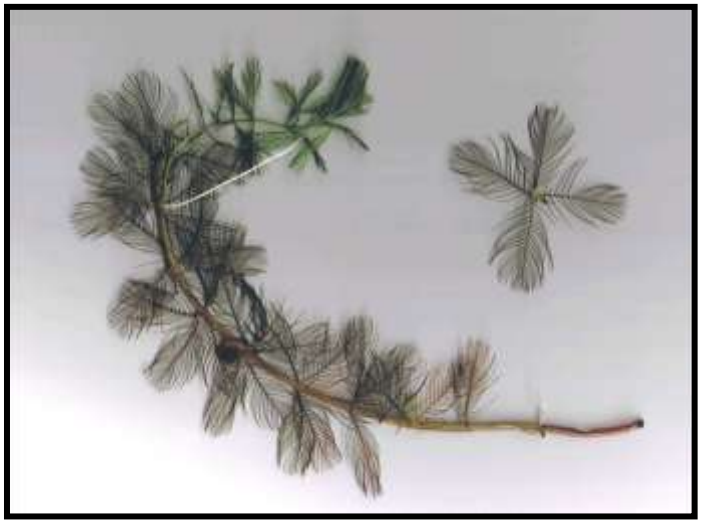
Eurasian water milfoil (*Myriophyllum spicatum*) Pre/Post Herbicide and Fall Bed Mapping Surveys Sand Lake - WBIC: 2661100 Barron County, Wisconsin



2012 EWM Treatment Areas

Project Initiated by:
Sand Lake Management District, Short Elliot Hendrickson Inc., and the Wisconsin Department of Natural Resources

Sand Lake October Shoreline at Perfect Calm During Bed Mapping Survey

Survey Conducted by and Report Prepared by:
Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin
May 17, July 18, and October 12, 2012

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INTRODUCTION:

Sand Lake (WBIC 2661100) is a 322 acre drainage lake in northwestern Barron County, Wisconsin in the Town of Maple Plain (T36N R14W S17 NW NE). It reaches a maximum depth of 57ft in the south basin and has an average depth of approximately 30ft. Sand Lake is mesotrophic bordering on oligotrophic in nature with good water clarity. From 1988 to 2012, summer Secchi readings have ranged from 10-18ft with an average of 13.6ft (WDNR 2012). The bottom substrate is predominately sand and sandy muck with scattered gravel primarily along the shoreline. Some areas of thick organic muck occur in bays on the west side of the lake and at the far north and south ends (Miller et al. 1965).

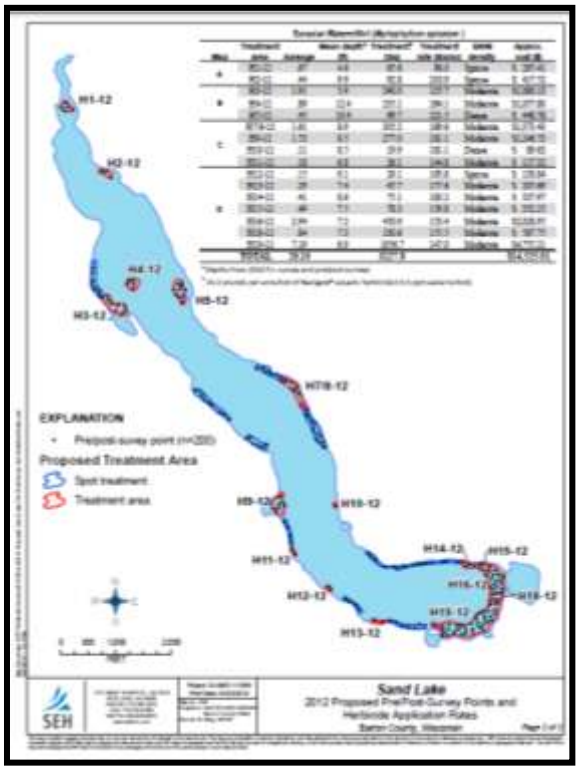


Figure 1: Proposed 2012 Spring EWM Treatment Areas

Eurasian water milfoil (*Myriophyllum spicatum*) (EWM), was discovered in the lake in 2002, and the Sand Lake Management District (SLMD) is engaged in active management to control this invasive exotic species. Following the 2011 fall EWM bed mapping survey that found high numbers of EWM plants scattered throughout the lake, the SLMD, under the direction of Short, Elliot, Hendrickson, Inc. (SEH), decided to chemically treat 16 areas in 2012. All combined, they totaled 21.10 acres or 6.6% of the lake's surface area. Nine additional areas were slated for spot treatment on an as needed basis (Figure 1).

On May 17nd, 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 18th large scale herbicide application, we conducted a July 18th posttreatment survey to evaluate the effectiveness of the treatment. We also conducted a October 12th EWM bed mapping survey to determine where EWM control might be considered in 2013. This report is the summary analysis of these three field surveys.

METHODS:

Pre/Post Herbicide Survey:

SEH biologists generated 200 pre/post survey points based on the size and shape of the proposed treatment areas. This equated to approximately 10pts/acre which is the maximum recommended by WDNR protocol (Appendix I).

We located each survey 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 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 $p < .005$.

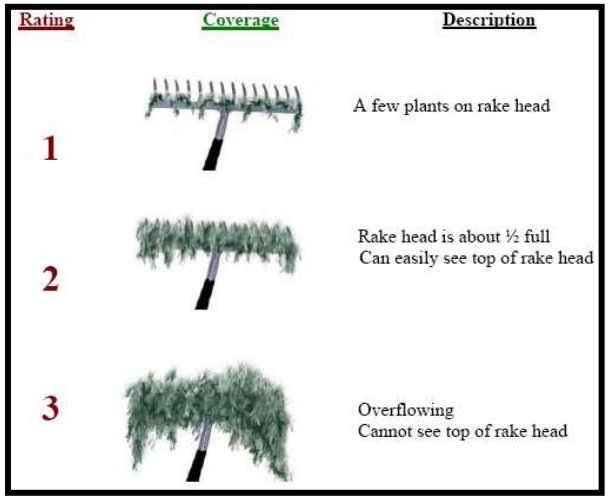


Figure 2: Rake Fullness Ratings

Fall Eurasian Water Milfoil Bed Mapping:

On October 12th, 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.

RESULTS AND DISCUSSION:

Finalization of Treatment Areas:

Initial expectations were to treat 16 areas totaling 21.10 acres with granular 2, 4-D (Navigate) at a concentration of 1.5 ppm (Table 1). The pretreatment survey revealed that, although EWM was patchy, it was found on point or interpoint in all areas. Because of this, it was decided to maintain all treatment areas as proposed. This initial treatment was conducted by Northern Aquatics Services on June 18th (Figure 3) (Appendix I). On June 28th, 189 spot treatments in the "S" areas added two additional acres to this total. Following the posttreatment survey, a July 30 spot treatment of 43 spots located throughout the lake covered 0.25 acres. This was followed by another 51 spots covering 0.50 acres on September 5th.

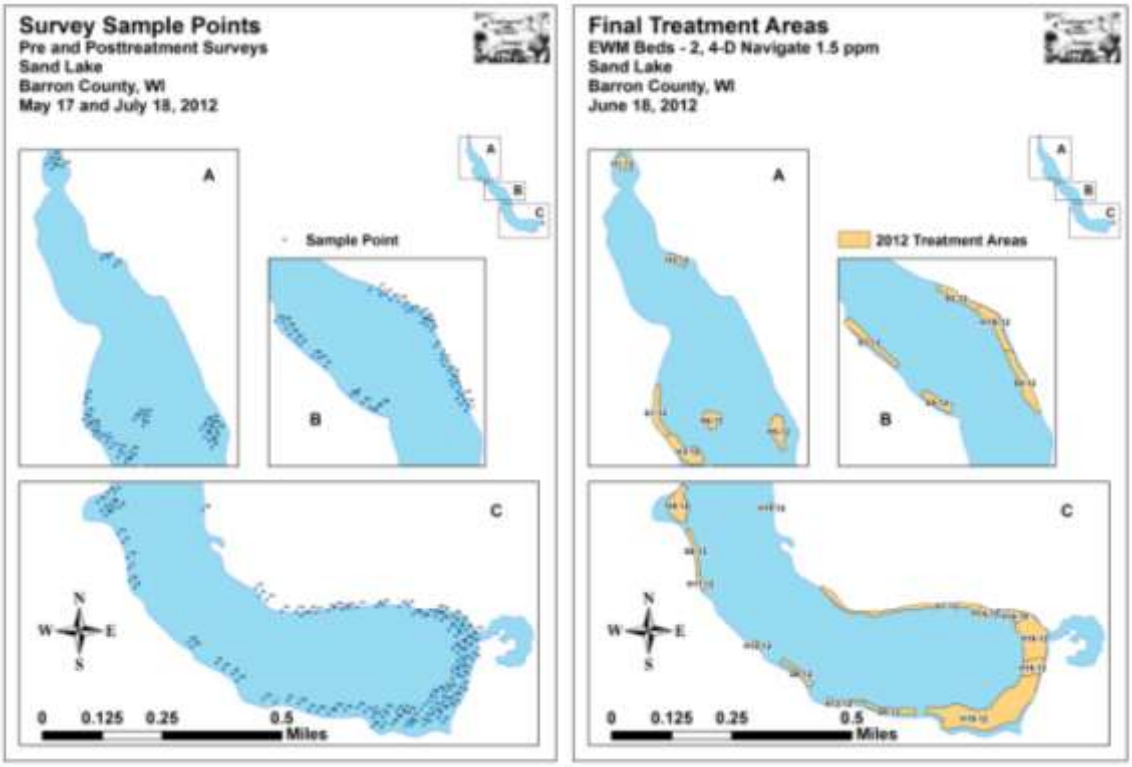


Figure 3: 2012 Survey Sample Points and Final Treatment Areas

Table 1: Spring EWM Treatment Summary
Sand Lake – June 18, 2012

Bed Number	Proposed Acreage	Final Acreage	Difference +/-
H1	0.67	0.67	0
H2	0.44	0.44	0
H3	1.91	1.91	0
H4	0.89	0.89	0
H5	1.45	1.45	0
H7/8	1.61	1.61	0
H9	1.53	1.53	0
H10	0.11	0.11	0
H11	0.18	0.18	0
H12	0.15	0.15	0
H13	0.29	0.29	0
H14	0.41	0.41	0
H15	0.49	0.49	0
H16	2.94	2.94	0
H18	0.84	0.84	0
H19	7.19	7.19	0
Total Acres	**21.10**	**21.10**	**0.00**

EWM Pre/Post Herbicide Survey:

The treatment area littoral zone extended to a maximum of 14.5ft during the pretreatment survey and 19.0ft during the posttreatment survey. Mean and median depths for all plants were 7.1ft and 7.0ft respectively during the pretreatment survey before declining slightly to 6.5ft and 6.0ft in the posttreatment survey (Table 2). Most EWM was established over organic and sandy muck in 5-13ft of water (Figure 4) (Appendix III).

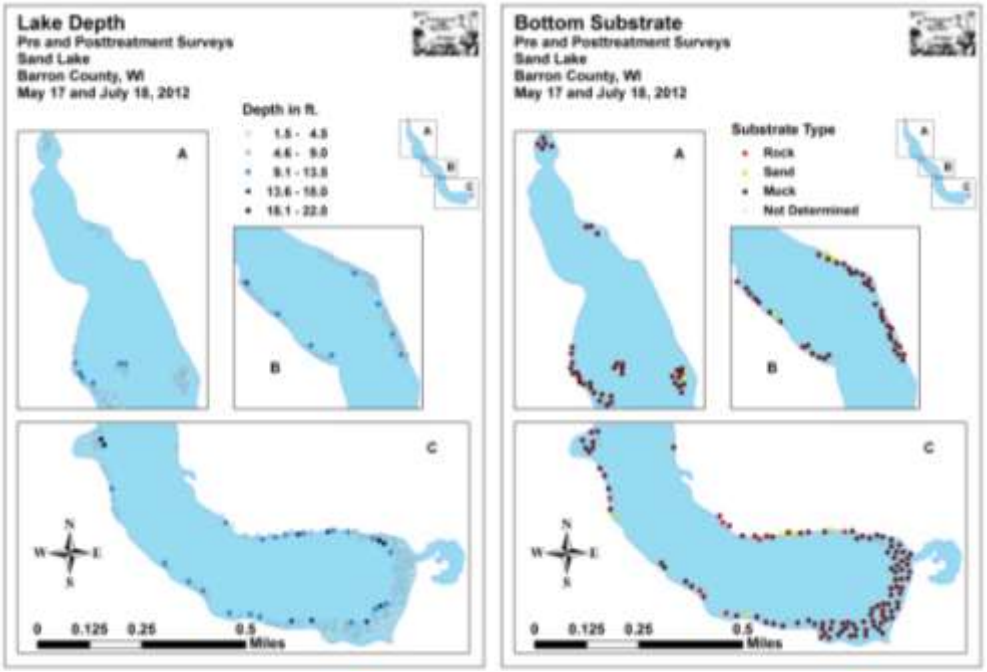


Figure 4: Treatment Area Depths and Bottom Substrate

Table 2: Pre/Post Survey Summary Statistics
Sand Lake, Barron County
May 17 and July 18, 2012

Summary Statistics:	Pre	Post
Total number of points sampled	200	200
Total number of sites with vegetation	183	189
Total number of sites shallower than the maximum depth of plants	192	198
Frequency of occurrence at sites shallower than maximum depth of plants	95.31	95.45
Simpson Diversity Index	0.87	0.89
Maximum depth of plants (ft)	14.5	19.0
Mean depth of plants (ft)	7.1	6.5
Median depth of plants (ft)	7.0	6.0
Average number of all species per site (shallower than max depth)	2.79	3.19
Average number of all species per site (veg. sites only)	2.92	3.34
Average number of native species per site (shallower than max depth)	2.63	3.14
Average number of native species per site (veg. sites only)	2.78	3.29
Species richness	19	23
Mean rake fullness (veg. sites only)	2.23	2.38

Initial diversity within the beds was high with a Simpson Diversity Index of 0.87. This value increased slightly to 0.89 posttreatment. Mean native species richness at sites with vegetation was 2.78/site pretreatment, and this value also increased to 3.29/site posttreatment (Figure 5). Mean total rake fullness at sites with vegetation increased from a moderately high 2.23 pretreatment to a high 2.38 posttreatment (Figure 6) (Appendix IV).

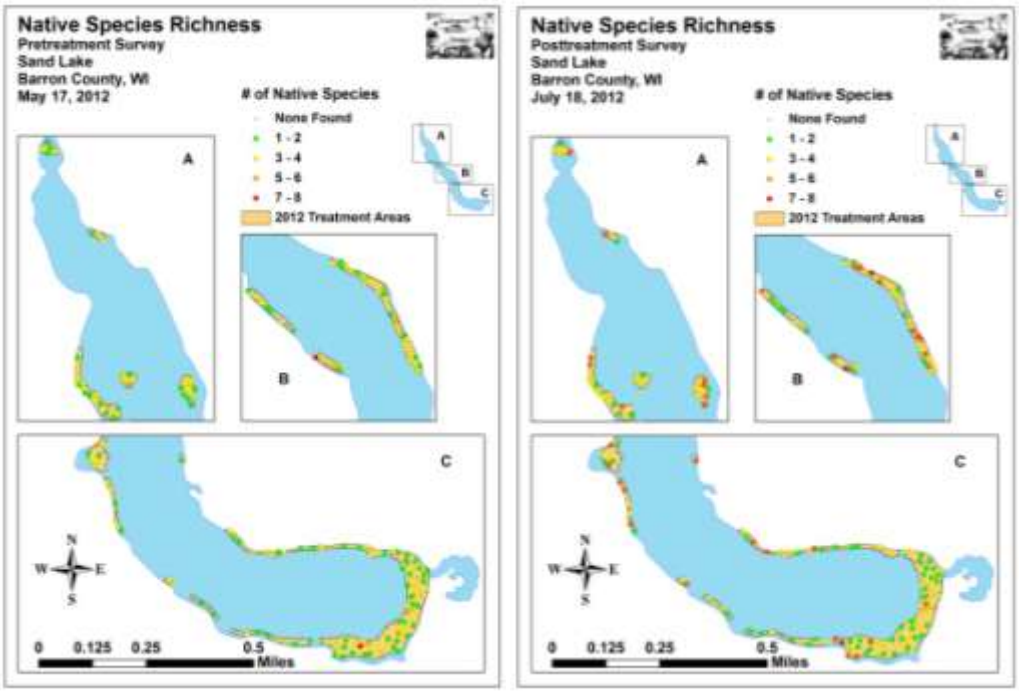


Figure 5: Pre/Post Native Species Richness

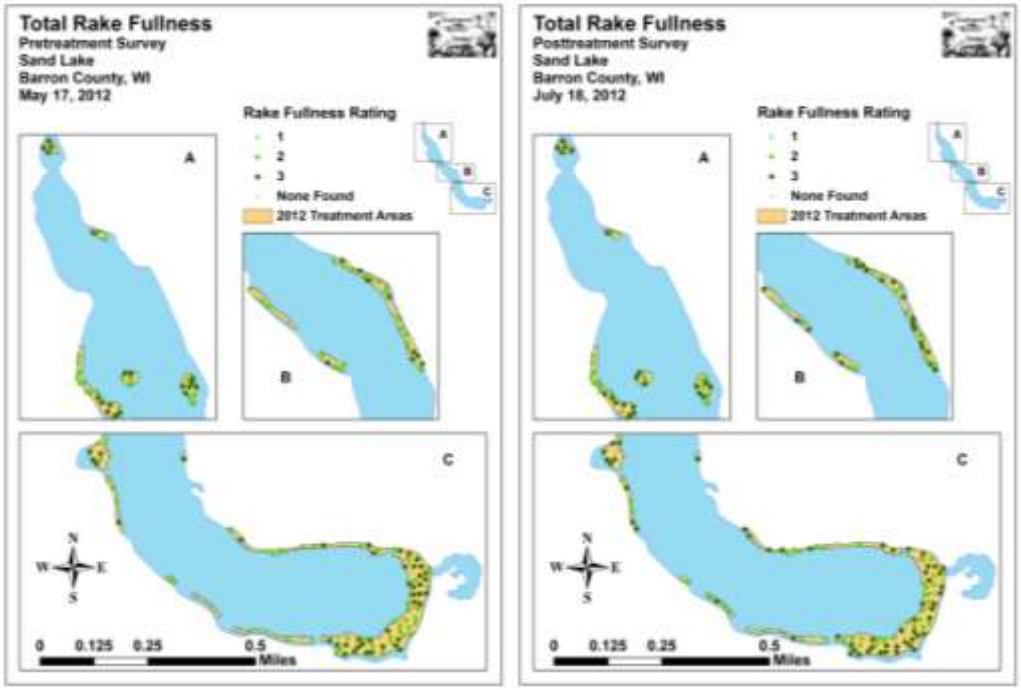


Figure 6: Pre/Post Total Rake Fullness

We found EWM at 31sites during the pretreatment survey. Of these, seven rated a 3, eight were a two, and the remaining 16 had a rake fullness rating of 1. We also recorded EWM as a visual at 25 points. During the posttreatment survey, we found EWM at only 11 sites. None rated a 3, five were a 2, and six were a 1 with a single additional visual record (Figure 7) (Appendix V). This decline in total EWM was moderately significant as was the decline when considering only the number of sites with a rake fullness of 3. There was no significant change in sites with a rake fullness of 2, but the number of sites with a rake fullness of 1 was significantly lower (Figure 8).

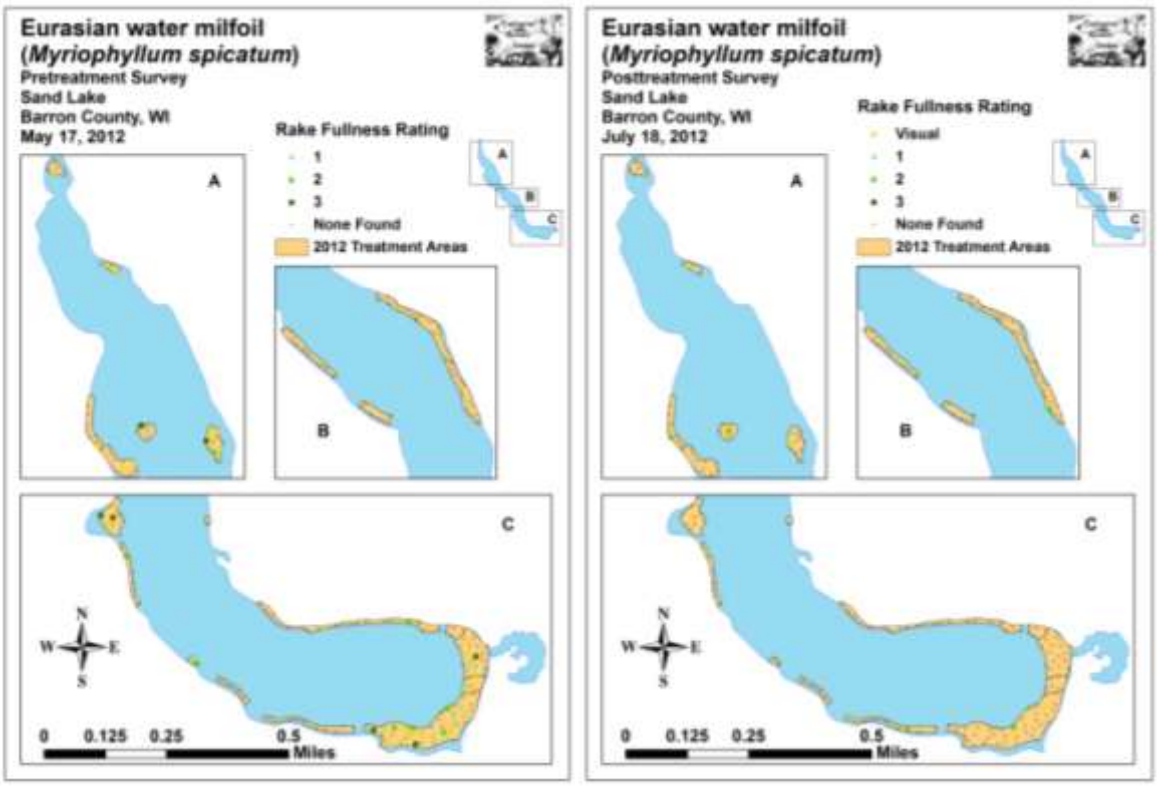
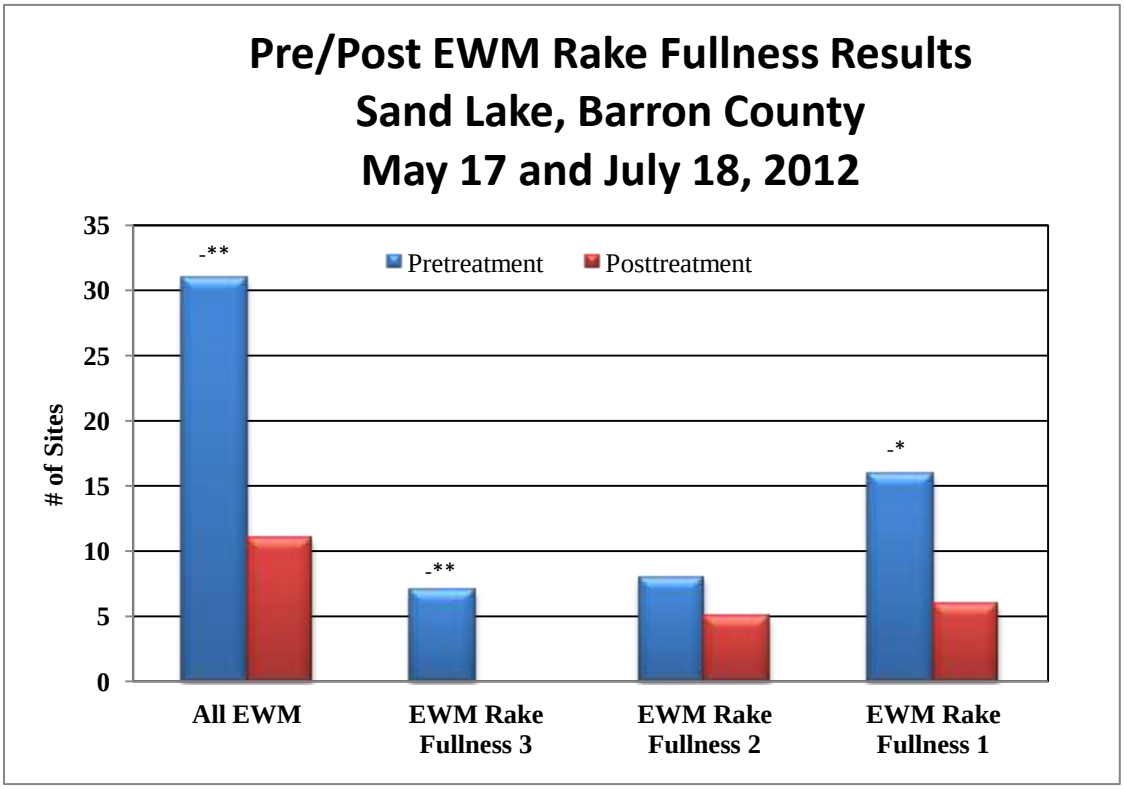


Figure 7: Pre/Post EWM Density and Distribution



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

Figure 8: Pre/Post Changes in EWM Rake Fullness

Coontail (*Ceratophyllum demersum*) and Northern water milfoil (*Myriophyllum sibiricum*) were two of the most common native species in both the pre and posttreatment surveys, and neither showed a significant change (Tables 3 and 4) (Figures 9 and 10). Interestingly, no species other than EWM showed a significant decline posttreatment (Figure 11). Small pondweed (*Potamogeton pusillus*), Wild celery (*Vallisneria americana*), Slender naiad (*Najas flexilis*), and Sago pondweed (*Stuckenia pectinata*) all showed highly significant increases posttreatment; Spatterdock (*Nuphar variegata*) showed a moderately significant increase; and Clasping-leaf pondweed (*Potamogeton richardsonii*) showed a significant increase. All of these species tend to be late growing and these increases are likely simply due to normal changes over the growing season (Maps for all species from the pre and posttreatment surveys are available in Appendixes VI and VII).

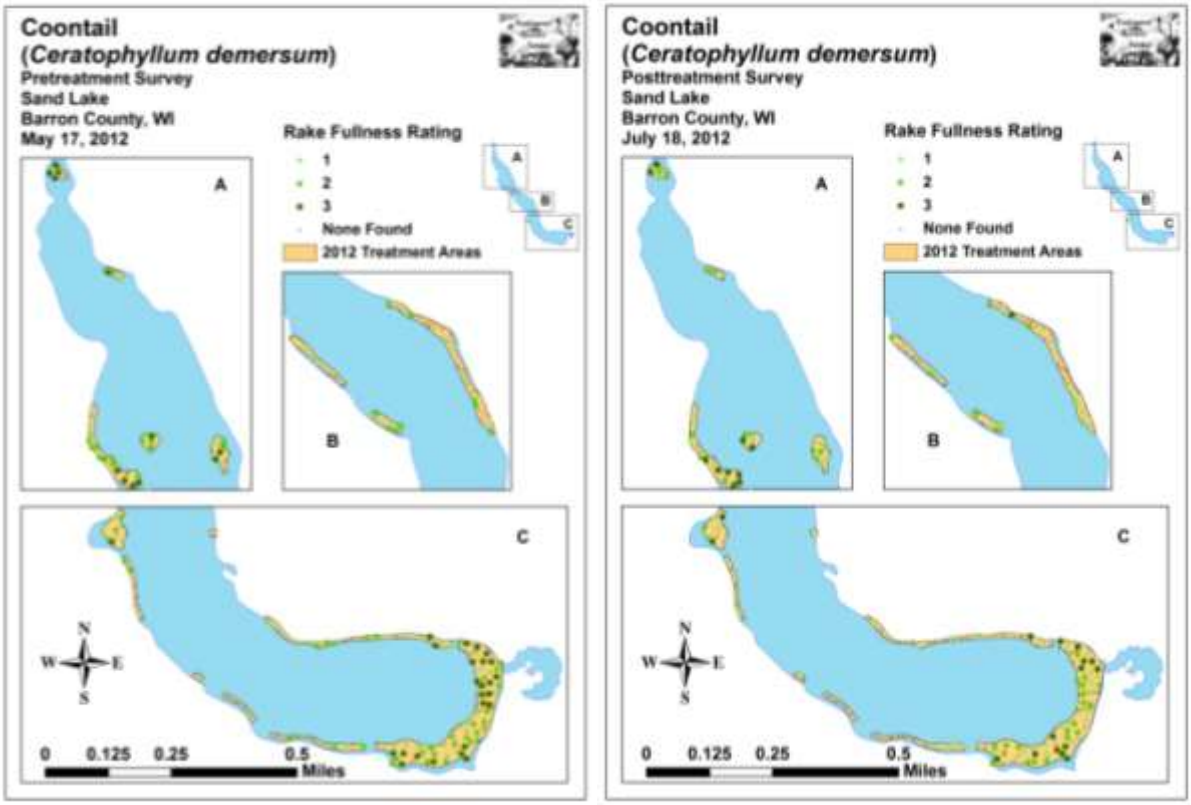


Figure 9: Pre/Post Coontail Density and Distribution

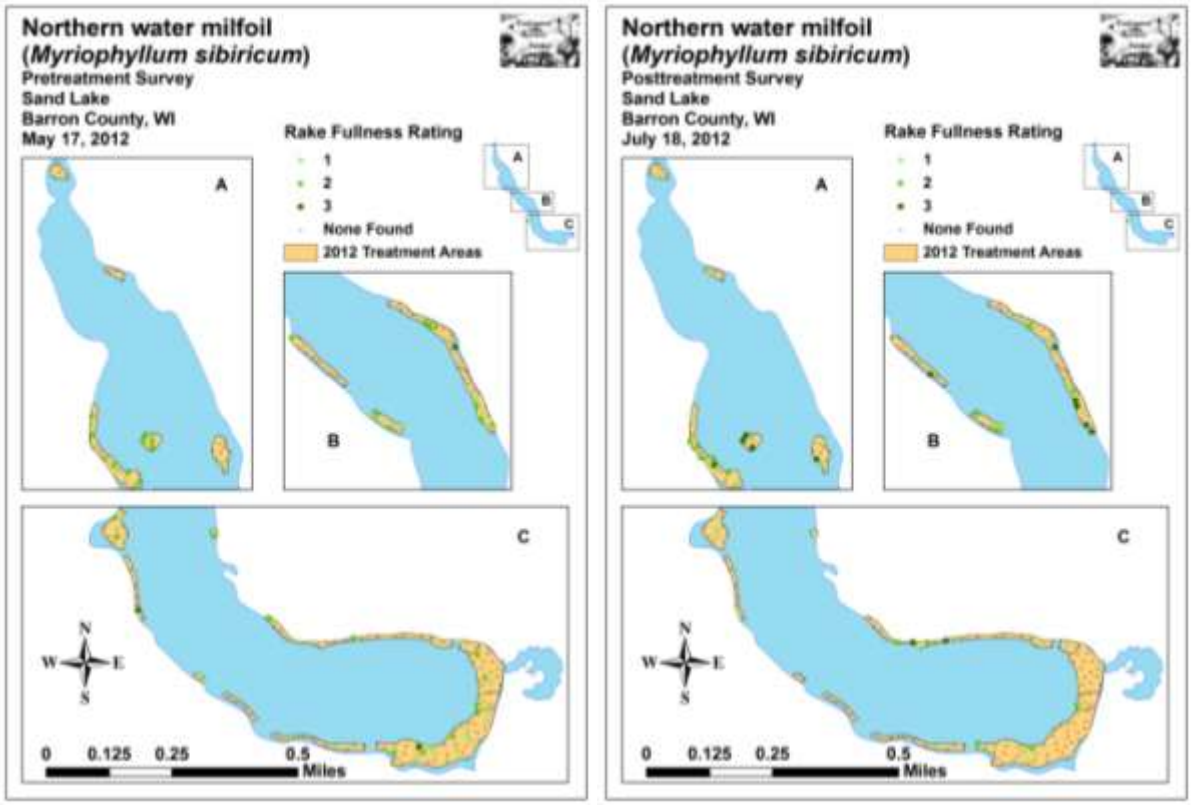
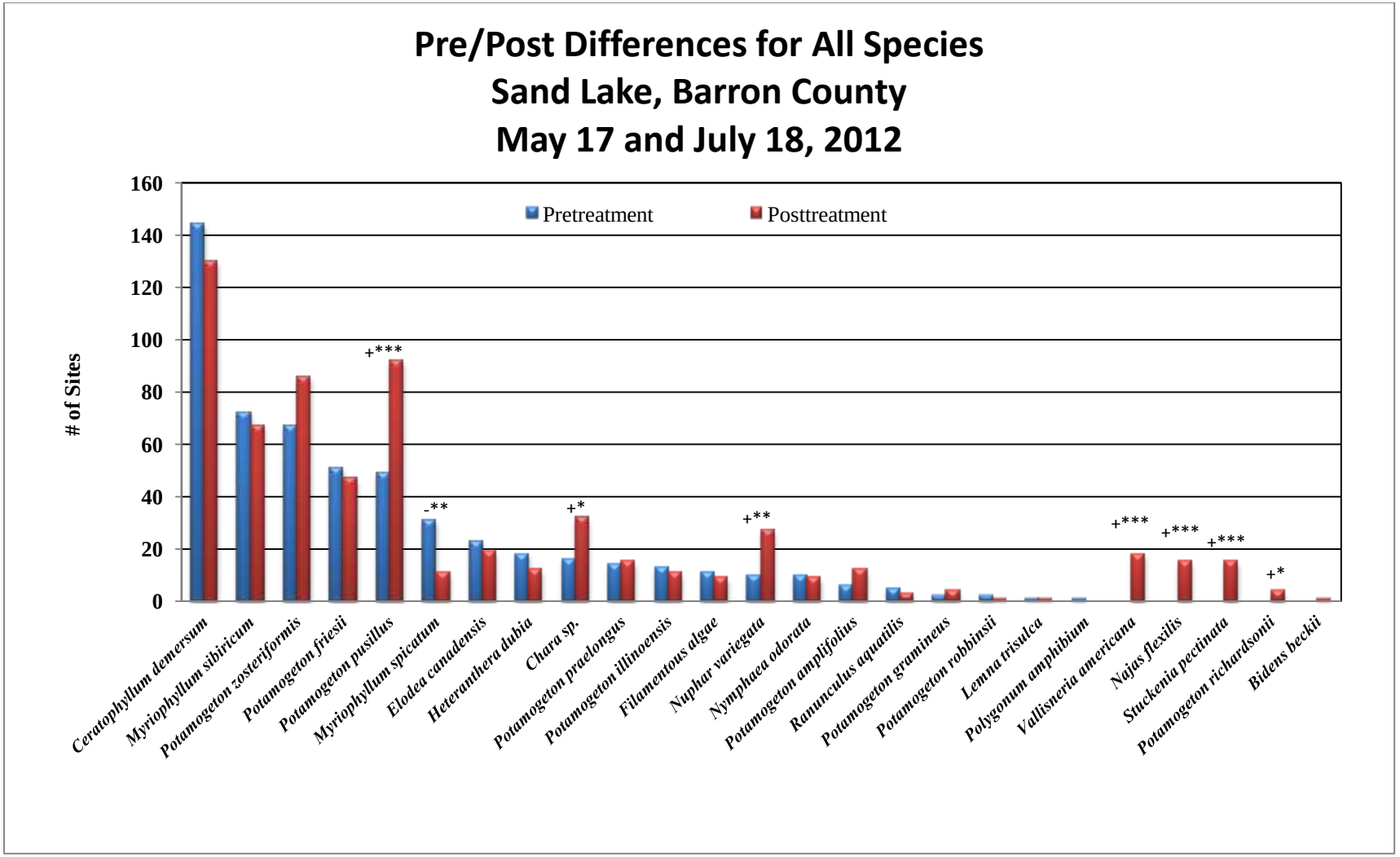


Figure 10: Pre/Post Northern Water Milfoil Density and Distribution



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 Sand Lake, Barron County
May 17, 2012

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
Ceratophyllum demersum	Coontail	144	26.92	78.69	75.00	1.92	0
Myriophyllum sibiricum	Northern water-milfoil	72	13.46	39.34	37.50	1.50	0
Potamogeton zosteriformis	Flat-stem pondweed	67	12.52	36.61	34.90	1.24	0
Potamogeton friesii	Fries' pondweed	51	9.53	27.87	26.56	1.25	0
Potamogeton pusillus	Small pondweed	49	9.16	26.78	25.52	1.55	0
Myriophyllum spicatum	Eurasian water milfoil	31	5.79	16.94	16.15	1.71	25
Elodea canadensis	Common waterweed	23	4.30	12.57	11.98	1.35	0
Heteranthera dubia	Water star-grass	18	3.36	9.84	9.38	1.33	0
Chara sp.	Muskgrass	16	2.99	8.74	8.33	2.31	0
Potamogeton praelongus	White-stem pondweed	14	2.62	7.65	7.29	1.07	0
Potamogeton illinoensis	Illinois pondweed	13	2.43	7.10	6.77	1.15	0
	Filamentous algae	11	*	6.01	5.73	1.55	0
Nuphar variegata	Spatterdock	10	1.87	5.46	5.21	1.20	0
Nymphaea odorata	White water lily	10	1.87	5.46	5.21	1.00	0
Potamogeton amplifolius	Large-leaf pondweed	6	1.12	3.28	3.13	1.00	0
Ranunculus aquatilis	White water crowfoot	5	0.93	2.73	2.60	1.20	0
Potamogeton gramineus	Variable pondweed	2	0.37	1.09	1.04	1.00	0
Potamogeton robbinsii	Fern pondweed	2	0.37	1.09	1.04	1.00	0
Lemna trisulca	Forked duckweed	1	0.19	0.55	0.52	1.00	0
Polygonum amphibium	Water smartweed	1	0.19	0.55	0.52	2.00	0

* Excluded from Relative Frequency Analysis

Table 4: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Posttreatment Survey Sand Lake, Barron County
July 18, 2012

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake	Visual Sites
Ceratophyllum demersum	Coontail	130	20.57	68.78	65.66	1.71	0
Potamogeton pusillus	Small pondweed	92	14.56	48.68	46.46	1.63	0
Potamogeton zosteriformis	Flat-stem pondweed	86	13.61	45.50	43.43	1.45	0
Myriophyllum sibiricum	Northern water-milfoil	67	10.60	35.45	33.84	1.61	0
Potamogeton friesii	Fries' pondweed	47	7.44	24.87	23.74	1.21	0
Chara sp.	Muskgrass	32	5.06	16.93	16.16	1.94	0
Nuphar variegata	Spatterdock	27	4.27	14.29	13.64	2.78	0
Elodea canadensis	Common waterweed	19	3.01	10.05	9.60	1.26	0
Vallisneria americana	Wild celery	18	2.85	9.52	9.09	1.17	0
Najas flexilis	Slender naiad	15	2.37	7.94	7.58	1.33	0
Potamogeton praelongus	White-stem pondweed	15	2.37	7.94	7.58	1.20	0
Stuckenia pectinata	Sago pondweed	15	2.37	7.94	7.58	1.33	0
Heteranthera dubia	Water star-grass	12	1.90	6.35	6.06	1.25	0
Potamogeton amplifolius	Large-leaf pondweed	12	1.90	6.35	6.06	1.17	0
Myriophyllum spicatum	Eurasian water milfoil	11	1.74	5.82	5.56	1.45	1
Potamogeton illinoensis	Illinois pondweed	11	1.74	5.82	5.56	1.27	0
Nymphaea odorata	White water lily	9	1.42	4.76	4.55	1.44	0
	Filamentous algae	9	*	4.76	4.55	1.78	0
Potamogeton gramineus	Variable pondweed	4	0.63	2.12	2.02	1.00	0
Potamogeton richardsonii	Clasping-leaf pondweed	4	0.63	2.12	2.02	1.50	0
Ranunculus aquatilis	White water crowfoot	3	0.47	1.59	1.52	1.00	0
Bidens beckii	Water marigold	1	0.16	0.53	0.51	1.00	0
Lemna trisulca	Forked duckweed	1	0.16	0.53	0.51	1.00	0
Potamogeton robbinsii	Fern pondweed	1	0.16	0.53	0.51	1.00	0

* Excluded from Relative Frequency Analysis

Fall EWM Bed Mapping Survey:

On October 12th, 2012, we searched the lake's entire visible littoral zone for EWM. Conditions were calm with bright overhead sun. However, water clarity was much reduced compared to fall 2011, and we could only see down approximately 5ft into the water column. Because of this, we used a rake to check areas that had been treated in June to see if the EWM beds had recovered.

The 2011 survey found 19 high EWM density areas totaling 15.25 acres (Table 5). In 2012, the 18.1km transect survey located and mapped a total of **122 individual plants**. No beds of any kind were found despite extensive raking at the edge of the littoral zone and in areas that had large numbers of EWM in 2011 (Figure 12) (Appendix VIII).

In summary, the 2012 treatment appears to have taken EWM back down to very low levels. Because the 2012 treatment schedule gave such favorable results, we believe that delaying future pretreatment surveys until late May/early June when EWM on the lake is actively growing is again advisable. We also recommend that this survey place exploratory points in former beds/high density areas at depths that aren't normally visible from the surface. We believe this offers the best change of determining when and where these deep water beds reestablish thus allowing treatment to occur before they again grow to the levels seen in fall 2011/spring 2012.

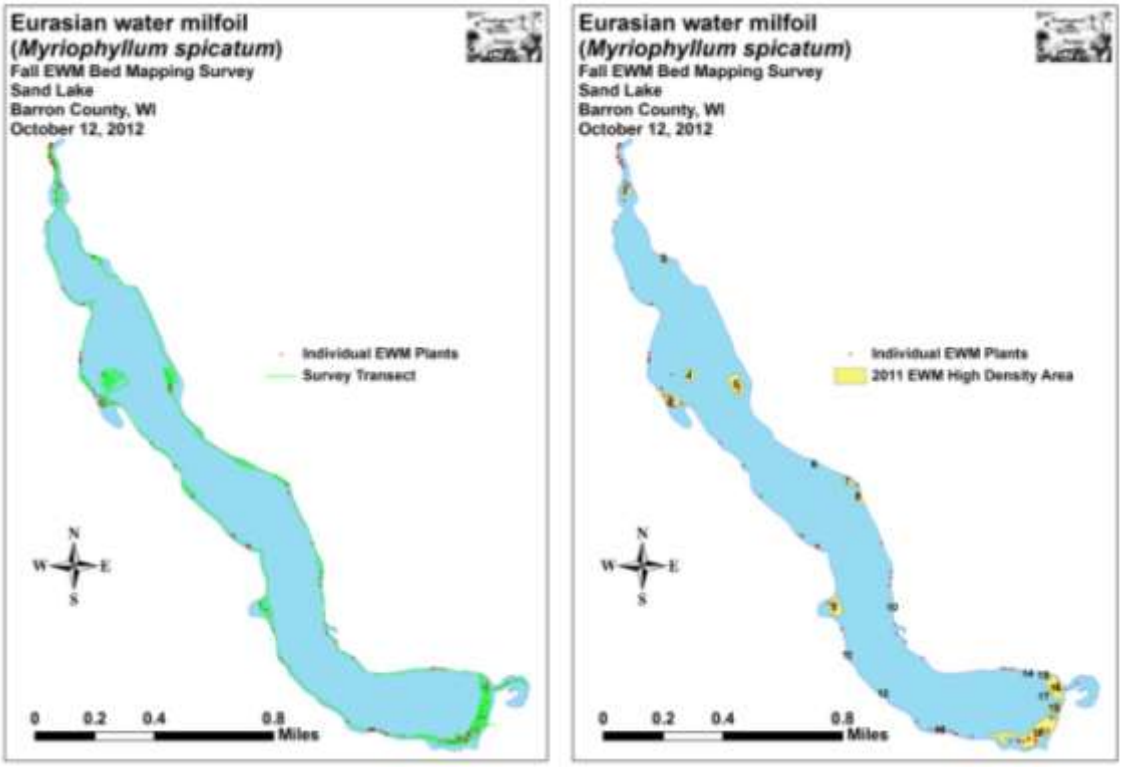


Figure 12: 2012 Fall EWM Maps

Table 5: Fall Eurasian Water Milfoil Bed Mapping Summary
Sand Lake, Barron County
October 12, 2012

HDA Number	2012 Fall Bed Acreage	2011 Fall Bed Acreage	2012 Change in Acreage	Estimated 2012 Mean Rakefull	2012 Bed Characteristics And Field Notes
1	0	0.48	-0.48	<1	Scattered EWM expanding near outlet
2	0	0.17	-0.17	0	No plants found
3	0	1.27	-1.27	<1	Low density; all plants rake removed
4	0	0.66	-0.66	0	No plants found
5	0	1.61	-1.61	<1	Low density; all plants rake removed
6	0	0.03	-0.03	0	No plants found
7	0	0.44	-0.44	0	No plants found
8	0	0.60	-0.60	<1	Two plants found; were both rake removed
9	0	1.49	-1.49	<1	Large plant at edge of littoral zone
10	0	0.02	-0.02	0	No plants found
11	0	0.06	-0.06	<1	A single plant was removed
12	0	0.02	-0.02	0	No plants found
13	0	0.10	-0.10	<1	Scattered plants on the east corner of area
14	0	0.08	-0.08	0	No plants found
15	0	0.16	-0.16	0	No plants found
16	0	2.12	-2.12	<1	Low density; all plants rake removed
17	0	0.09	-0.09	0	No plants found
18	0	0.56	-0.56	0	No plants found
19	0	5.29	-5.29	<1	Low density; scattered plants throughout
Total Acres	**0.00**	**15.25**	**-15.25**		

Descriptions of Current and Former EWM Beds/High Density Areas:

HDA 1 – We found a single plant in this area, but, downstream in the lake outlet, numbers of EWM plants were establishing in water 4-6ft deep.

HDA 2 – We found no plants in this area during the survey, although two plants were located inshore from the area. We removed both of them.

HDAs 3 and 4 – A few scattered plants were removed from HDA 3 among the Spatterdock in Silo Bay. We did not find any EWM in HDA 4 on the bar although we did find a single plant on the inshore side of the bar. Plants were also scattered northwest of the bar along the shoreline.

HDA 5 – One of the worst areas in 2011, we had a hard time finding any plants in this area. The four we did locate were rake removed. No plants were found in either of the former solid canopied beds at the center of this area which was a pleasant surprise.

HDA 6 and 7 – We found no plants in either area.

HDA 8 – We found and removed two plants in this general area.

HDA 9– Although we only found two plants in this area, the one beyond the visible littoral zone that we raked up on the outside of the bed was 5ft tall, vibrant and growing. We believe this area again deserves thorough examination in spring 2013.

HDAs 10, 11, and 12 – We removed a single plant from HDA 11. No other EWM was found.

HDA 13 – One of the highest density areas on the lake, 14 scattered plants were found on the eastern corner of the area.

HDAs 14 and 15 – We did not find a single plant in these areas.

HDAs 16-19 – The southeast bay near the boat landing continues to have scattered plants throughout. Despite this, they were dramatically reduced from 2011 levels.

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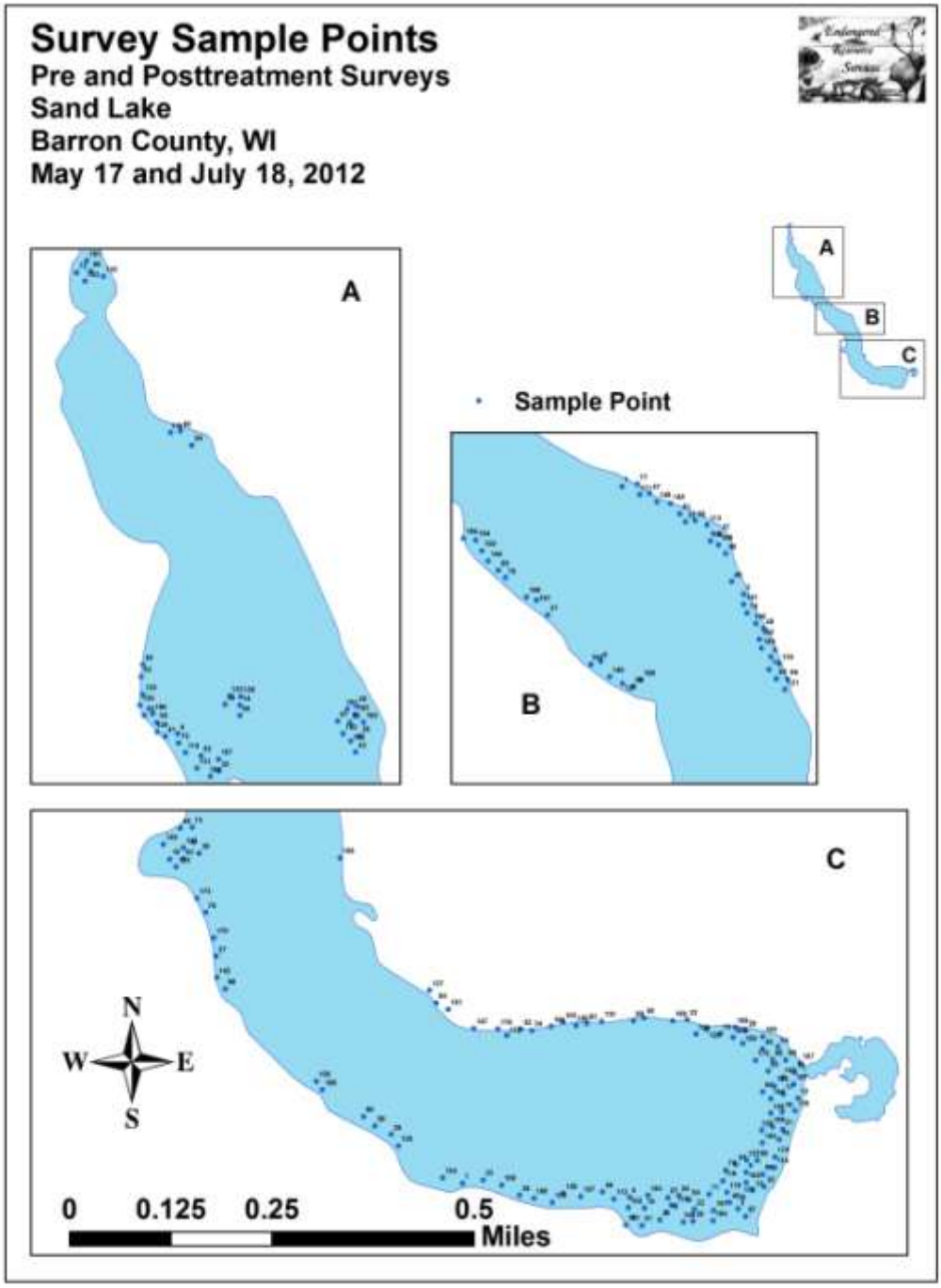
Appendix I: Survey Sample Points and EWM Treatment Areas


Survey Sample Points
Pre and Posttreatment Surveys
Sand Lake
Barron County, WI
May 17 and July 18, 2012
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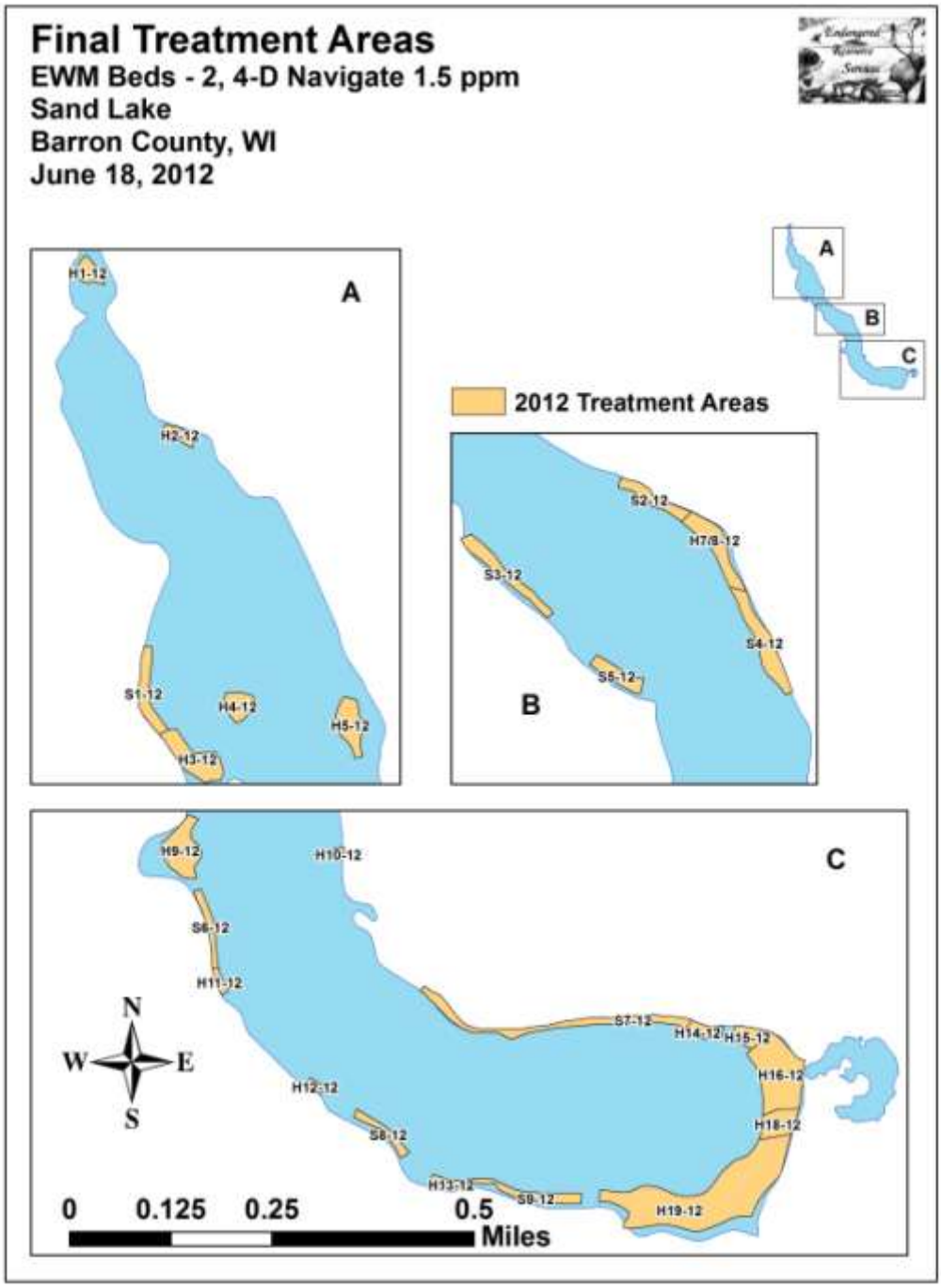
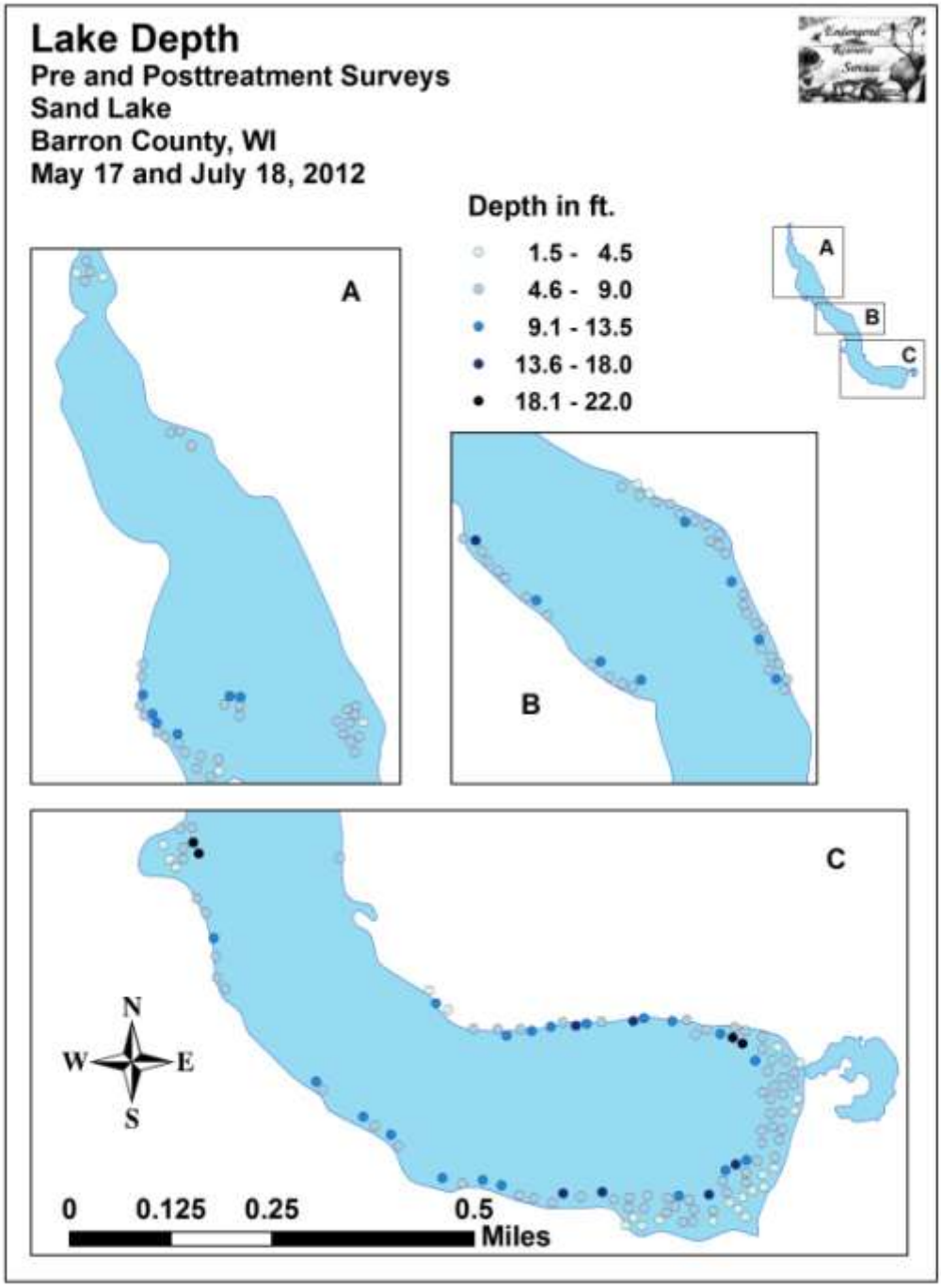
B
C
Sample Point
N
W
E
S
0
0.125
0.25
0.5
Miles

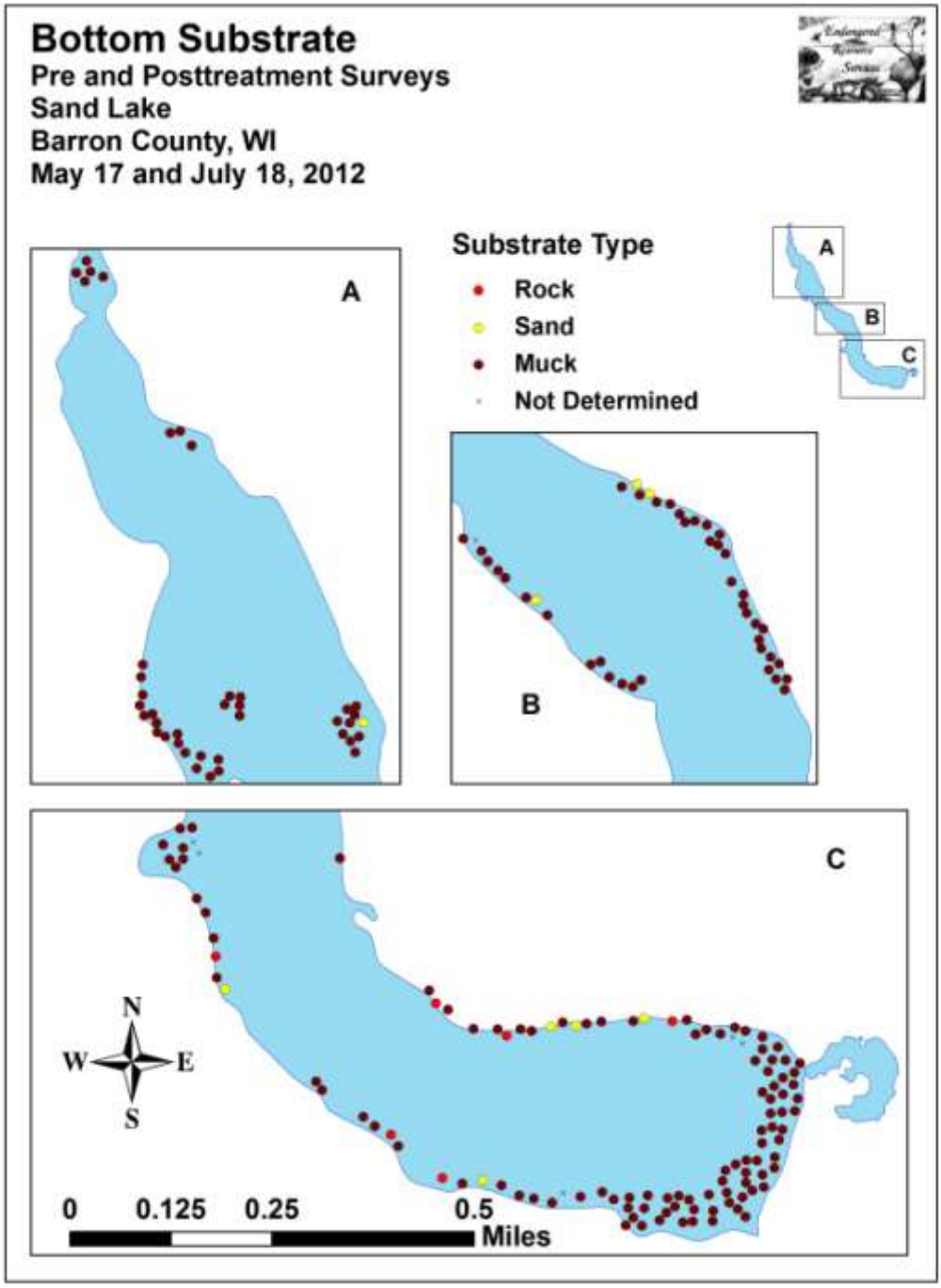

Final Treatment Areas
EWM Beds - 2, 4-D Navigate 1.5 ppm
Sand Lake
Barron County, WI
June 18, 2012
A
B
C
2012 Treatment Areas
H1-12
H2-12
S1-12
H4-12
H5-12
H3-12
S2-12
H7/8-12
S3-12
S4-12
S5-12
H9-12
H10-12
S6-12
H11-12
S7-12
H14-12
H15-12
H16-12
H12-12
H18-12
S8-12
H13-12
S9-12
H19-12
N
W
E
S
0
0.125
0.25
0.5
Miles

Appendix II: Vegetative Survey Data Sheet

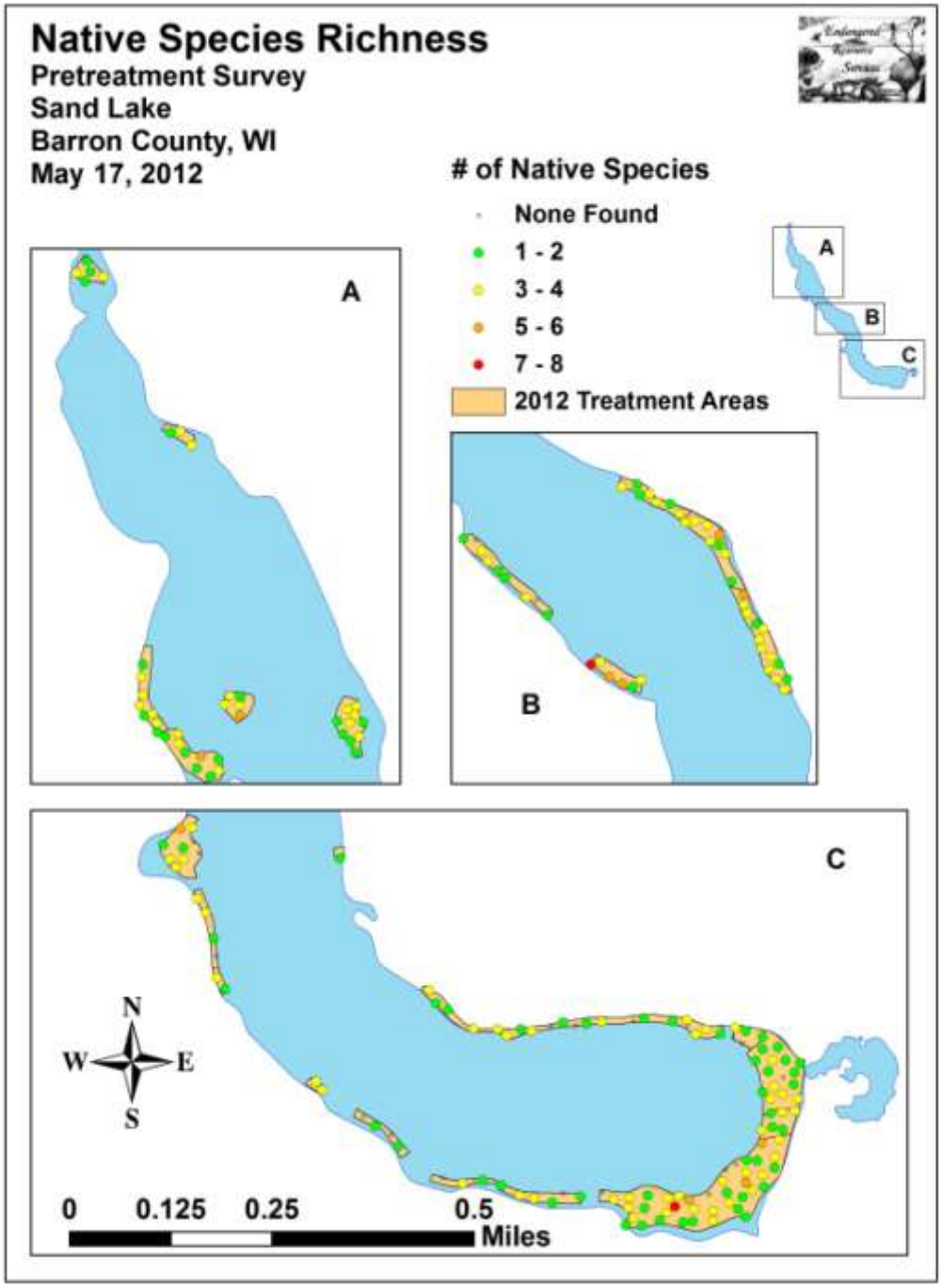
Observers for this lake: names and hours worked by each:																										
Lake:									**WBIC**									**County**						**Date:**		
Site #	**Depth (ft)**	**Muck (M), Sand (S), Rock (R)**	**Rake pole (P) or rake rope (R)**	**Total Rake Fullness**	**EWM**	**CLP**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13																									
14																									
15																									
16																									
17																									
18																									
19																									
20																									

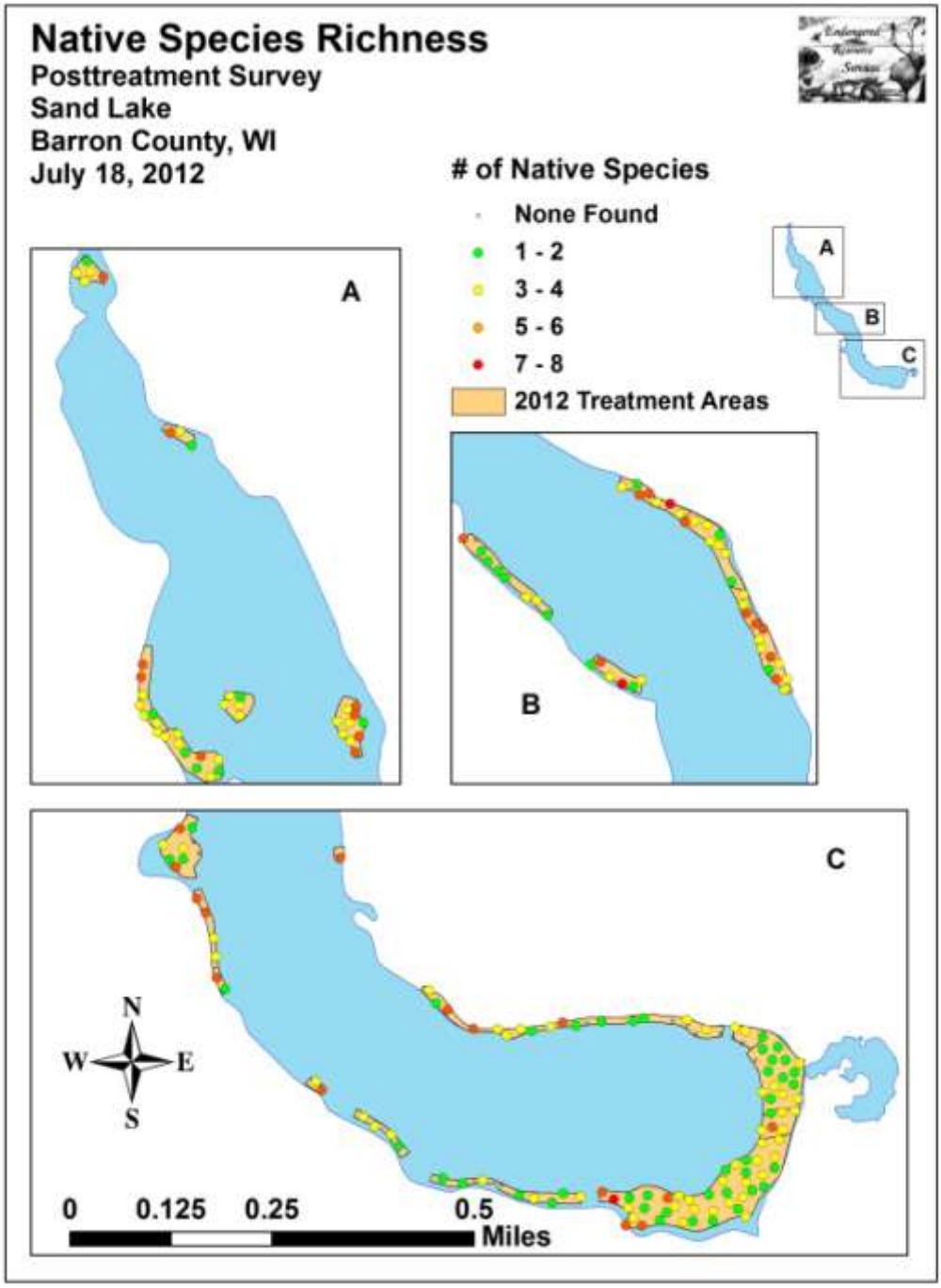
Appendix III: Pre/Post Habitat Variable Maps

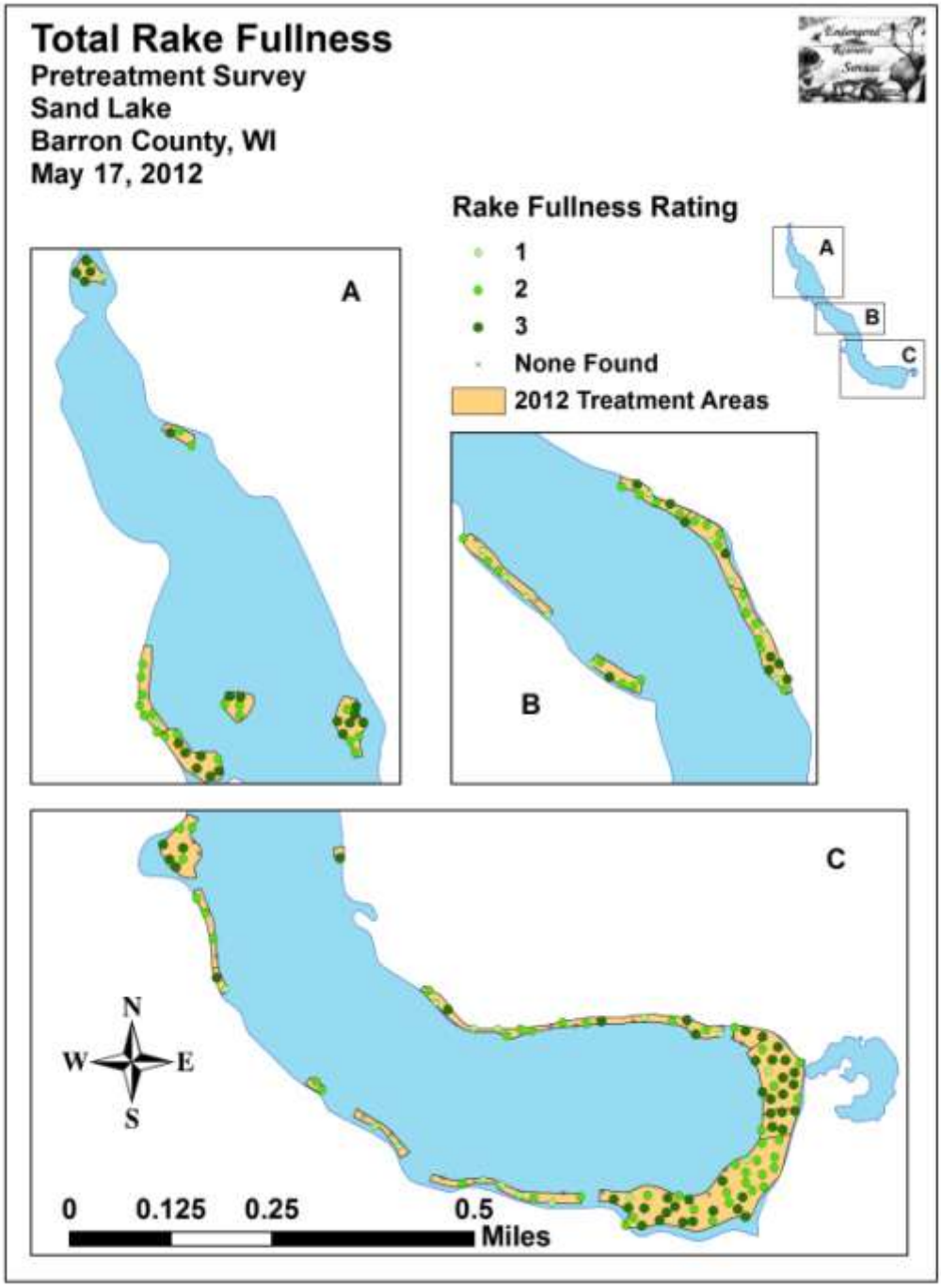

Lake Depth
Pre and Posttreatment Surveys
Sand Lake
Barron County, WI
May 17 and July 18, 2012
Depth in ft.
1.5 - 4.5
4.6 - 9.0
9.1 - 13.5
13.6 - 18.0
18.1 - 22.0
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

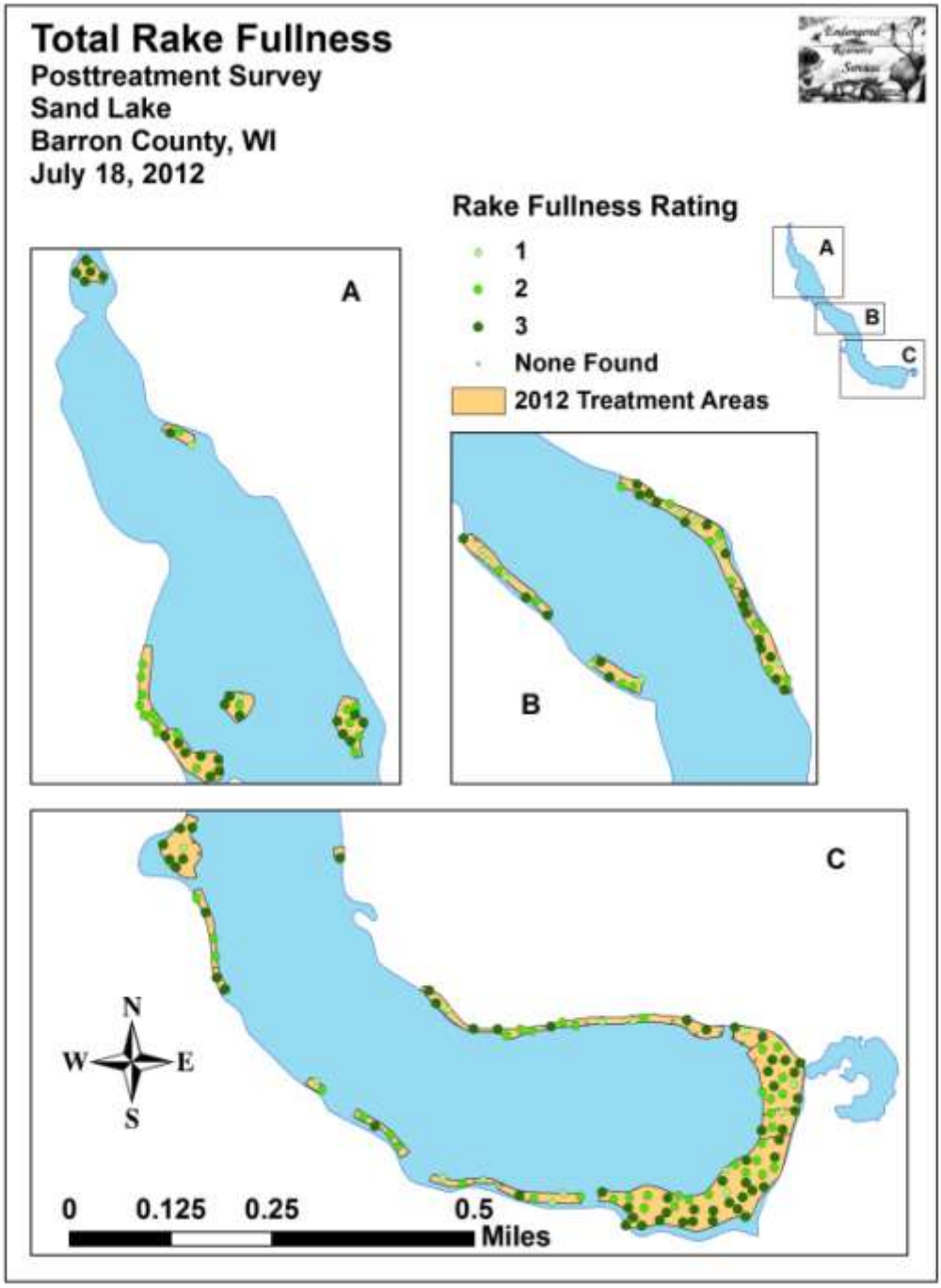

Bottom Substrate
Pre and Posttreatment Surveys
Sand Lake
Barron County, WI
May 17 and July 18, 2012
Substrate Type
Rock
Sand
Muck
Not Determined
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

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

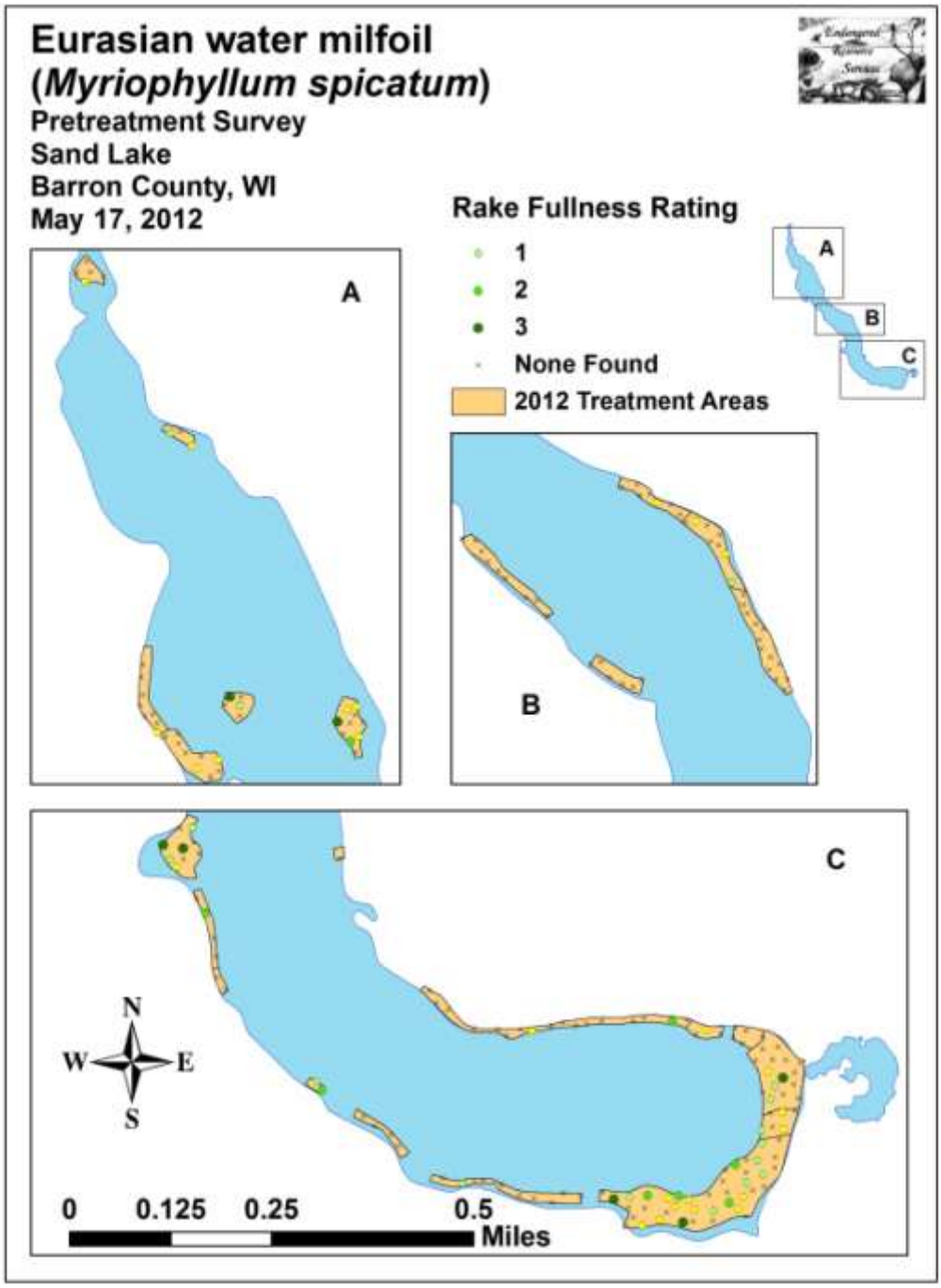

Native Species Richness
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
7 - 8
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

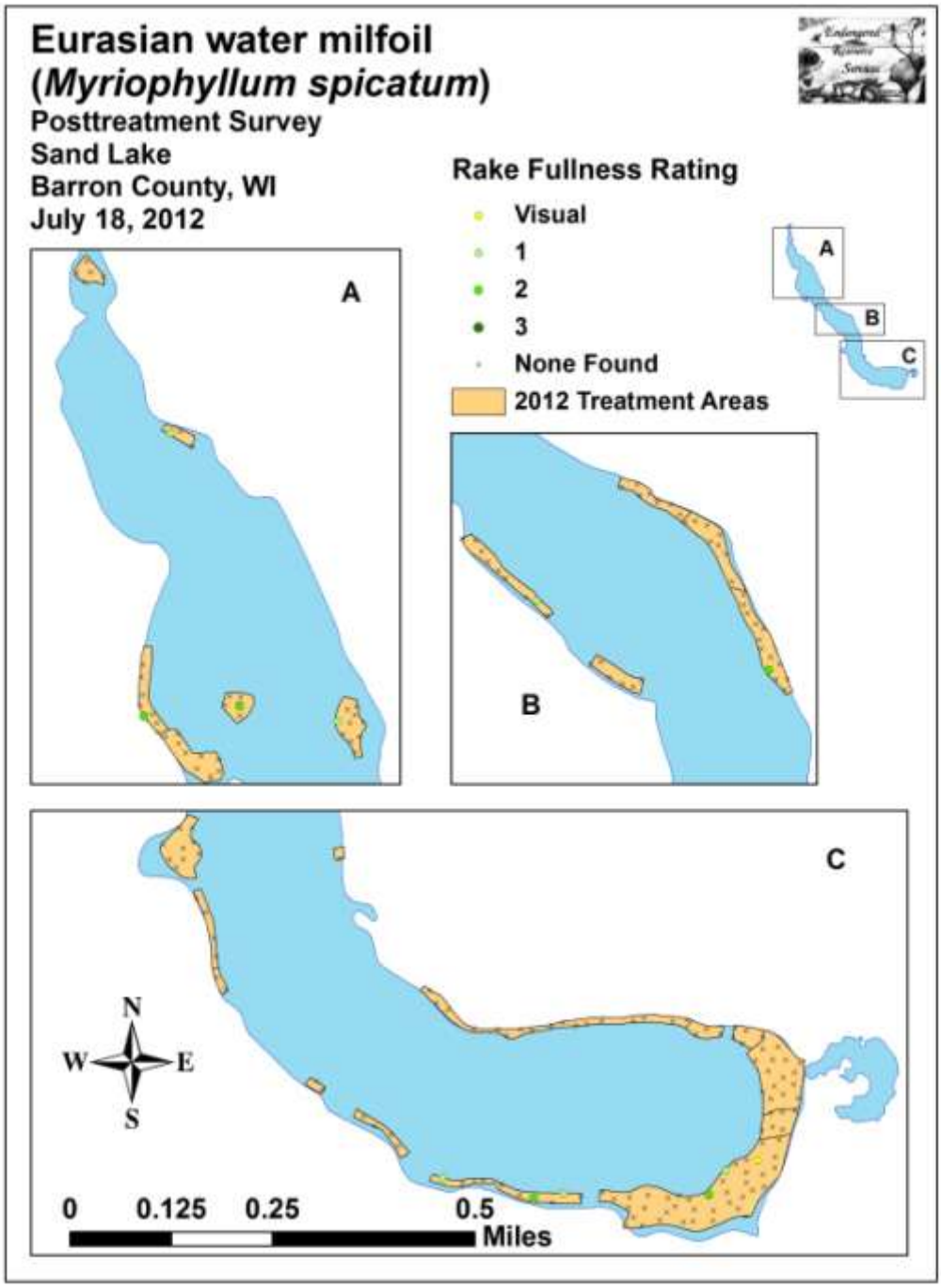

Native Species Richness
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
# of Native Species
None Found
1 - 2
3 - 4
5 - 6
7 - 8
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles


Total Rake Fullness
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

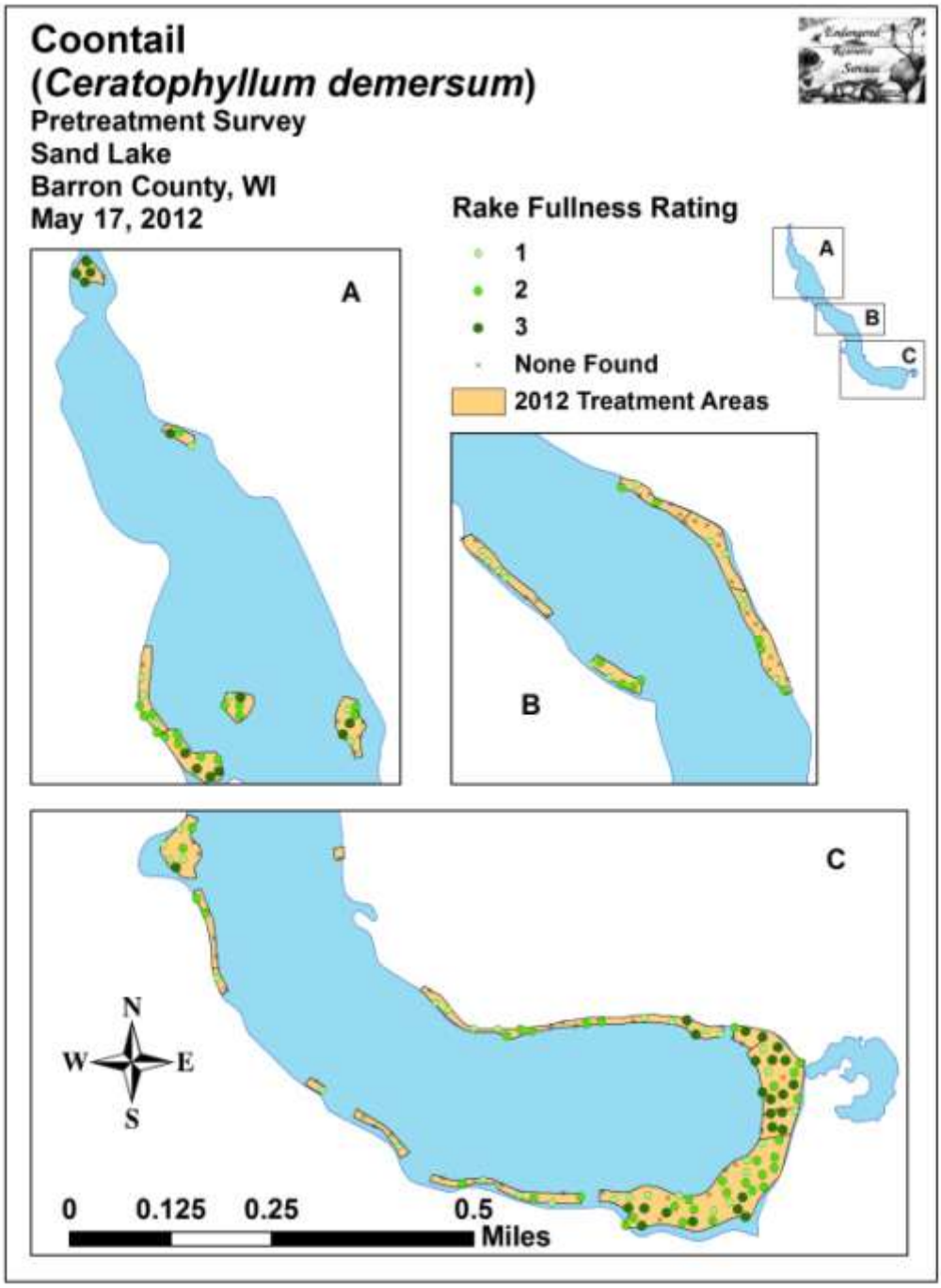

Total Rake Fullness
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

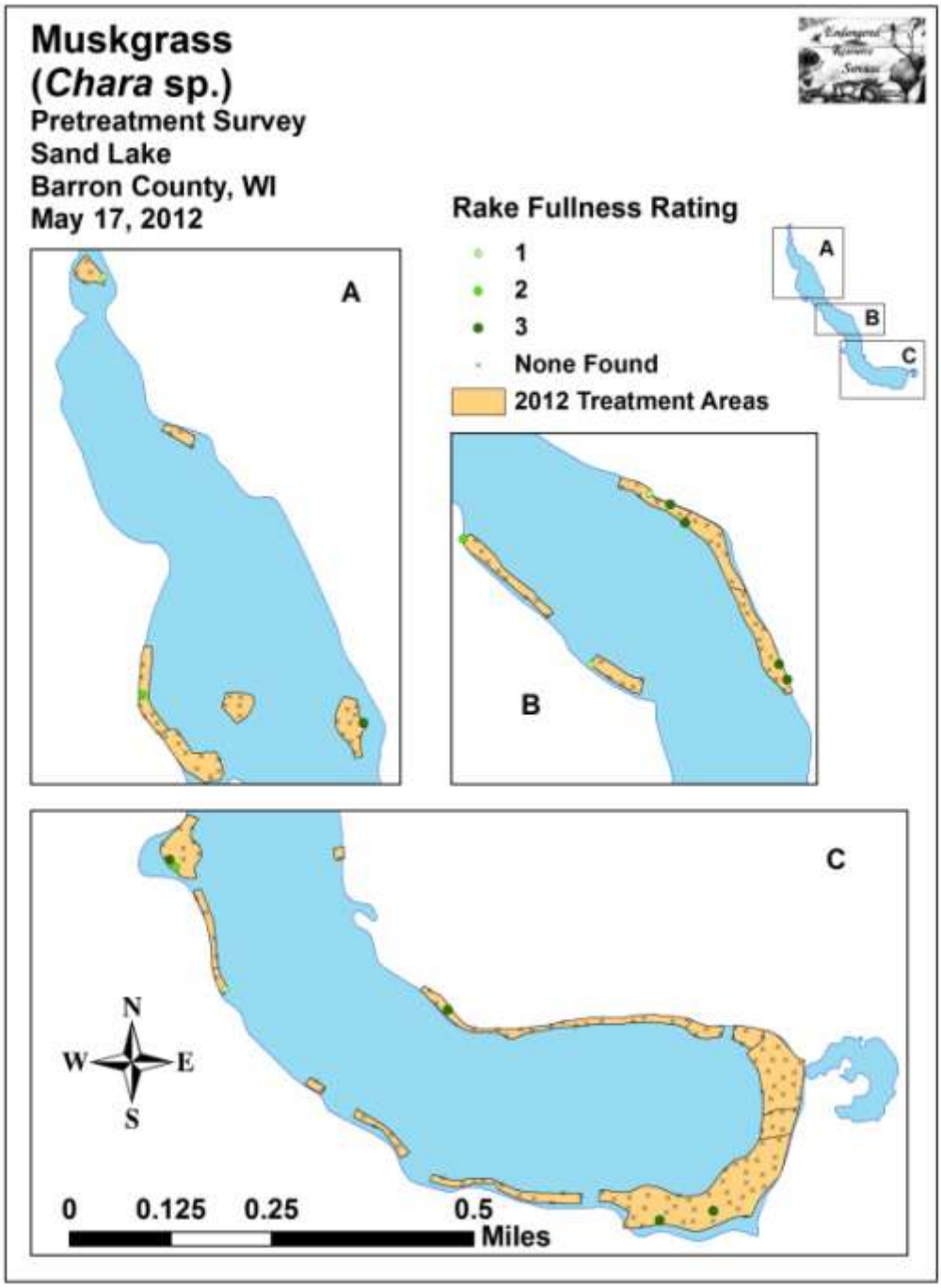
Appendix V: EWM Pre/Post Density and Distribution

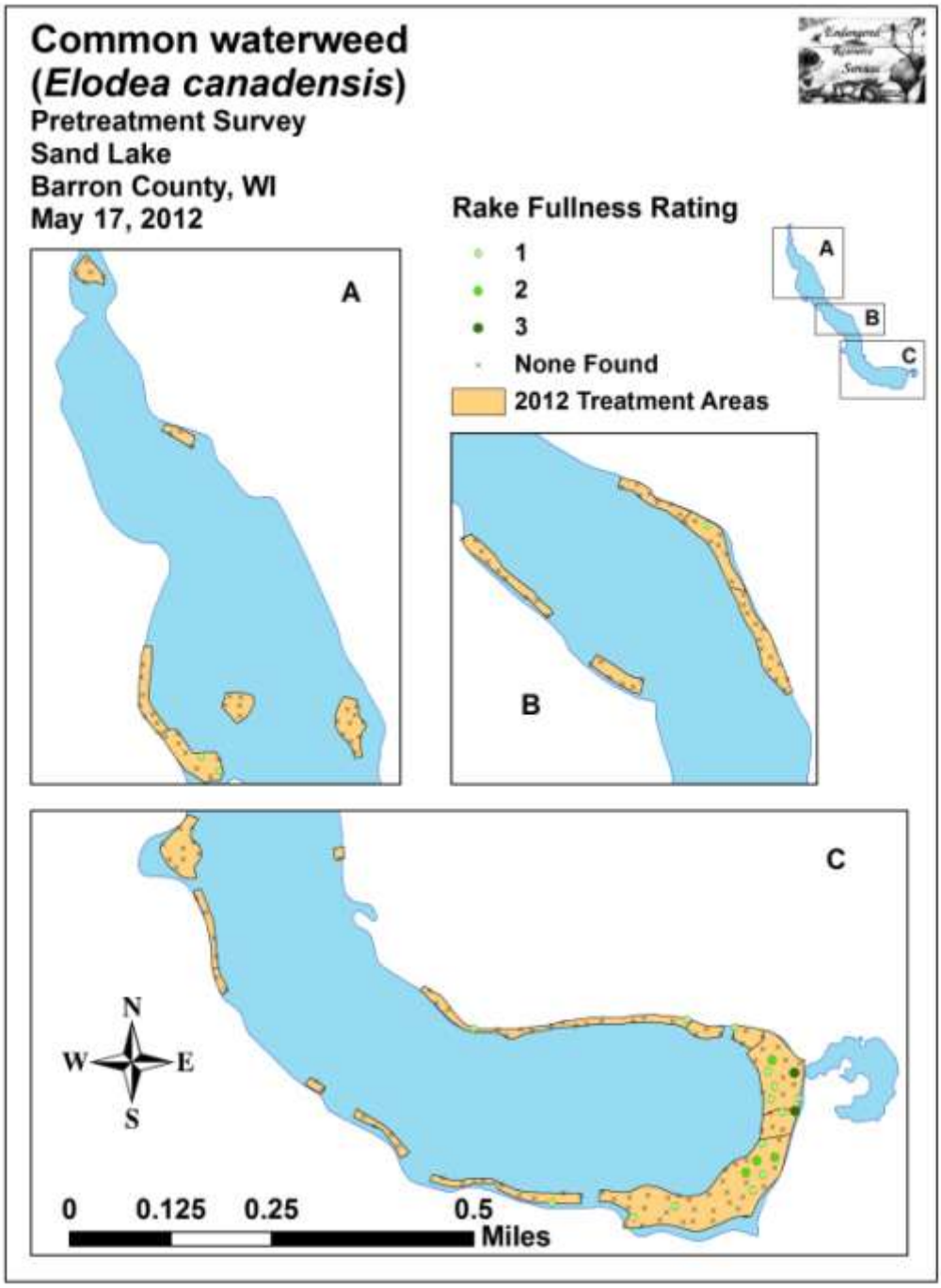

Eurasian water milfoil
(Myriophyllum spicatum)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

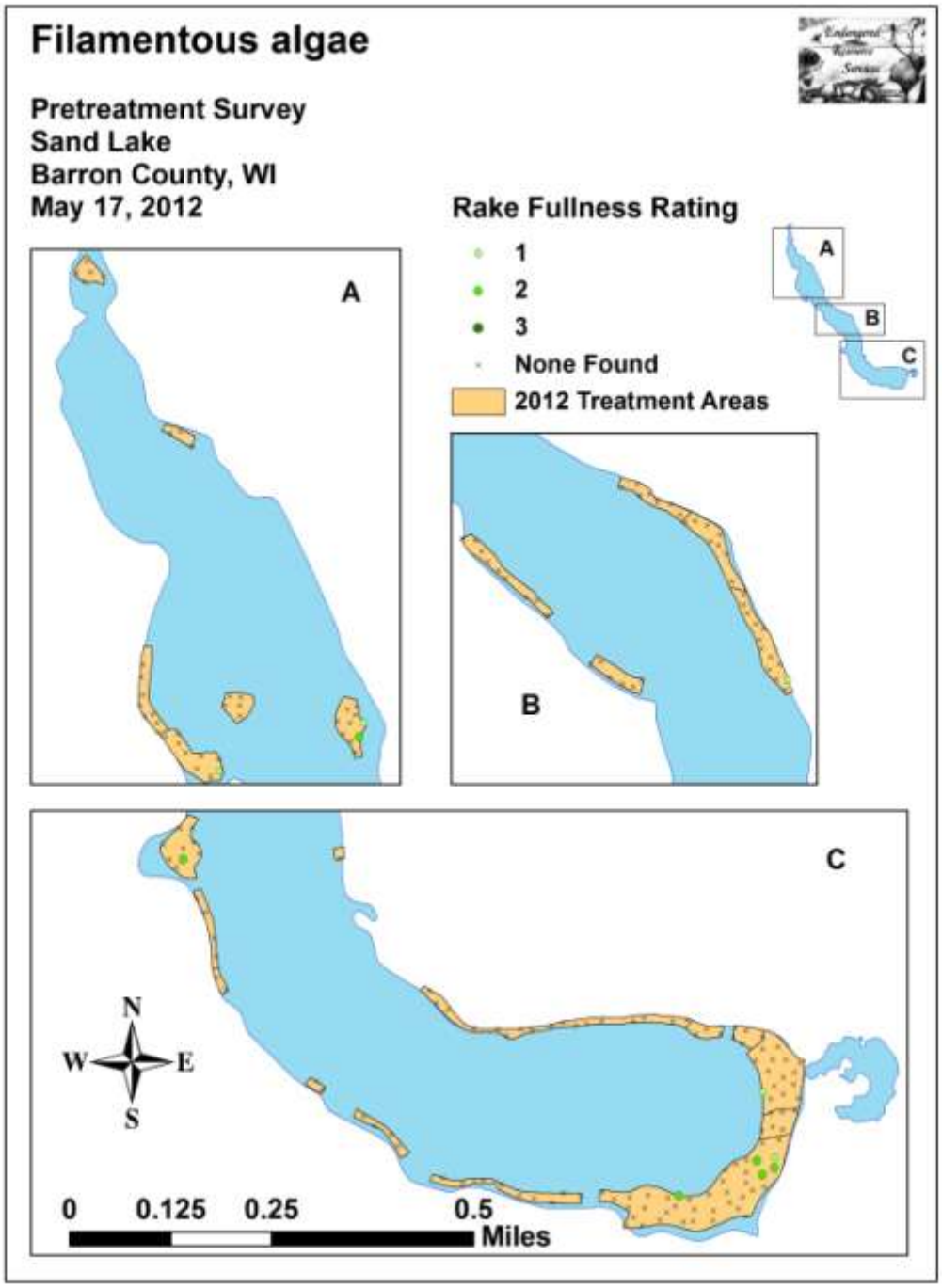

Eurasian water milfoil
(Myriophyllum spicatum)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
Visual
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

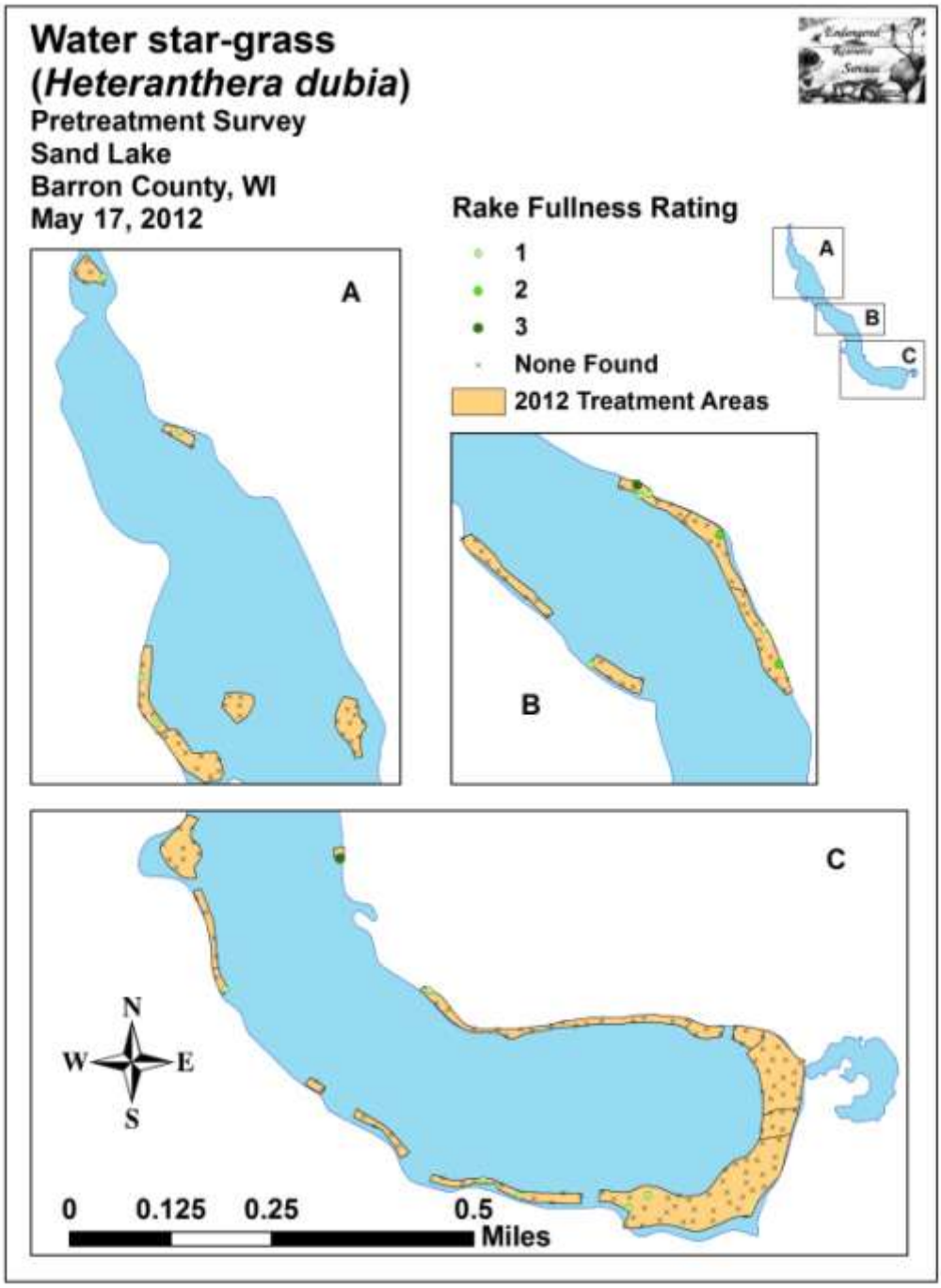
Appendix VI: Pretreatment Native Species Density and Distribution

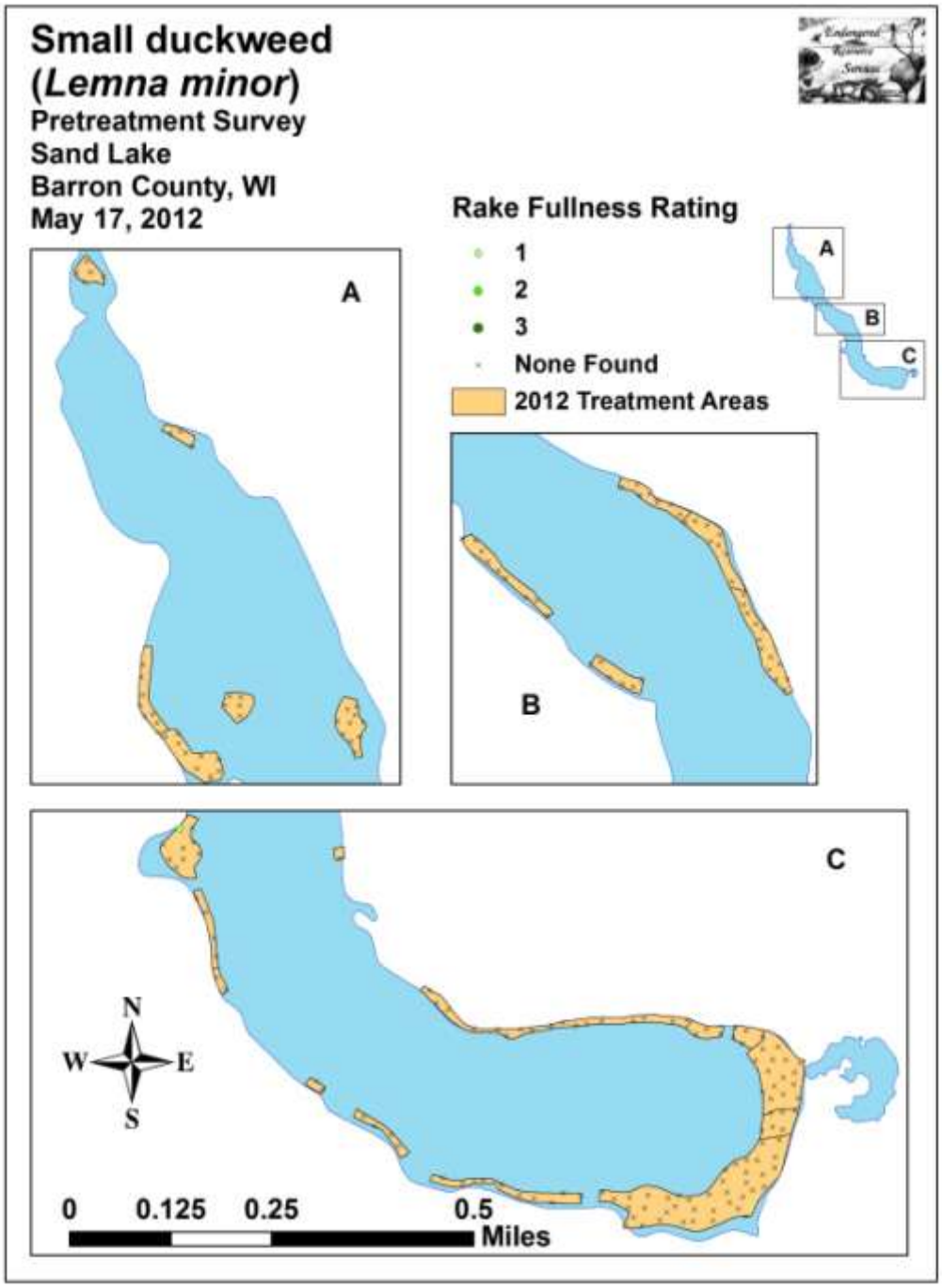

Coontail
(Ceratophyllum demersum)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

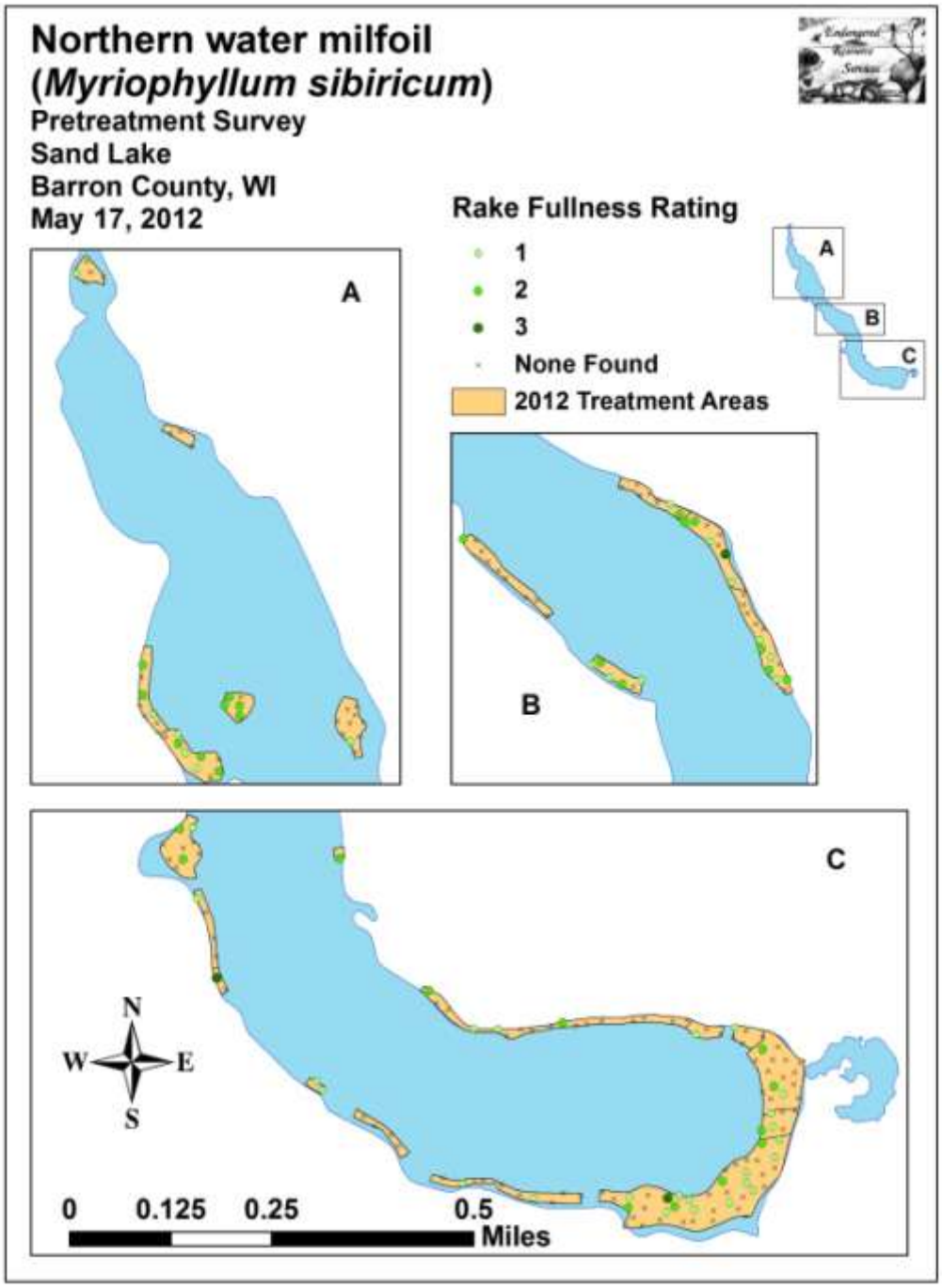

Muskgrass
(Chara sp.)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

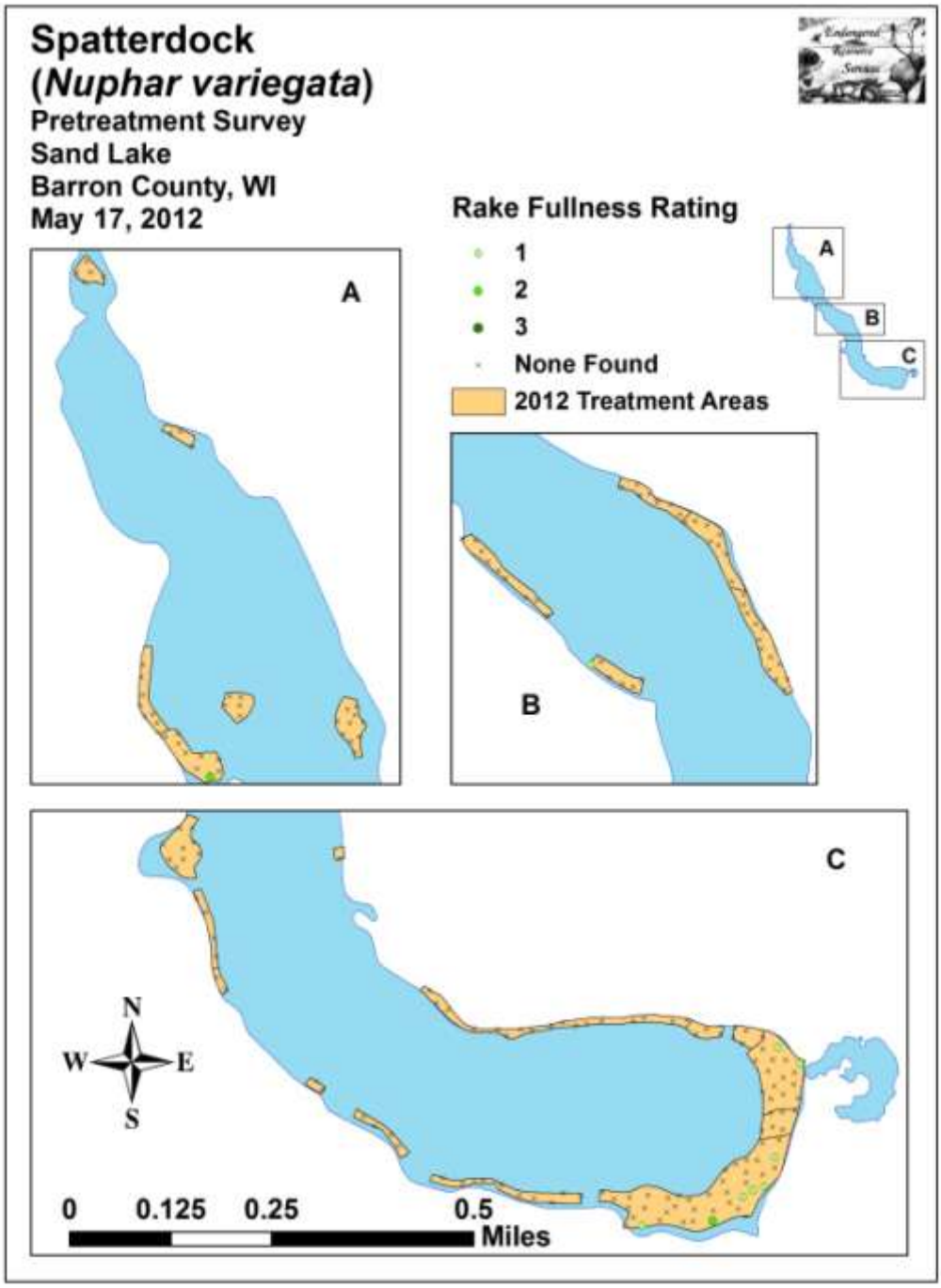

Common waterweed
(Elodea canadensis)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

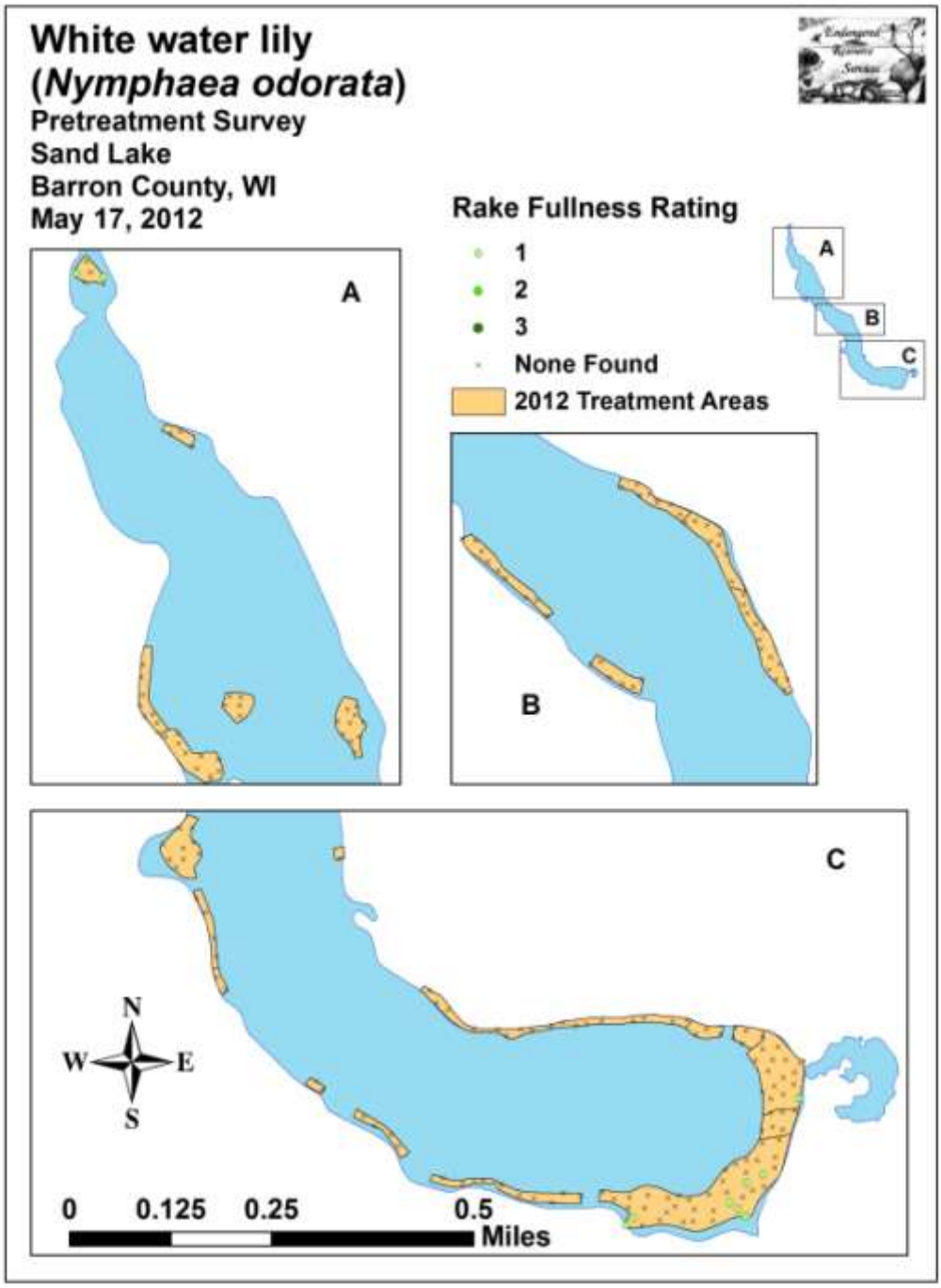

Filamentous algae
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

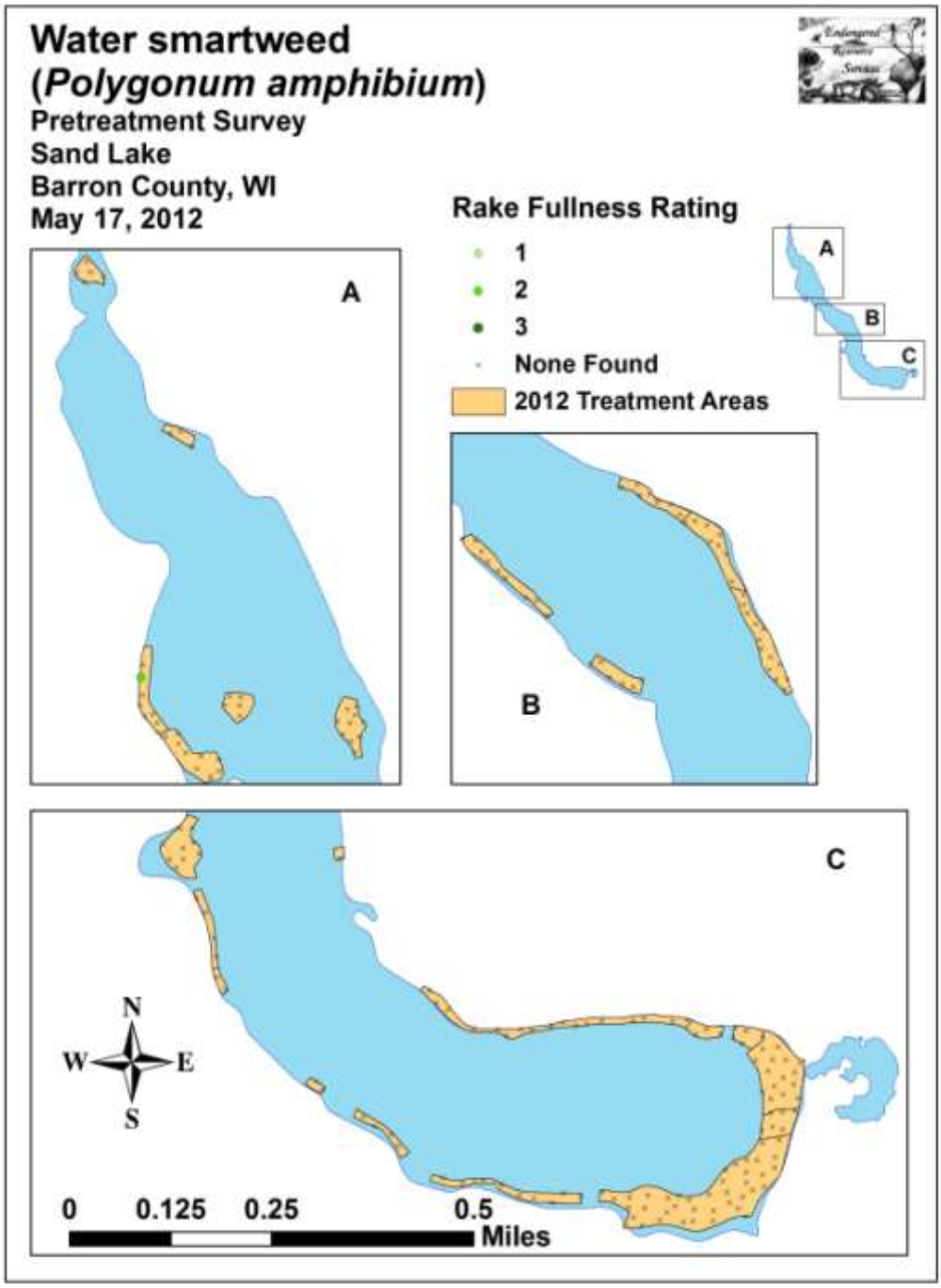

Water star-grass
(Heteranthera dubia)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

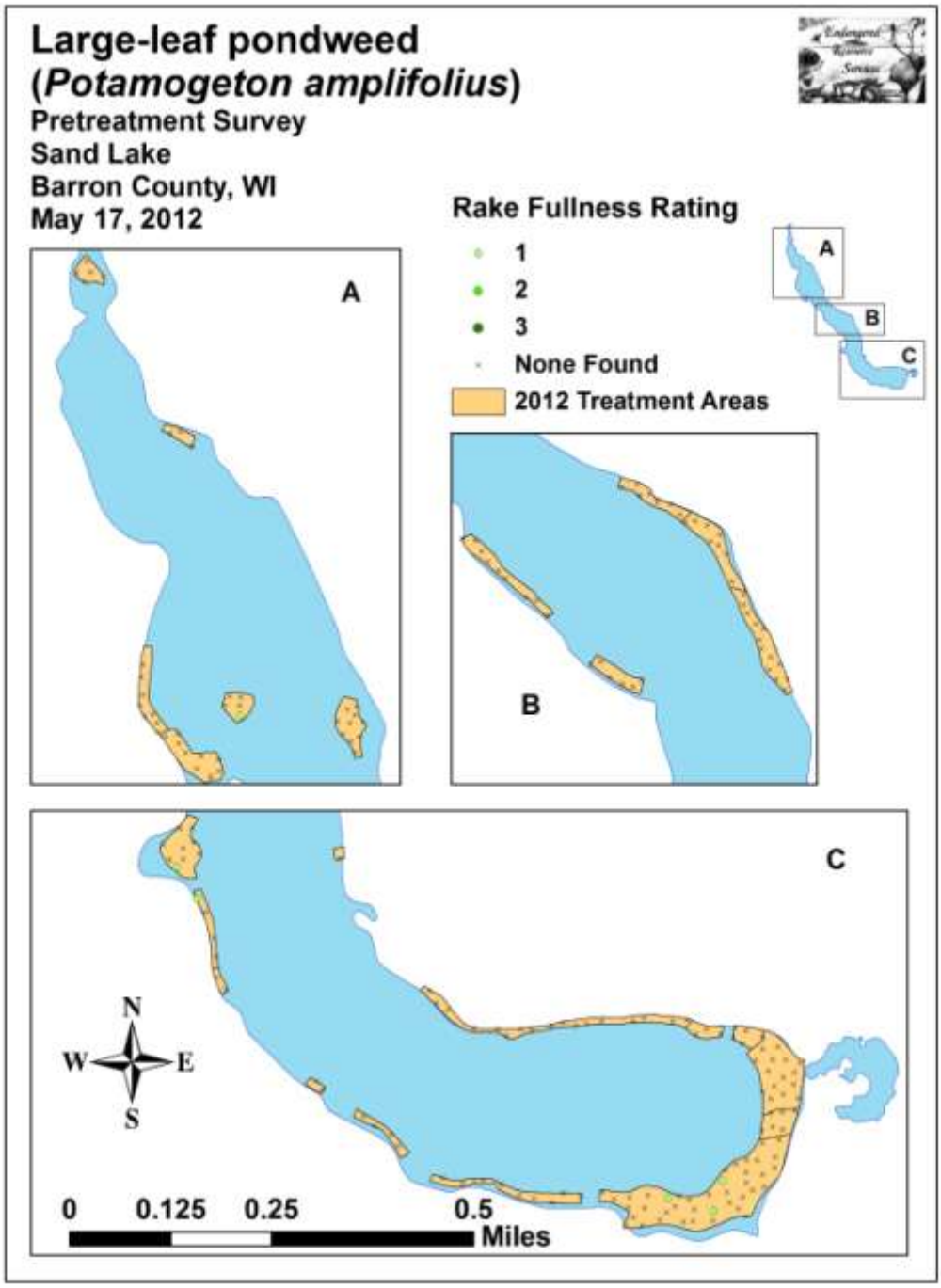

Small duckweed
(Lemna minor)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

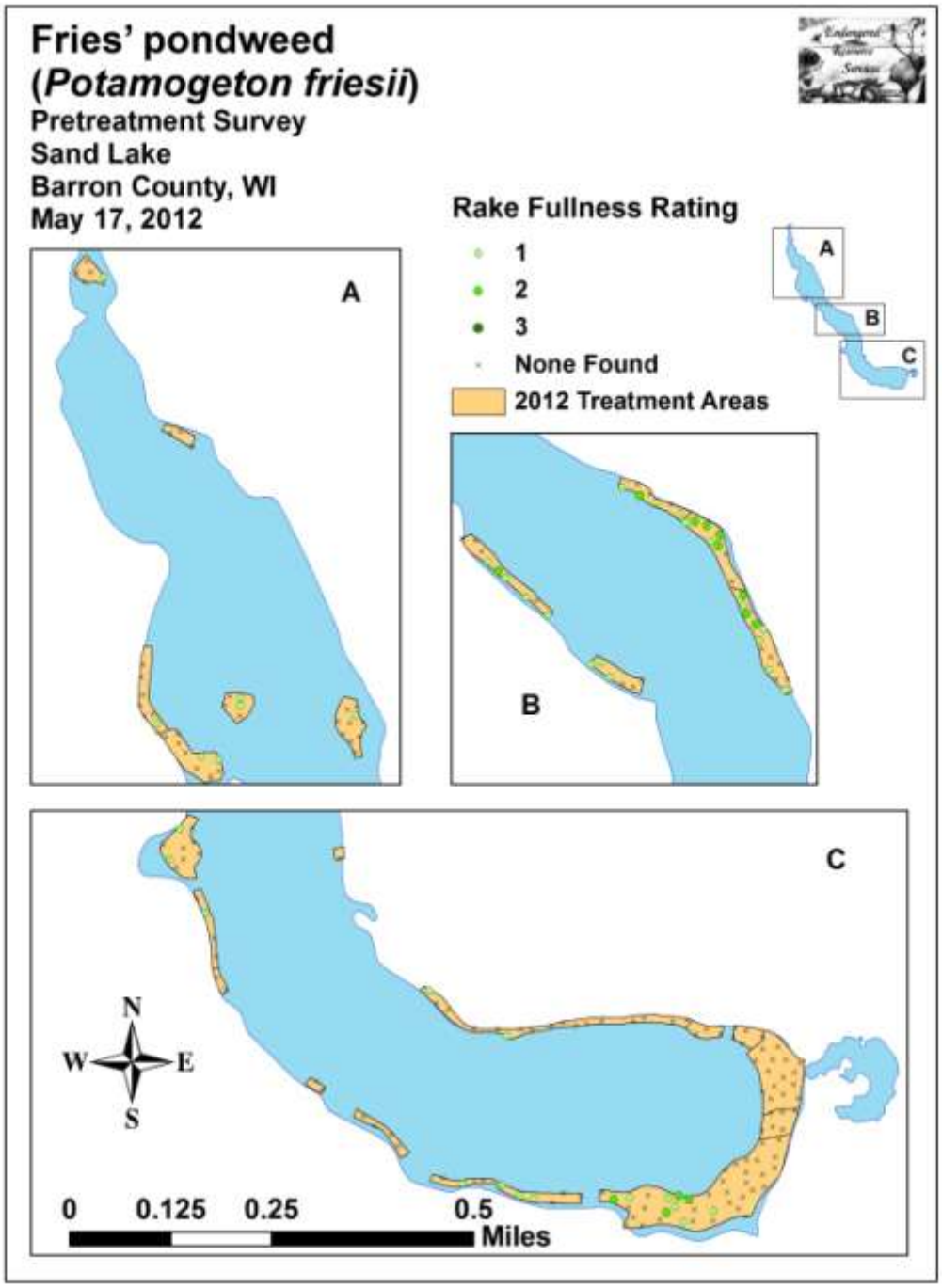

Northern water milfoil
(Myriophyllum sibiricum)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

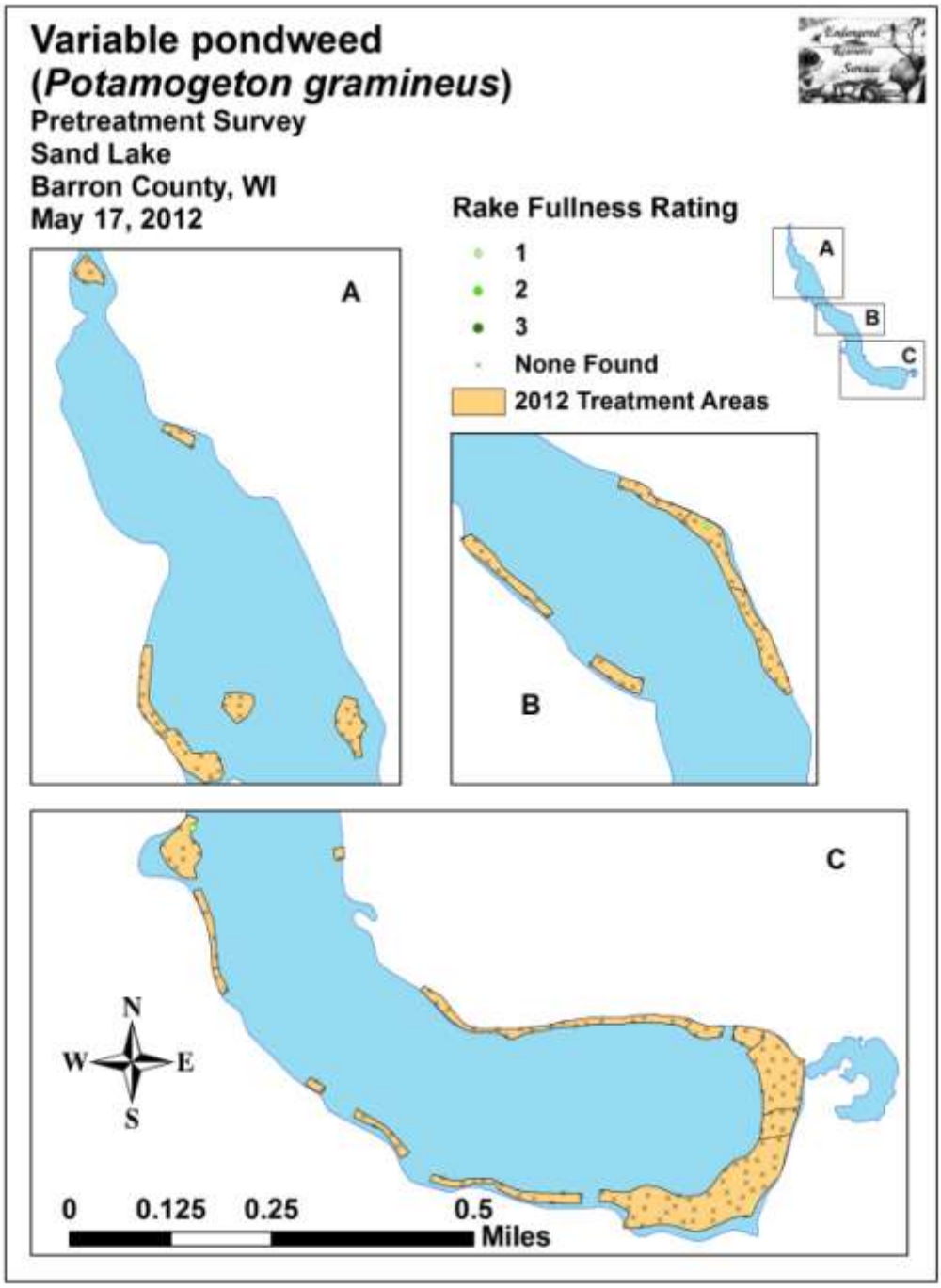

Spatterdock
(Nuphar variegata)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

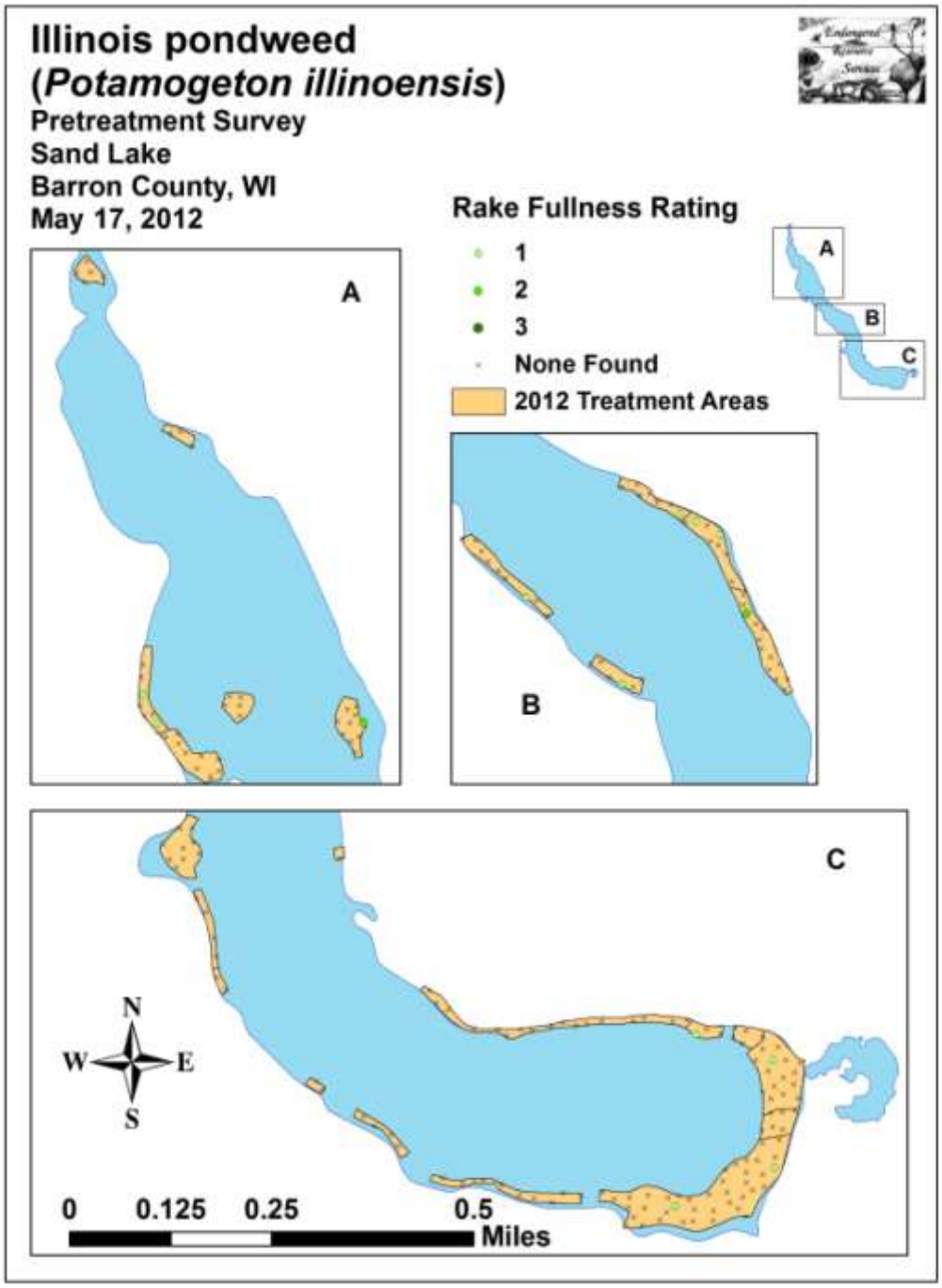

White water lily
(Nymphaea odorata)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

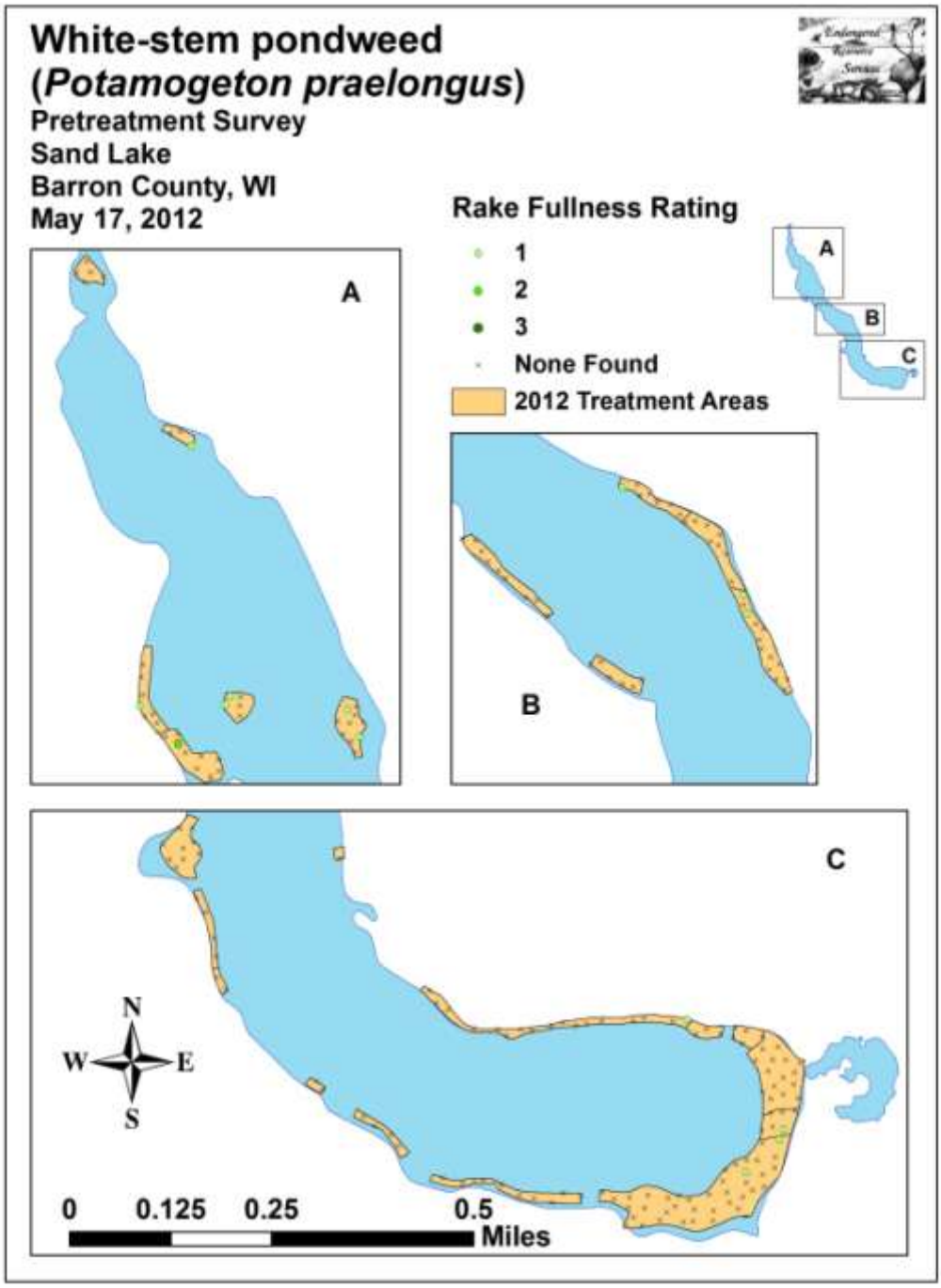

Water smartweed
(Polygonum amphibium)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

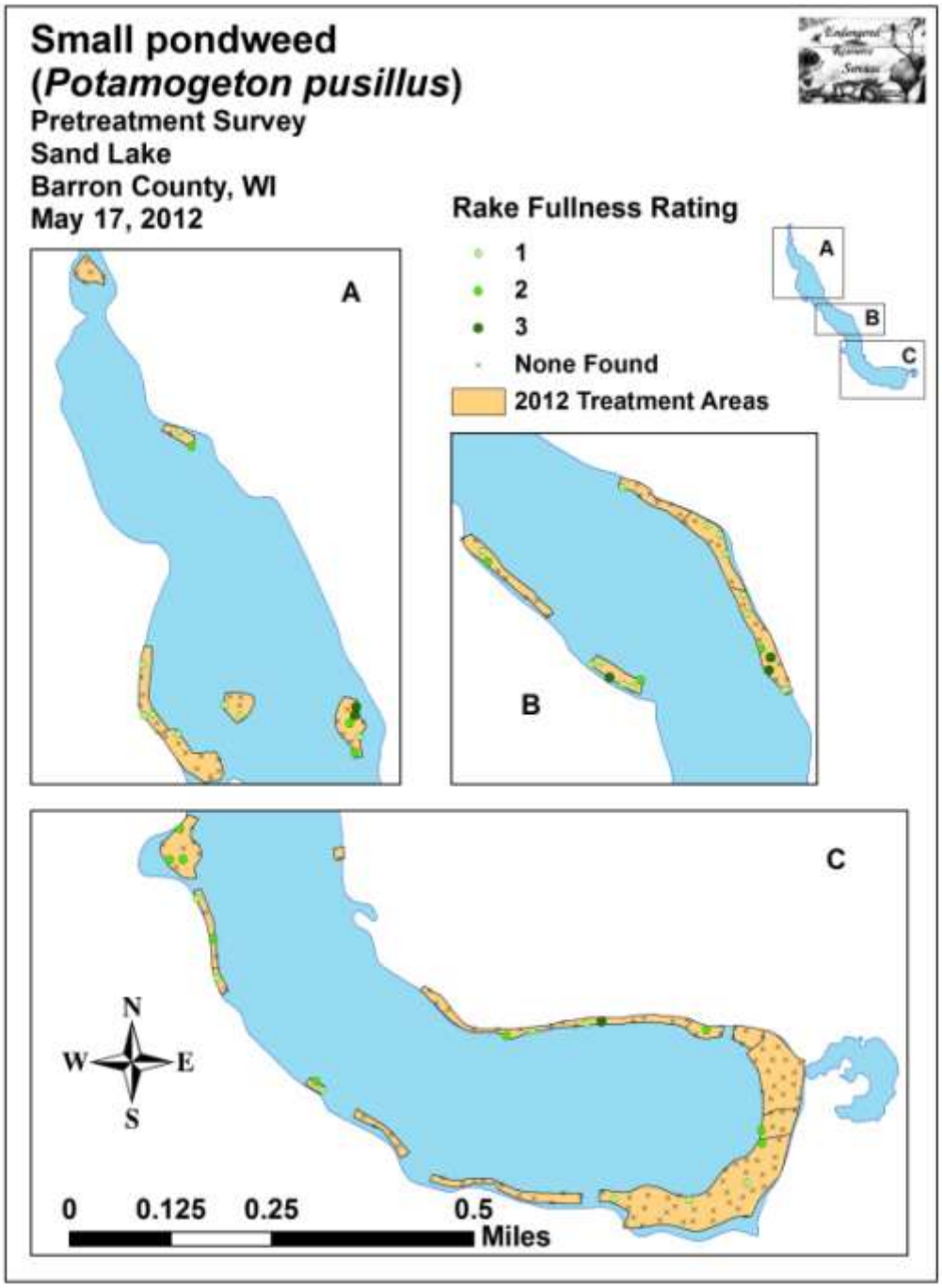

Large-leaf pondweed
(Potamogeton amplifolius)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

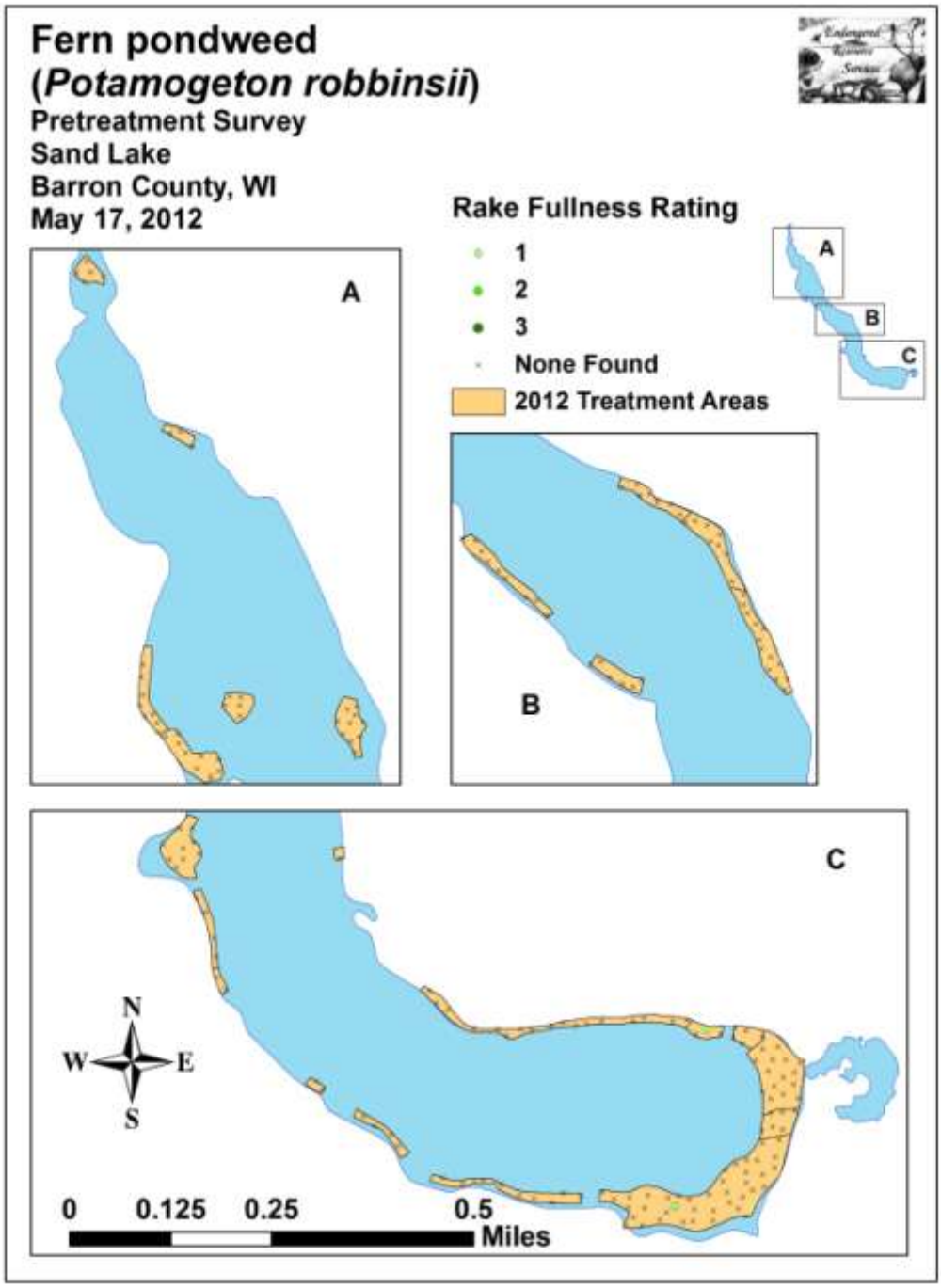

Fries' pondweed
(Potamogeton friesii)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

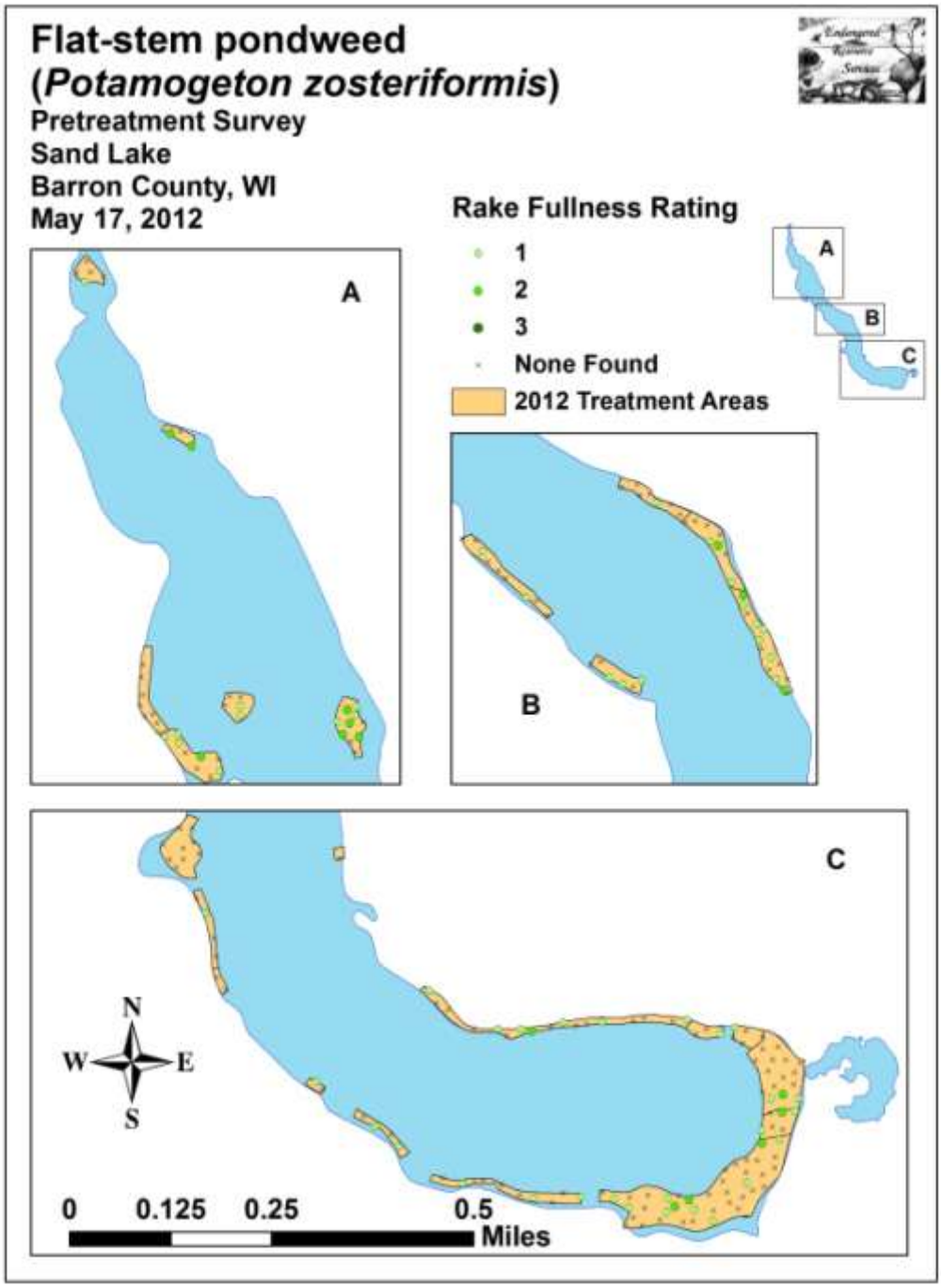

Variable pondweed
(Potamogeton gramineus)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

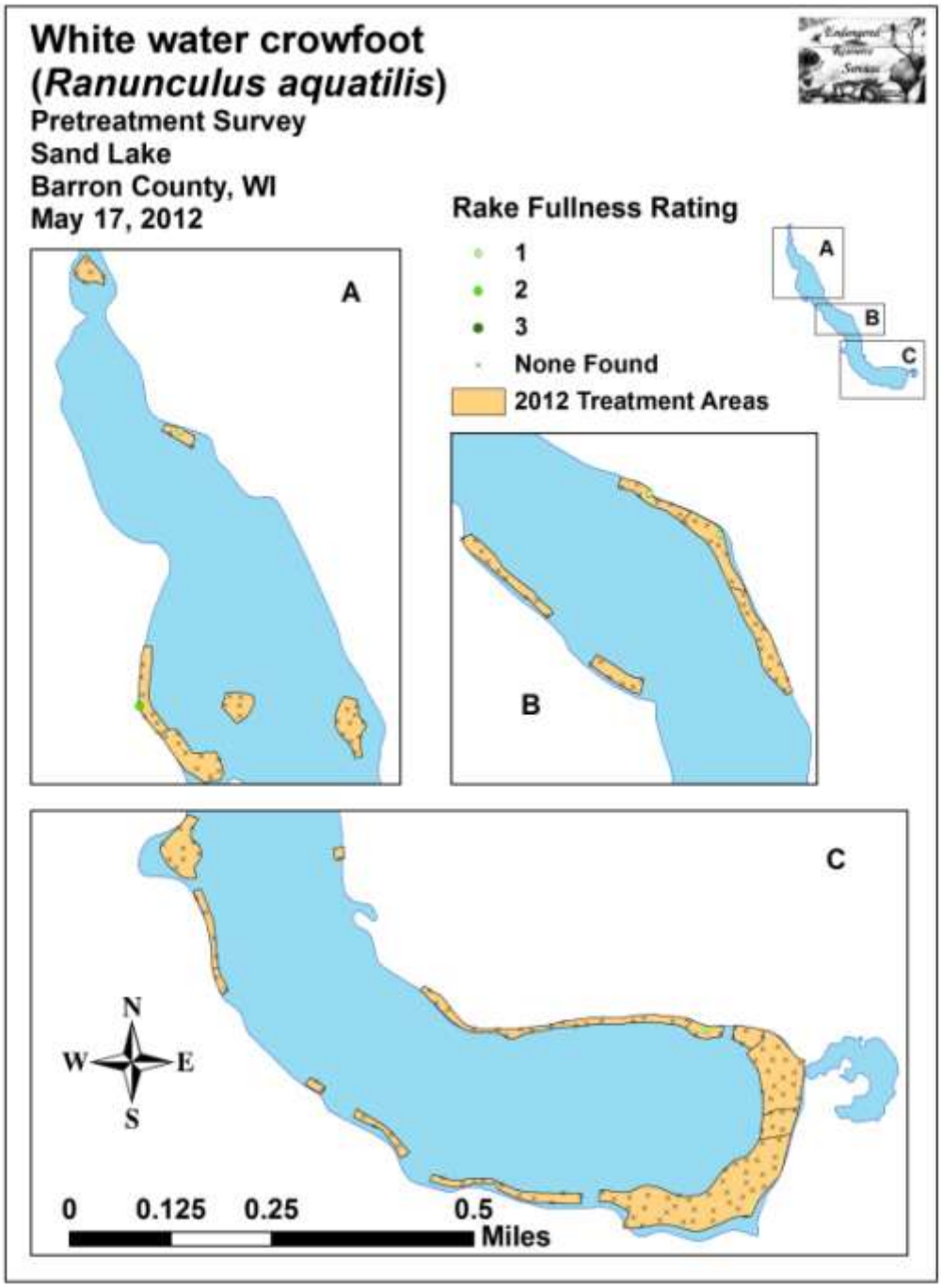

Illinois pondweed
(Potamogeton illinoensis)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles


White-stem pondweed
(Potamogeton praelongus)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

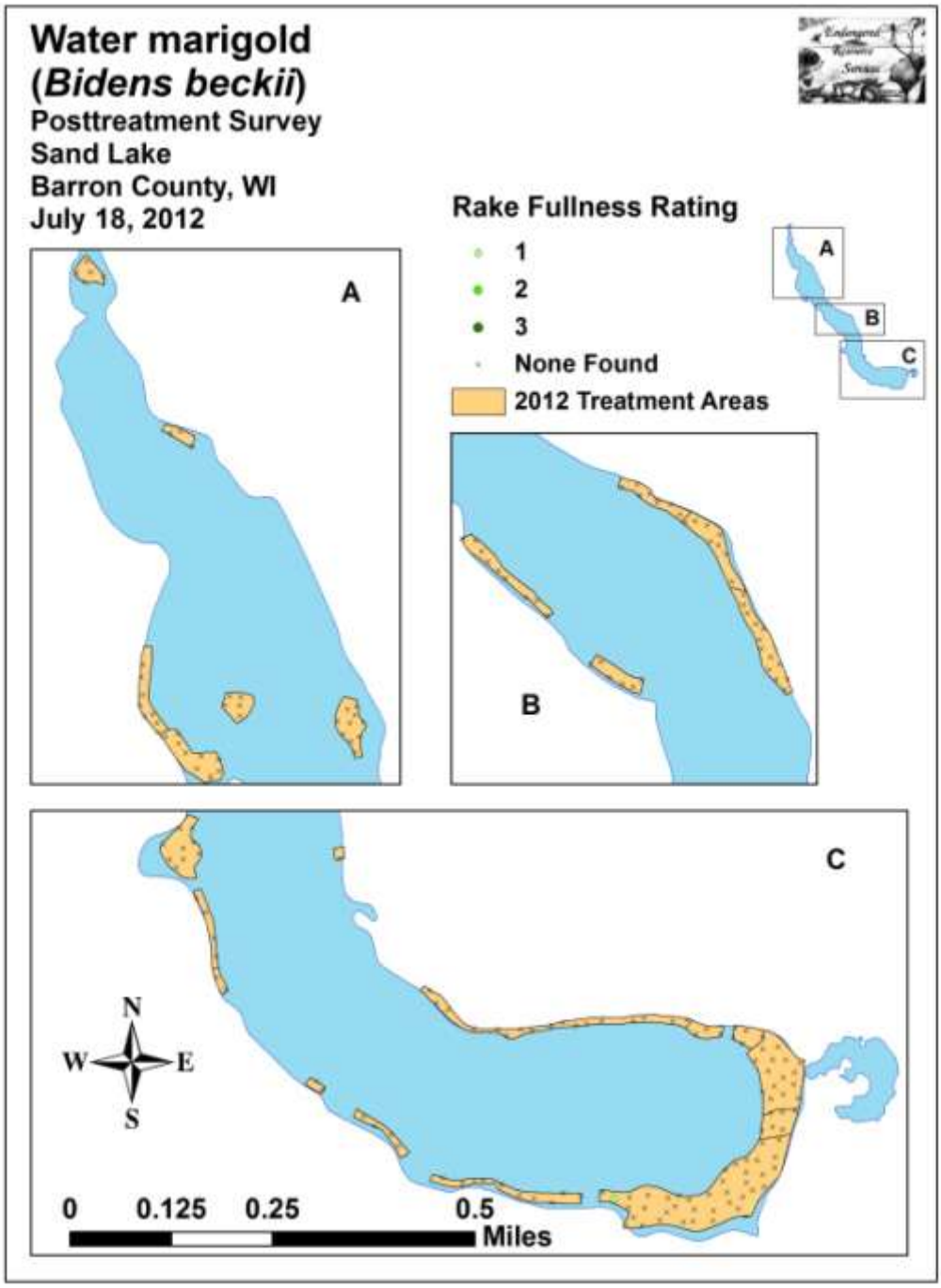

Small pondweed
(Potamogeton pusillus)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

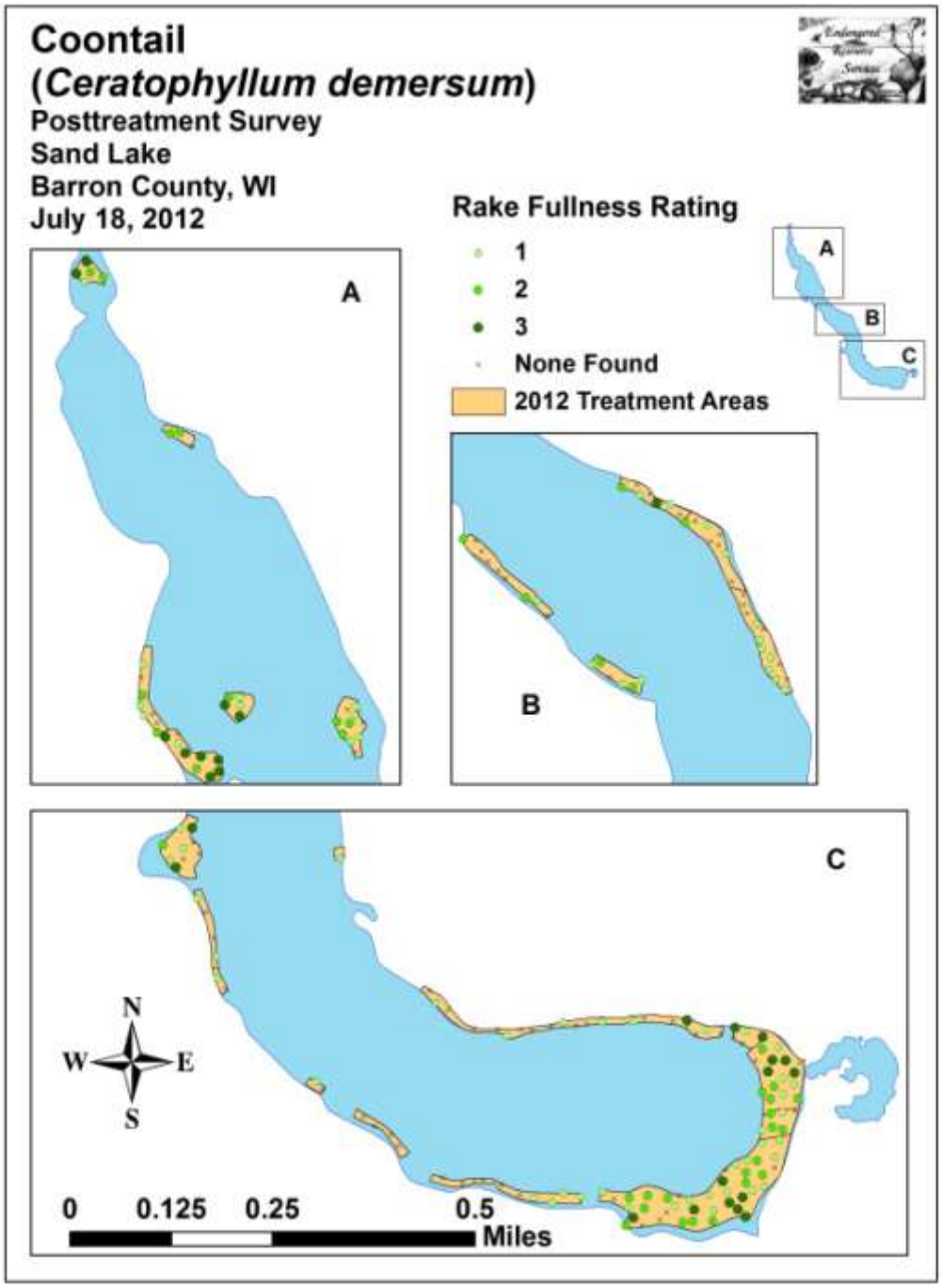

Fern pondweed
(Potamogeton robbinsii)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

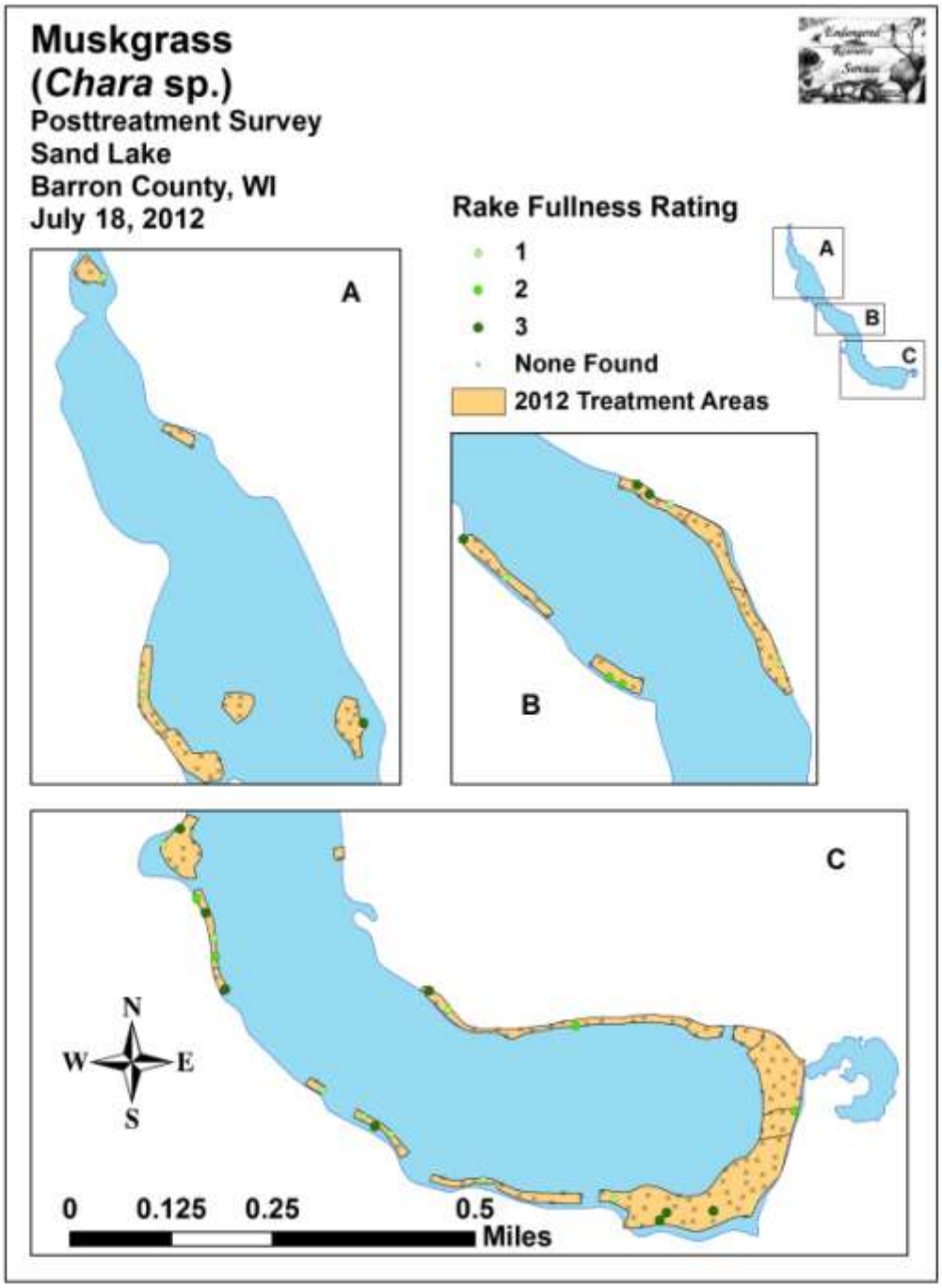

Flat-stem pondweed
(Potamogeton zosteriformis)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

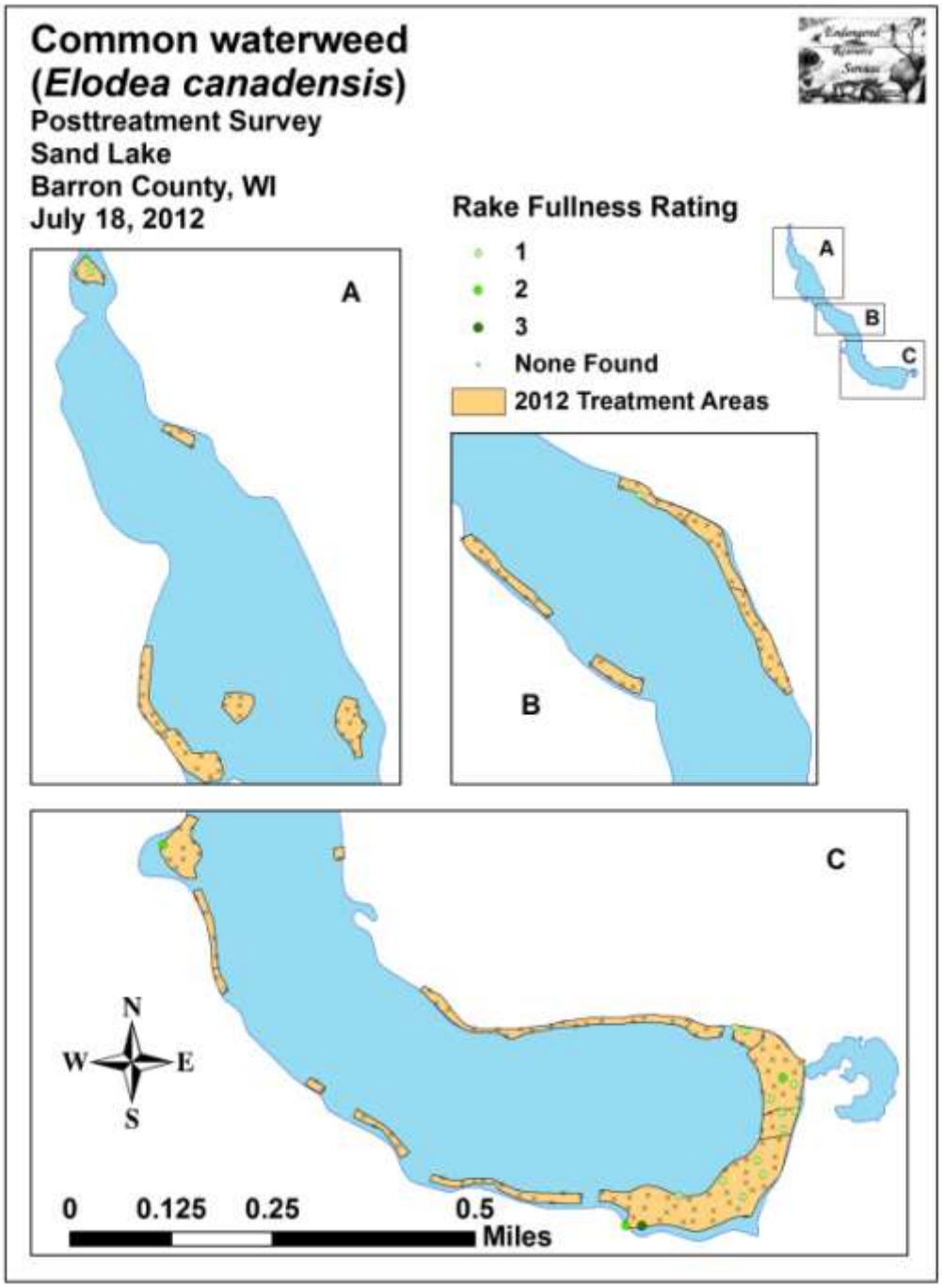

White water crowfoot
(Ranunculus aquatilis)
Pretreatment Survey
Sand Lake
Barron County, WI
May 17, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

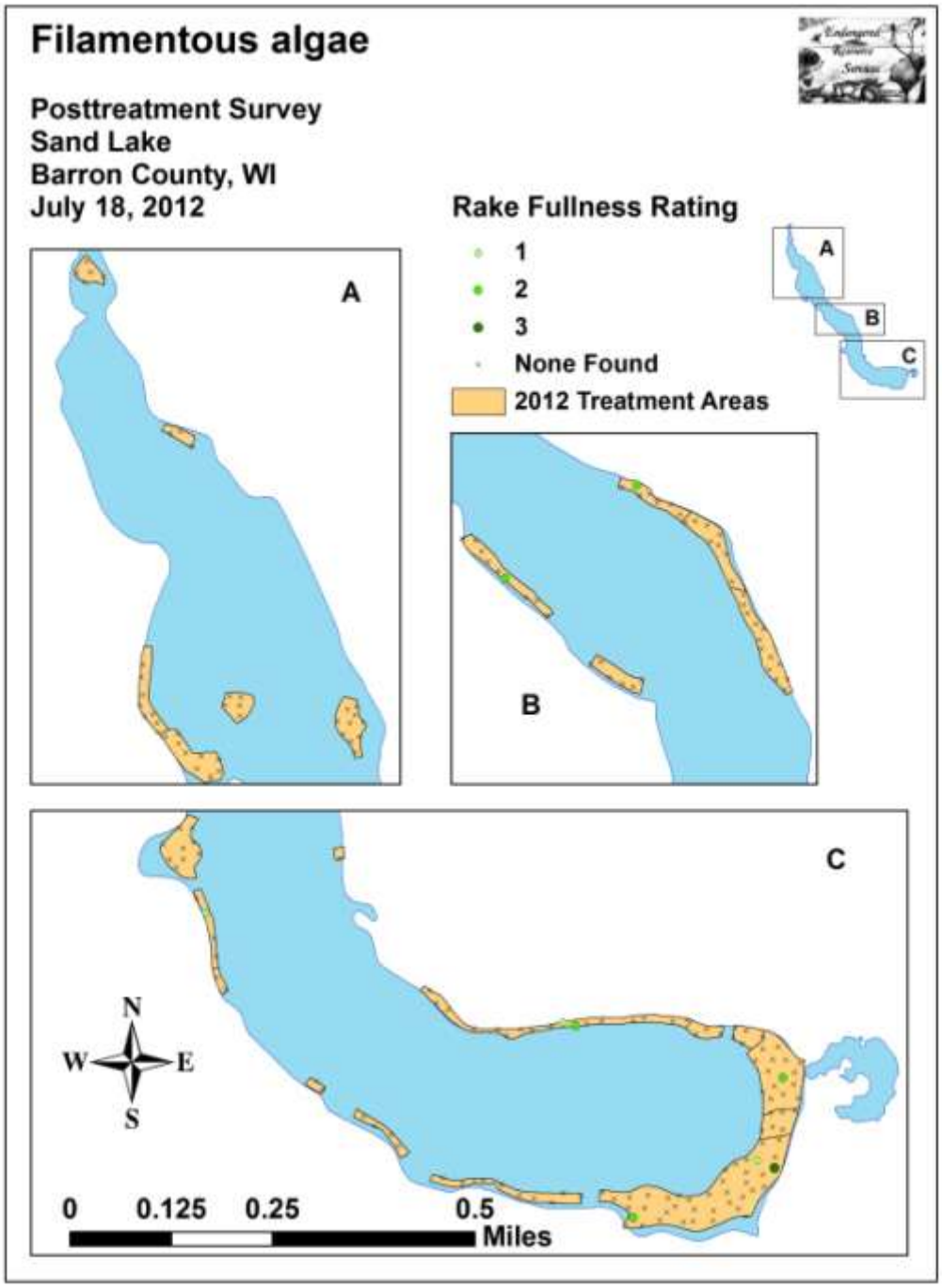
Appendix VII: Posttreatment Native Species Density and Distribution

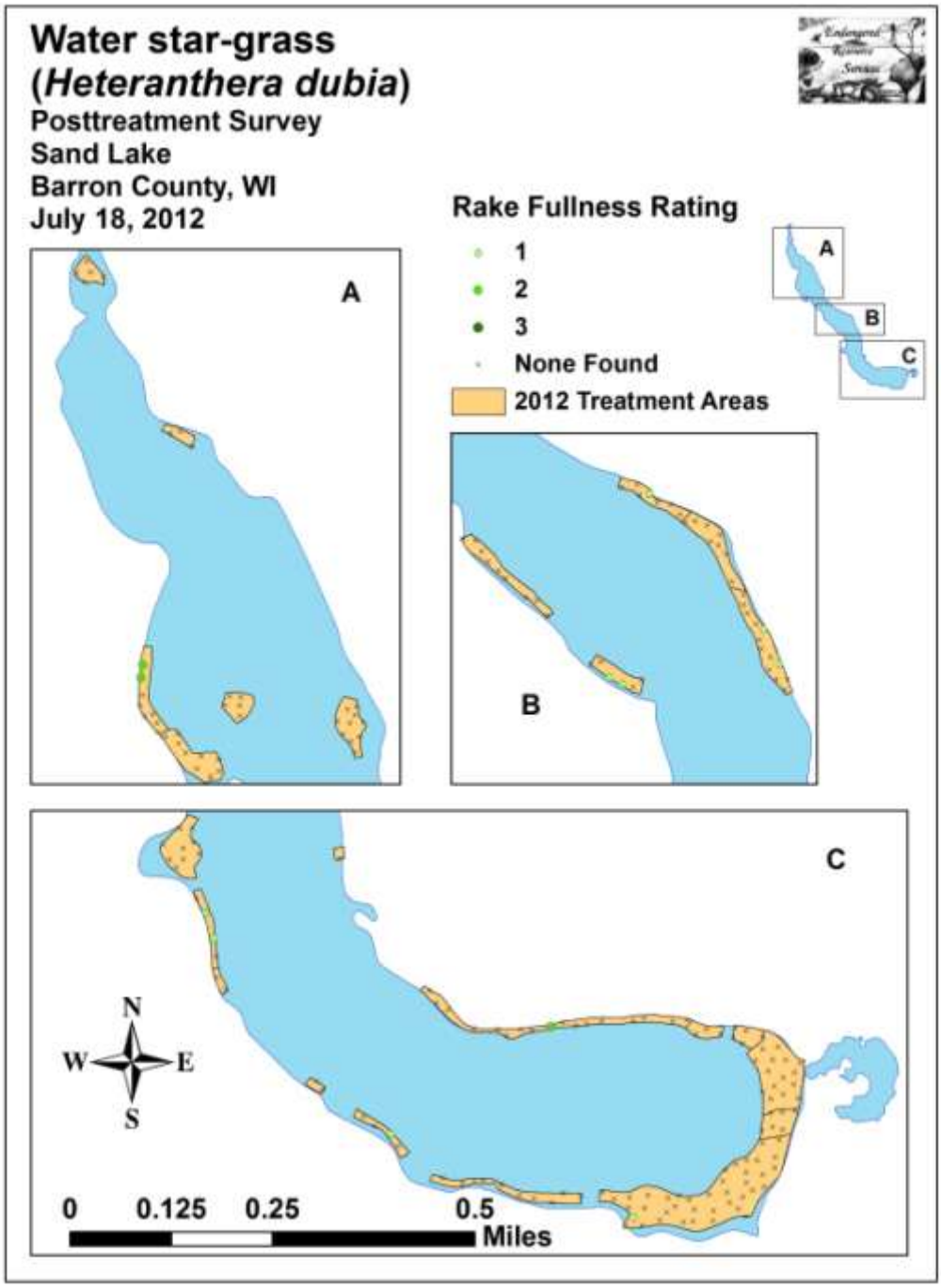

Water marigold
(Bidens beckii)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

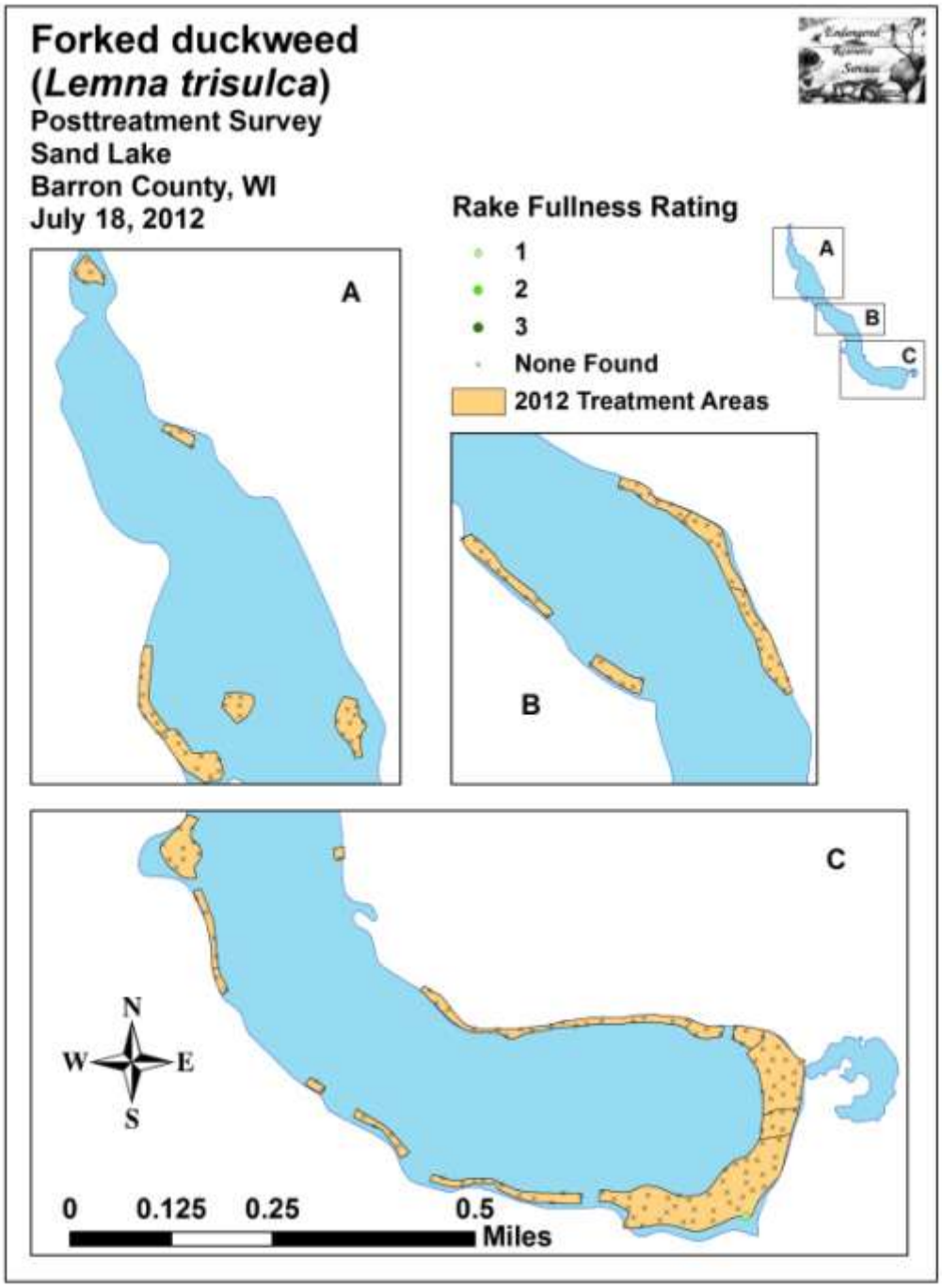

Coontail
(Ceratophyllum demersum)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

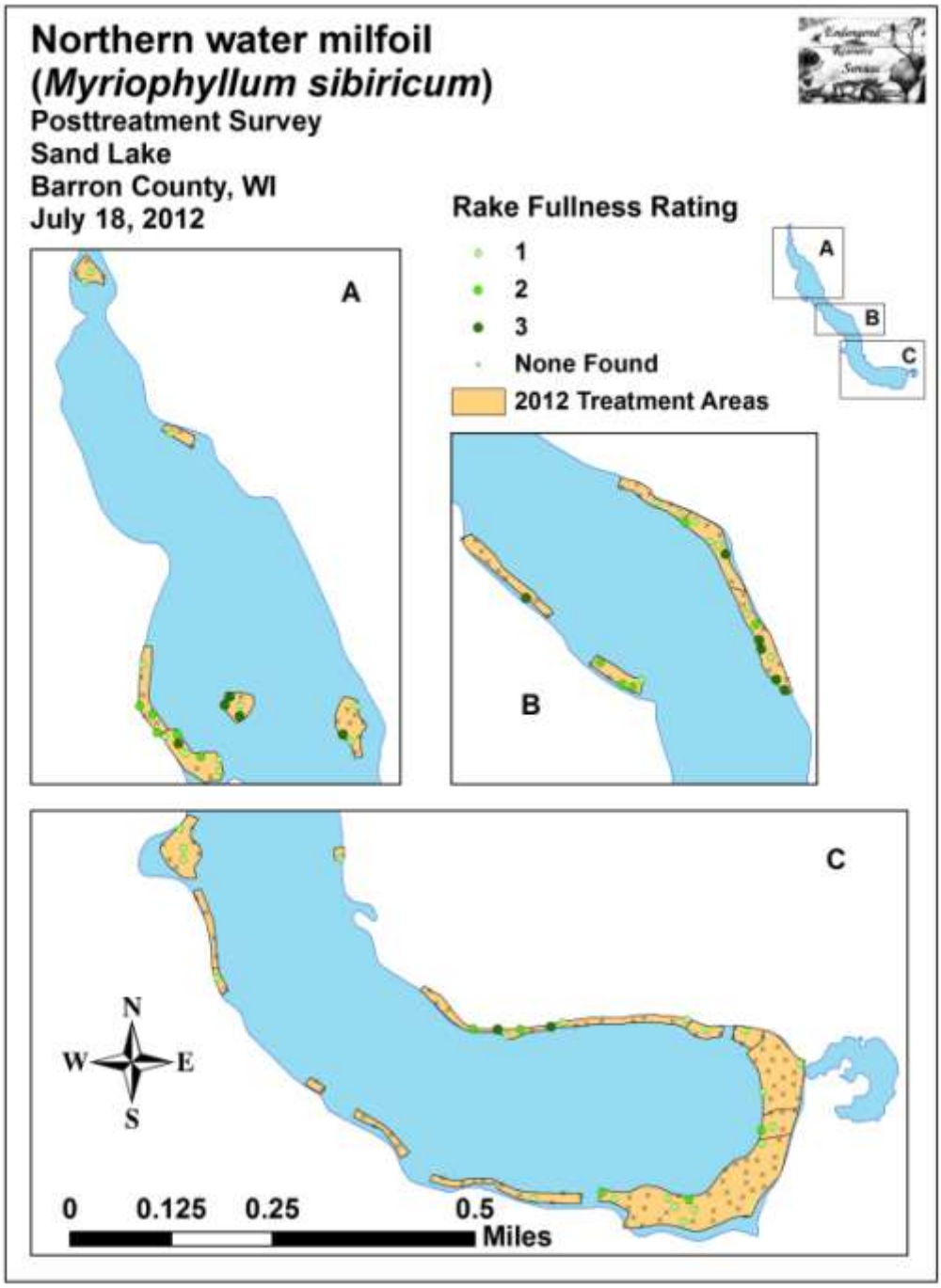

Muskgrass
(Chara sp.)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

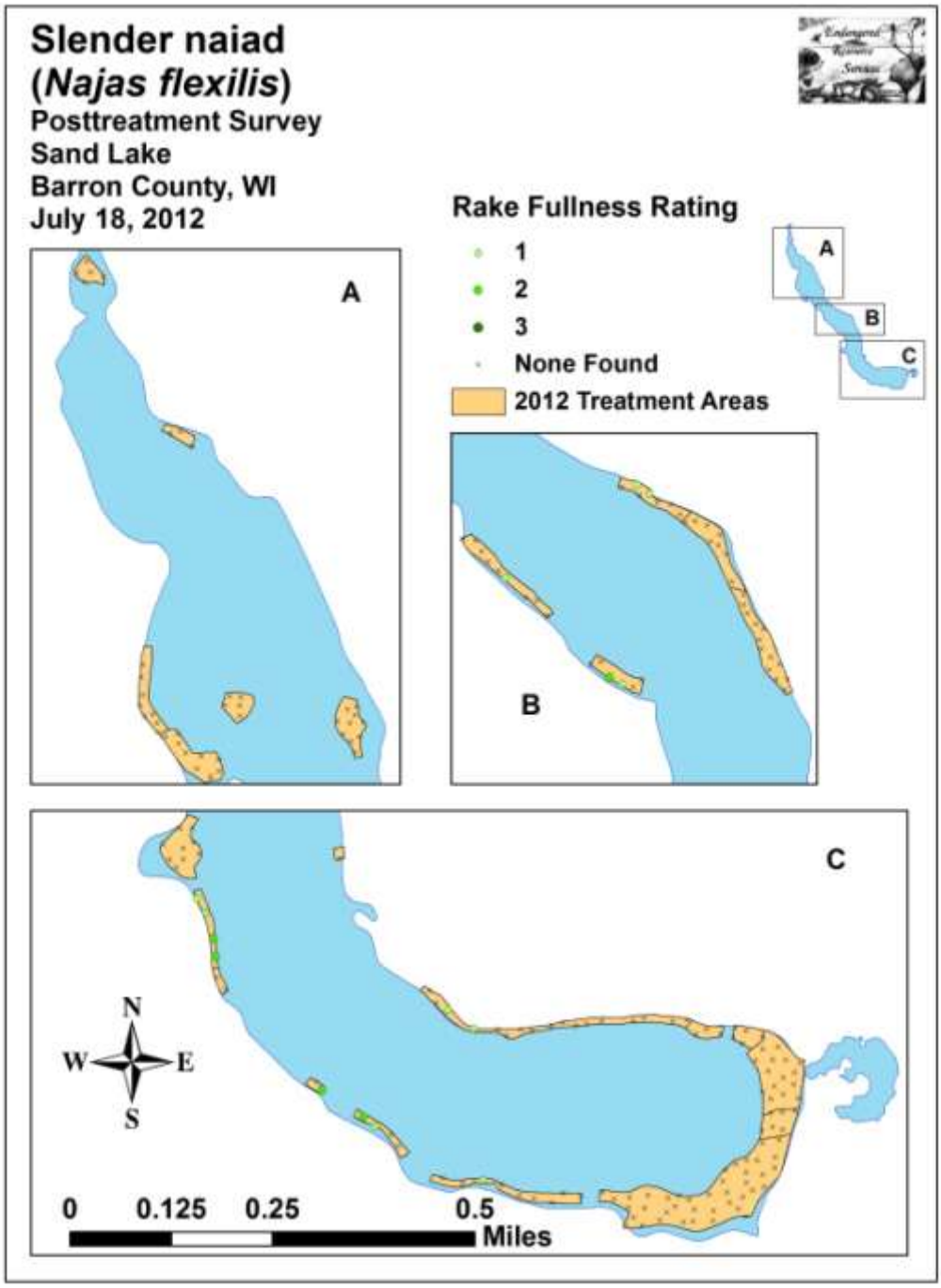

Common waterweed
(Elodea canadensis)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

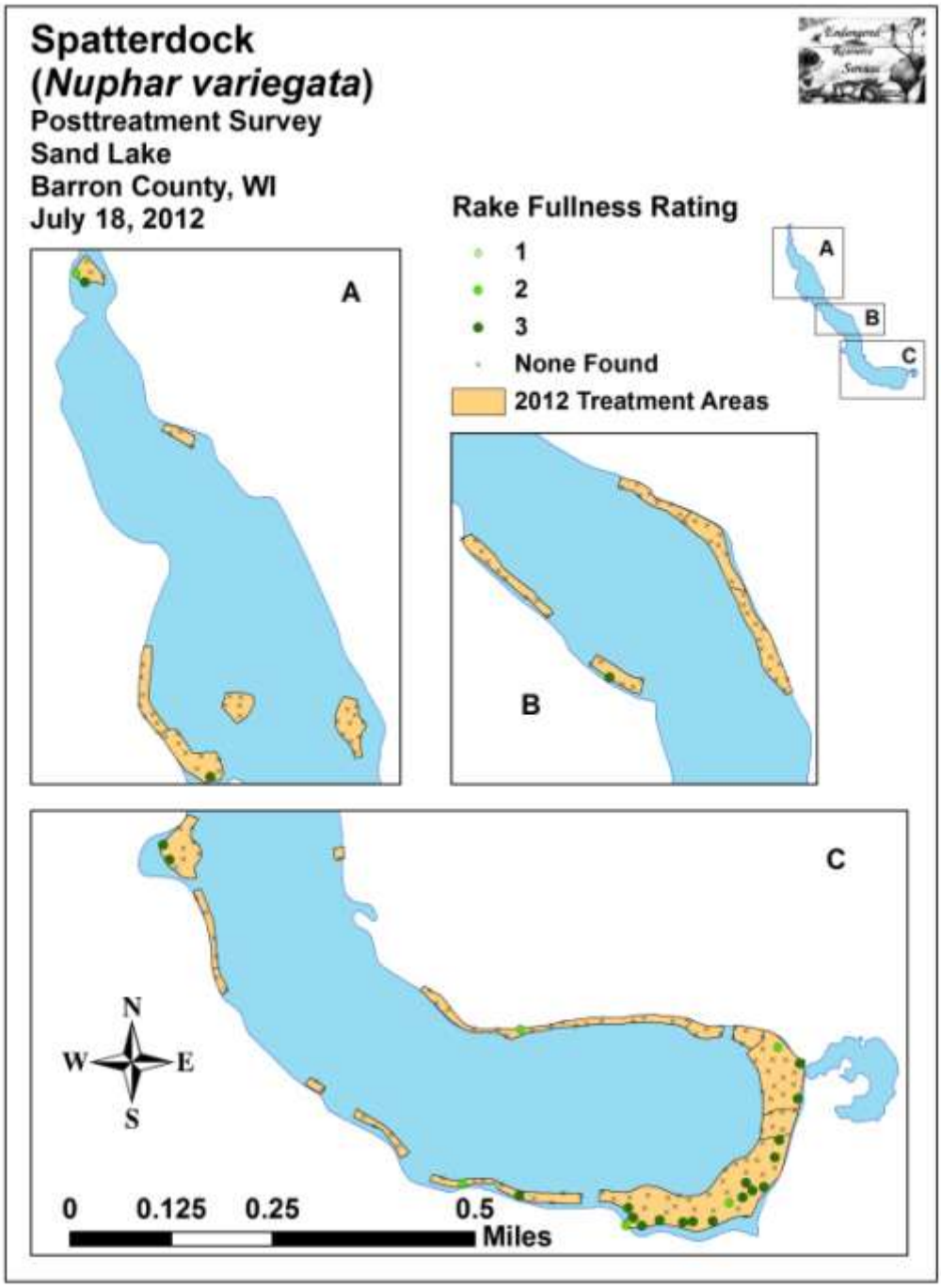

Filamentous algae
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

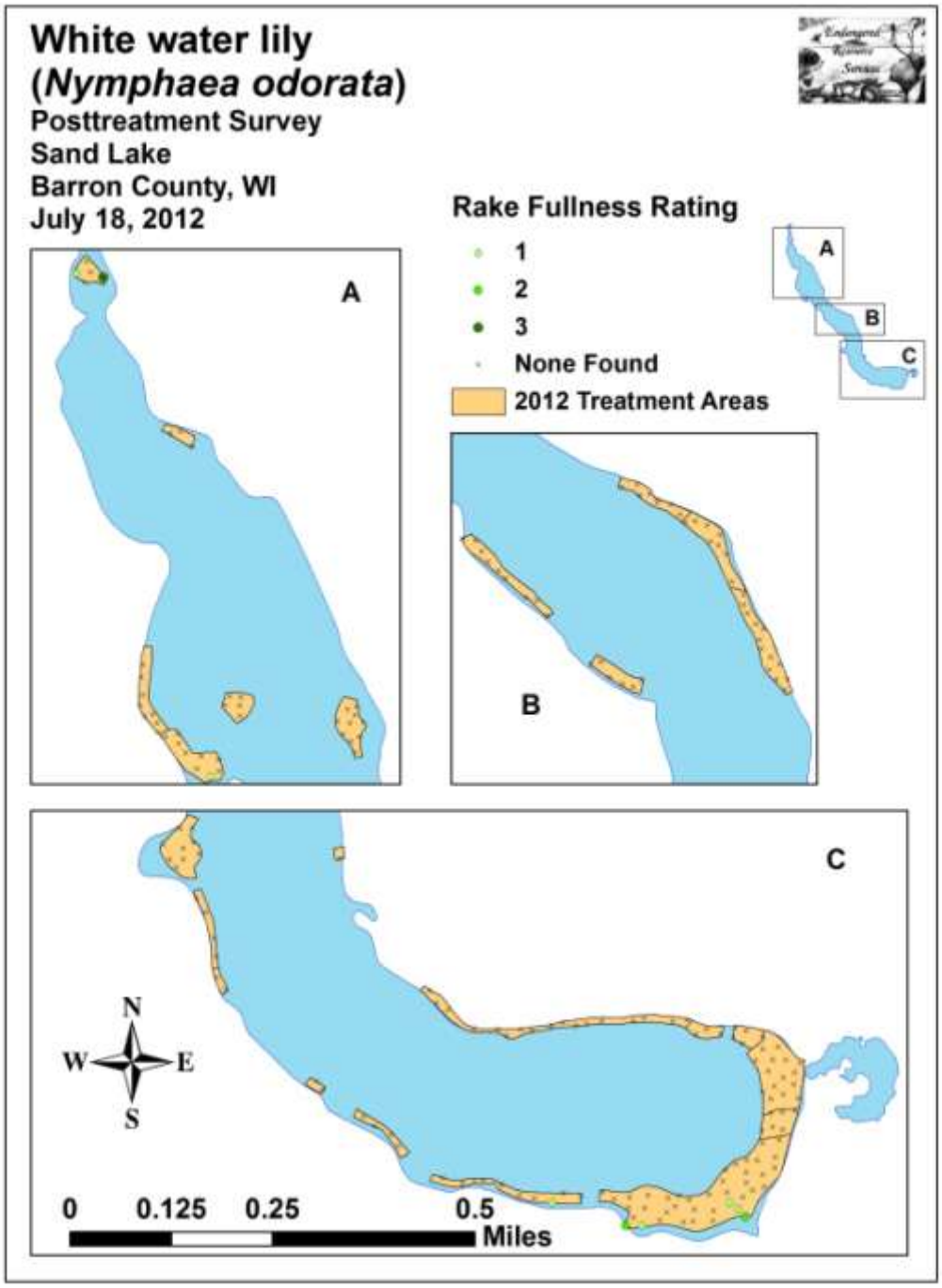

Water star-grass
(Heteranthera dubia)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

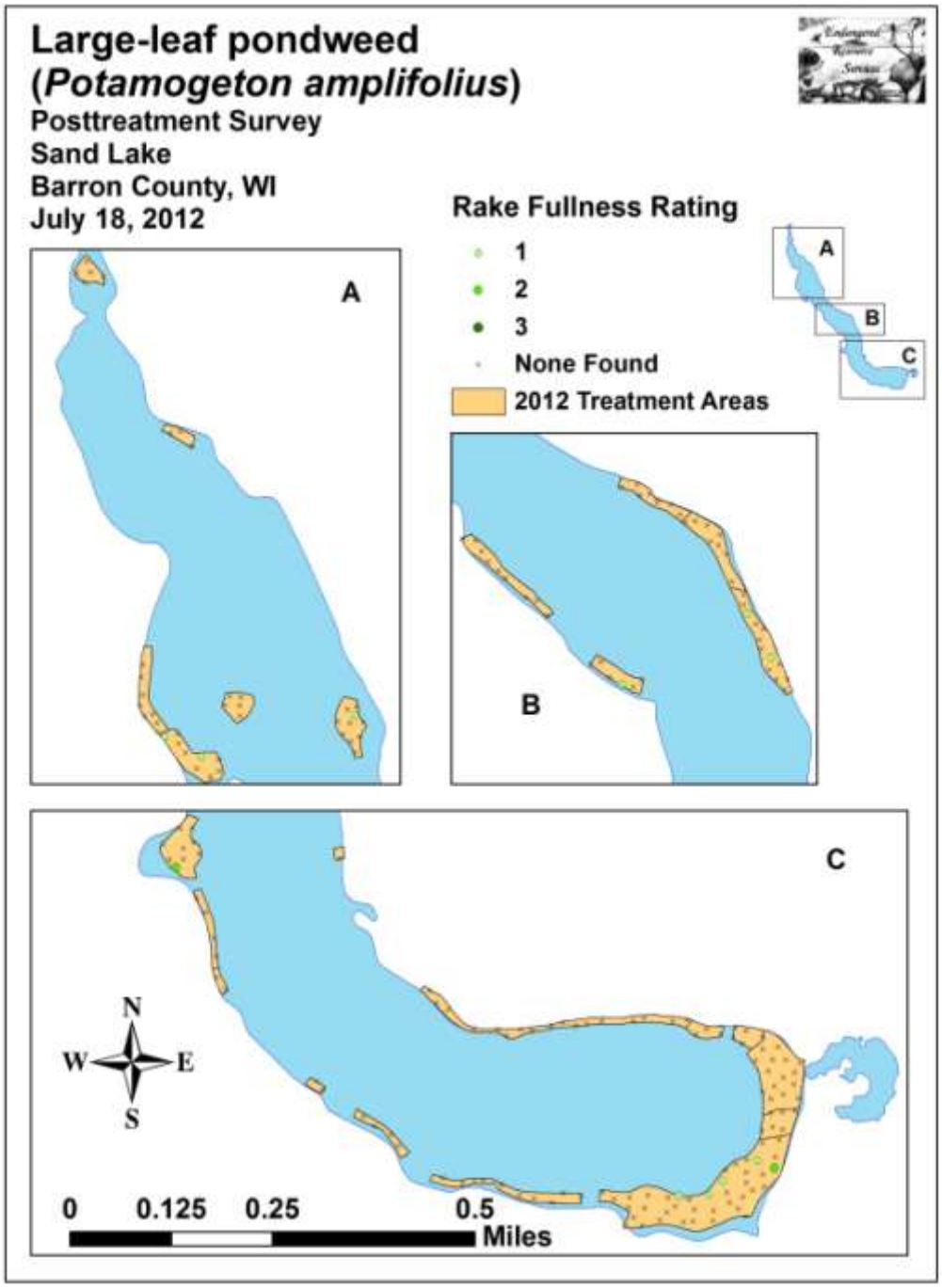

Forked duckweed
(Lemna trisulca)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

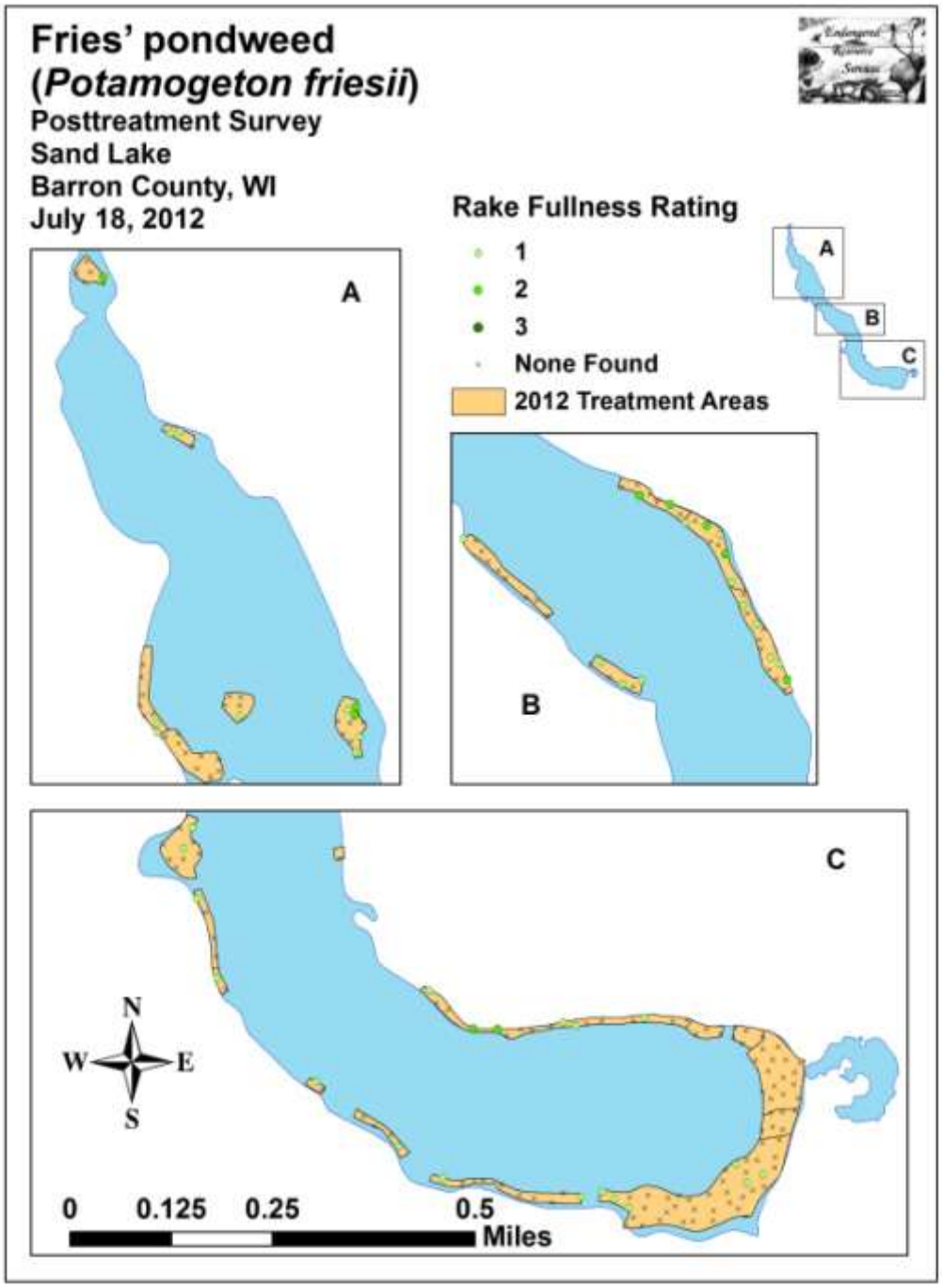

Northern water milfoil
(Myriophyllum sibiricum)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles


Slender naiad
(Najas flexilis)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles


Spatterdock
(Nuphar variegata)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles


White water lily
(Nymphaea odorata)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles


Large-leaf pondweed
(Potamogeton amplifolius)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles


Fries' pondweed
(Potamogeton friesii)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
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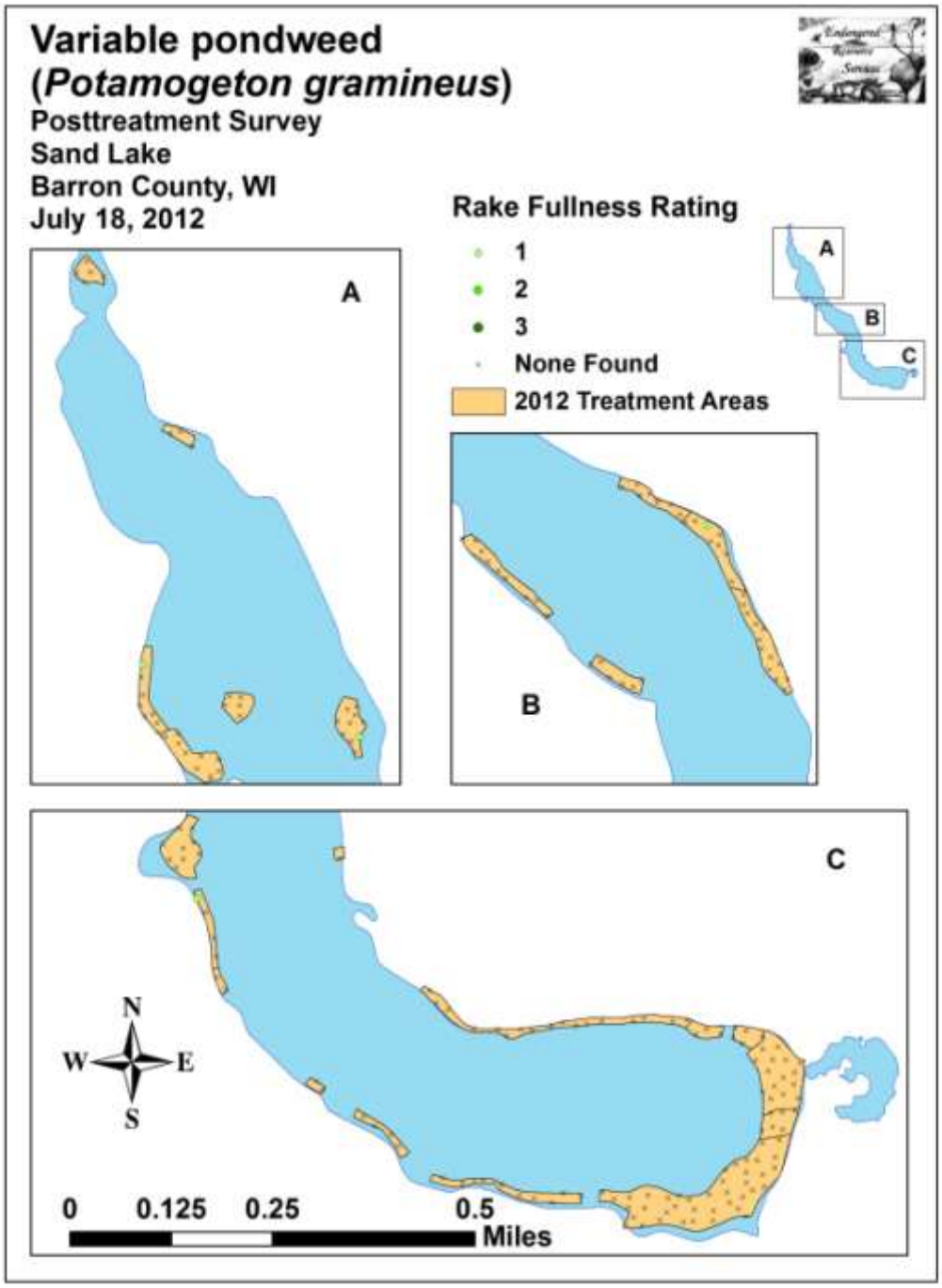
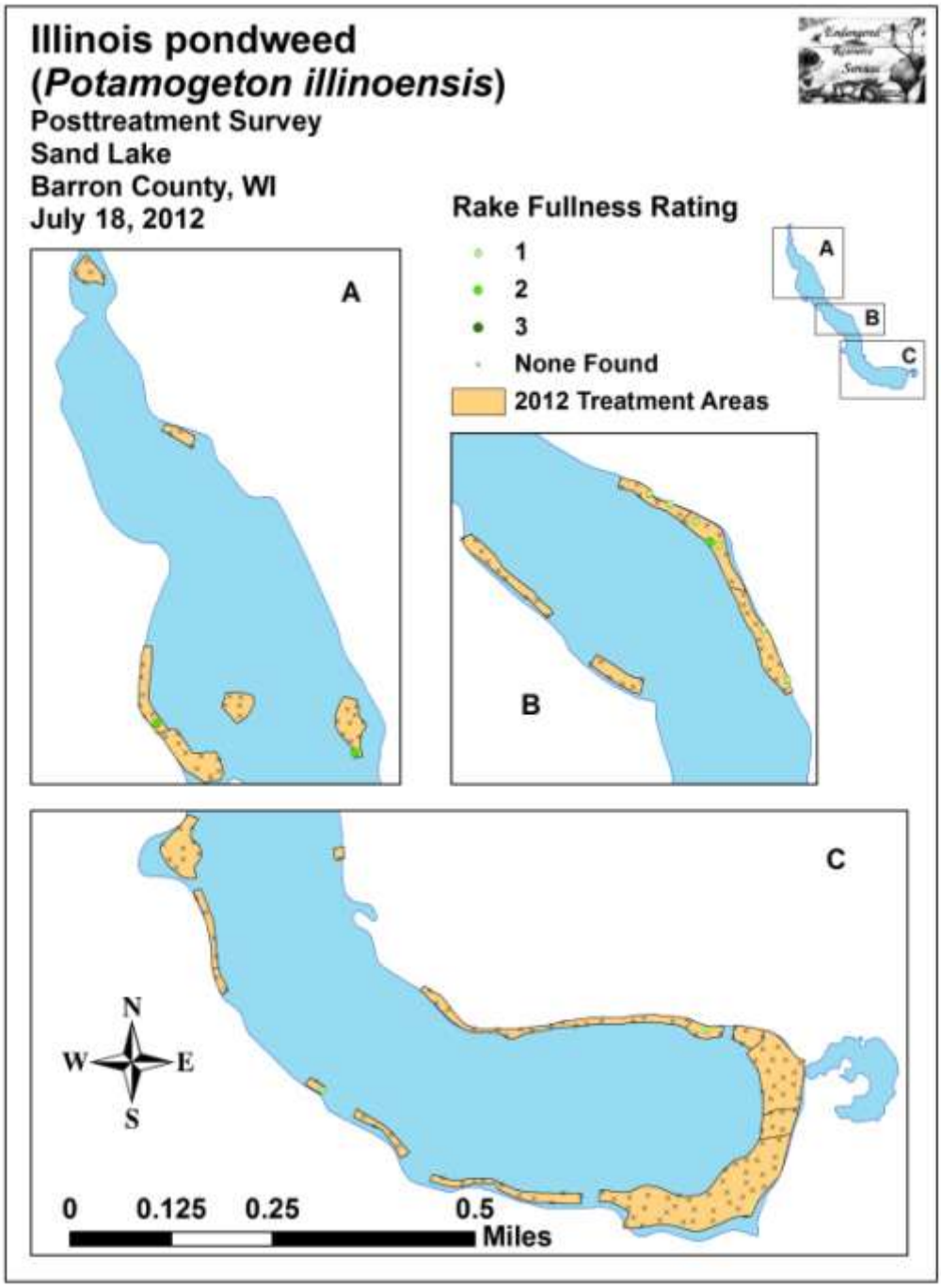
S
0
0.125
0.25
0.5
Miles


Variable pondweed
(Potamogeton gramineus)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles


Illinois pondweed
(Potamogeton illinoensis)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
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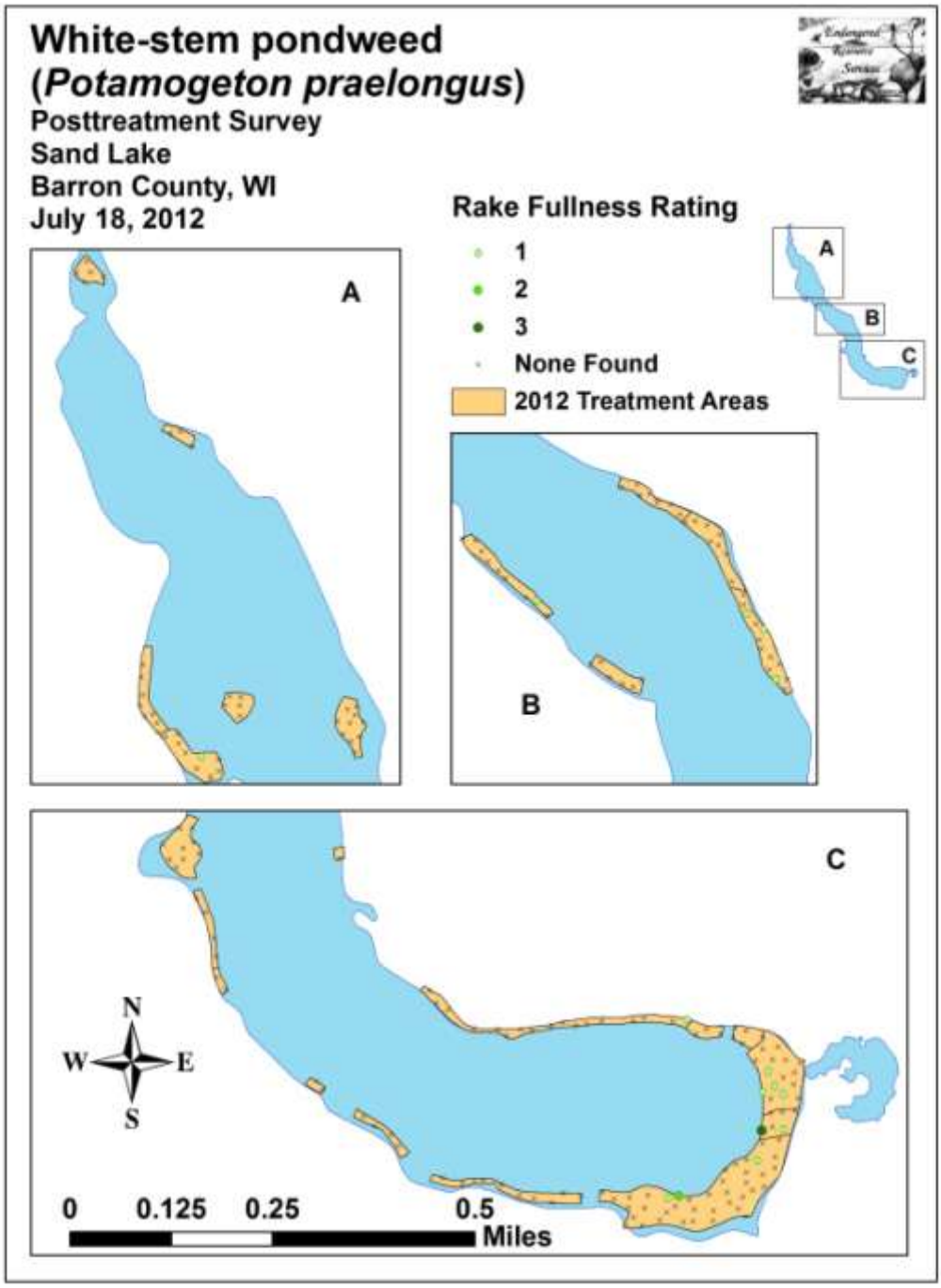
S
0
0.125
0.25
0.5
Miles


White-stem pondweed
(Potamogeton praelongus)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
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W
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S
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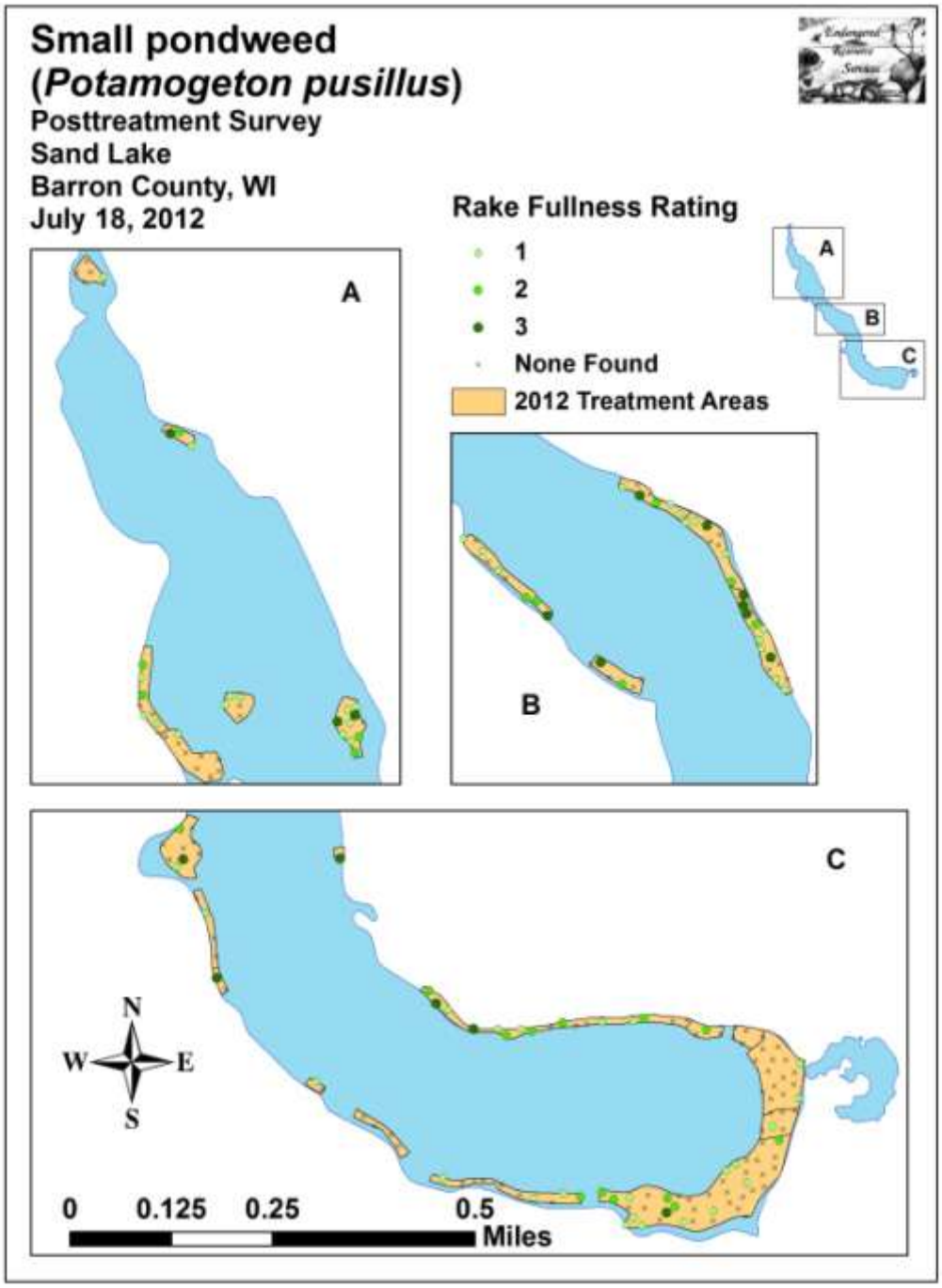
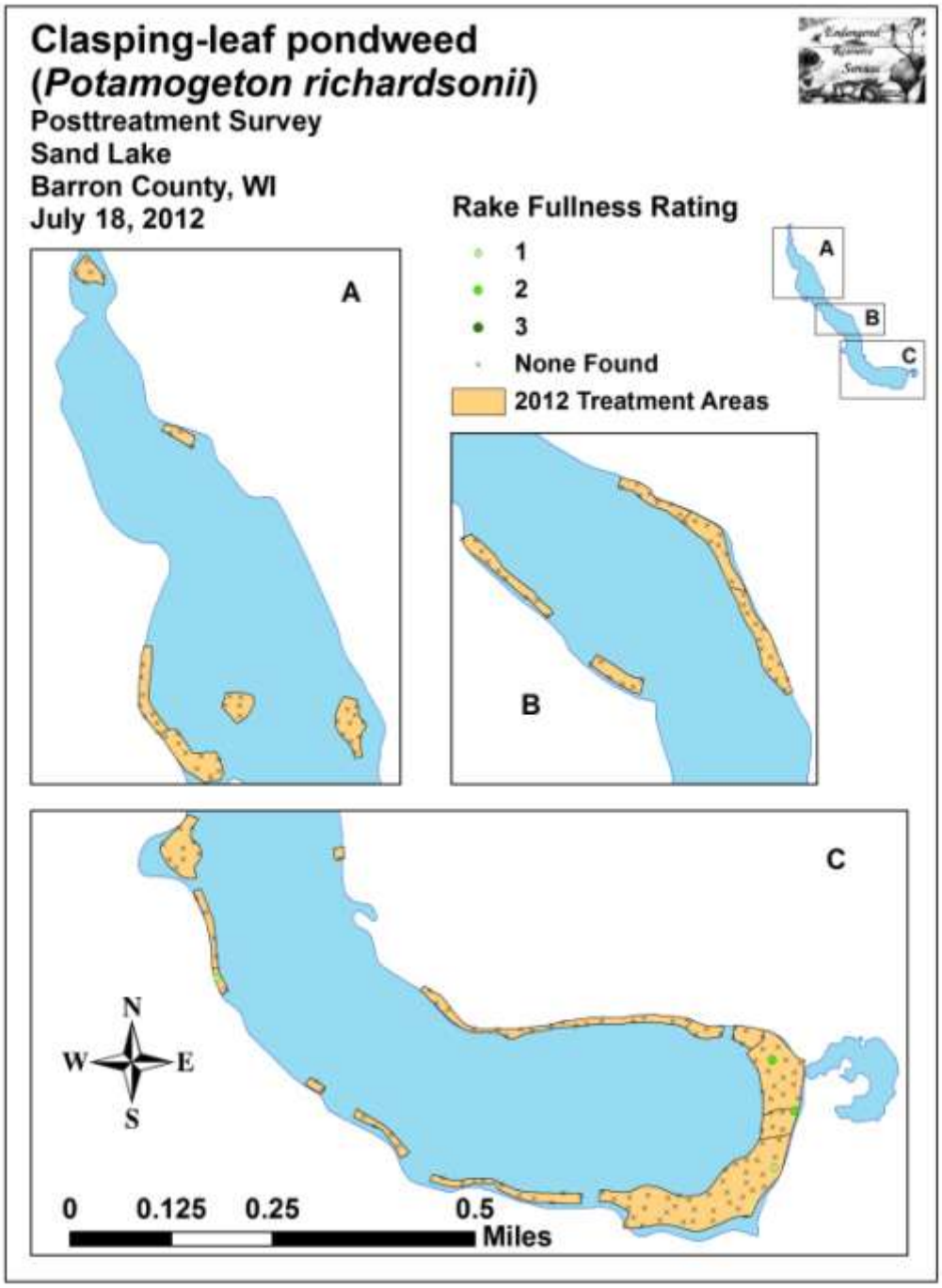
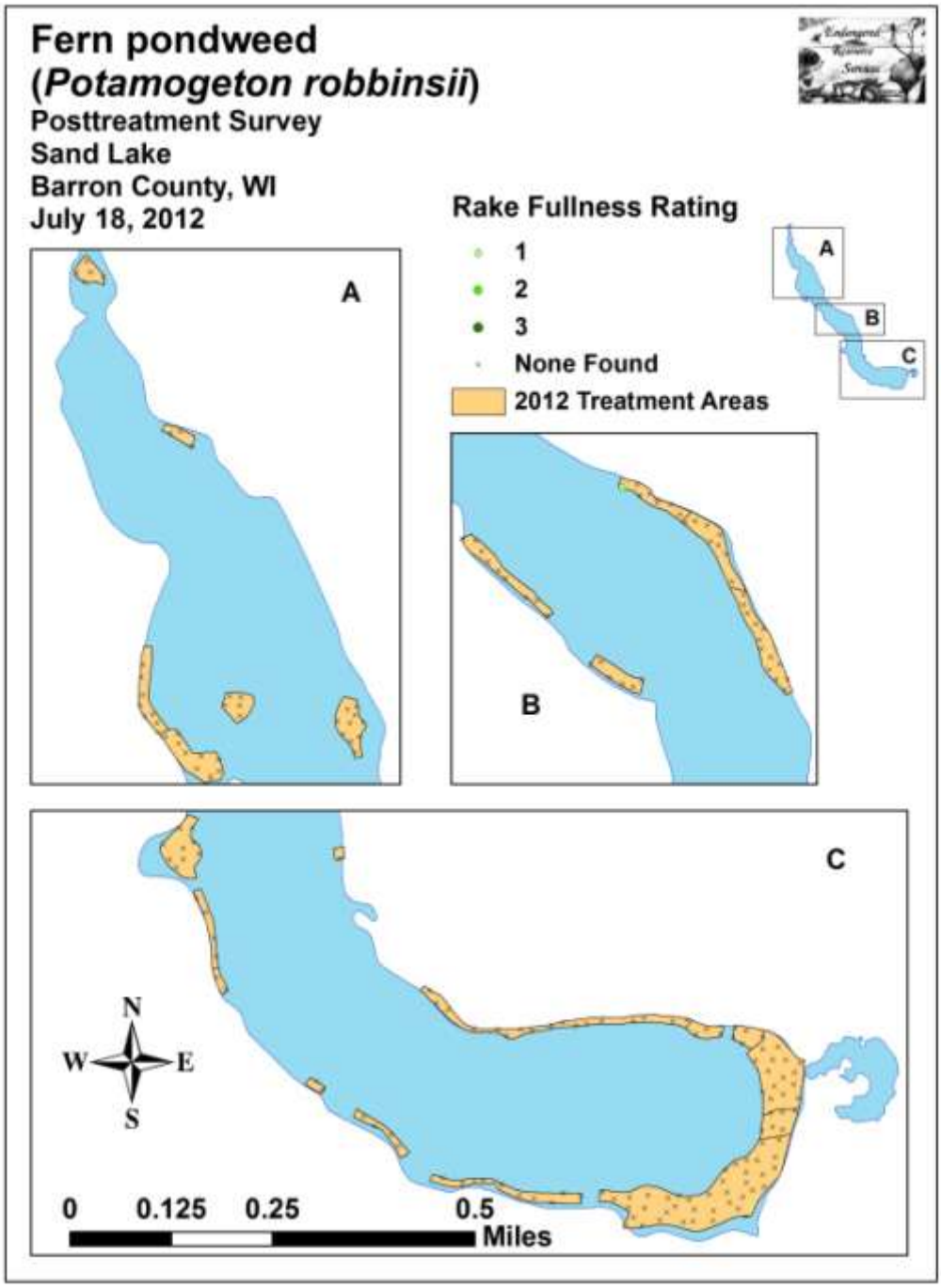
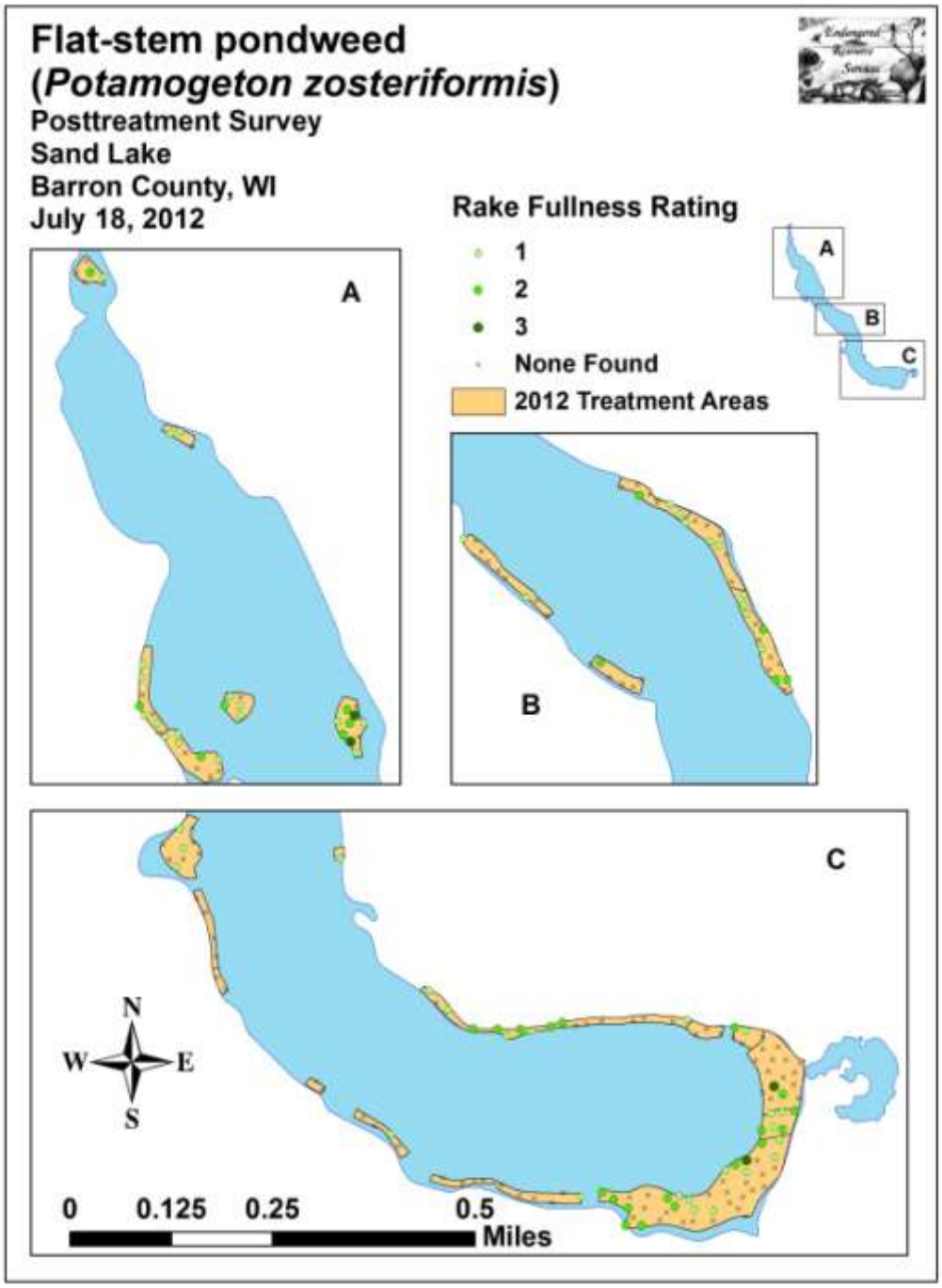
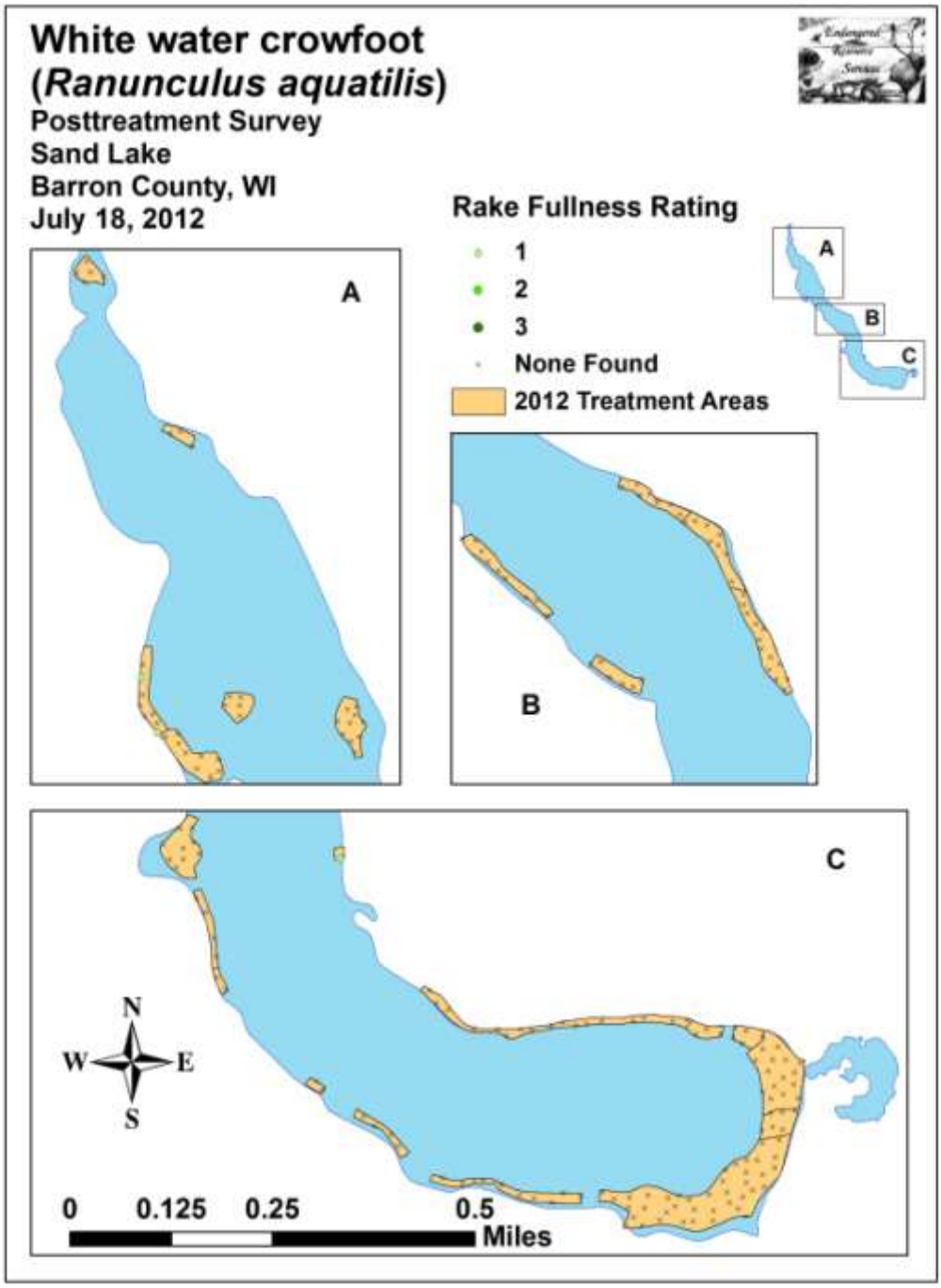
0.125
0.25
0.5
Miles

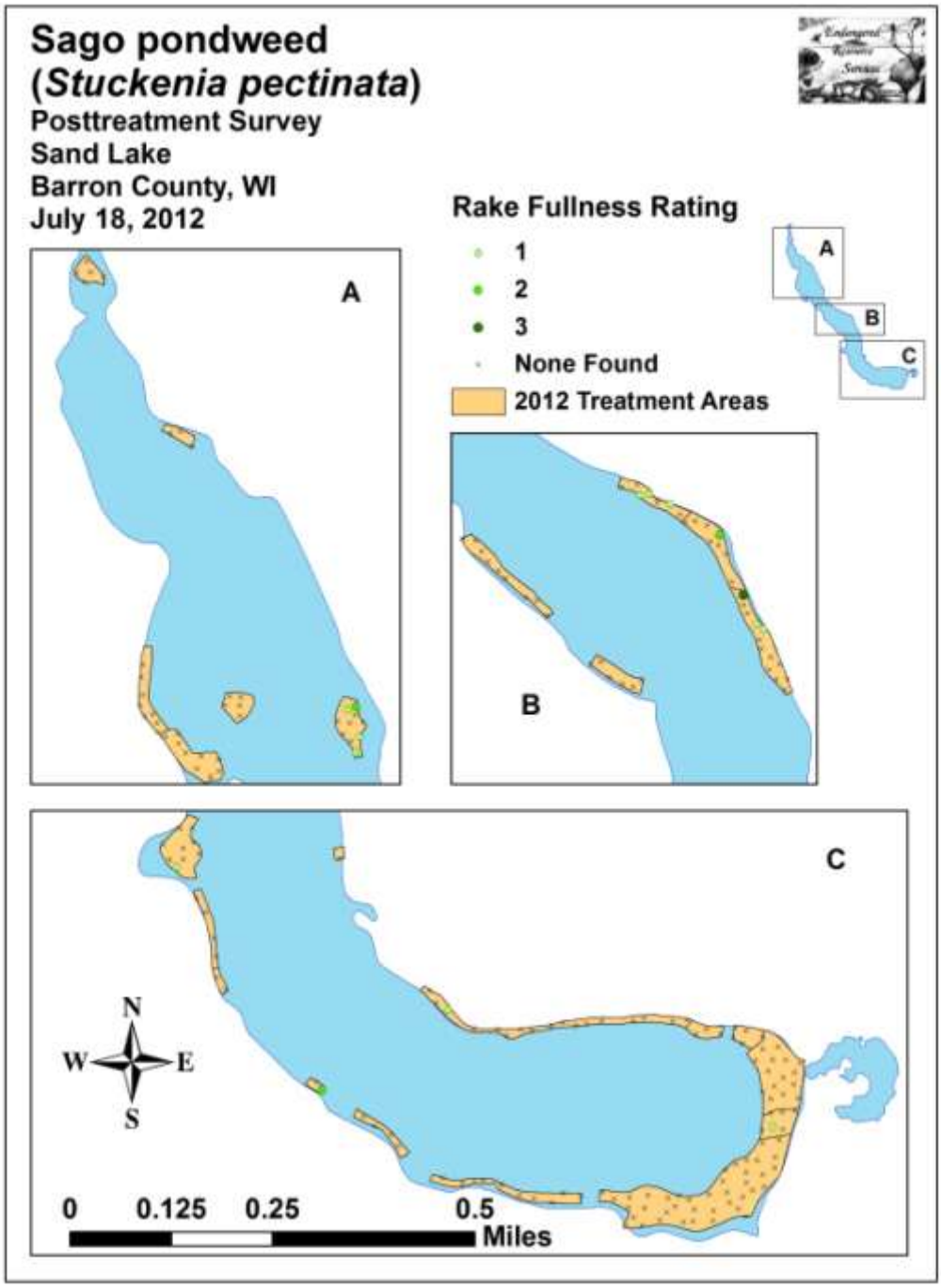

Small pondweed
(Potamogeton pusillus)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

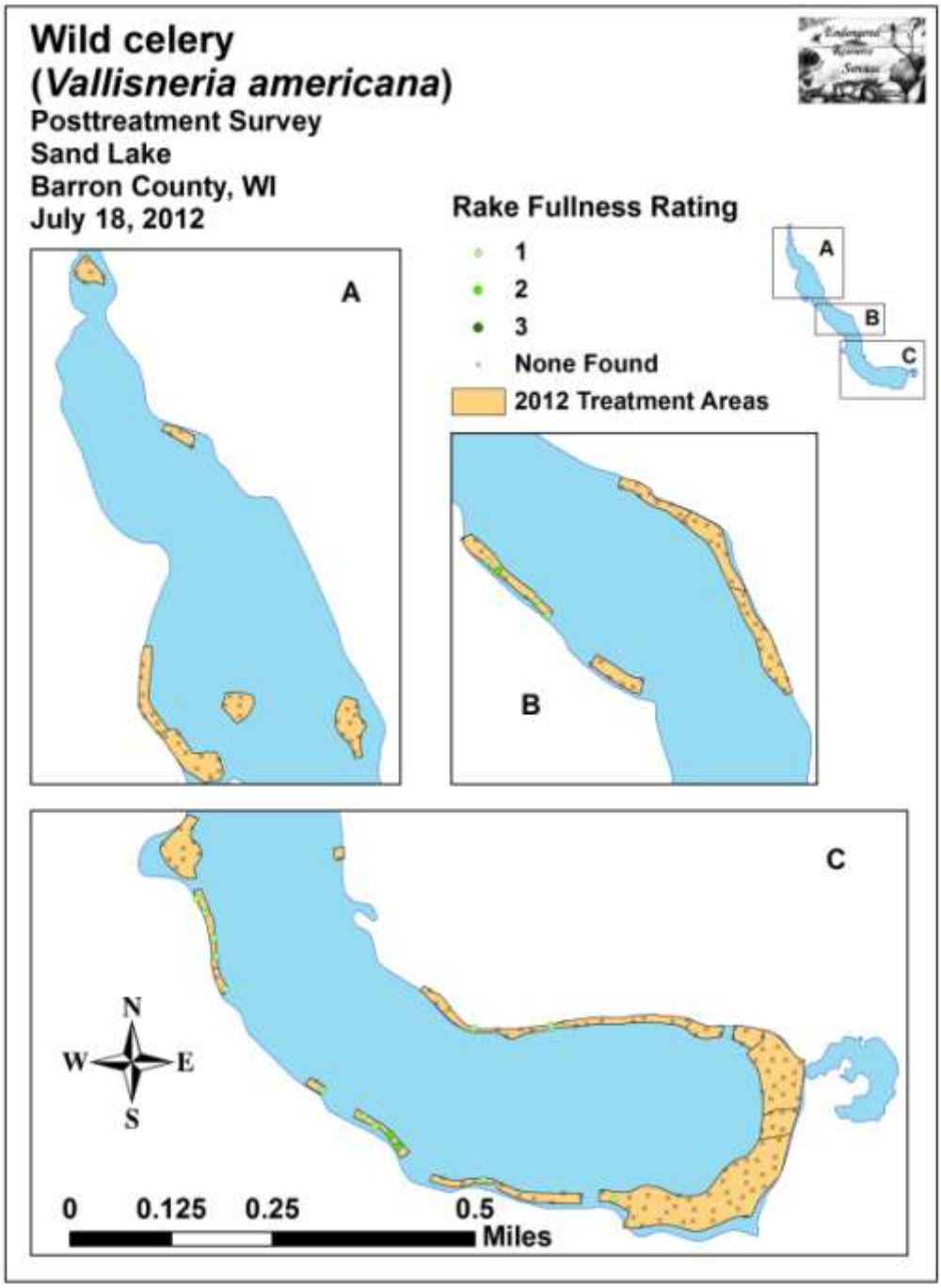

Clasping-leaf pondweed
(Potamogeton richardsonii)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles


Fern pondweed
(Potamogeton robbinsii)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

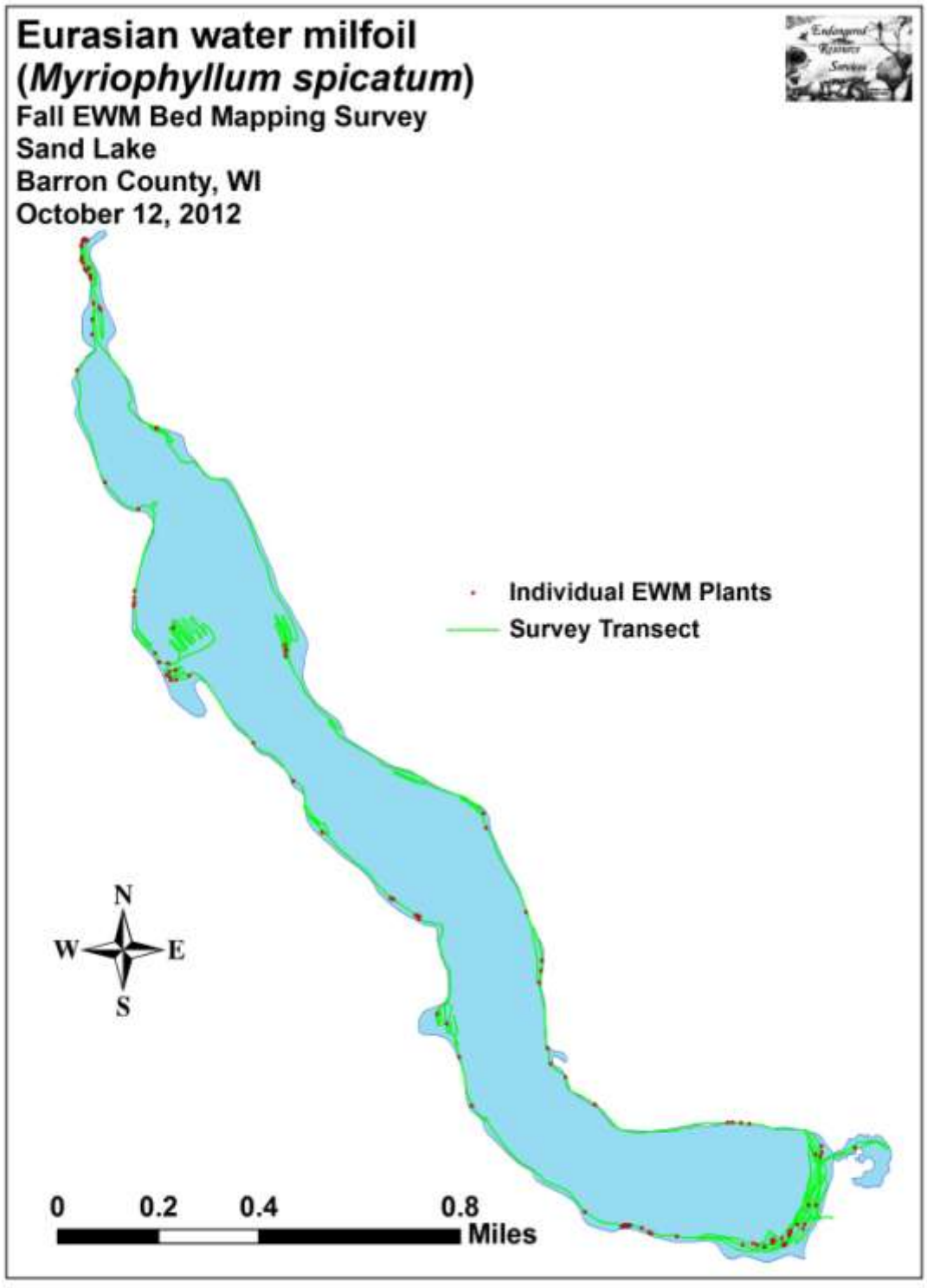

Flat-stem pondweed
(Potamogeton zosteriformis)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

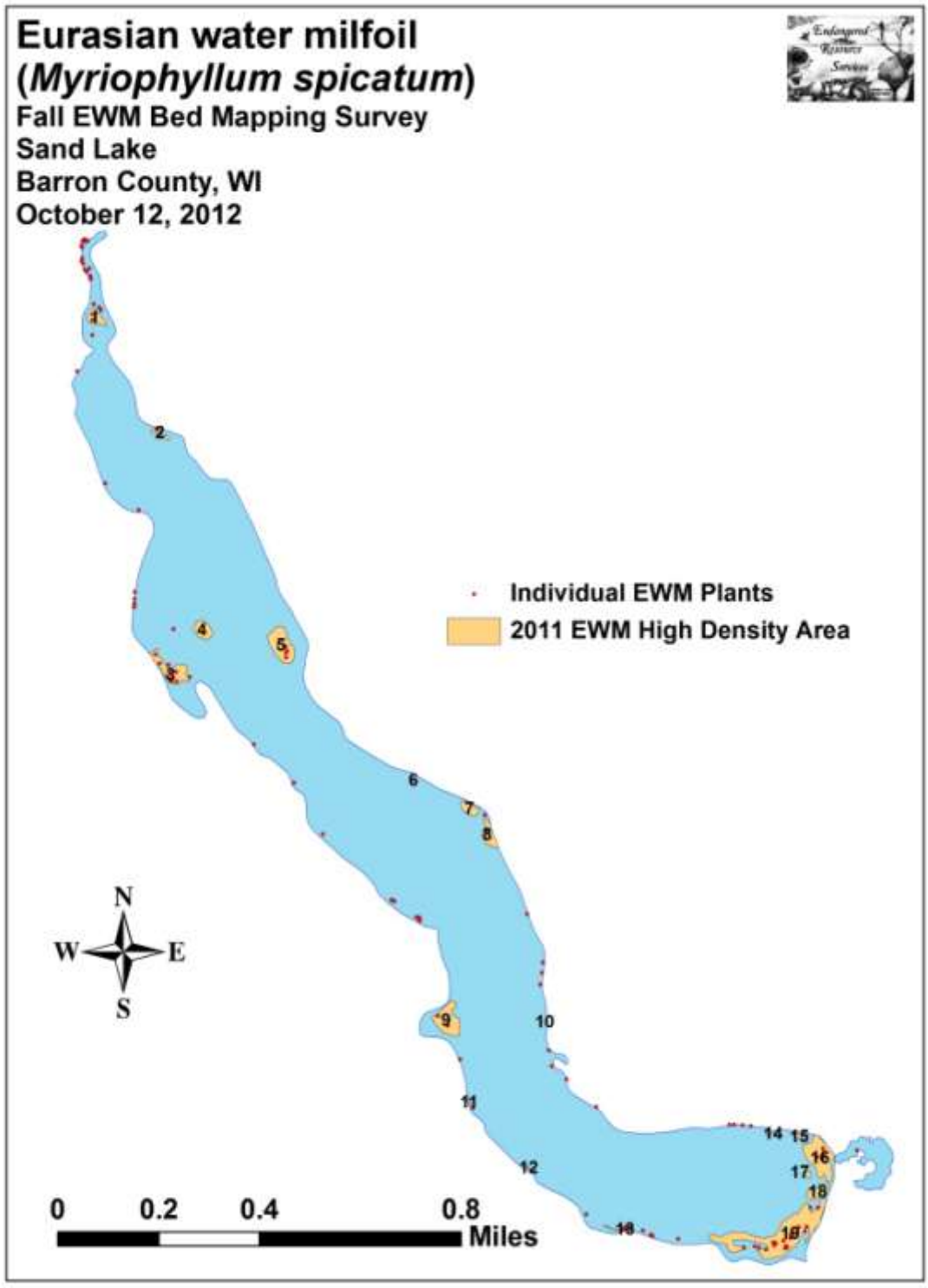

White water crowfoot
(Ranunculus aquatilis)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles


Sago pondweed
(Stuckenia pectinata)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles


Wild celery
(Vallisneria americana)
Posttreatment Survey
Sand Lake
Barron County, WI
July 18, 2012
Rake Fullness Rating
1
2
3
None Found
2012 Treatment Areas
A
B
C
N
W
E
S
0
0.125
0.25
0.5
Miles

Appendix VIII: Sand Lake Fall 2012 EWM Survey Maps


Eurasian water milfoil
(Myriophyllum spicatum)
Fall EWM Bed Mapping Survey
Sand Lake
Barron County, WI
October 12, 2012
Individual EWM Plants
Survey Transect
N
W
E
S
0
0.2
0.4
0.8
Miles


Eurasian water milfoil
(Myriophyllum spicatum)
Fall EWM Bed Mapping Survey
Sand Lake
Barron County, WI
October 12, 2012
Individual EWM Plants
2011 EWM High Density Area
N
W
E
S
0
0.2
0.4
0.8
Miles