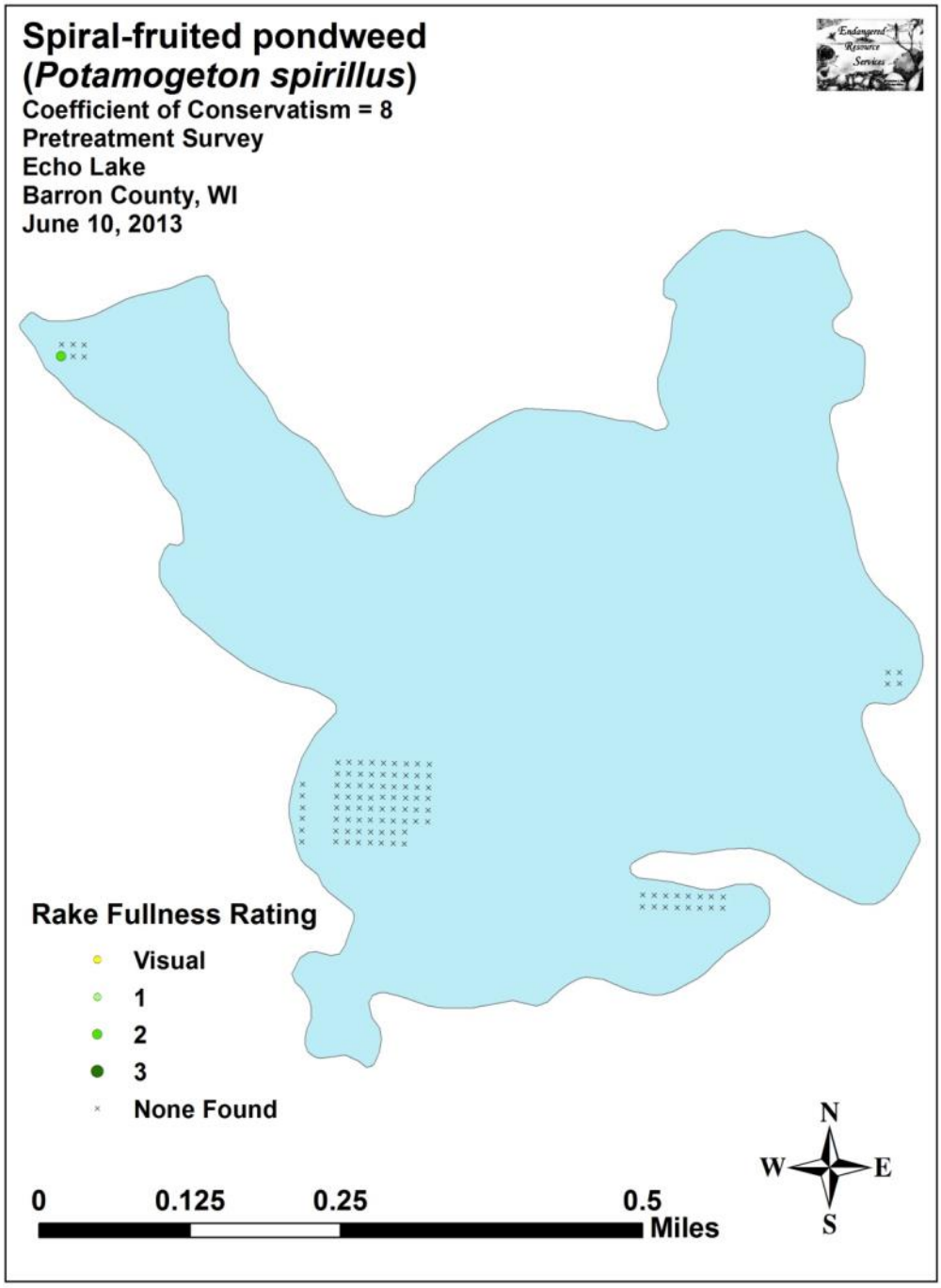

Nitella
(Nitella sp.)
Coefficient of Conservatism = 7
Pretreatment Survey
Echo Lake
Barron County, WI
June 10, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles


White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Pretreatment Survey
Echo Lake
Barron County, WI
June 10, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

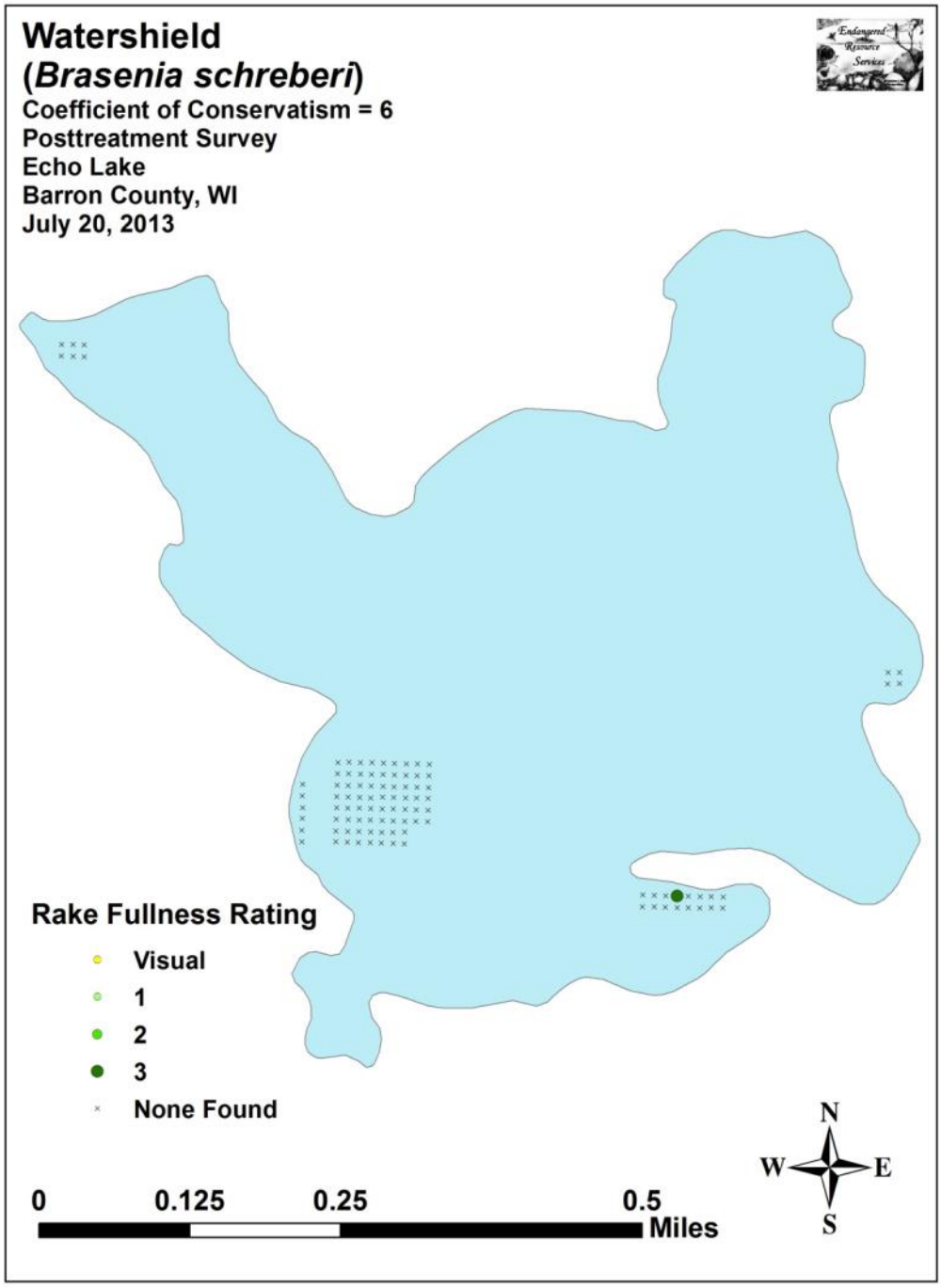

Large-leaf pondweed
(Potamogeton amplifolius)
Coefficient of Conservatism = 7
Pretreatment Survey
Echo Lake
Barron County, WI
June 10, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

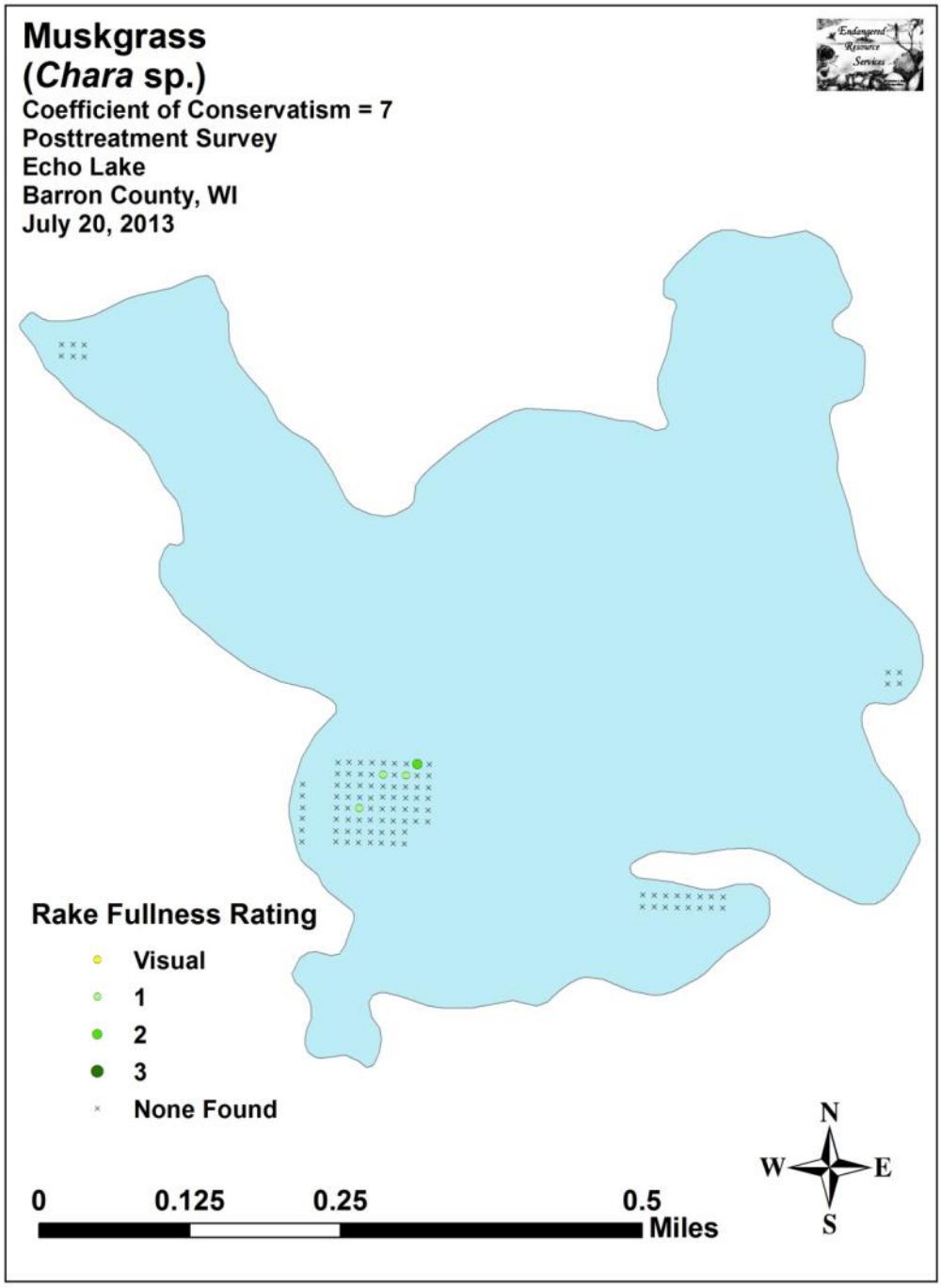

Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Pretreatment Survey
Echo Lake
Barron County, WI
June 10, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

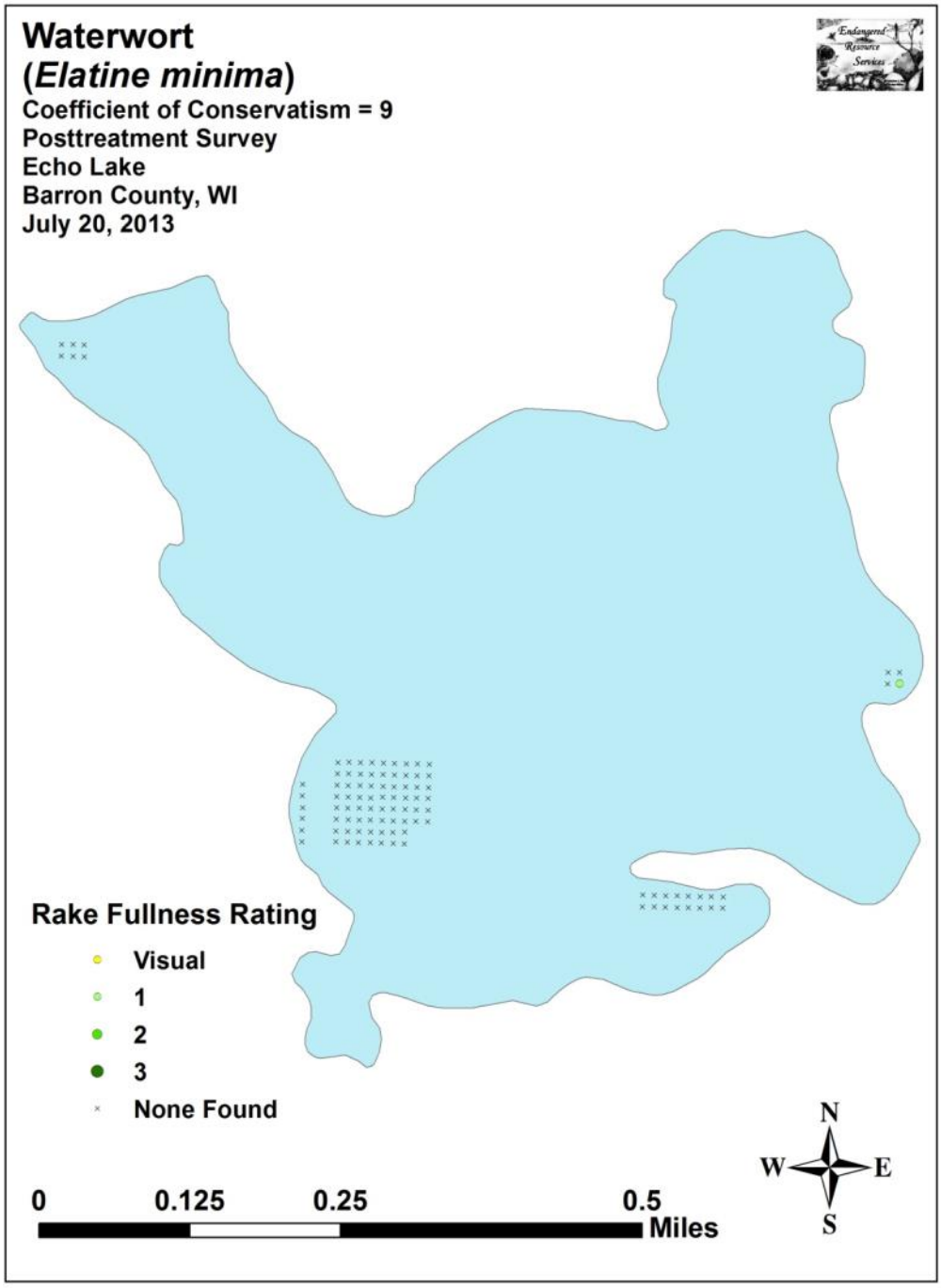

Fern pondweed
(Potamogeton robbinsii)
Coefficient of Conservatism = 8
Pretreatment Survey
Echo Lake
Barron County, WI
June 10, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

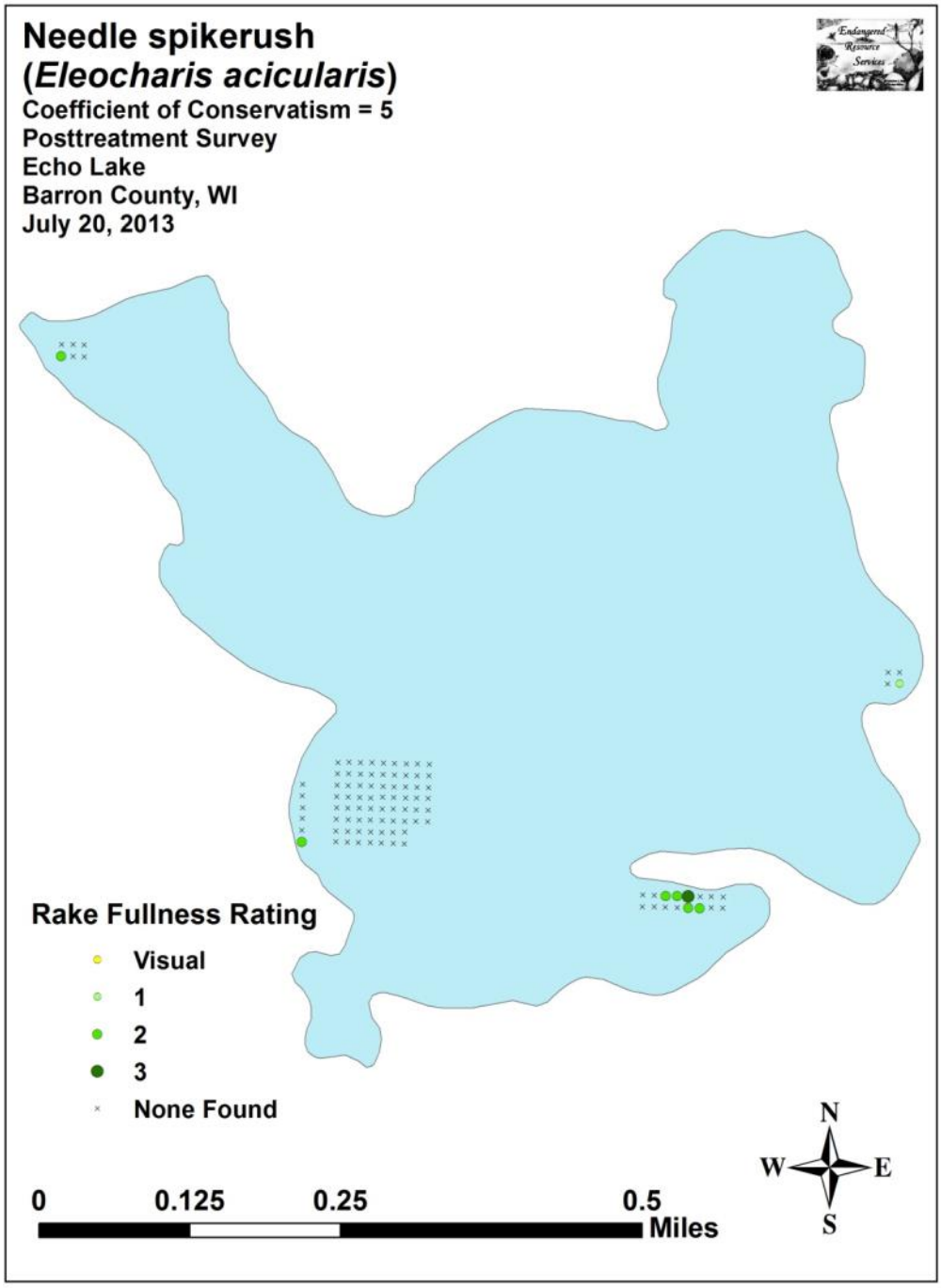

Spiral-fruited pondweed
(Potamogeton spirillus)
Coefficient of Conservatism = 8
Pretreatment Survey
Echo Lake
Barron County, WI
June 10, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

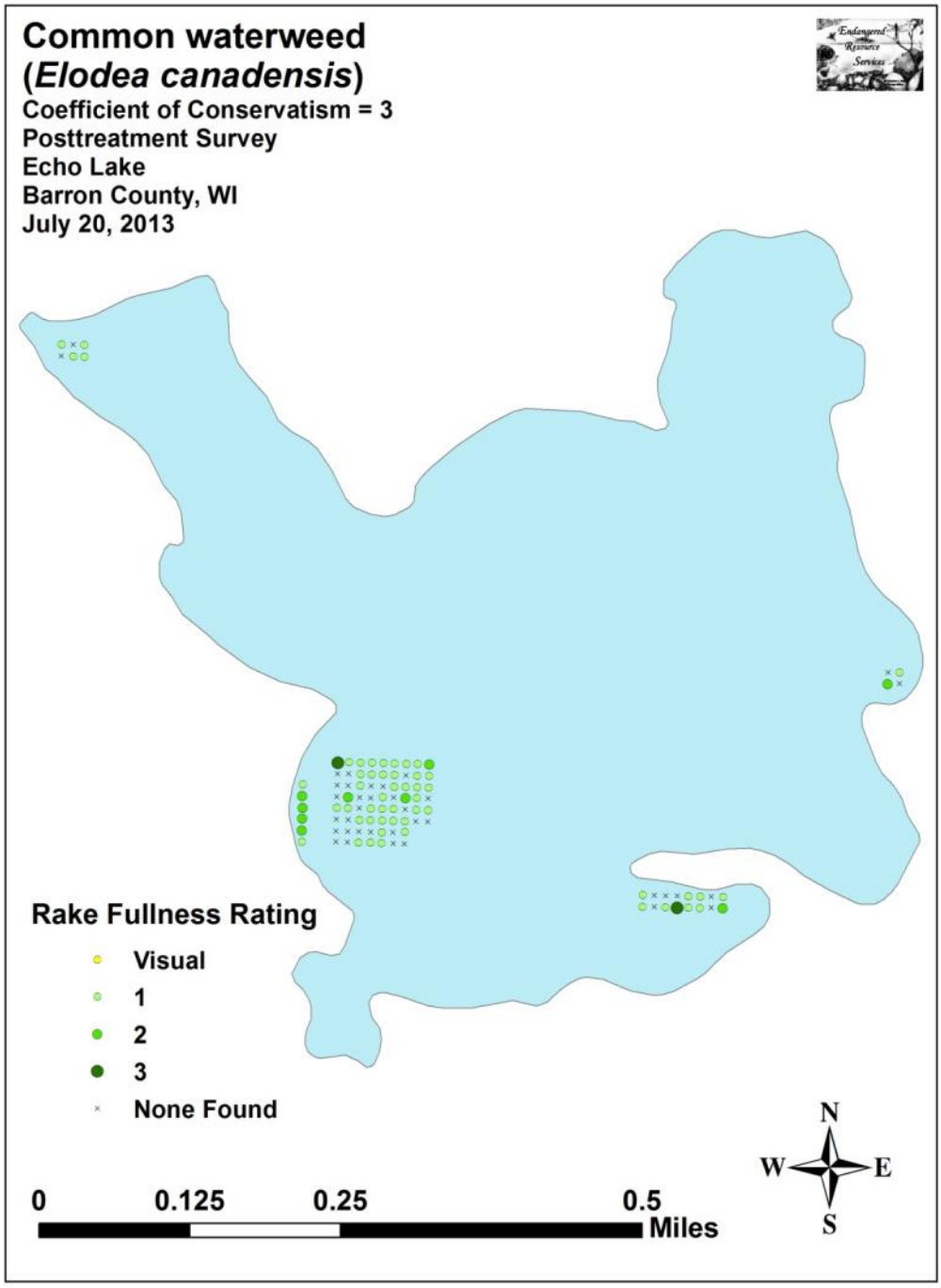
Appendix VII: Posttreatment Native Species Density and Distribution

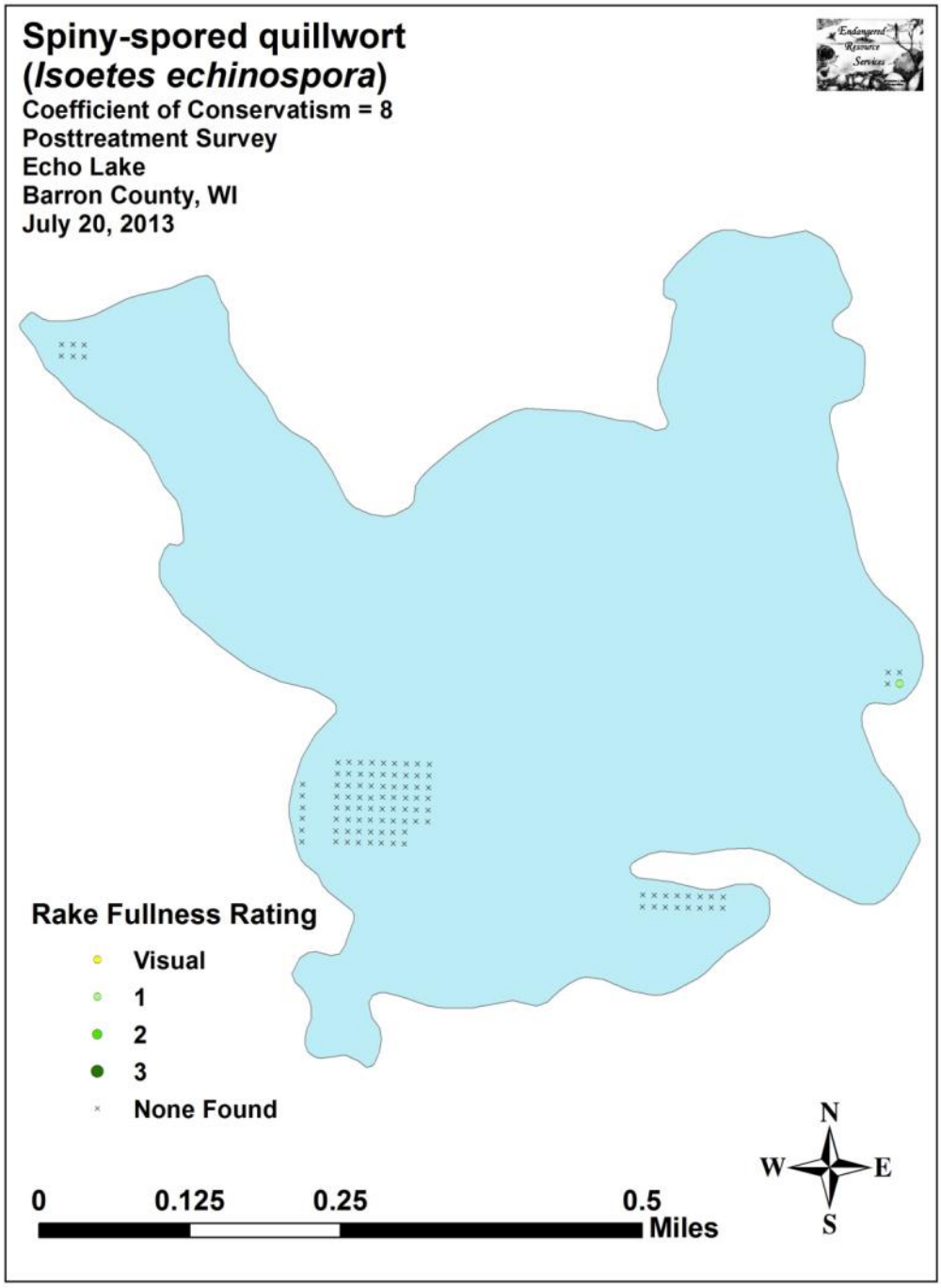

Watershield
(Brasenia schreberi)
Coefficient of Conservatism = 6
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

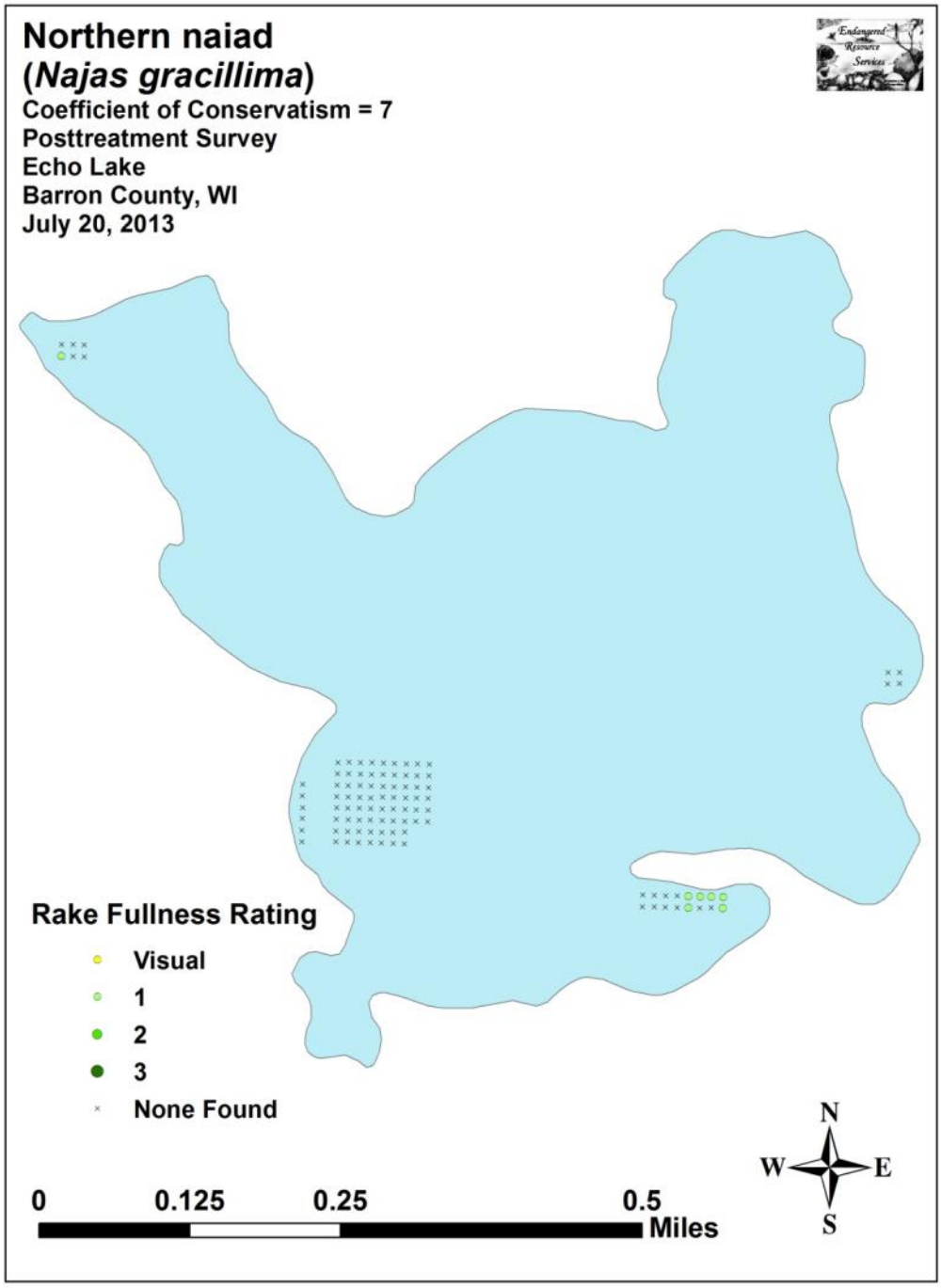

Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

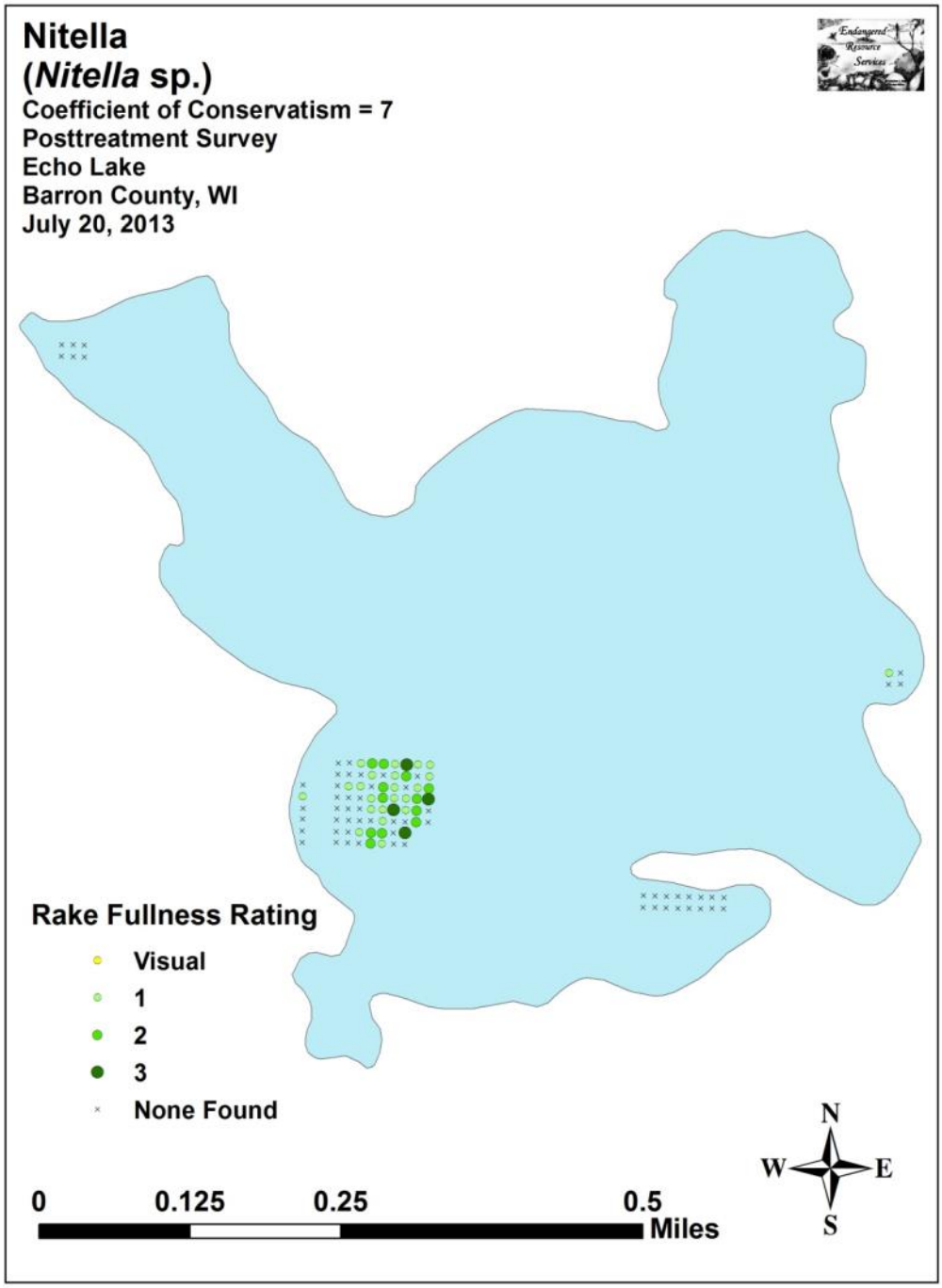

Waterwort
(Elatine minima)
Coefficient of Conservatism = 9
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

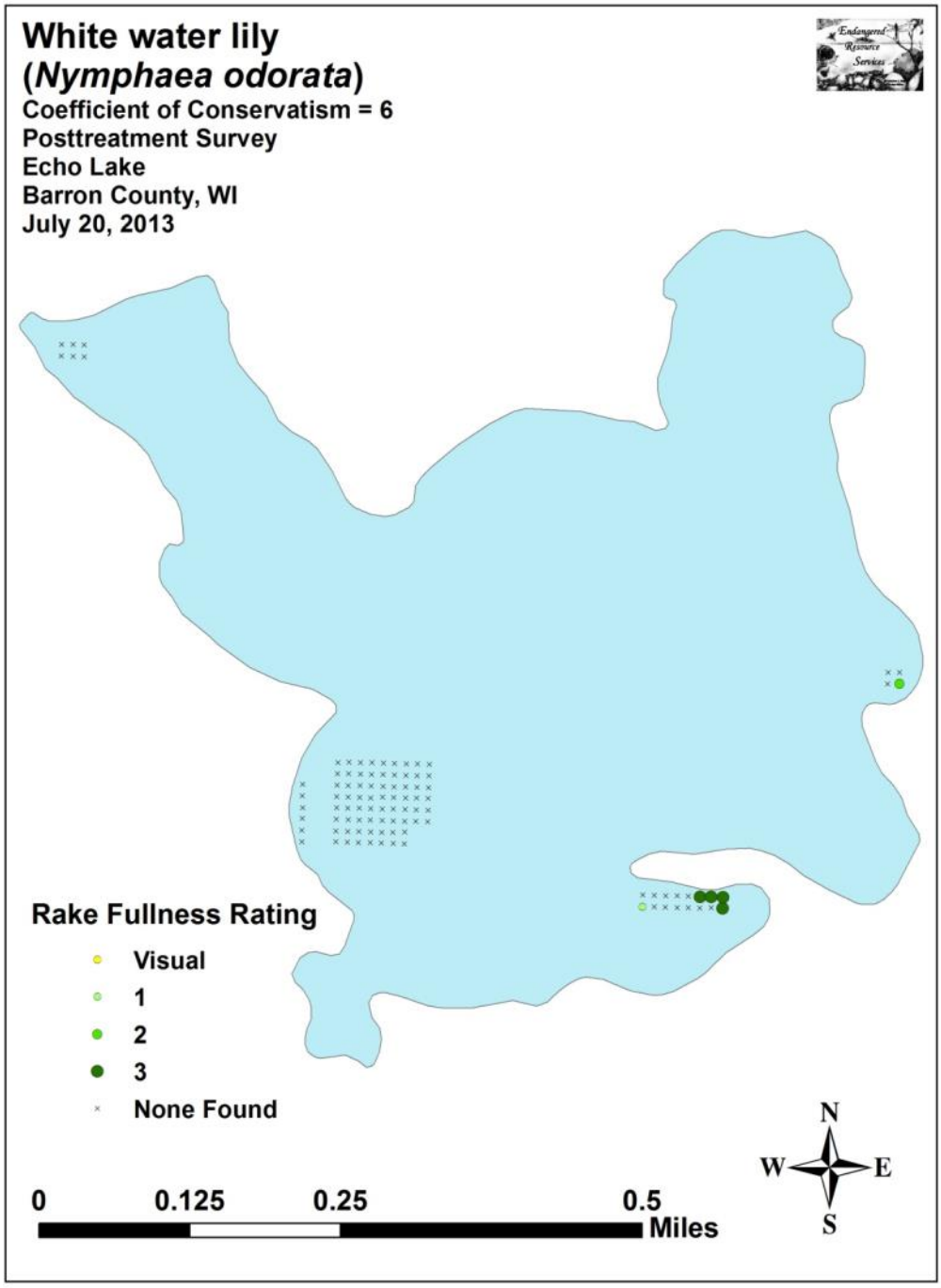

Needle spikerush
(Eleocharis acicularis)
Coefficient of Conservatism = 5
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

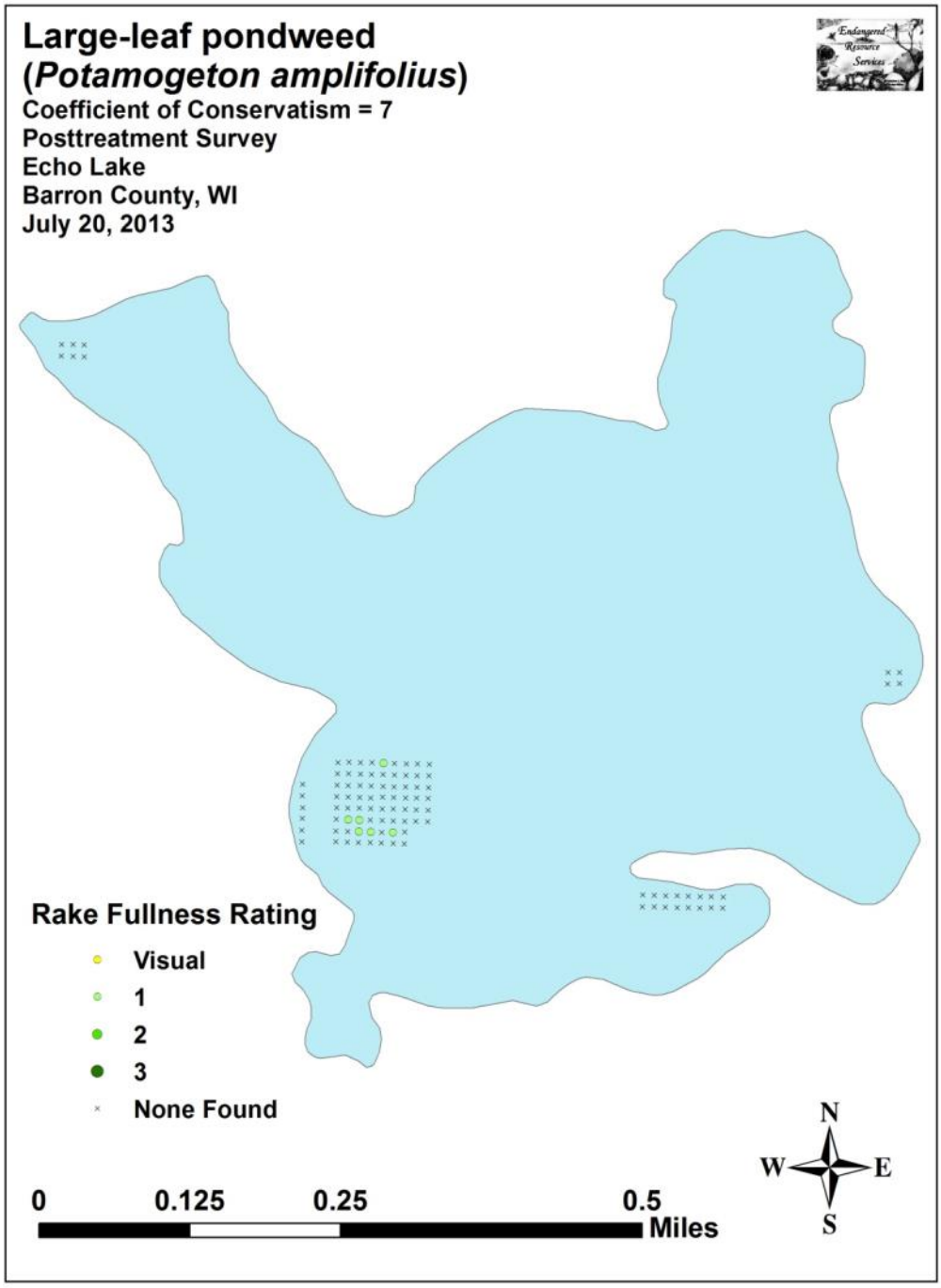

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

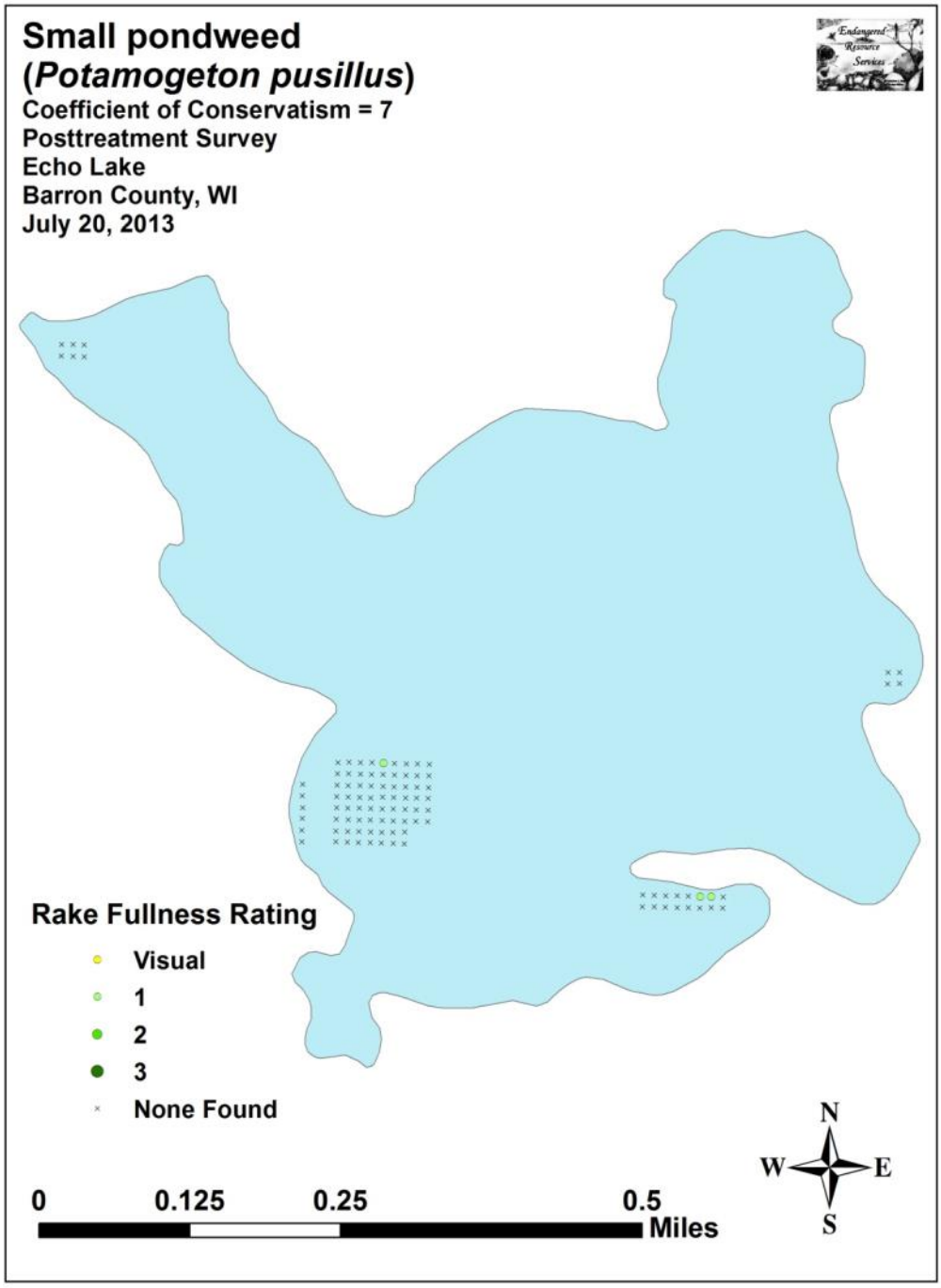

Spiny-spored quillwort
(Isoetes echinospora)
Coefficient of Conservatism = 8
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

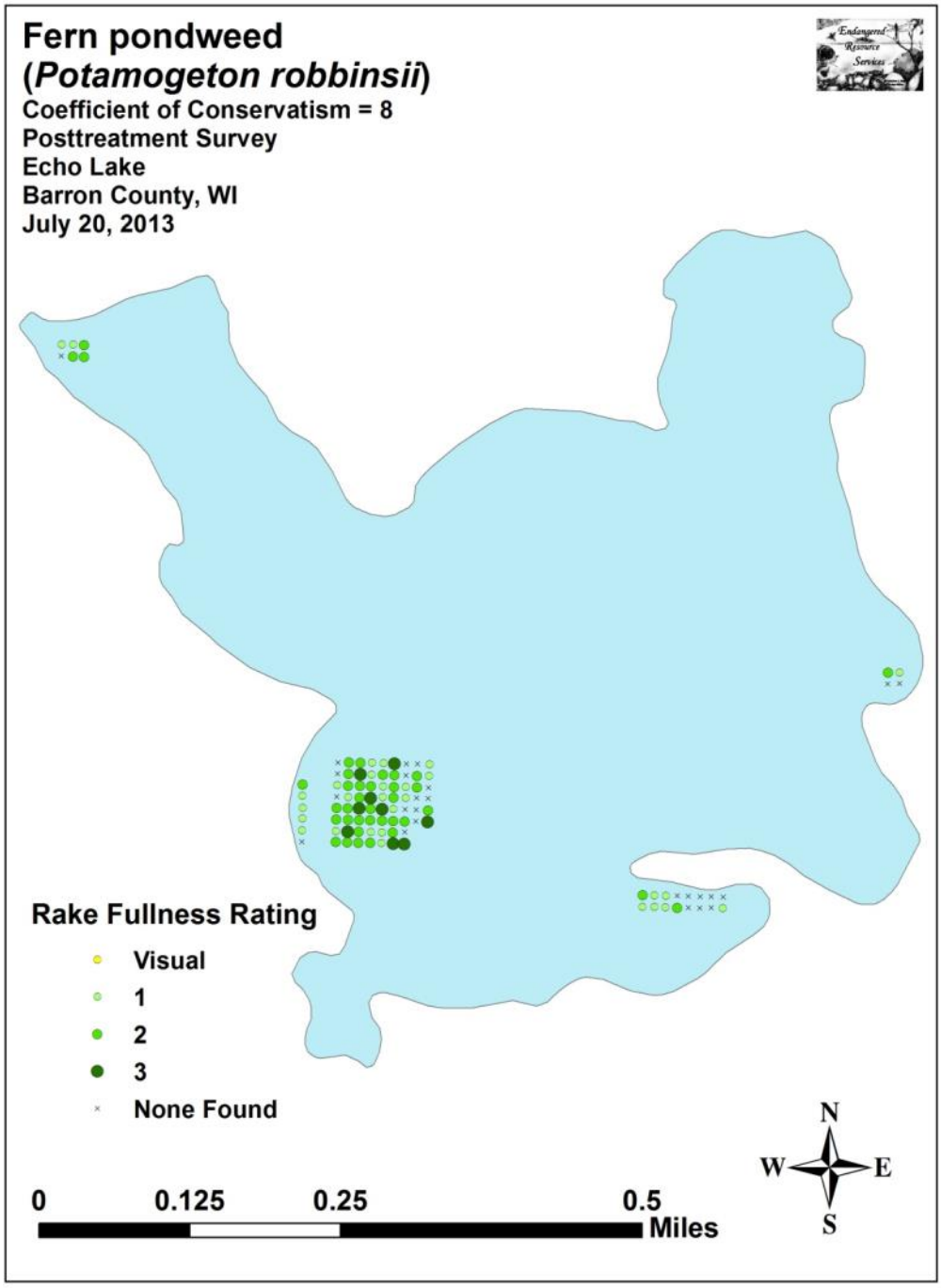

Northern naiad
(Najas gracillima)
Coefficient of Conservatism = 7
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

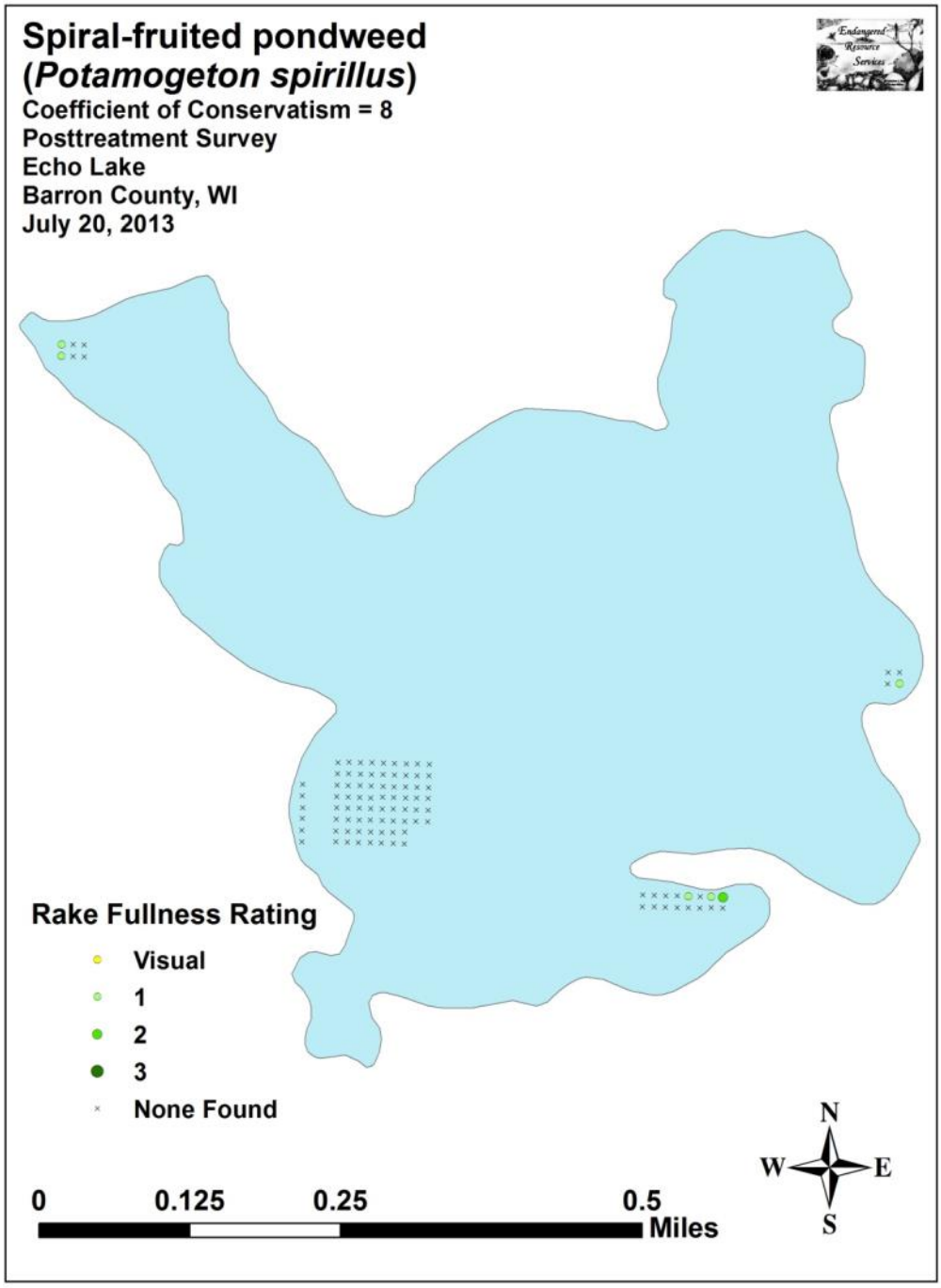

Nitella
(*Nitella* sp.)
Coefficient of Conservatism = 7
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

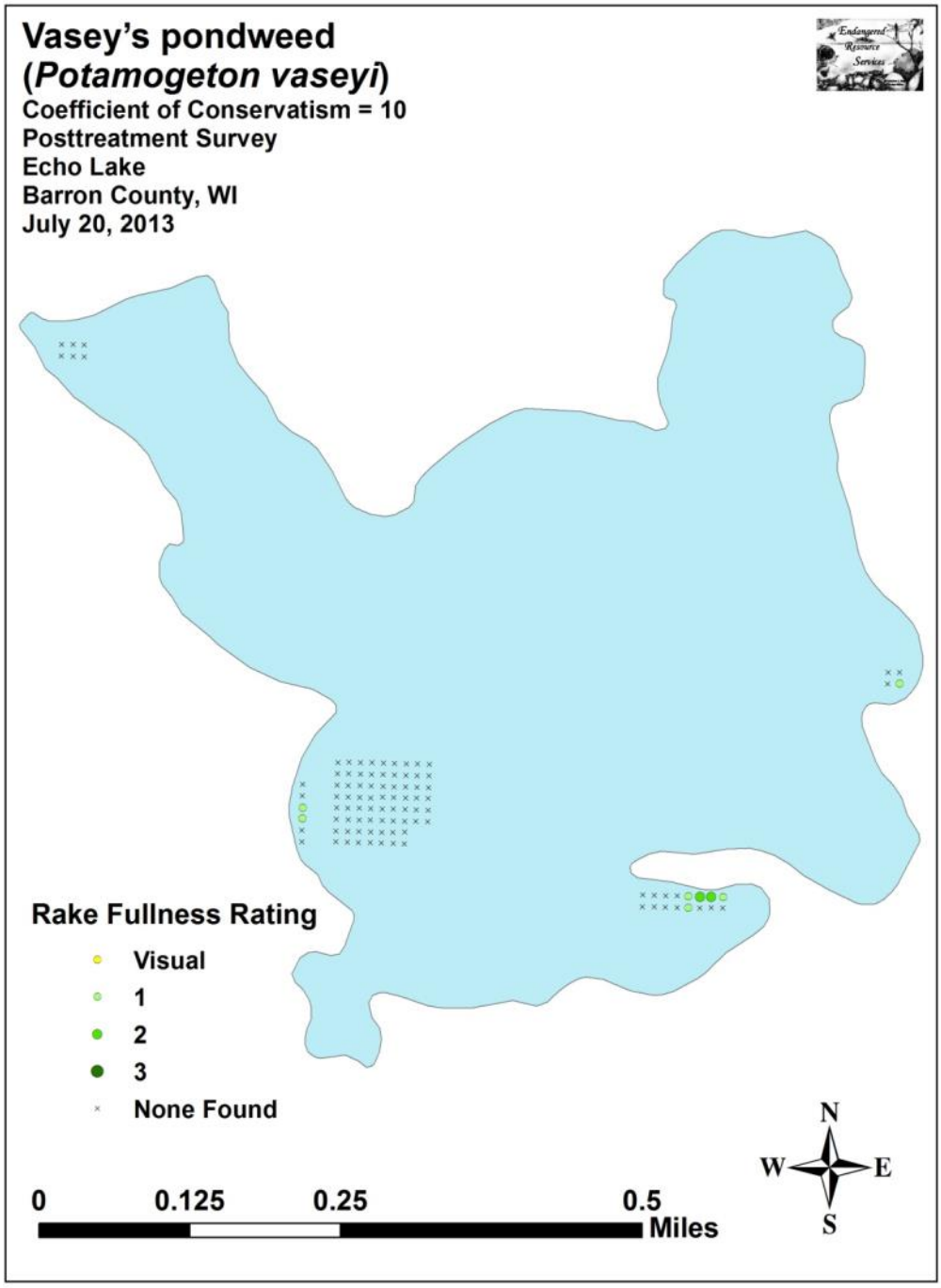

White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

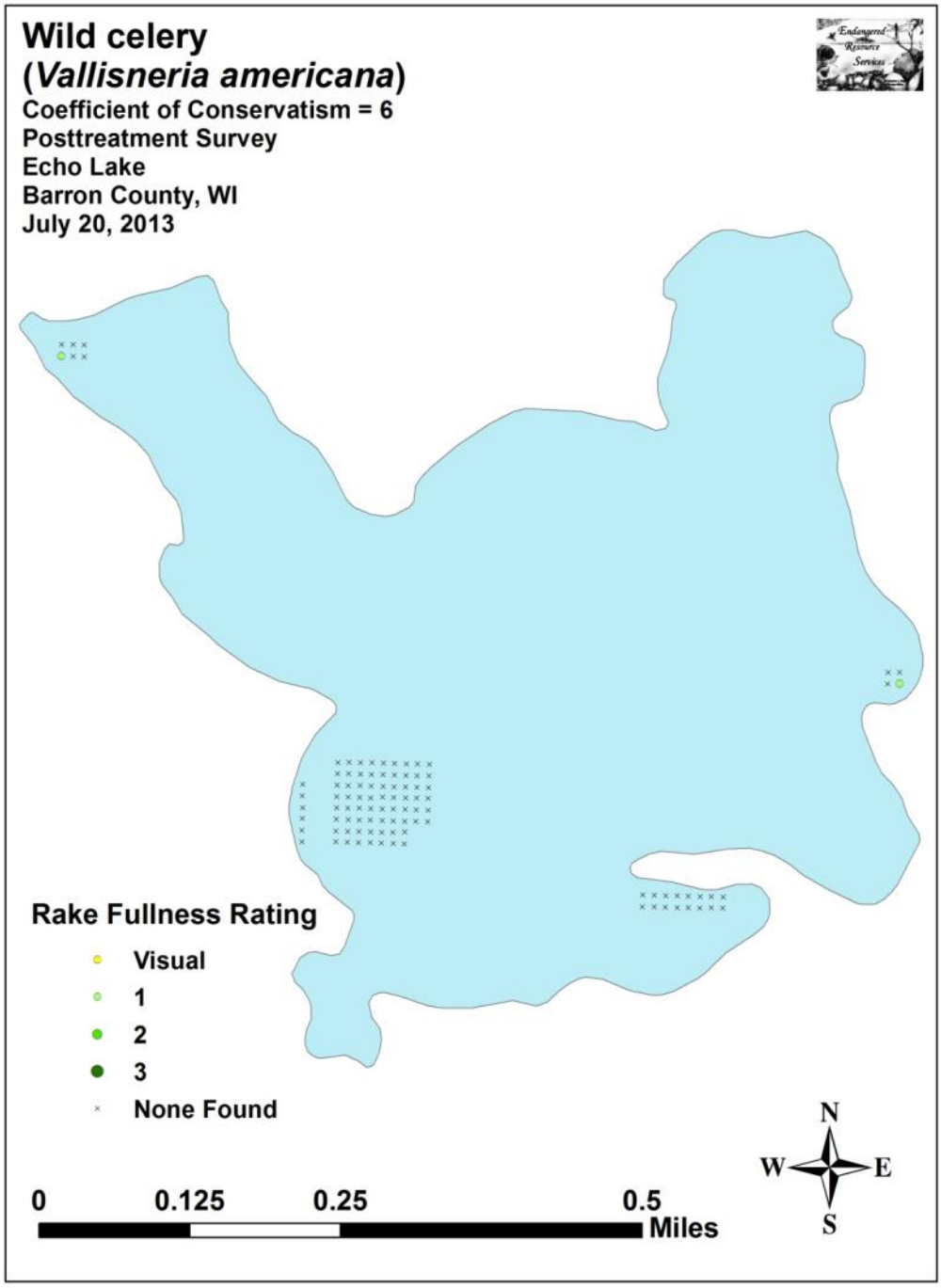

Large-leaf pondweed
(Potamogeton amplifolius)
Coefficient of Conservatism = 7
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles


Small pondweed
(Potamogeton pusillus)
Coefficient of Conservatism = 7
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

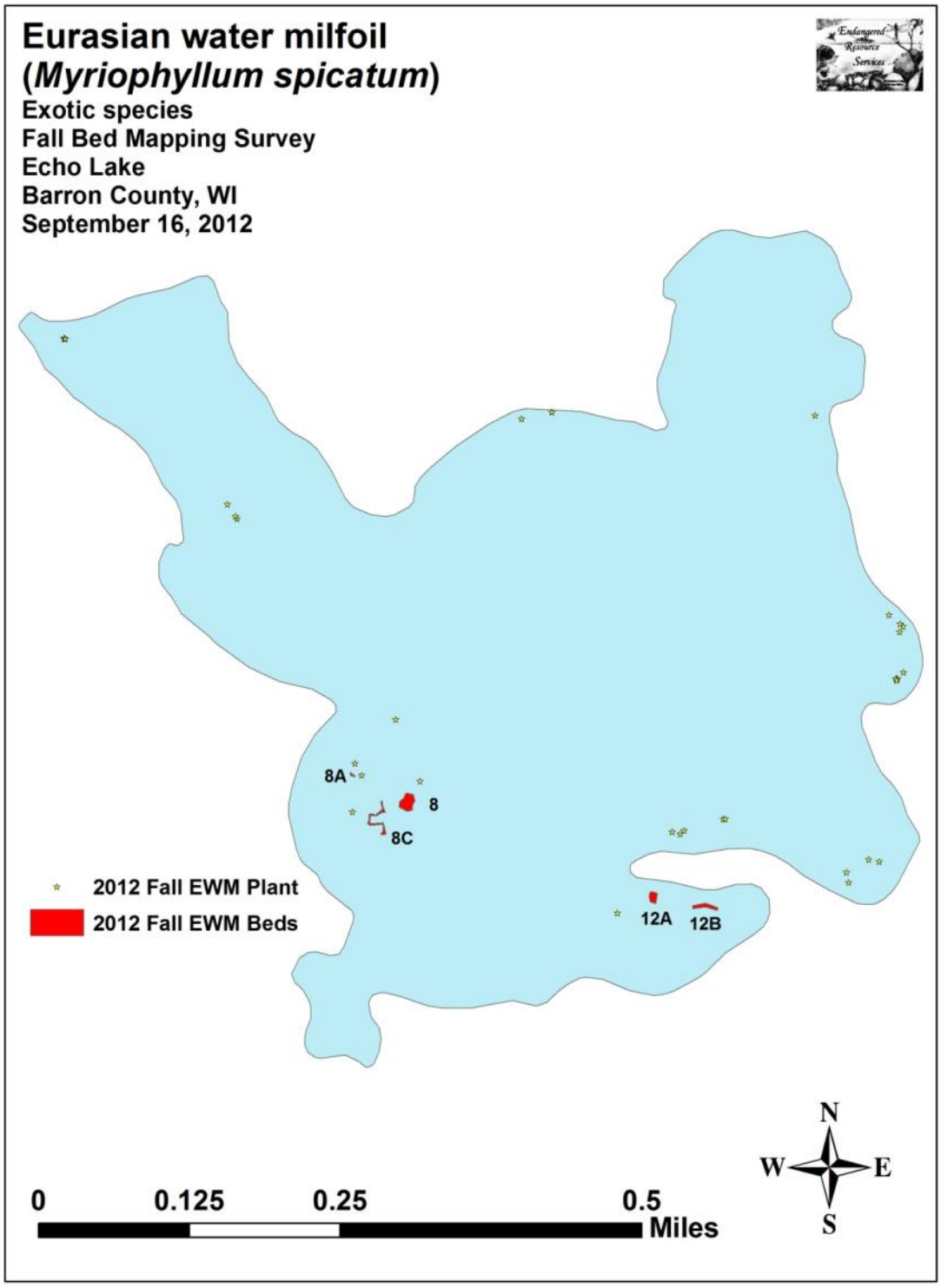

Fern pondweed
(Potamogeton robbinsii)
Coefficient of Conservatism = 8
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

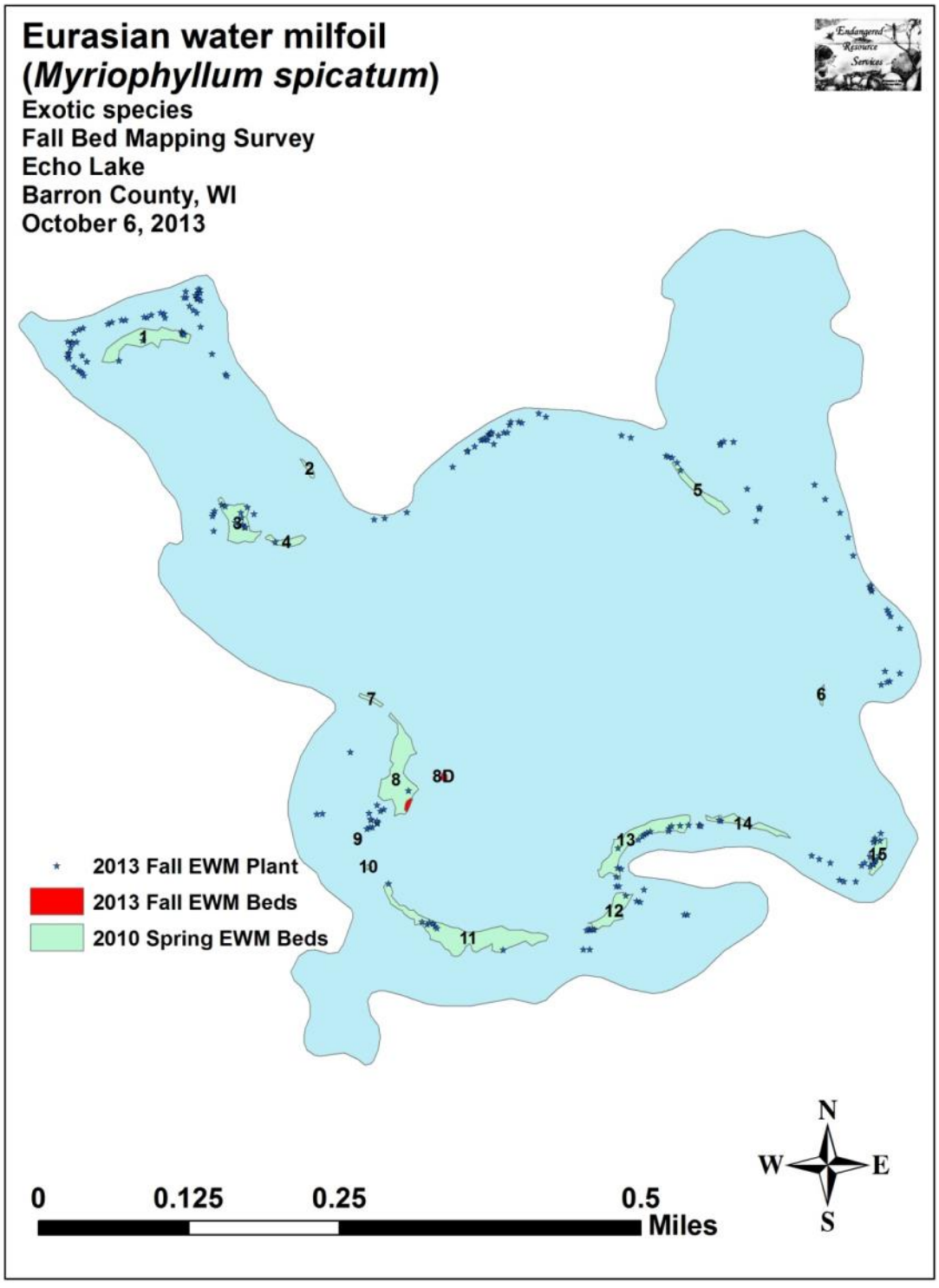

Spiral-fruited pondweed
(Potamogeton spirillus)
Coefficient of Conservatism = 8
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles


Vasey's pondweed
(Potamogeton vaseyi)
Coefficient of Conservatism = 10
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles


Wild celery
(Vallisneria americana)
Coefficient of Conservatism = 6
Posttreatment Survey
Echo Lake
Barron County, WI
July 20, 2013
Rake Fullness Rating
Visual
1
2
3
None Found
N
W
E
S
0
0.125
0.25
0.5
Miles

Appendix VIII: Echo Lake Fall 2012 and 2013 EWM Bed Maps


Eurasian water milfoil
(Myriophyllum spicatum)
Exotic species
Fall Bed Mapping Survey
Echo Lake
Barron County, WI
September 16, 2012
Endangered Resource Services
8A
8
8C
12A
12B
2012 Fall EWM Plant
2012 Fall EWM Beds
0
0.125
0.25
0.5
Miles
N
W
E
S


Eurasian water milfoil
(Myriophyllum spicatum)
Exotic species
Fall Bed Mapping Survey
Echo Lake
Barron County, WI
October 6, 2013
Endangered Resource Services
1
2
3
4
5
6
7
8
8D
9
10
11
12
13
14
15
2013 Fall EWM Plant
2013 Fall EWM Beds
2010 Spring EWM Beds
N
W
E
S
0
0.125
0.25
0.5
Miles