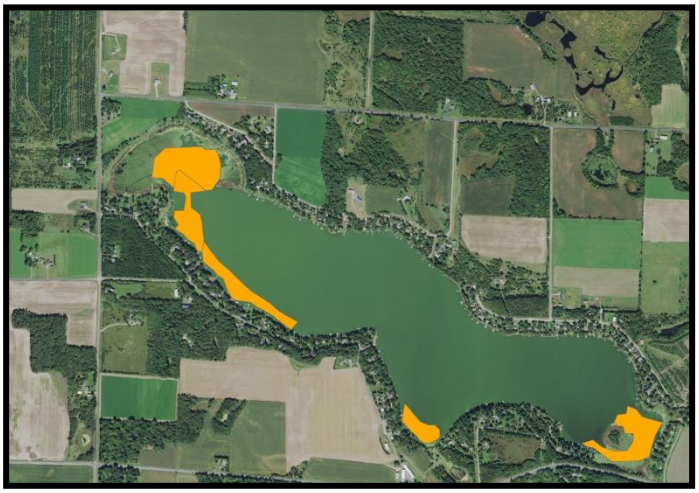
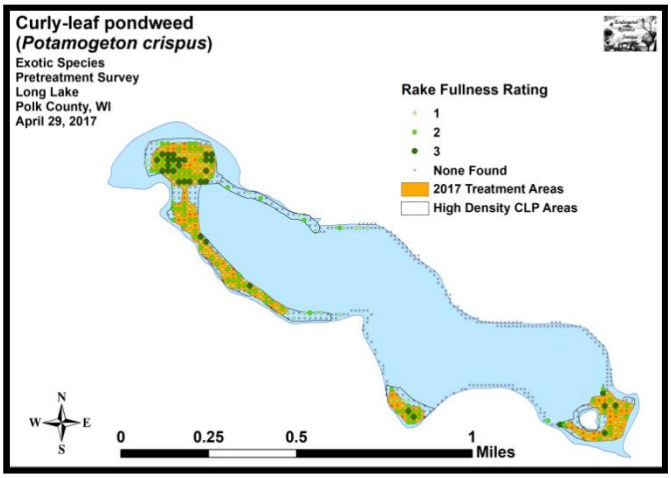
Curly-leaf pondweed (*Potamogeton crispus*)
Pre/Post Herbicide Treatment Surveys
Long Lake - WBIC: 2478200
Polk County, Wisconsin



Long Lake Aerial Photo with Final 2017 Treatment Areas

Dead CLP Posttreatment 6/6/17

Project Initiated by:
Long Lake Protection and Rehabilitation District, Harmony Environmental, and the Wisconsin Department of Natural Resources



2017 CLP Pretreatment Density and Distribution

Surveys Conducted by and Report Prepared by:
Endangered Resource Services, LLC
Matthew S. Berg, Research Biologist
St. Croix Falls, Wisconsin
April 29 and June 5-6, 2017

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION:

Long Lake (WBIC 2478200) is a 272 acre seepage lake in central Polk County, Wisconsin in the Town of Balsam Lake (T34N R17W S07 NE NE). It reaches a maximum depth of just over 17ft in the central basin and has an average depth of approximately 11ft (Busch et al. 1969) (Figure 1). Long Lake is eutrophic trending toward hypereutrophic, and visibility is generally poor with summer Secchi readings averaging 4.6ft since 1992 (WDNR 2017). The bottom substrate in the lake's bays and central basin is predominately thick organic muck, while exposed points and most north/south shorelines are dominated by gravel and sand.

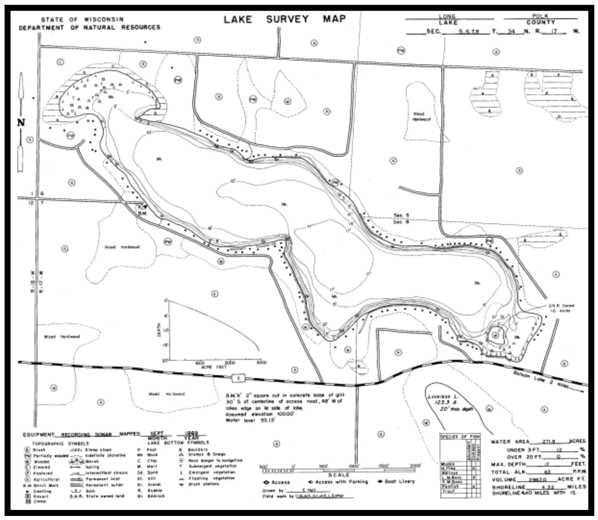


Figure 1: Long Lake Bathymetric Map

BACKGROUND AND STUDY RATIONALE:

Long Lake and the Long Lake Protection and Rehabilitation District (LLPRD) have an extended history of battling Curly-leaf pondweed (*Potamogeton crispus*) (CLP) - an exotic invasive species that thrives in the nutrient-rich sediments found in many parts of the lake. In the past, CLP often grew so densely in the spring and early summer that it made lake access and boating difficult for residents. CLP's late-June to early-July senescence was also cited in past studies by Barr Engineering and the Polk County Land and Water Conservation Department (PCLWCD) as a significant contributor to the lake's overall phosphorus load, and it was at least partially responsible for the lake's frequent late-summer toxic blue-green algae blooms. In 2010, after years of study, the LLPRD and the Wisconsin Department of Natural Resources (WDNR) authorized an initial lakewide herbicide treatment of over 65 acres of CLP. The LLPRD treated nearly 57 acres again in 2011, and 58 acres in 2012. After updating the District's WDNR approved Aquatic Plant Management Plan (APMP) in 2012, it was decided to treat just 27 acres in 2013, and only 20 acres in 2014. Although **the 2010-2013 treatments resulted in highly significant reductions** in both CLP coverage and density on the lake, **the 2014 treatment showed no significant change from pretreatment levels**. A follow-up survey of CLP turions in the lake's sediment also suggested 2015 CLP levels would likely be very low in most parts of the lake. Based on these data, and following a discussion with the lake's executive board and APMP director Cheryl Clemens (Harmony Environmental) in the fall of 2014, it was decided **not to treat CLP in 2015**.

Because both the 2015 June CLP point-intercept monitoring survey and the fall CLP turion sediment data suggested CLP had made a significant rebound throughout much of the lake, **it was decided that herbicide treatments (not to exceed 35 acres) would resume in the future**. Ultimately, the LLPRD decided to treat 34.97 acres in 2016.

Prior to the 2017 herbicide application, we conducted a pretreatment survey of the lake on April 24th to determine initial CLP levels and finalize treatment areas. Following the May 3rd Aquathol K ® application on 33.65 acres of CLP (12.4% of the lake's surface area), a posttreatment survey was conducted on June 5-6th to determine the treatment's effectiveness. This report is the summary analysis of these two surveys.

METHODS:

Pre/Post Treatment Surveys:

Following three years (2010-12) of doing extensive plant surveys as was required for the lakewide herbicide treatments, it was established that most midlake sandy/rocky shorelines that had narrow littoral areas supported extremely low densities of CLP. Because of this, these areas were annually greatly reduced or eliminated from treatment plans. In 2013, we divided the lake into high/low CLP density areas. Within the high density areas (HDAs), we used Hawth's Analysis Tools Extension to ArcGIS 9.3.1 to generate pre/post survey points at 25m resolution within that year's 50 acres of proposed treatment areas. The resulting sampling grid contained 323 points which approximated to 6.5 points/acre. In the historically low density areas (LDAs), we constructed an alternative 200 point grid at 18m resolution where we conducted exploratory CLP point-intercept surveys to monitor for any potential resurgence in CLP. Because of the expansion of CLP in 2015, all 523 points were used for both the pre and posttreatment surveys in both 2016 and 2017 (Appendix I).

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

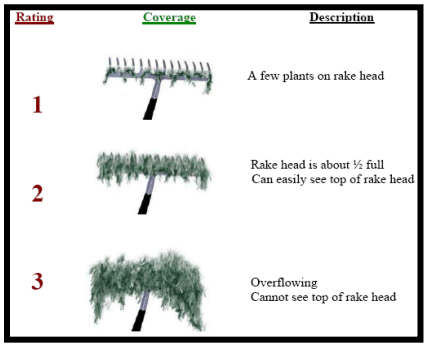


Figure 2: Rake Fullness Ratings

We entered all data collected into the standard APM spreadsheet (Appendix II) (UWEX 2010). Data was analyzed using the linked statistical summary sheet and the WDNR pre/post analysis worksheet (UWEX 2010). Pre/post differences were determined to be significant at $p < .05$, moderately significant at $p < .01$ and highly significant at $p < .001$.

RESULTS AND DISCUSSION:

Finalization of Treatment Areas:

Of the seven areas identified by Barr Engineering as having CLP in 2009, we have consistently found high density CLP in only six of them in an area covering 49.88 acres (Table 1). Following analysis of the pretreatment survey, it was decided to eliminate Area 3 and trim the rest of the areas to encompass the 33.65 acres (12.4% of the lake's surface area) that had the highest CLP densities in 2017 (Figure 3) (Appendix I).

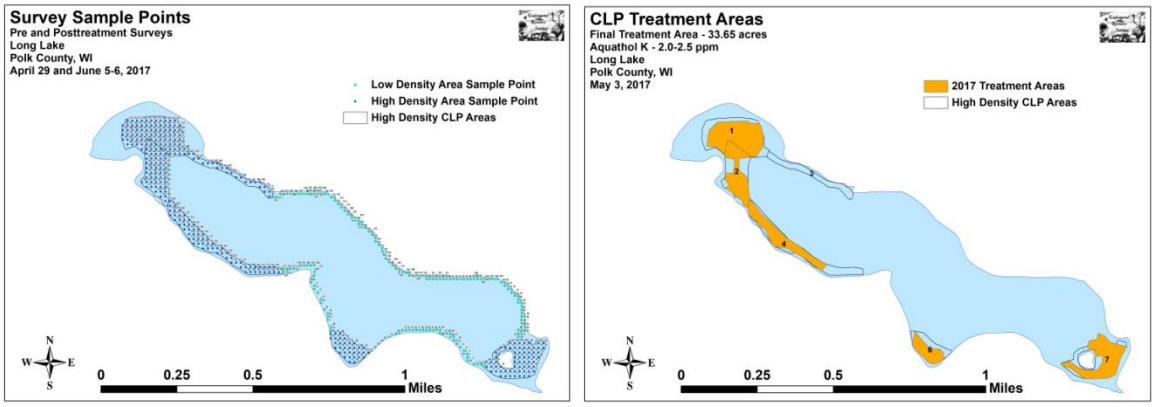


Figure 3: 2017 Pre/Post Survey Points and Final CLP Treatment Areas

Treatment occurred on May 3, 2017 with Northern Aquatics (Dresser, WI) applying Aquathol K (Endothall) at a rate of 2.0-2.5 ppm (326.4 total gallons). The reported water temperature at the time of application was 50.0°F which was at the bottom threshold of the WDNR's recommended treatment temperature range of 50 - 60°F. Wind speeds were reported to be 1-6mph out of the west.

Table 1: Spring CLP Treatment Summary
May 3, 2017 - Long Lake, Polk Co.

High Density CLP Area	Potential Treatment (acres)	Final Treatment (acres)	Difference (+/-)
1	13.34	10.05	-3.29
2	8.46	6.12	-2.34
3	3.84	0.00	-3.84
4	9.51	6.35	-3.16
6	4.88	3.09	-1.79
7	9.85	8.04	-1.81
	49.88	**33.65**	**-16.23**

Pre/Post Treatment Surveys:

All high density Curly-leaf pondweed areas occurred in water between 0.5ft and 15.0ft (Figure 4). During the pretreatment survey, we found the mean and median depth of plant growth in the high density areas to be 6.6ft and 6.0ft respectively. These declined a foot posttreatment to 5.6ft and 5.0ft; likely related to the death of CLP plants which dominated the deep-water plant community (Table 2). In the low density areas, the pretreatment mean and median depths were 7.0ft and 6.5ft. before nearly inverting to 6.7ft and 7.0ft. Most CLP within the HDAs occurred over organic muck, although the western edge of Bed 7 near the island was established over sandy/rocky substrates. LDAs were dominated by sand and rock (Figure 4) (Appendix III).

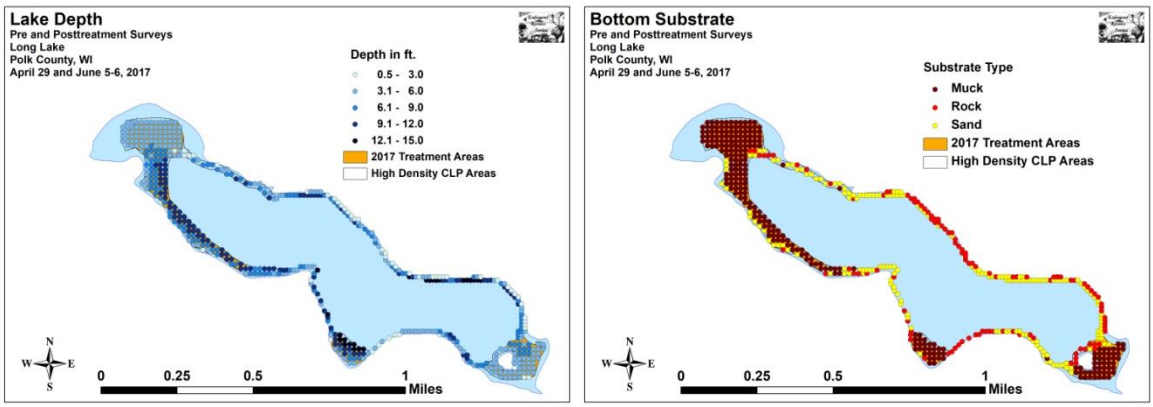


Figure 4: CLP Area Depths and Bottom Substrate

Table 2: Pre/Post Survey Summary Statistics
Long Lake, Polk County
April 29 and June 5-6, 2017

Summary Statistics:	Pre-High	Post-High	Pre-Low	Post-Low
Total number of points sampled	323	323	200	200
Total number of sites with vegetation	251	183	31	82
Total number of sites shallower than the maximum depth of plants	321	318	200	196
Frequency of occurrence at sites shallower than max. depth of plants	78.2	57.6	15.5	41.8
Simpson Diversity Index	0.61	0.72	0.79	0.79
Mean Coefficient of Conservatism	5.0	5.4	5.2	5.4
Floristic Quality Index	11.2	16.3	12.7	15.2
Average number of all species per site (shallower than max depth)	1.19	0.85	0.19	0.55
Average number of all species per site (veg. sites only)	1.52	1.48	1.19	1.30
Ave. number of native species/site (shallower than max depth)	0.57	0.84	0.13	.55
Ave. number of native species/site (sites with native plants only)	1.26	1.47	1.25	1.30
Species Richness	6	10	7	8
Maximum depth of plants (ft)	14.0	13.0	15.0	13.0
Mean depth of plants (ft)	6.6	5.6	7.0	6.7
Median depth of plants (ft)	6.0	5.0	6.5	7.0
Mean Rake Fullness	1.75	1.33	1.29	1.04

The pretreatment littoral zone extended to 15.0ft (14.0ft HDAs/15.0ft LDAs) before contracting slightly to 13.0ft in both the high and low density areas posttreatment (Figure 5) (Appendix IV). The frequency of plants encountered in the HDAs decreased from 78.2% pretreatment to 57.6% posttreatment. Conversely, in the LDAs, where plants were uncommon within the litteral zone prestreatment (15.5% coverage), the frequency more than doubled to 41.8% posttreatment. Within the HDAs, richness nearly doubled from six species pretreatment to ten posttreatment, while the LDAs increased only slightly from seven to eight species. This helped the Simpson's Diversity Index increase in the HDAs from 0.61 pretreatment to 0.72 posttreament; the LDAs, however, were unchanged at 0.79 during both the pre and posttreatment surveys. The Floristic Quality Index (another measure of the native plant community health) in the HDAs increased from 11.2 pretreatment to 16.3 posttreatment. In the LDAs, it increased from 12.7 to 15.2.

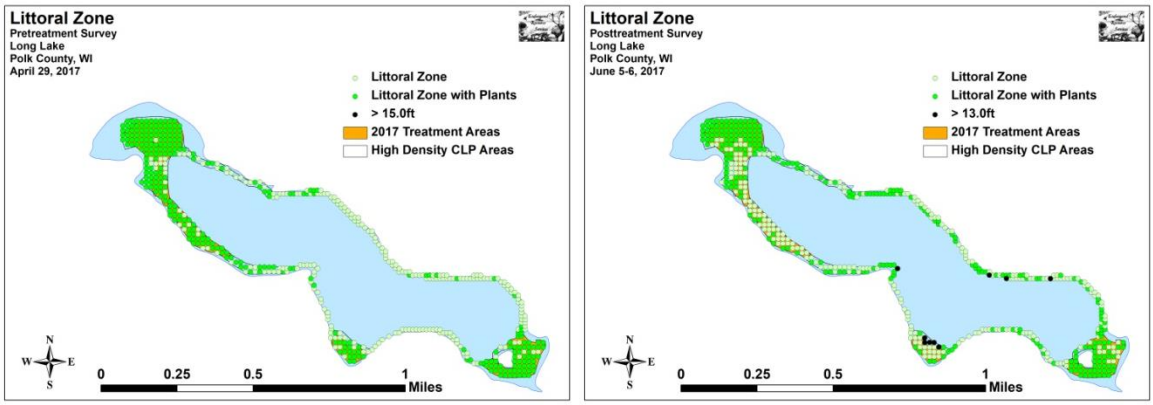


Figure 5: Pre/Post Littoral Zone

We found localized native species richness to be quite low throughout the lake. In the high density areas, richness at points with native plants increased from 1.26 species/site pretreatment to 1.47 species/site posttreatment (Figures 6). In low density areas, this value grew from 1.25 species/site pretreatment to 1.30 species/site posttreatment. Total mean rake fullness in HDAs was a low/moderate 1.75 pretreatment before falling to a low 1.33 posttreament. In LDAs, where the April mean rake fullness was already an exceptionally low 1.29, we found this level dropped further to 1.04 in June (Figures 7) (Appendix IV).

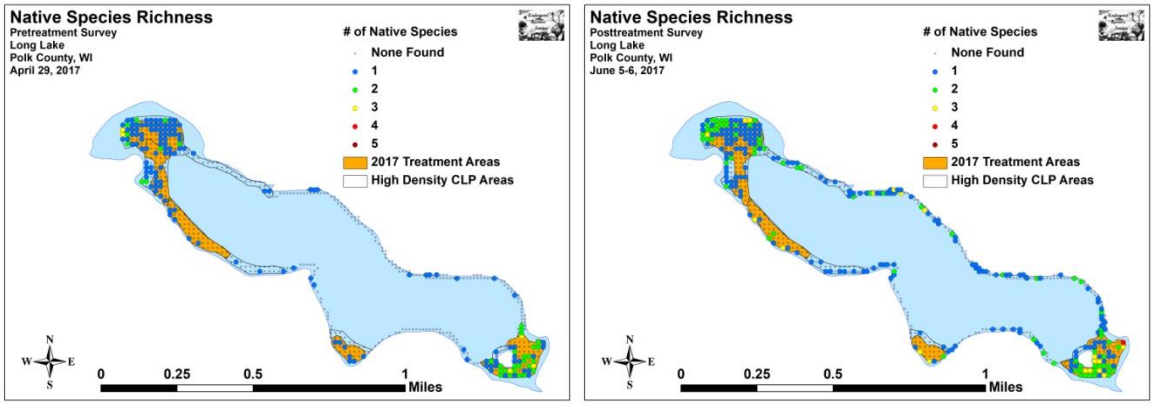


Figure 6: Pre/Post Native Species Richness

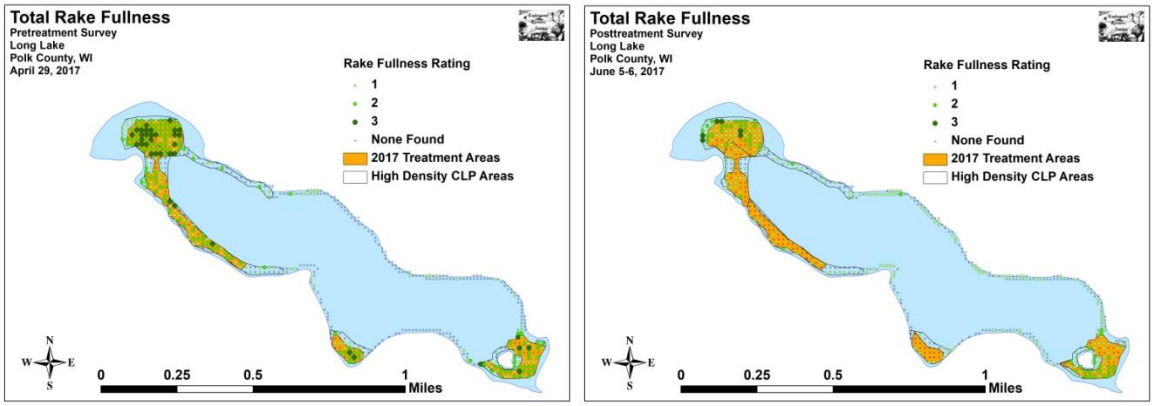


Figure 7: Pre/Post Total Rake Fullness

During the pretreatment survey, we found Curly-leaf pondweed at 209 of 523 total sites (40.0% coverage). Of these, 197 occurred within the high density area's 323 points (61.0% coverage), and 12 occurred within the low density area's 200 points (6.0% coverage) (Figure 8) (Appendix V). The HDAs had 31 points with a rake fullness rating of 3, 78 with a 2, and 88 were a 1. This produced a mean rake fullness of 1.71. The LDA's had two points rating a 3, four that were a 2, and the remaining six a 1 for a mean rake fullness of 1.67.

During the posttreatment survey, we found CLP at just two points (0.4% coverage) with each rating a 1, and both occurring in the the high density areas (0.6% coverage). In the low density areas, we saw no evidence of CLP at or between any survey points. **Our findings suggest the treatment produced a highly significant reduction in CLP lakewide** (Figure 9), in the HDAs (Figure 10), **AND** in the LDAs (Figure 11). This was surprising as only the HDAs were treated, and, even here, only 67.5% of the acreage was treated. **That CLP was knocked back even in areas that weren't treated suggests that this dosage of Endothall over this acreage effectively resulted in a lakewide treatment.**

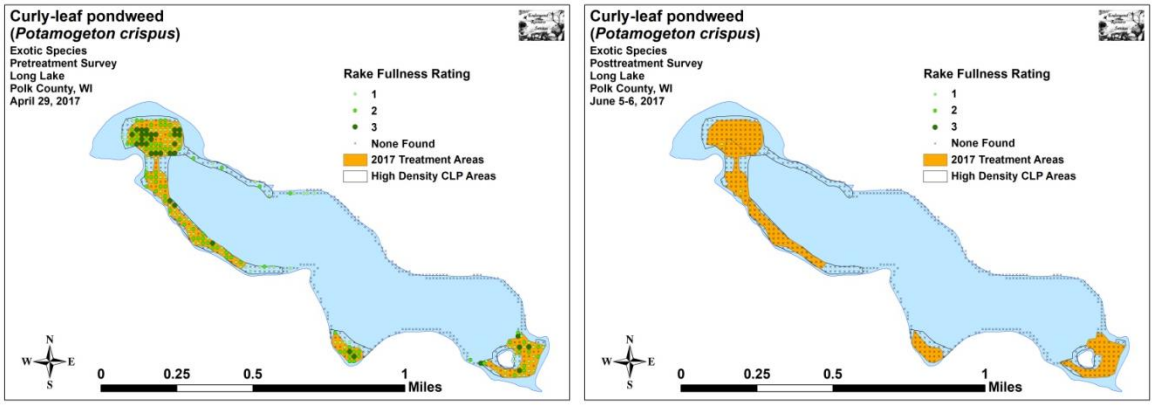
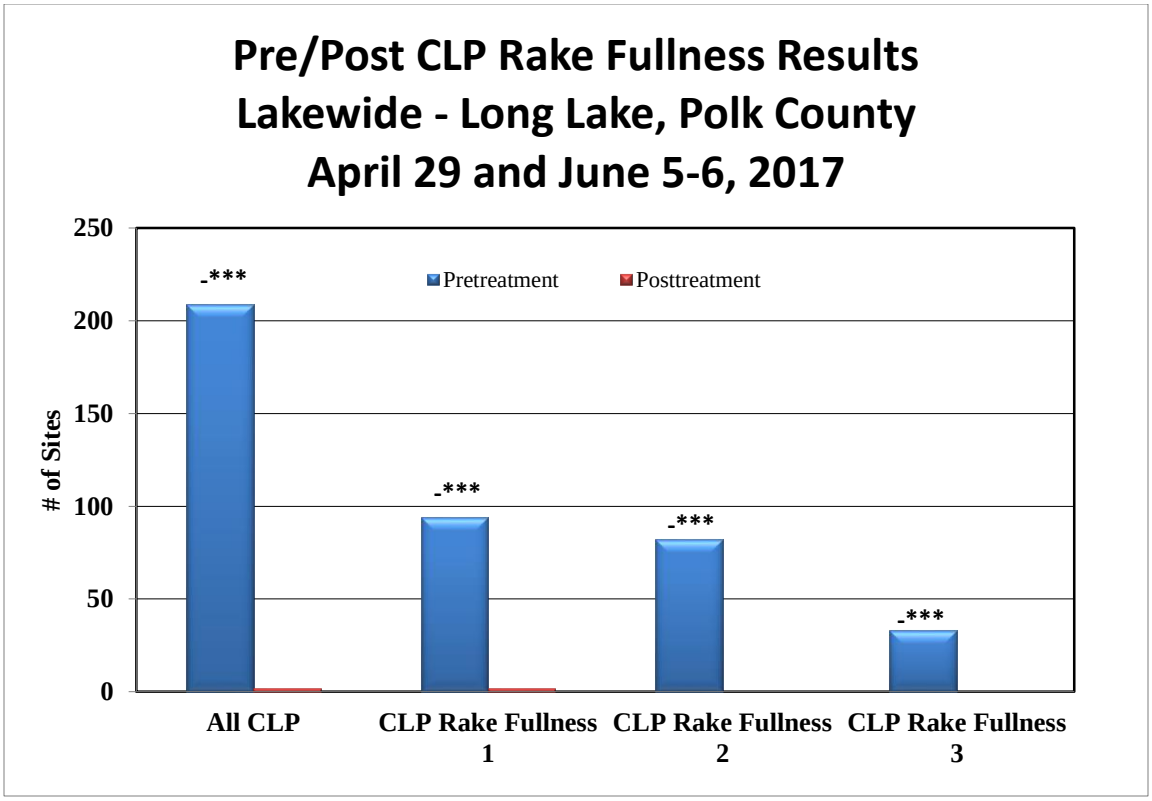
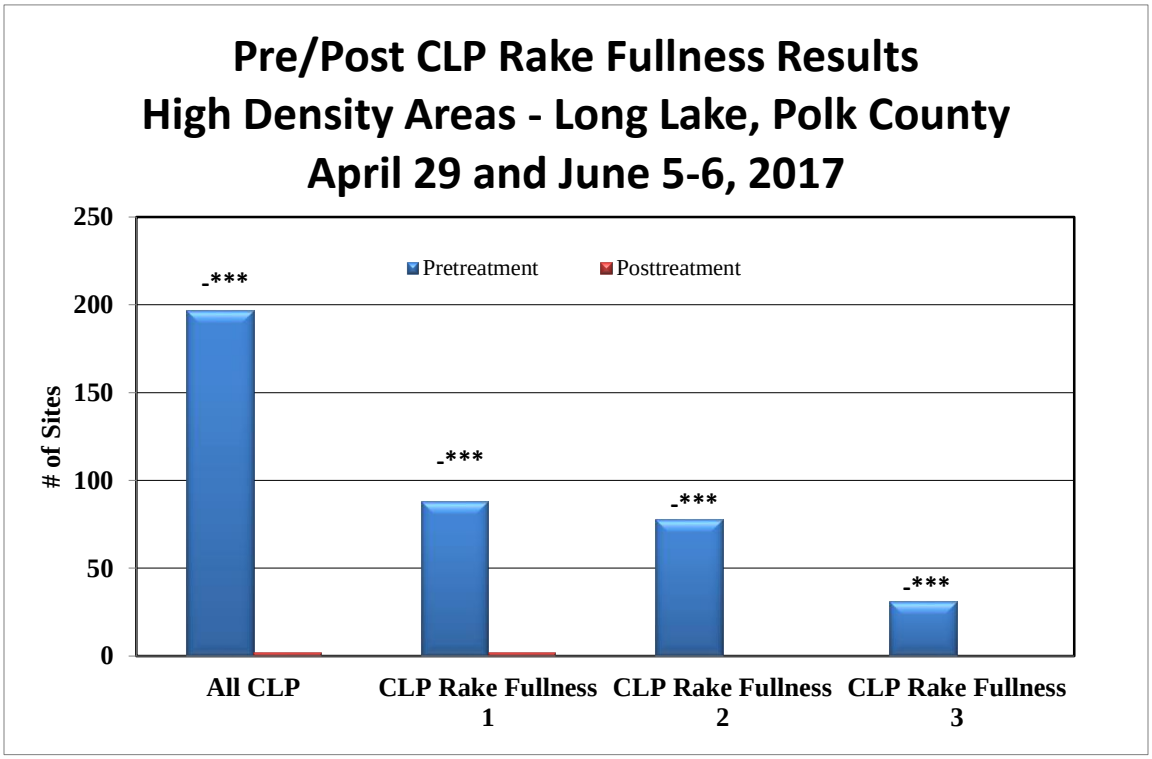


Figure 8: Pre/Post CLP Density and Distribution



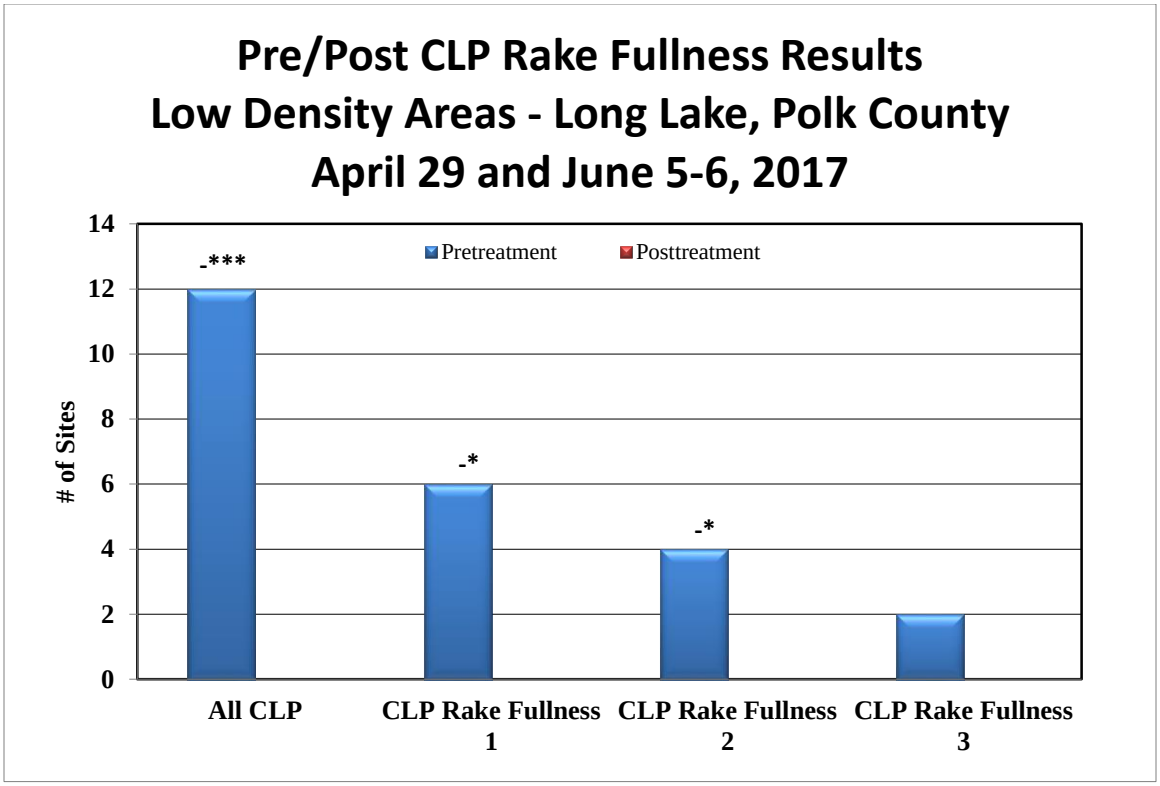
Significant differences = * $p < .05$, ** $p < .01$, *** $p < .001$

Figure 9: Whole Lake – Changes in CLP Rake Fullness Ratings



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

Figure 10: High Density Areas - Changes in CLP Rake Fullness Ratings



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

Figure 11: Low Density Areas - Changes in CLP Rake Fullness Ratings

Lakewide, we found Coontail (*Ceratophyllum demersum*) and Common waterweed (*Elodea canadensis*) were the most common and second most common native species during both the pre and posttreatment surveys (Figures 12 and 13) (Tables 3-6). Neither these, nor any other native species showed a significant decline posttreatment; however, filamentous algae and many later growing species that were largely dormant during the pretreatment survey showed significant lakewide increases (Figure 14). Specifically, filamentous algae, White water lily (*Nymphaea odorata*), Muskgrass (*Chara* sp.), Water star-grass (*Heteranthera dubia*), and Nitella (*Nitella* sp.) demonstrated highly significant increases; Slender naiad (*Najas flexilis*) and Needle spikerush (*Eleocharis acicularis*) showed moderately significant increases; and Common waterweed experienced a significant increase (Maps of all native species from the pre and posttreatment surveys can be found in Appendixes VI and VII).

Breaking the data out between high density areas (Figure 15) and low density areas (Figure 16) provided little additional information. Based on all these data that showed the overall effectivenss of the treatment at controlling CLP while simultaneously having minimal impact on native species, 2017 appears to have been highly successful at meeting the LLPRD's stated goals for managing CLP.

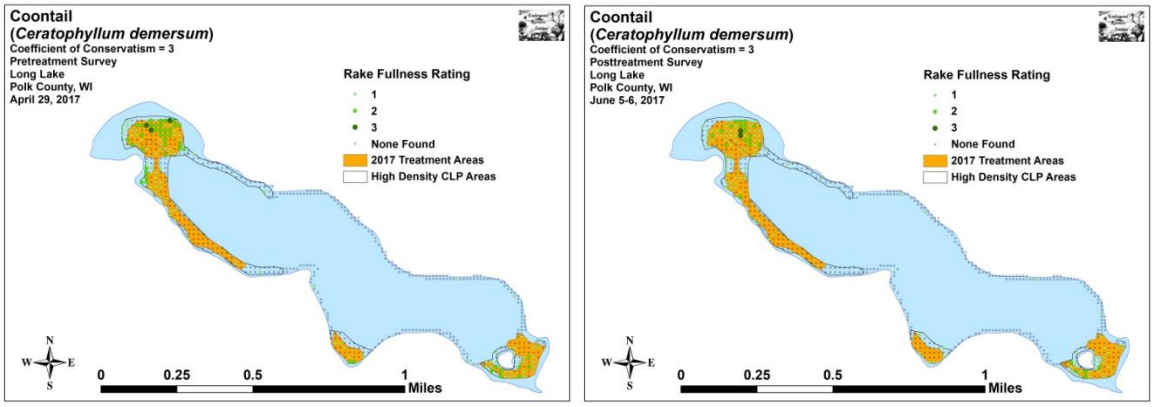


Figure 12: Pre/Post Coontail Density and Distribution

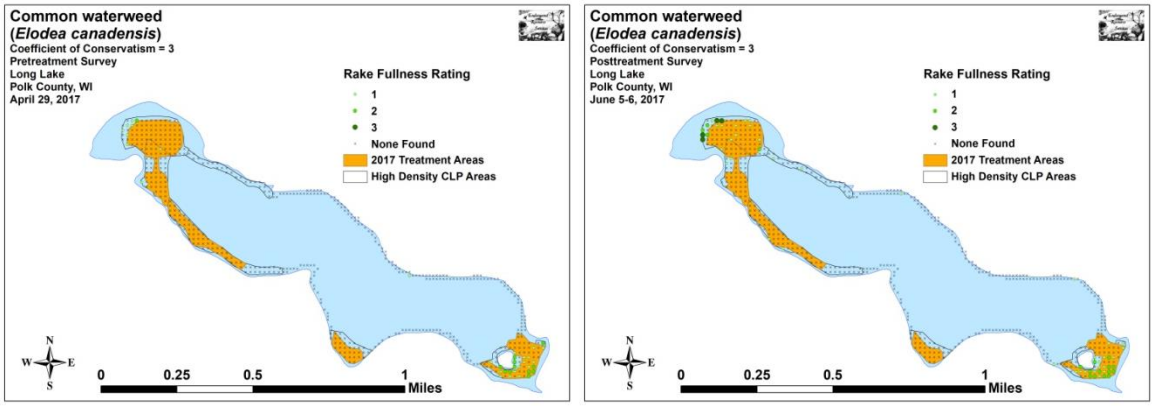


Figure 13: Pre/Post Common Waterweed Density and Distribution

Table 3: Frequencies and Mean Rake Sample of Aquatic Macrophytes Pretreatment Survey – High CLP Density Areas - Long Lake, Polk County April 29, 2017

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake
Potamogeton crispus	Curly-leaf pondweed	197	51.71	78.49	61.37	1.71
Ceratophyllum demersum	Coontail	130	34.12	51.79	40.50	1.38
Elodea canadensis	Common waterweed	35	9.19	13.94	10.90	1.34
	Filamentous algae	32	*	12.75	9.97	1.16
Nymphaea odorata	White water lily	10	2.62	3.98	3.12	1.00
Lemna trisulca	Forked duckweed	7	1.84	2.79	2.18	1.14
Chara sp.	Muskgrass	2	0.52	0.80	0.62	1.00

Table 4: Frequencies and Mean Rake Sample of Aquatic Macrophytes Pretreatment Survey – Low CLP Density Areas - Long Lake, Polk County April 29, 2017

Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake
Potamogeton crispus	Curly-leaf pondweed	12	32.43	38.71	6.00	1.67
Chara sp.	Muskgrass	7	18.92	22.58	3.50	1.14
Heteranthera dubia	Water star-grass	7	18.92	22.58	3.50	1.00
	Filamentous algae	7	*	22.58	3.50	1.00
Ceratophyllum demersum	Coontail	5	13.51	16.13	2.50	1.00
Lemna trisulca	Forked duckweed	4	10.81	12.90	2.00	1.00
Elodea canadensis	Common waterweed	1	2.70	3.23	0.50	1.00
Myriophyllum sibiricum	Northern water-milfoil	1	2.70	3.23	0.50	1.00

* Excluded from relative frequency analysis

Table 5: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Posttreatment Survey - High CLP Density Areas - Long Lake, Polk County
June 5-6, 2017

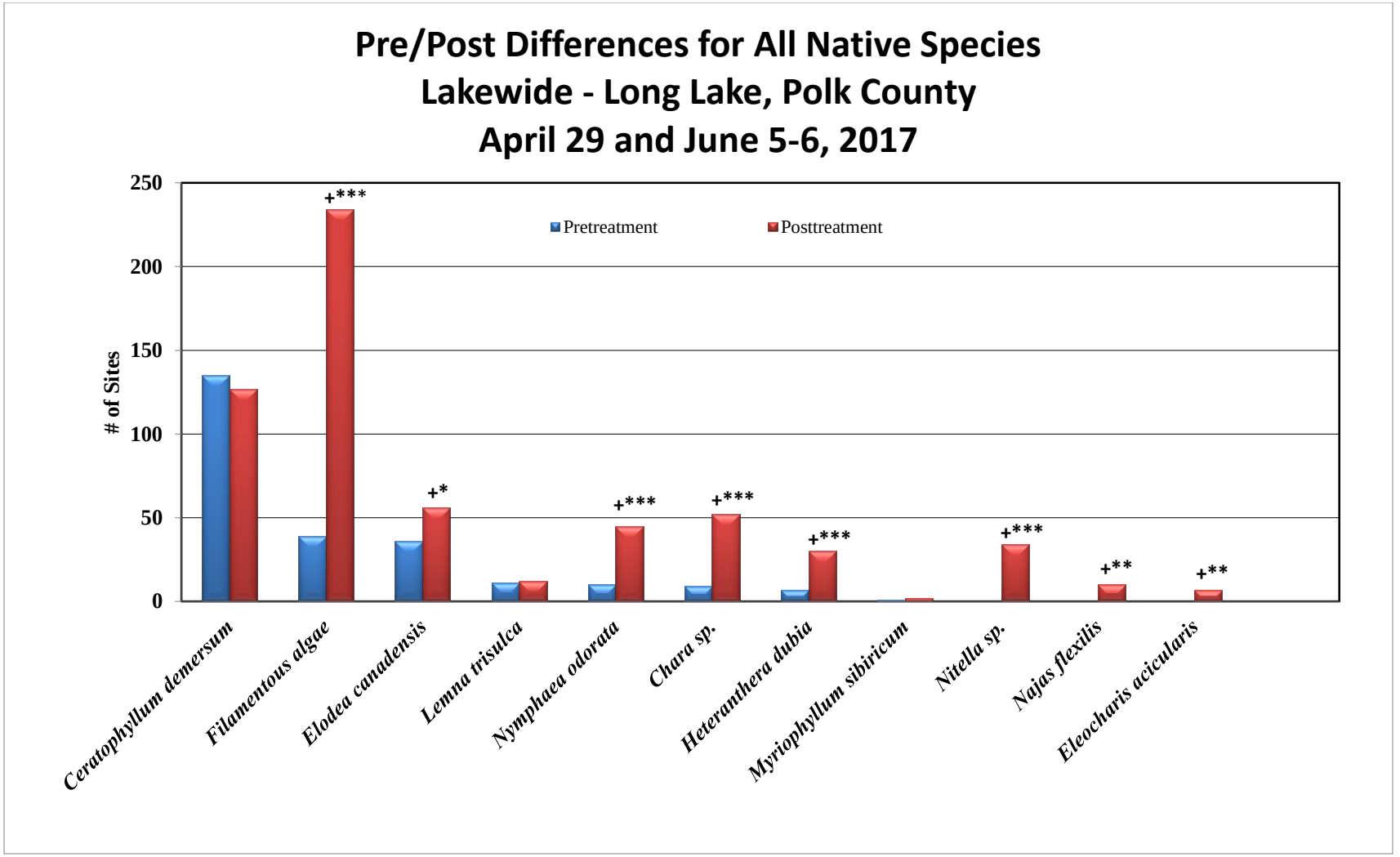
Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake
	Filamentous algae	142	*	77.60	44.65	1.18
Ceratophyllum demersum	Coontail	122	45.19	66.67	38.36	1.21
Elodea canadensis	Common waterweed	53	19.63	28.96	16.67	1.47
Nymphaea odorata	White water lily	45	16.67	24.59	14.15	1.16
Chara sp.	Muskgrass	21	7.78	11.48	6.60	1.10
Heteranthera dubia	Water star-grass	9	3.33	4.92	2.83	1.00
Lemna trisulca	Forked duckweed	7	2.59	3.83	2.20	1.00
Nitella sp.	Nitella	6	2.22	3.28	1.89	1.00
Eleocharis acicularis	Needle spikerush	3	1.11	1.64	0.94	1.33
Myriophyllum sibiricum	Northern water-milfoil	2	0.74	1.09	0.63	1.00
Potamogeton crispus	Curly-leaf pondweed	2	0.74	1.09	0.63	1.00

* Excluded from relative frequency analysis

Table 6: Frequencies and Mean Rake Sample of Aquatic Macrophytes
Posttreatment Survey - Low CLP Density Areas - Long Lake, Polk County
June 5-6, 2017

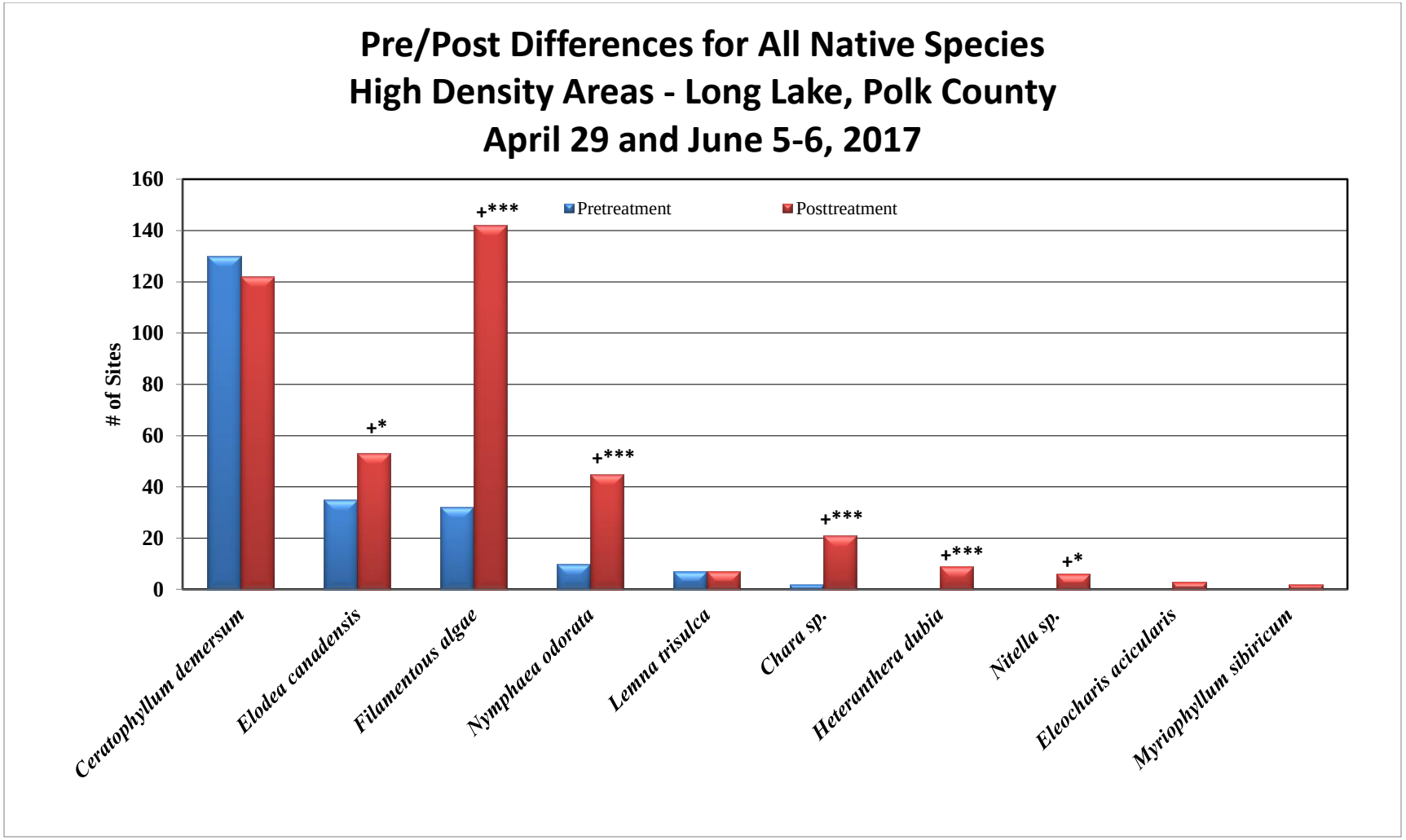
Species	Common Name	Total Sites	Relative Freq.	Freq. in Veg.	Freq. in Lit.	Mean Rake
	Filamentous algae	92	*	112.20	46.94	1.02
Chara sp.	Muskgrass	31	28.97	37.80	15.82	1.06
Nitella sp.	Nitella	28	26.17	34.15	14.29	1.04
Heteranthera dubia	Water star-grass	21	19.63	25.61	10.71	1.00
Najas flexilis	Slender naiad	10	9.35	12.20	5.10	1.00
Ceratophyllum demersum	Coontail	5	4.67	6.10	2.55	1.00
Lemna trisulca	Forked duckweed	5	4.67	6.10	2.55	1.00
Eleocharis acicularis	Needle spikerush	4	3.74	4.88	2.04	1.00
Elodea canadensis	Common waterweed	3	2.80	3.66	1.53	1.00

* Excluded from relative frequency analysis



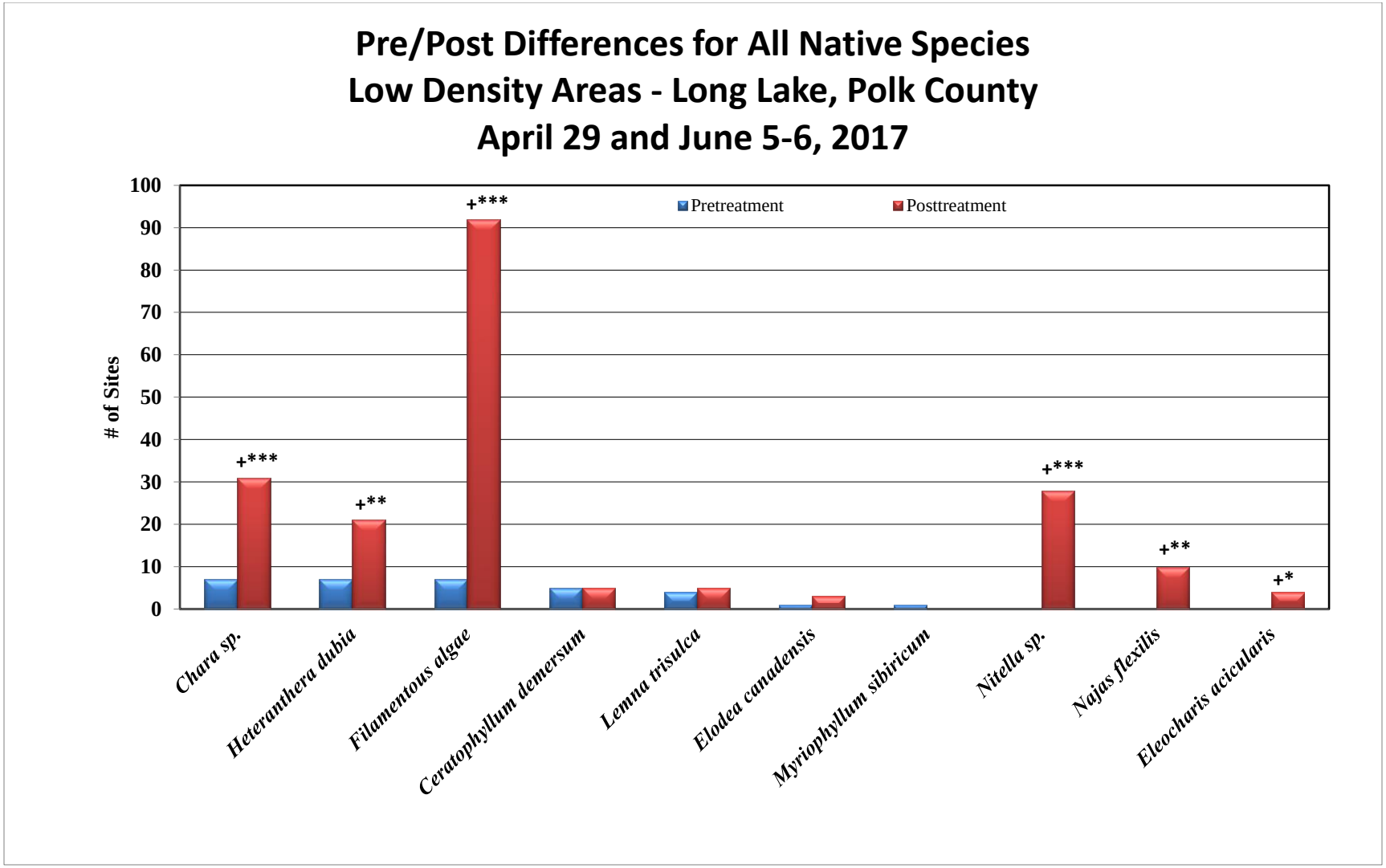
Significant differences = * $p < .05$, ** $p < .01$, *** $p < .001$

Figure 14: Whole Lake Pre/Post Native Species Changes



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

Figure 15: High Density Areas - Pre/Post Native Species Changes



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

Figure 16: Low Density Areas - Pre/Post Native Species Change

LITERATURE CITED

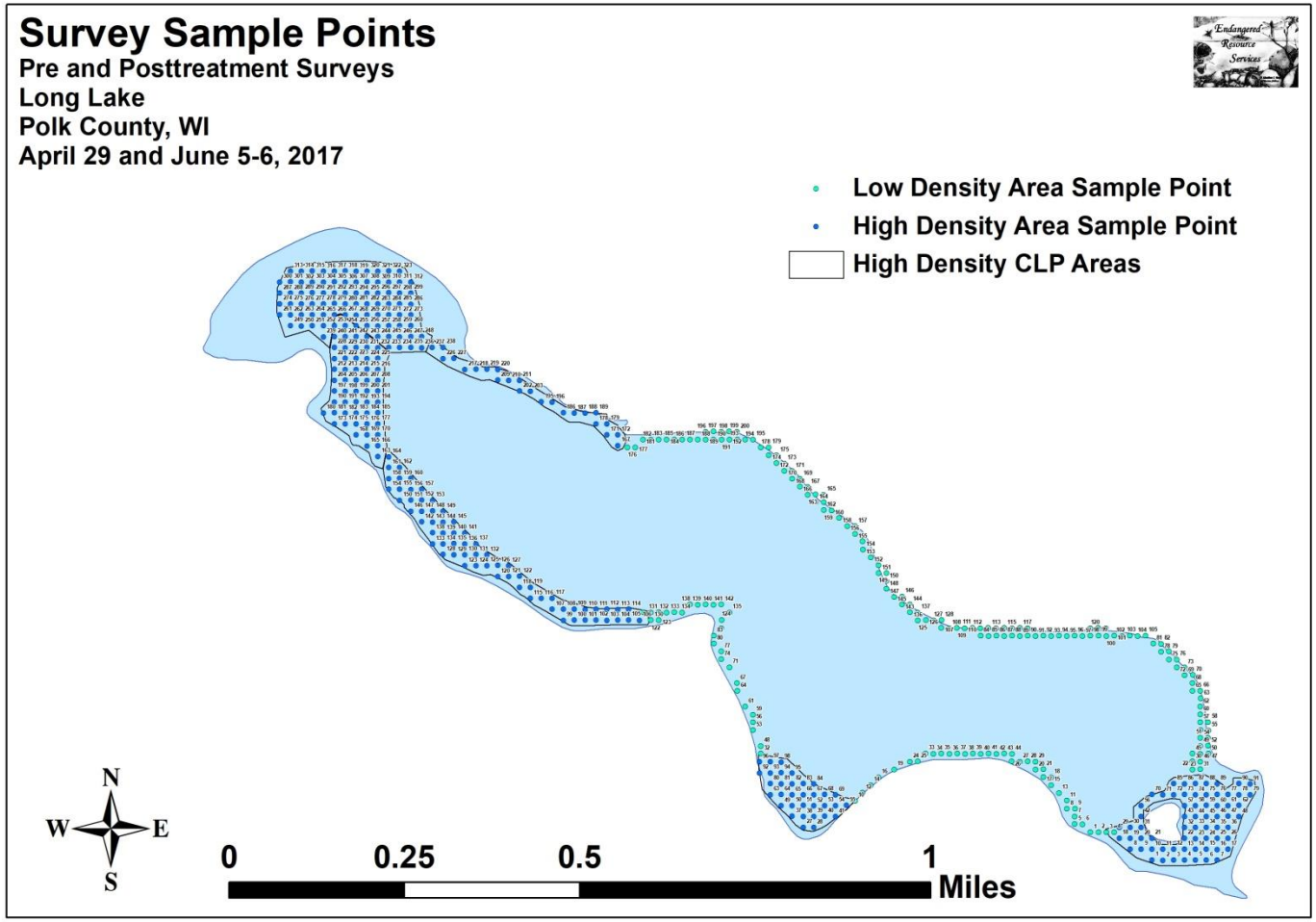
Busch, C., G. Lund, L. Sather, and C. Holt. 1969. Long Lake Map. Available from http://dnr.wi.gov/lakes/maps/DNR/2478200a.pdf (2017, December)

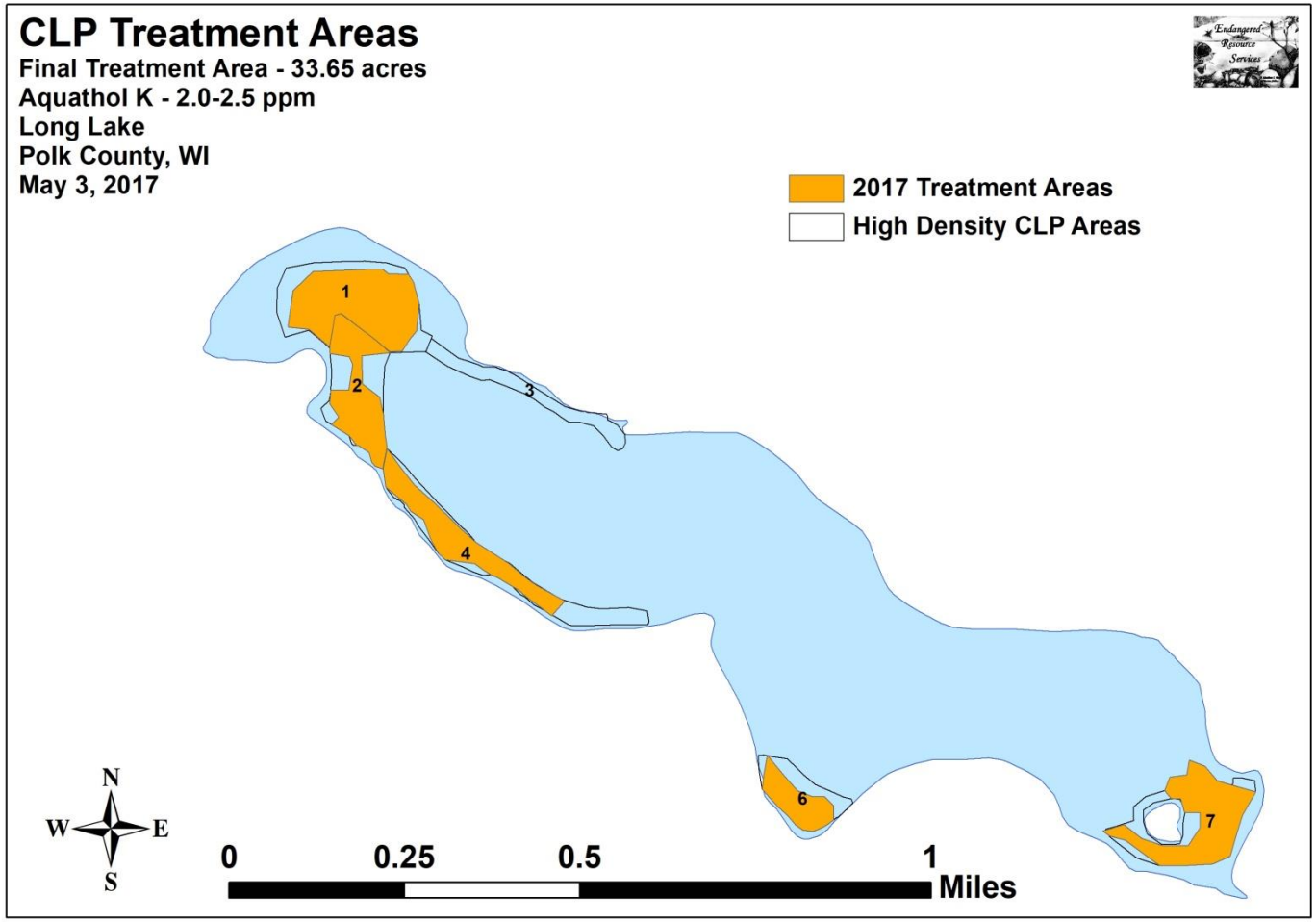
UWEX Lakes Program. [online]. 2010. Aquatic Plant Management in Wisconsin. Available from http://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/ecology/aquaticplants/default.aspx (2017, November).

UWEX Lakes Program. [online]. 2010. Pre/Post Herbicide Comparison. Available from http://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/ecology/Aquatic%20Plants/Appendix-D.pdf (2017, November).

WDNR. [online]. 2017. Citizen Lake Monitoring Water Quality Data Report for Long Lake. http://dnr.wi.gov/lakes/waterquality/Station.aspx?id=493102 (2017, December)

Appendix I: CLP Pre/Post Survey Sample Points and Final Treatment Areas

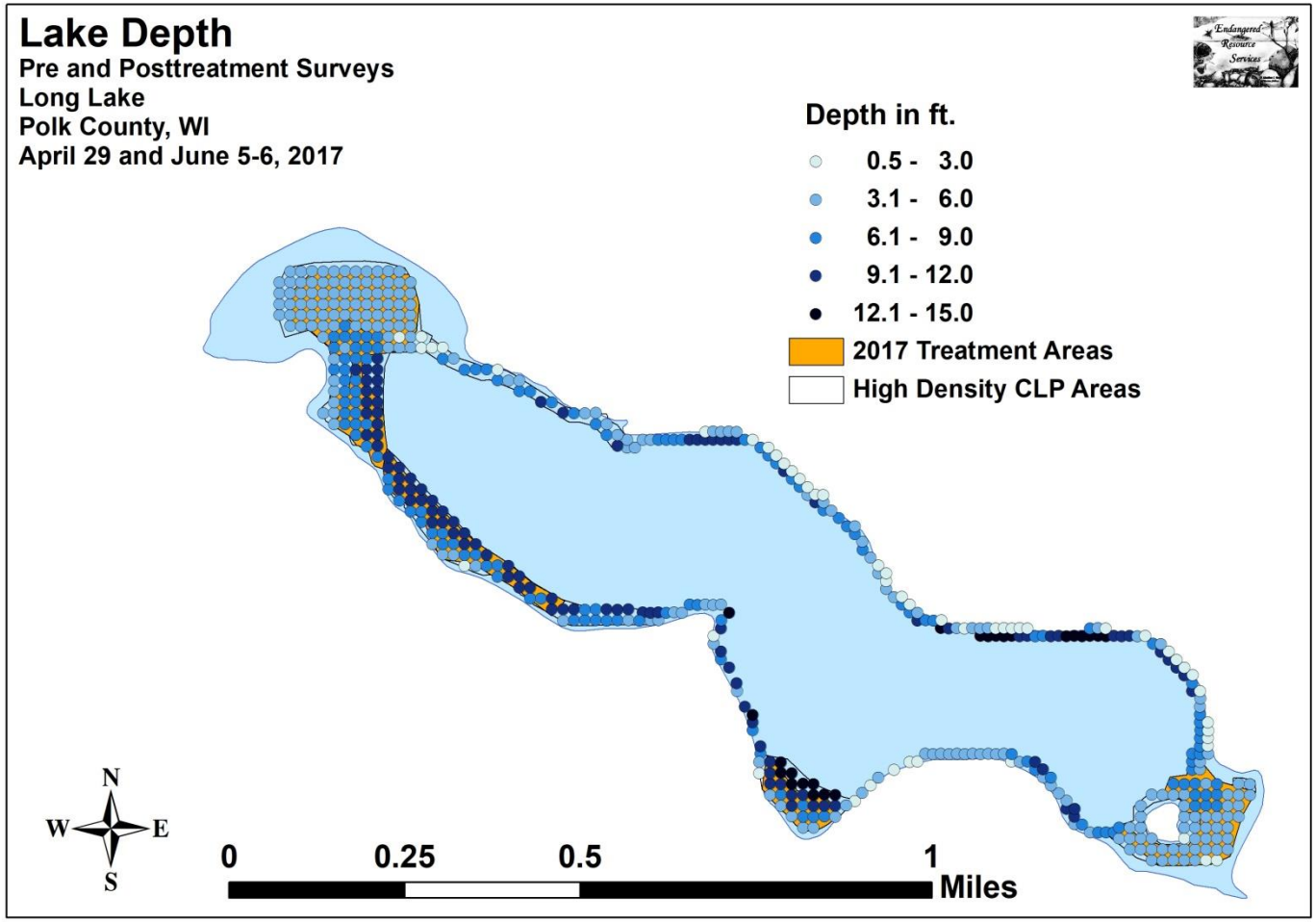

Survey Sample Points
Pre and Posttreatment Surveys
Long Lake
Polk County, WI
April 29 and June 5-6, 2017
Endangered Resource Services
Low Density Area Sample Point
High Density Area Sample Point
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

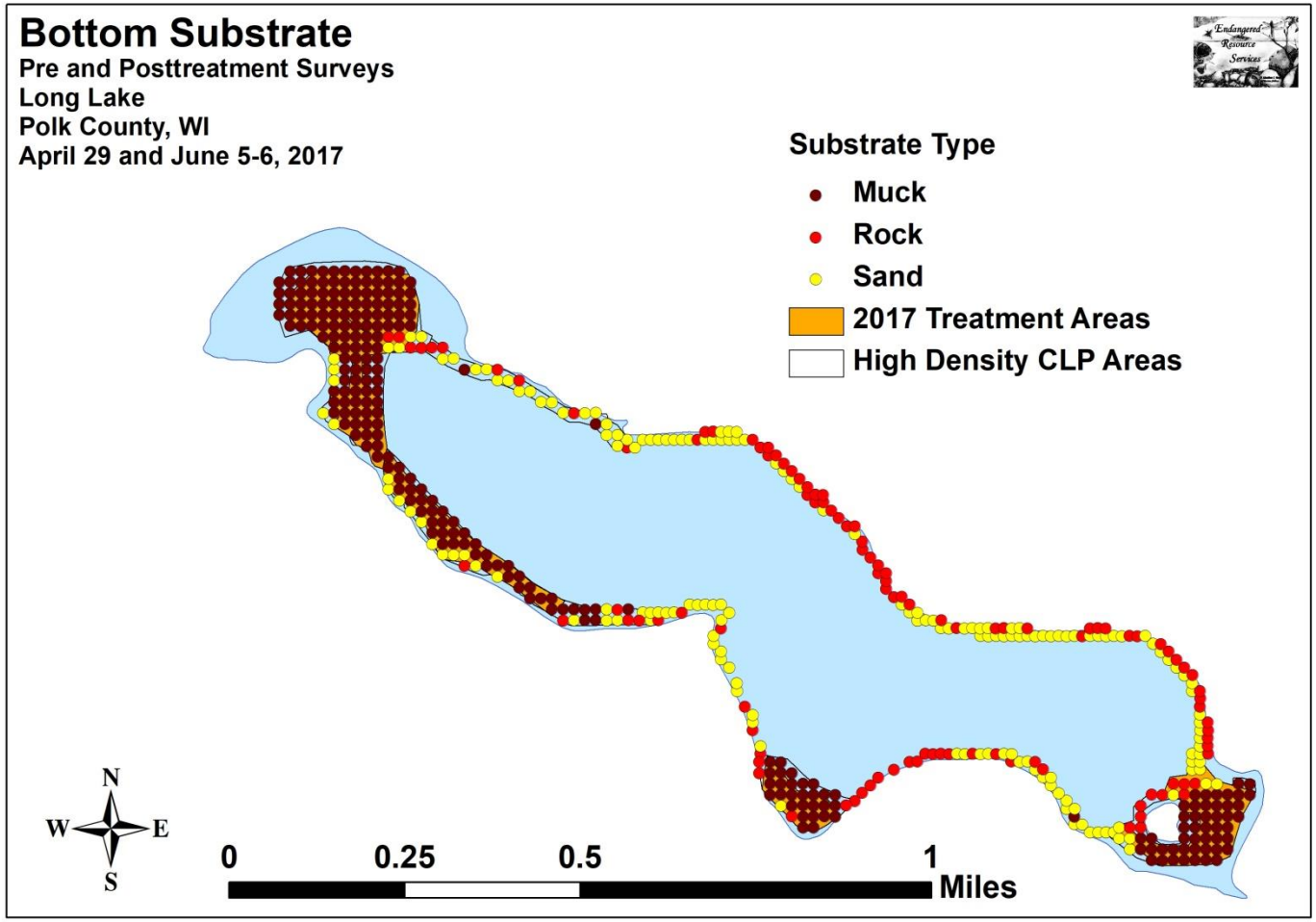

CLP Treatment Areas
Final Treatment Area - 33.65 acres
Aquathol K - 2.0-2.5 ppm
Long Lake
Polk County, WI
May 3, 2017
2017 Treatment Areas
High Density CLP Areas
1
2
3
4
6
7
N
W
E
S
0
0.25
0.5
1
Miles

Appendix II: Vegetative Survey Data Sheet

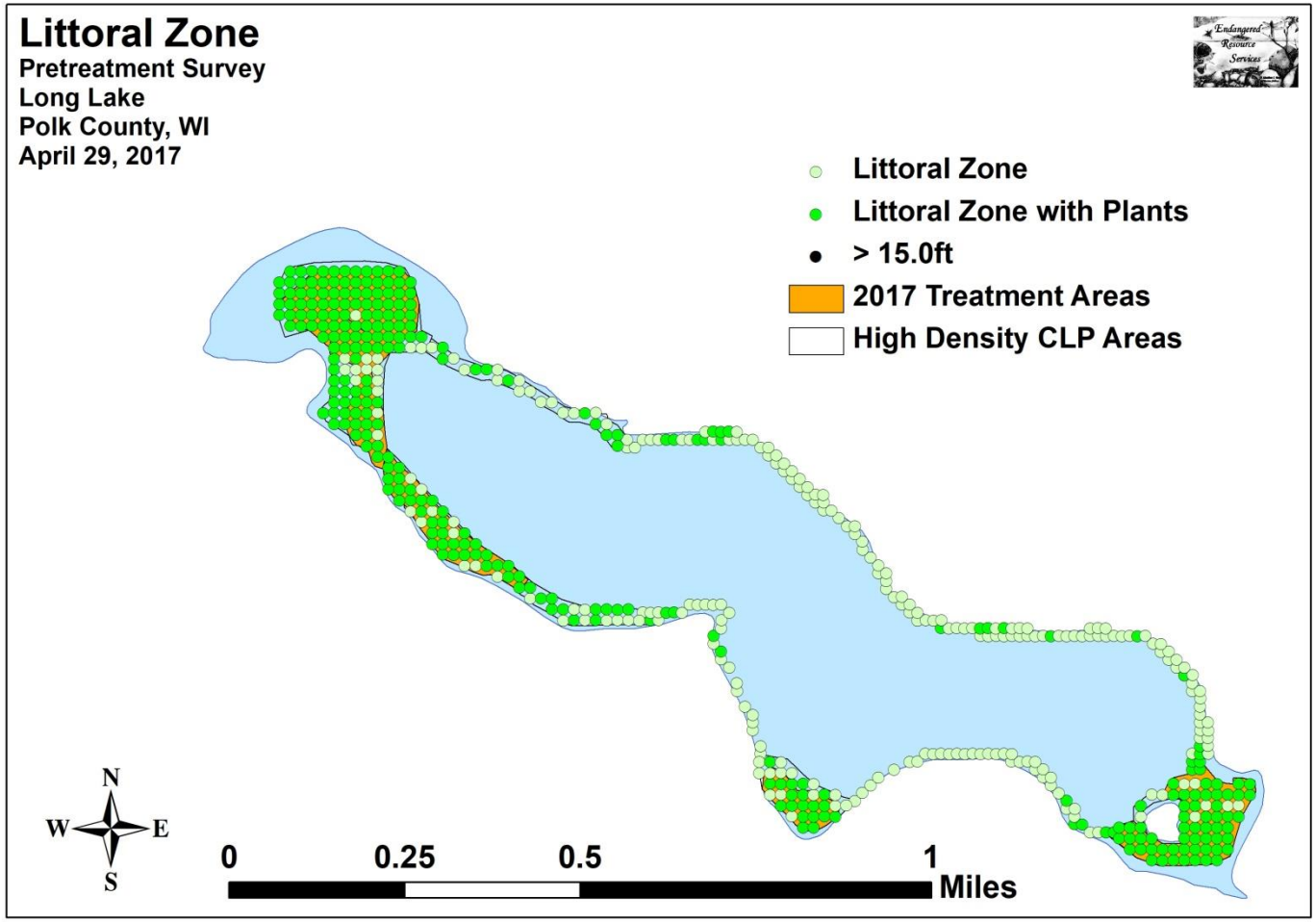
Observers for this lake: names and hours worked by each:																										
Lake:									WBIC									County						Date:	
Site #	Depth (ft)	Muck (M), Sand (S), Rock (R)	Rake pole (P) or rake rope (R)	Total Rake Fullness	CLP	CLP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1																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

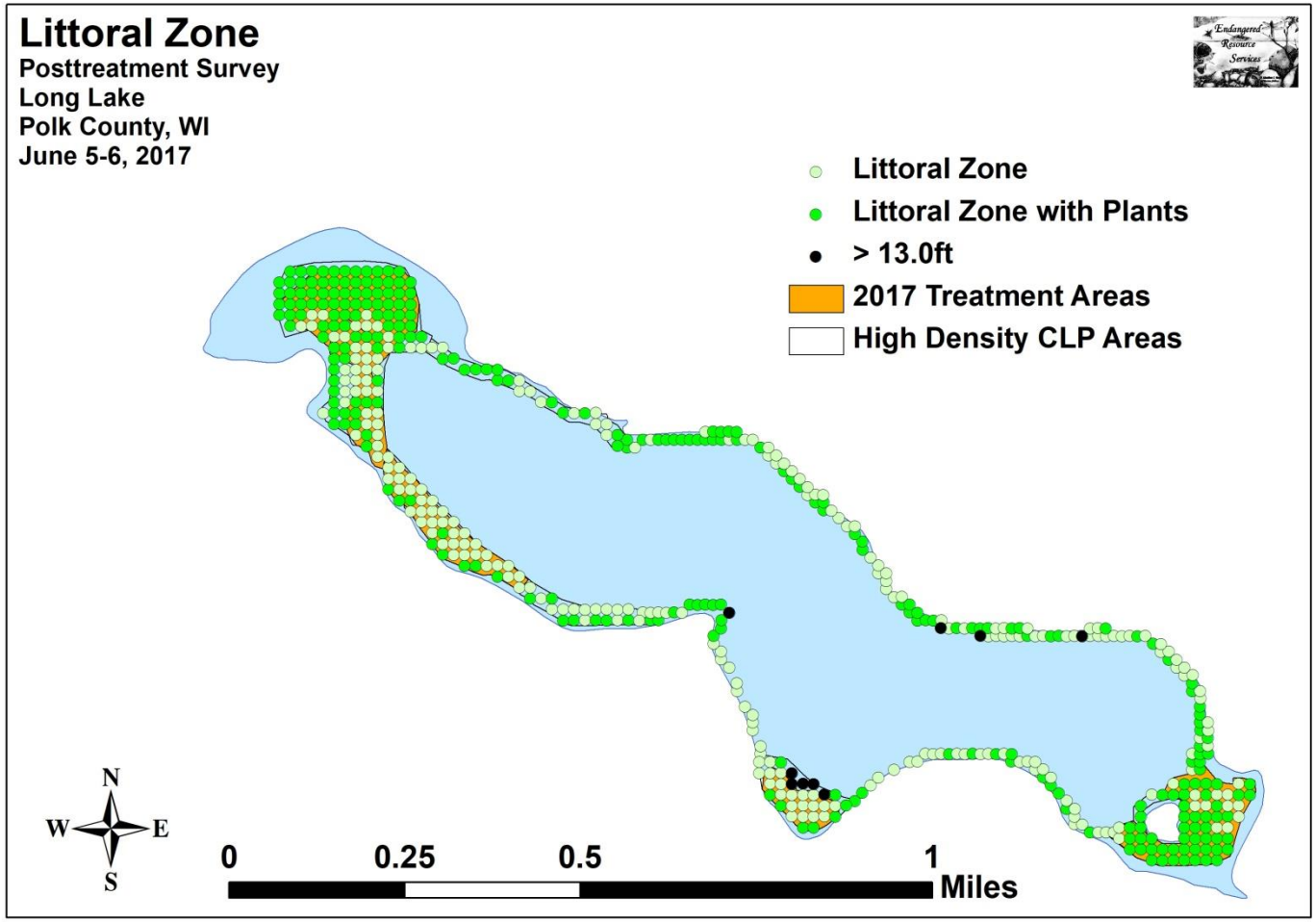
Appendix III: Pre/Post Habitat Variables

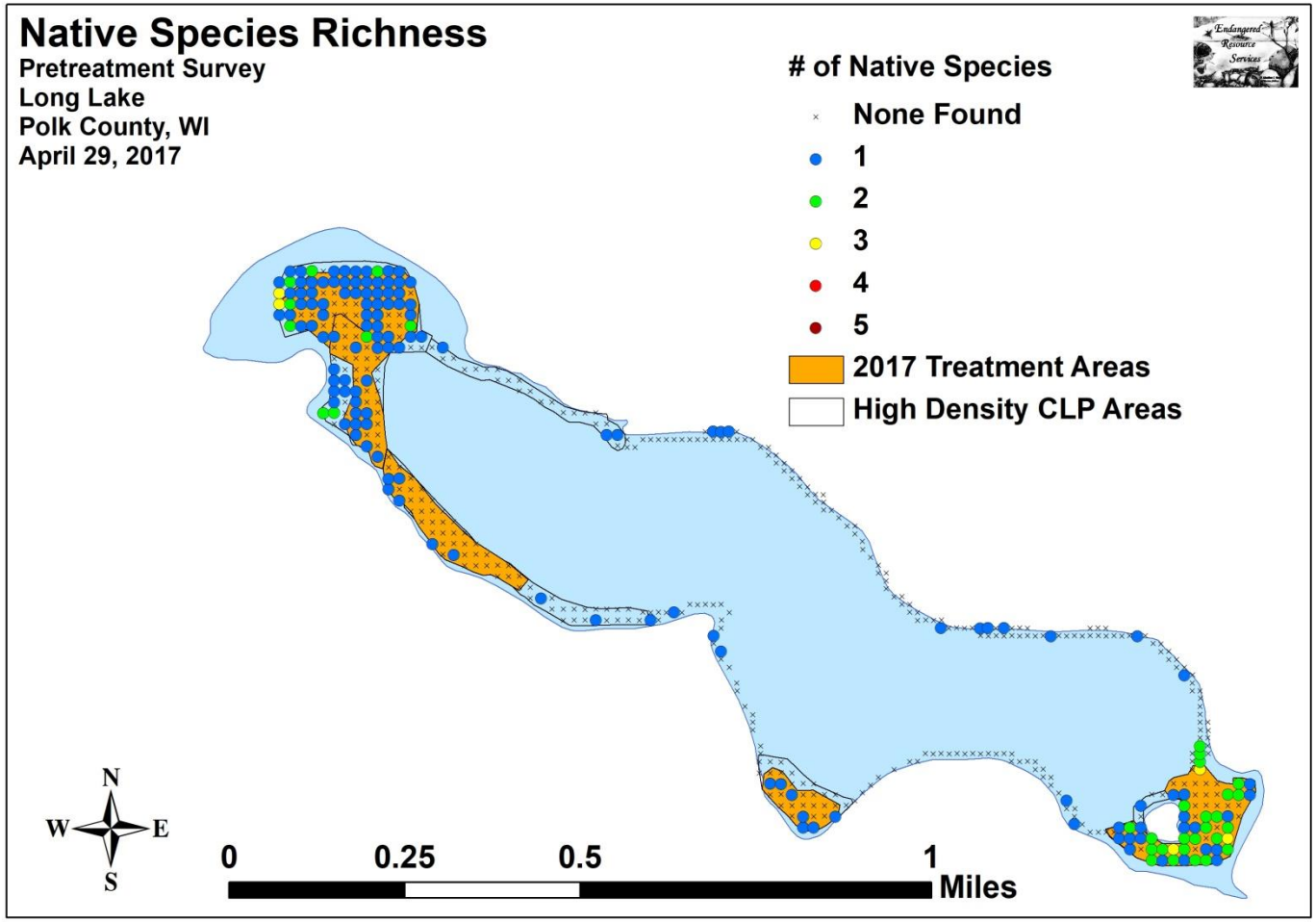

Lake Depth
Pre and Posttreatment Surveys
Long Lake
Polk County, WI
April 29 and June 5-6, 2017
Endangered Resource Services
Depth in ft.
0.5 - 3.0
3.1 - 6.0
6.1 - 9.0
9.1 - 12.0
12.1 - 15.0
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

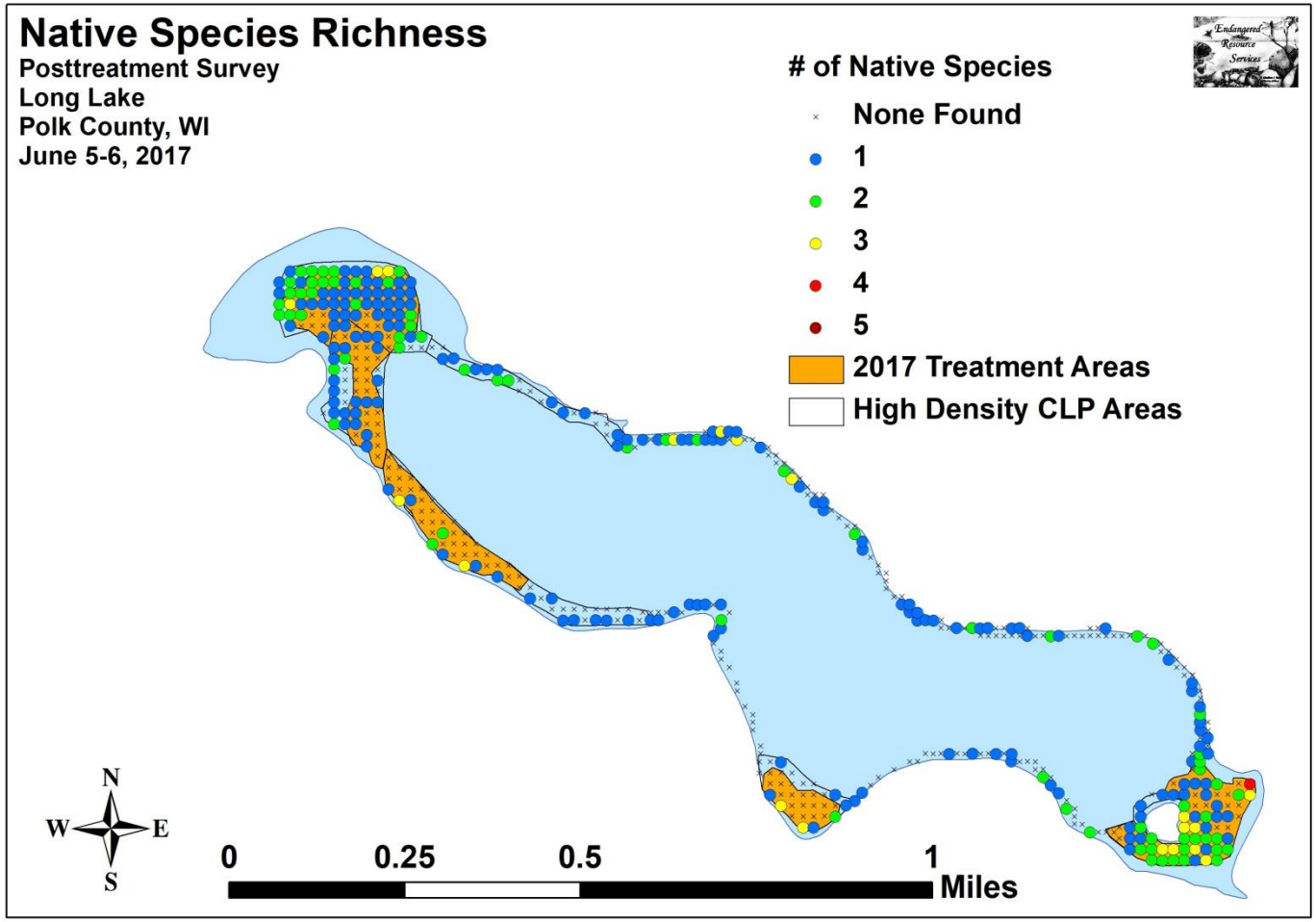

Bottom Substrate
Pre and Posttreatment Surveys
Long Lake
Polk County, WI
April 29 and June 5-6, 2017
Endangered Resource Services
Substrate Type
Muck
Rock
Sand
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

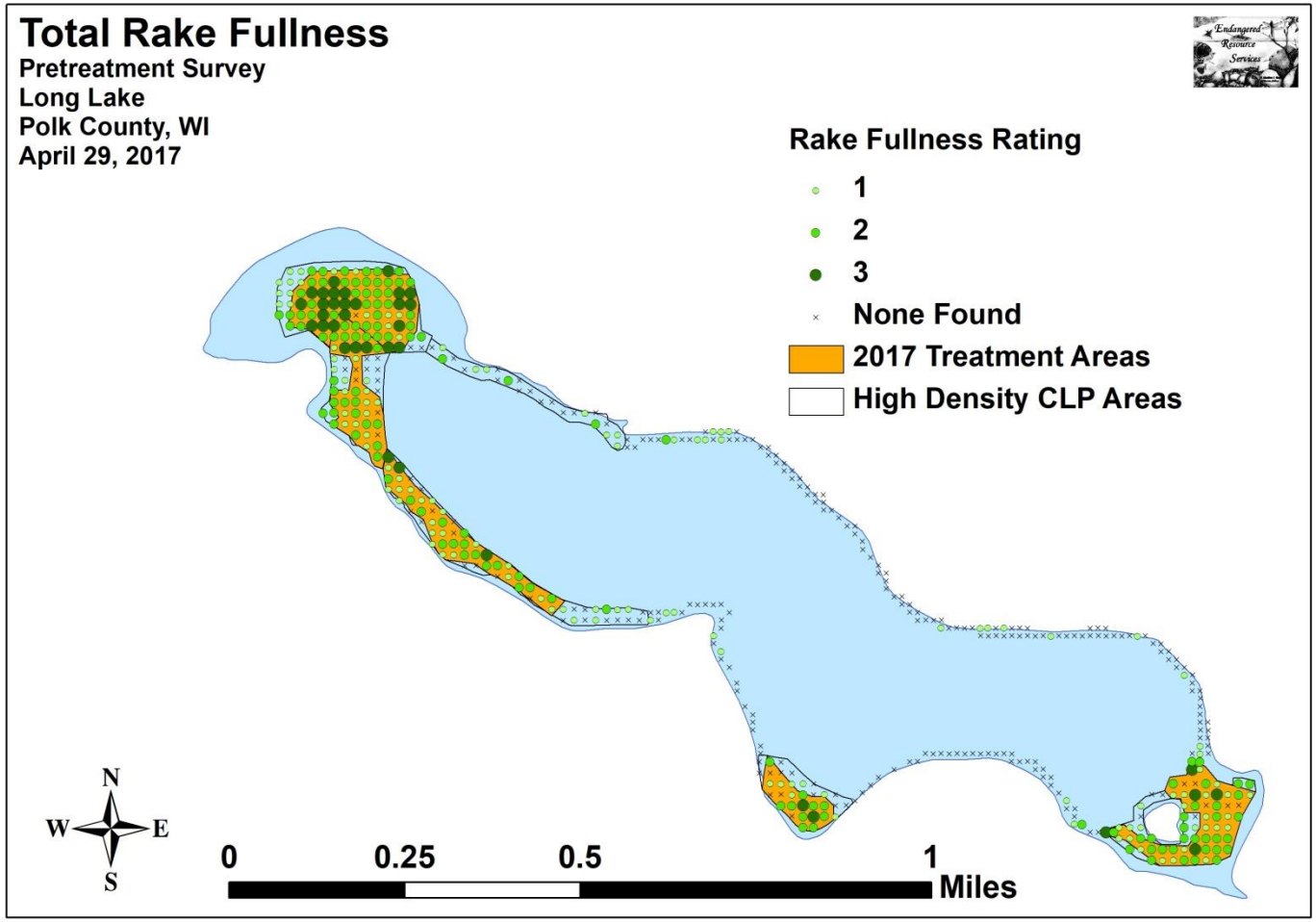
Appendix IV: Pre/Post Littoral Zone, Native Species Richness, and Total Rake Fullness

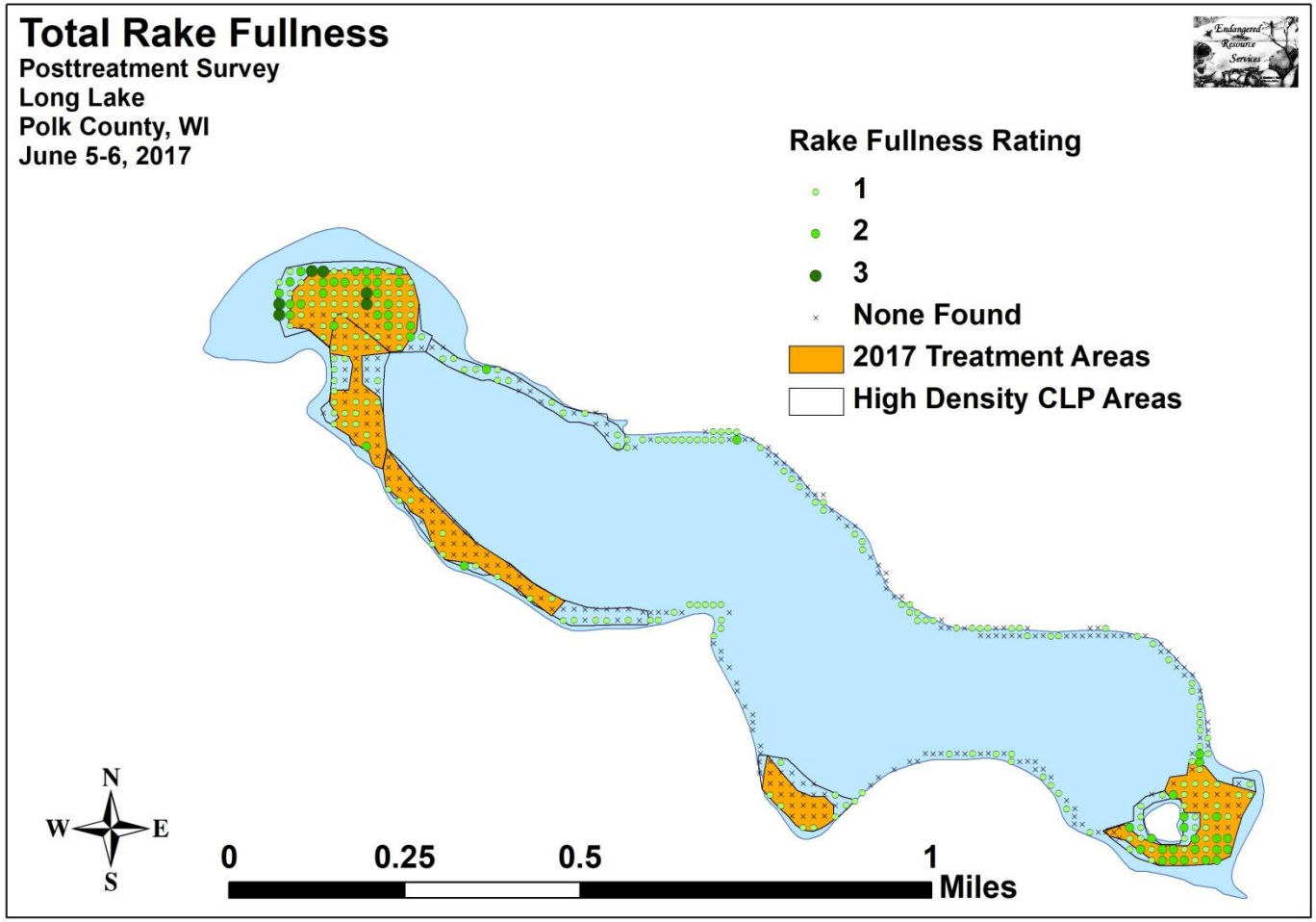

Littoral Zone
Pretreatment Survey
Long Lake
Polk County, WI
April 29, 2017
Endangered Resource Services
Littoral Zone
Littoral Zone with Plants
> 15.0ft
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles


Littoral Zone
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
Littoral Zone
Littoral Zone with Plants
> 13.0ft
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

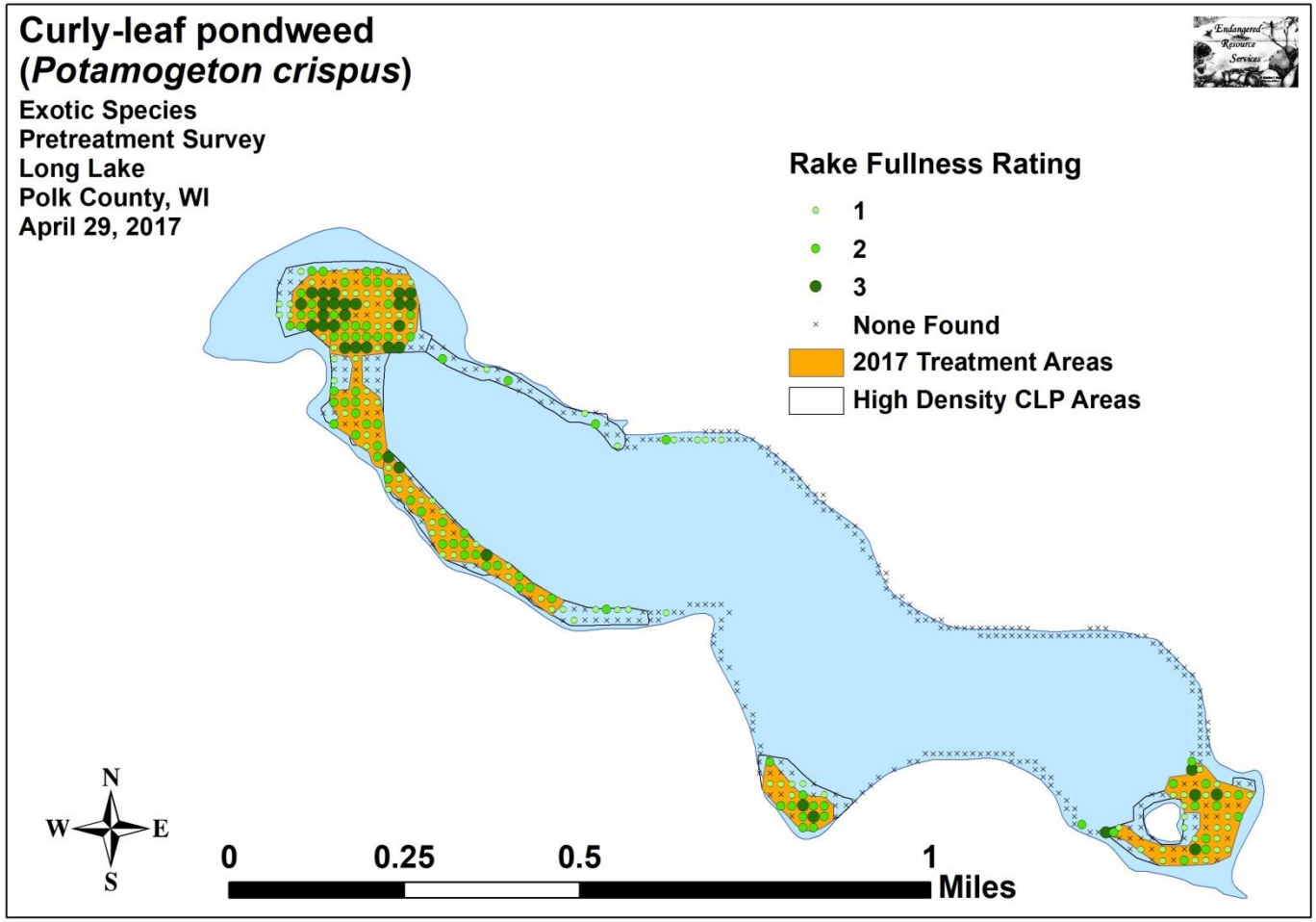

Native Species Richness
Pretreatment Survey
Long Lake
Polk County, WI
April 29, 2017
# of Native Species
None Found
1
2
3
4
5
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

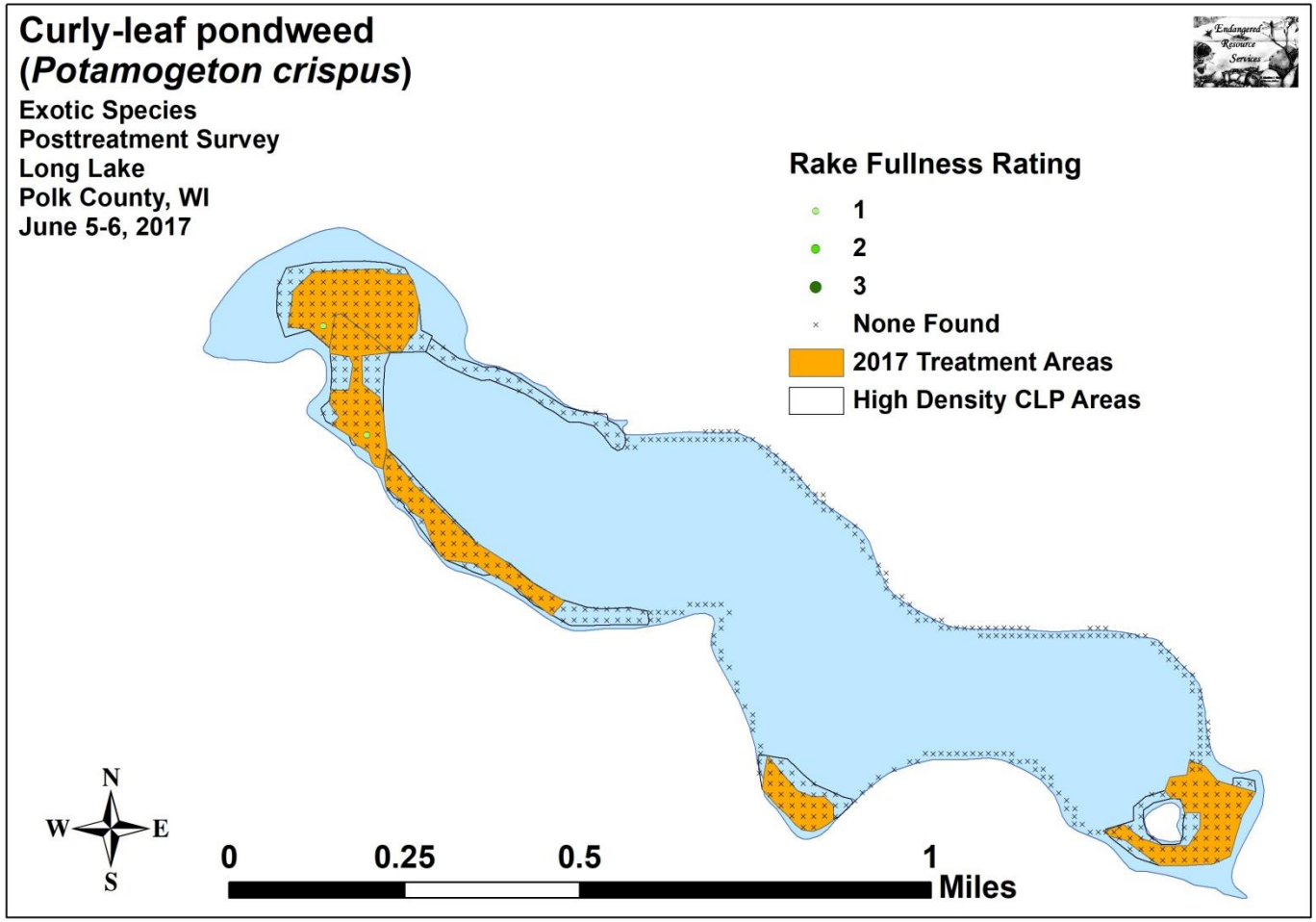

Native Species Richness
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
# of Native Species
None Found
1
2
3
4
5
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles


Total Rake Fullness
Pretreatment Survey
Long Lake
Polk County, WI
April 29, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

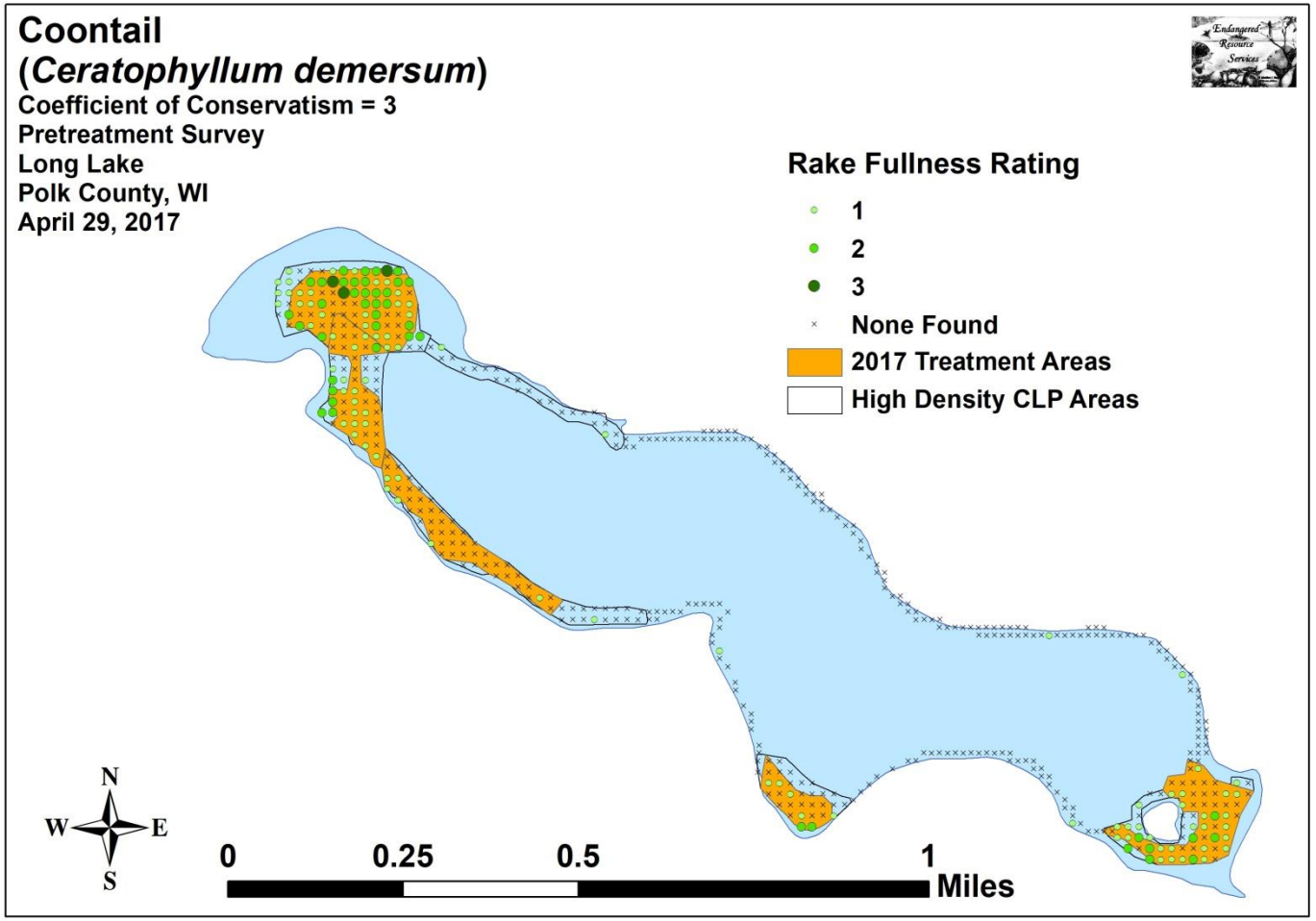

Total Rake Fullness
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

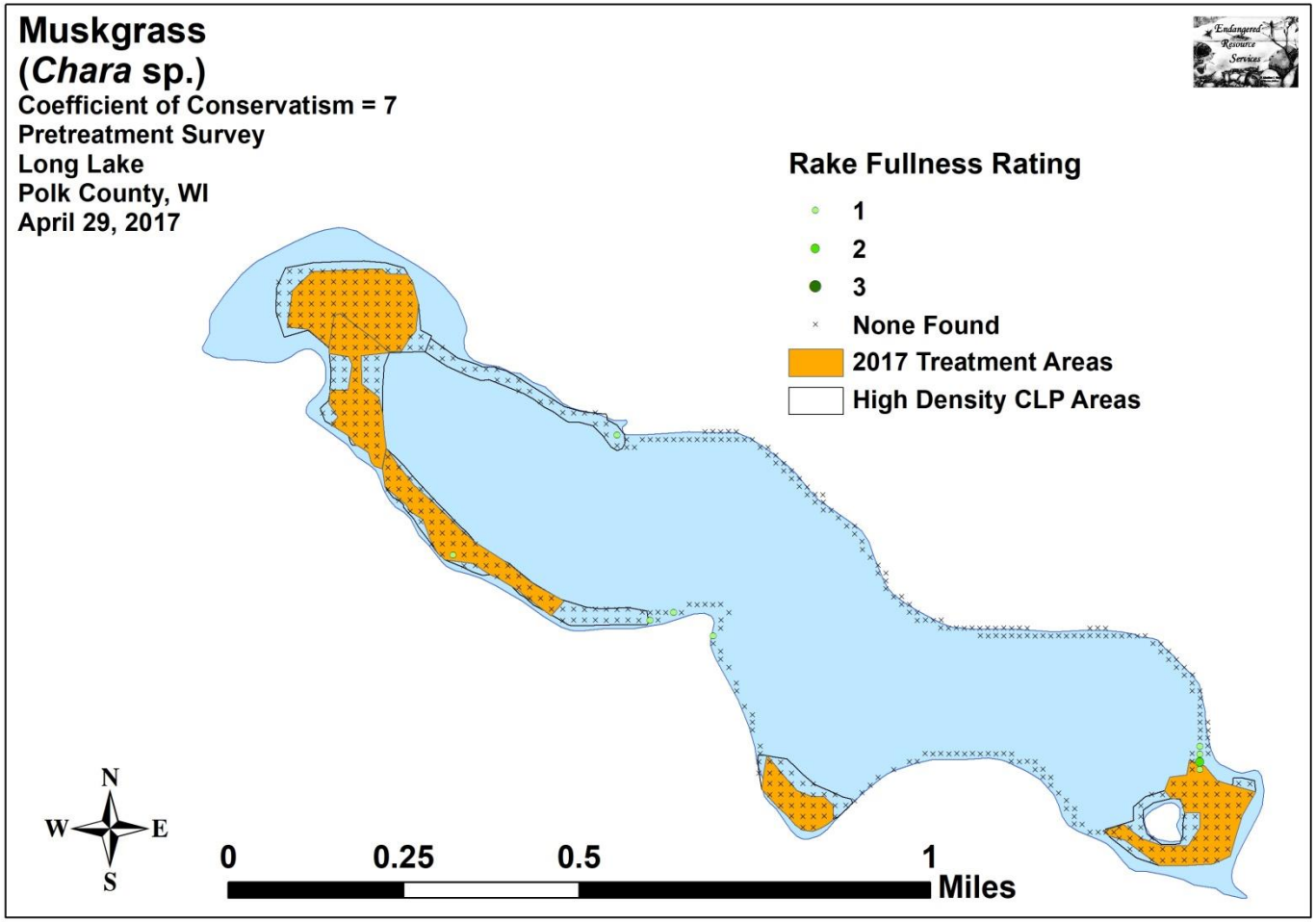
Appendix V: CLP Pre/Posttreatment Distribution

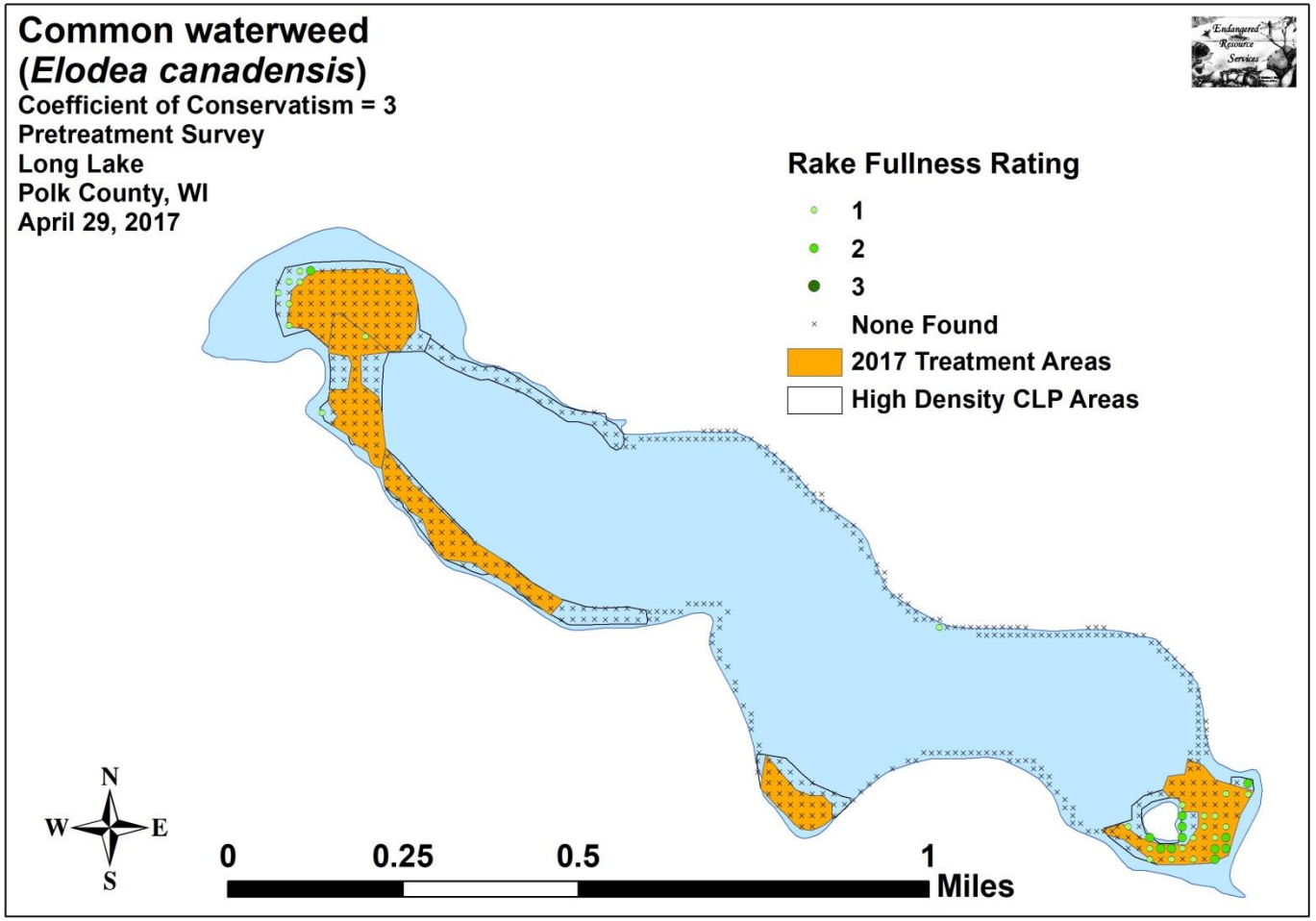

Curly-leaf pondweed
(*Potamogeton crispus*)
Exotic Species
Pretreatment Survey
Long Lake
Polk County, WI
April 29, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

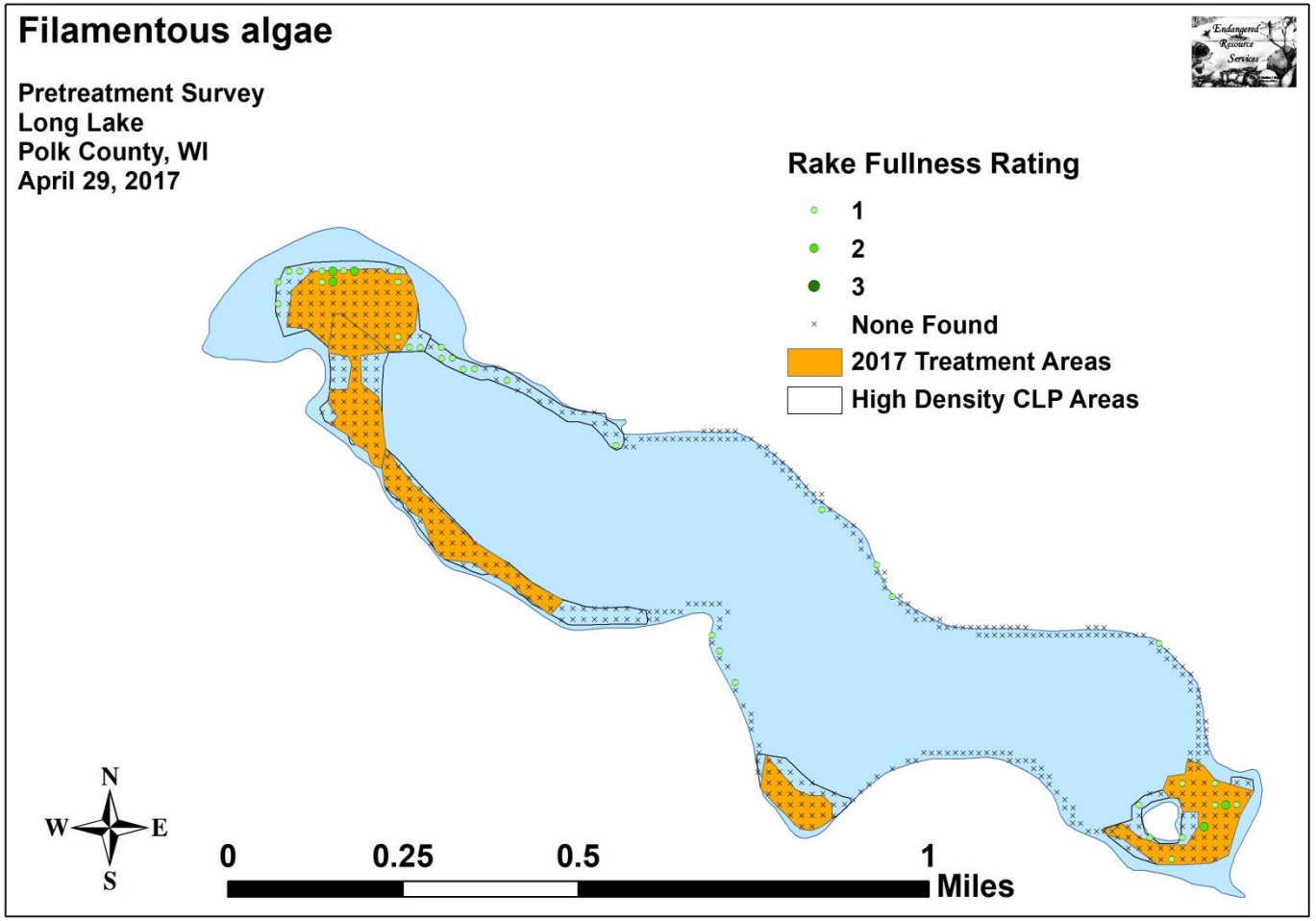

Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

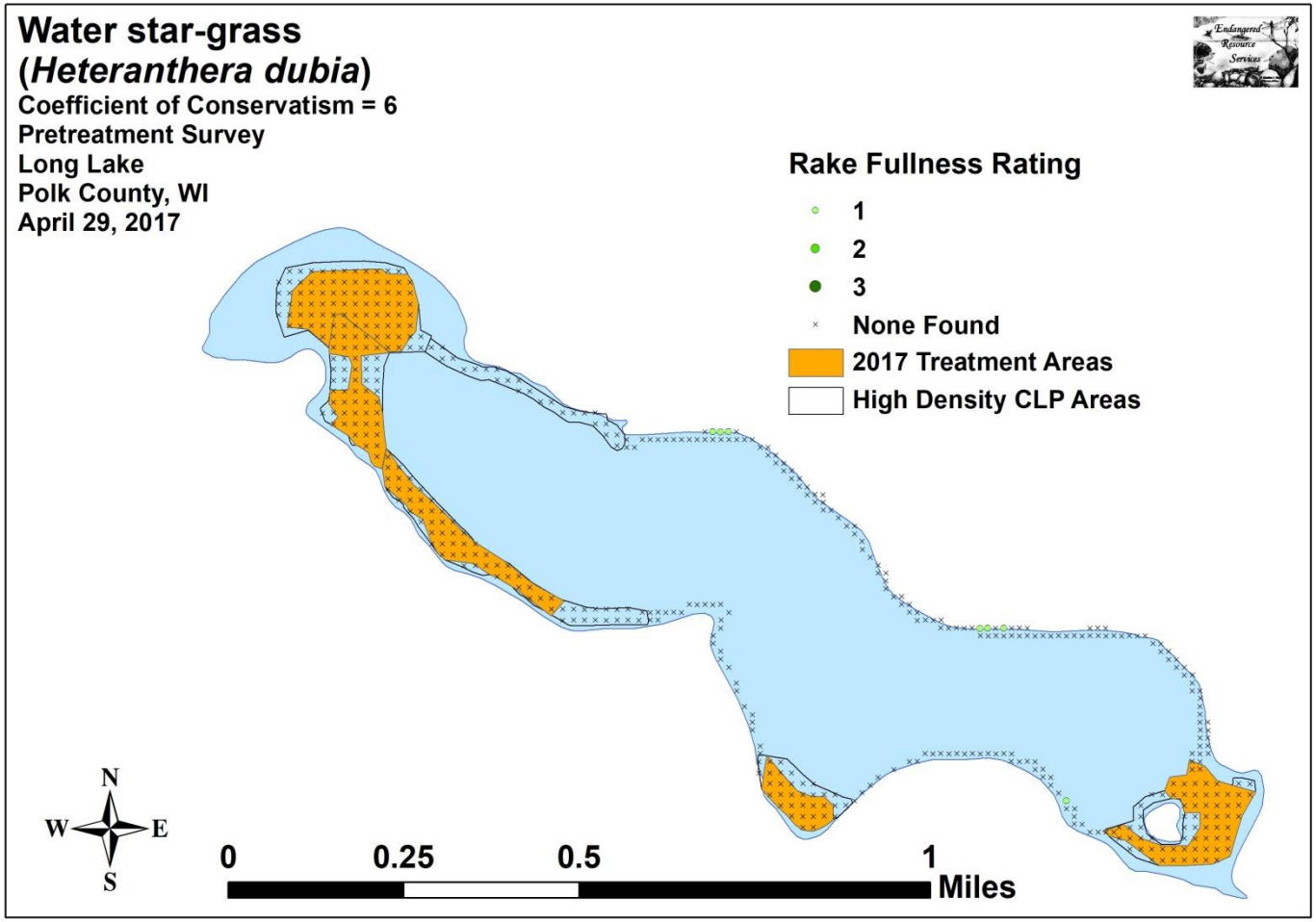
Appendix VI: Pretreatment Native Species Distribution

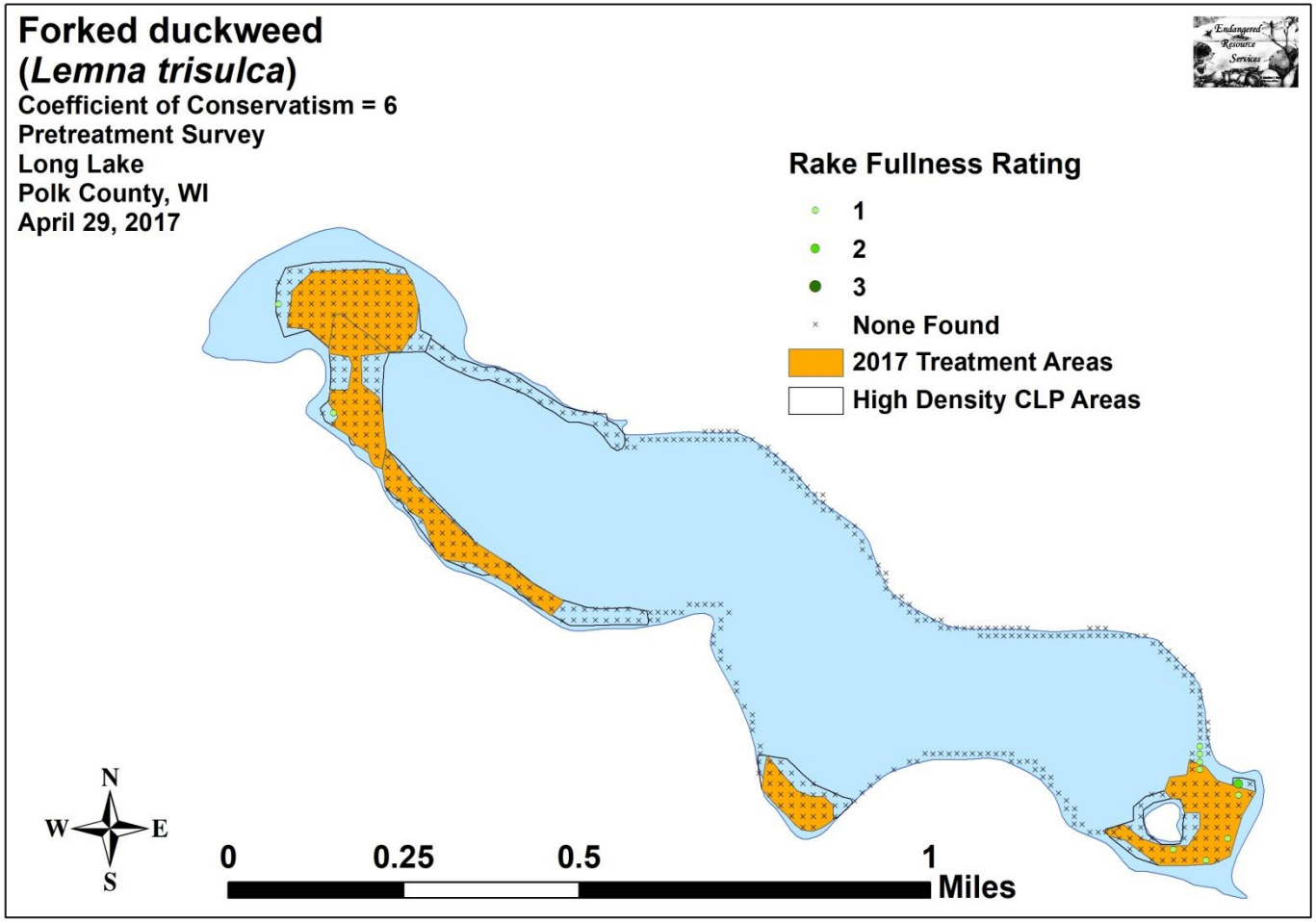

Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Pretreatment Survey
Long Lake
Polk County, WI
April 29, 2017
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

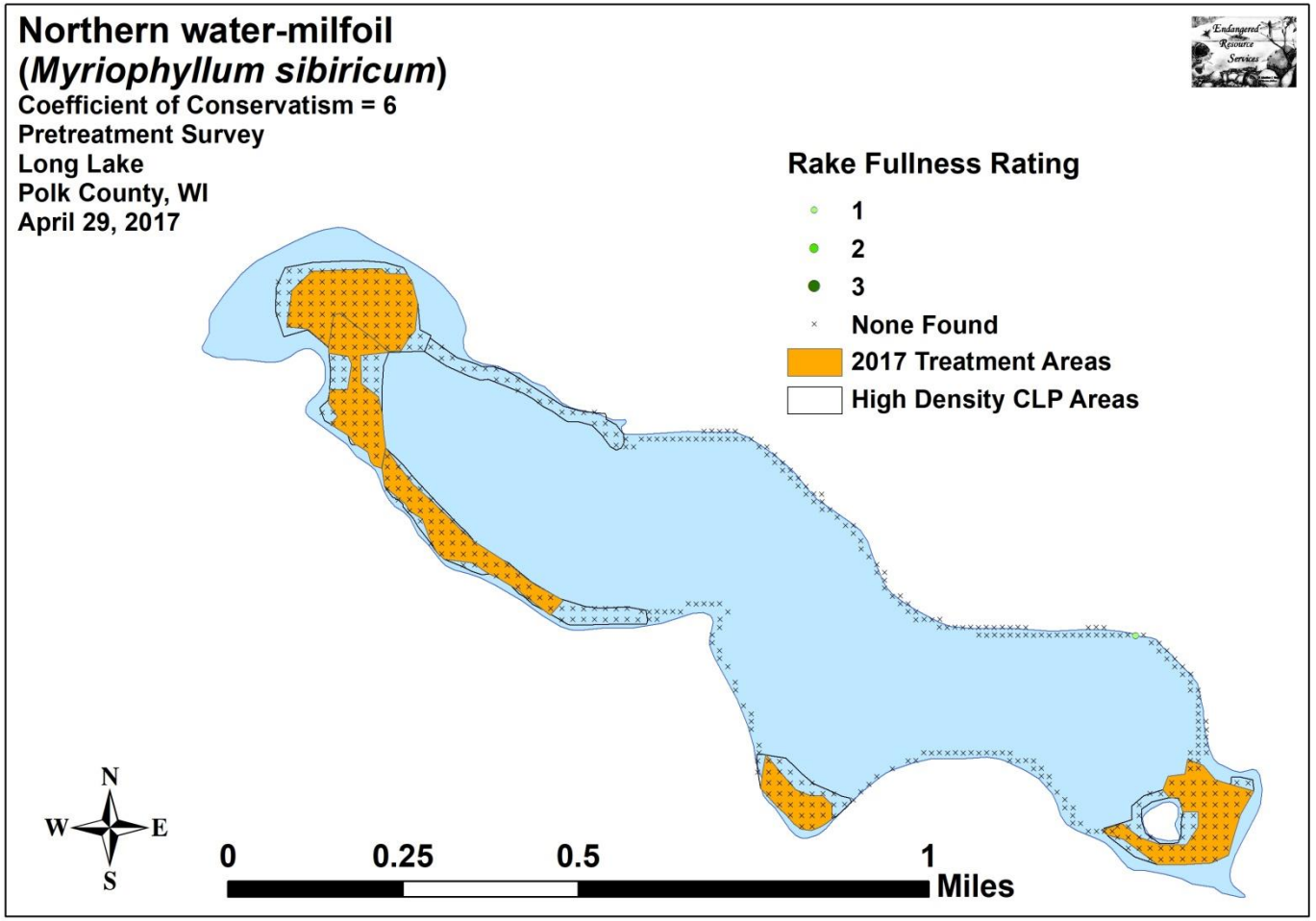

Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Pretreatment Survey
Long Lake
Polk County, WI
April 29, 2017
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

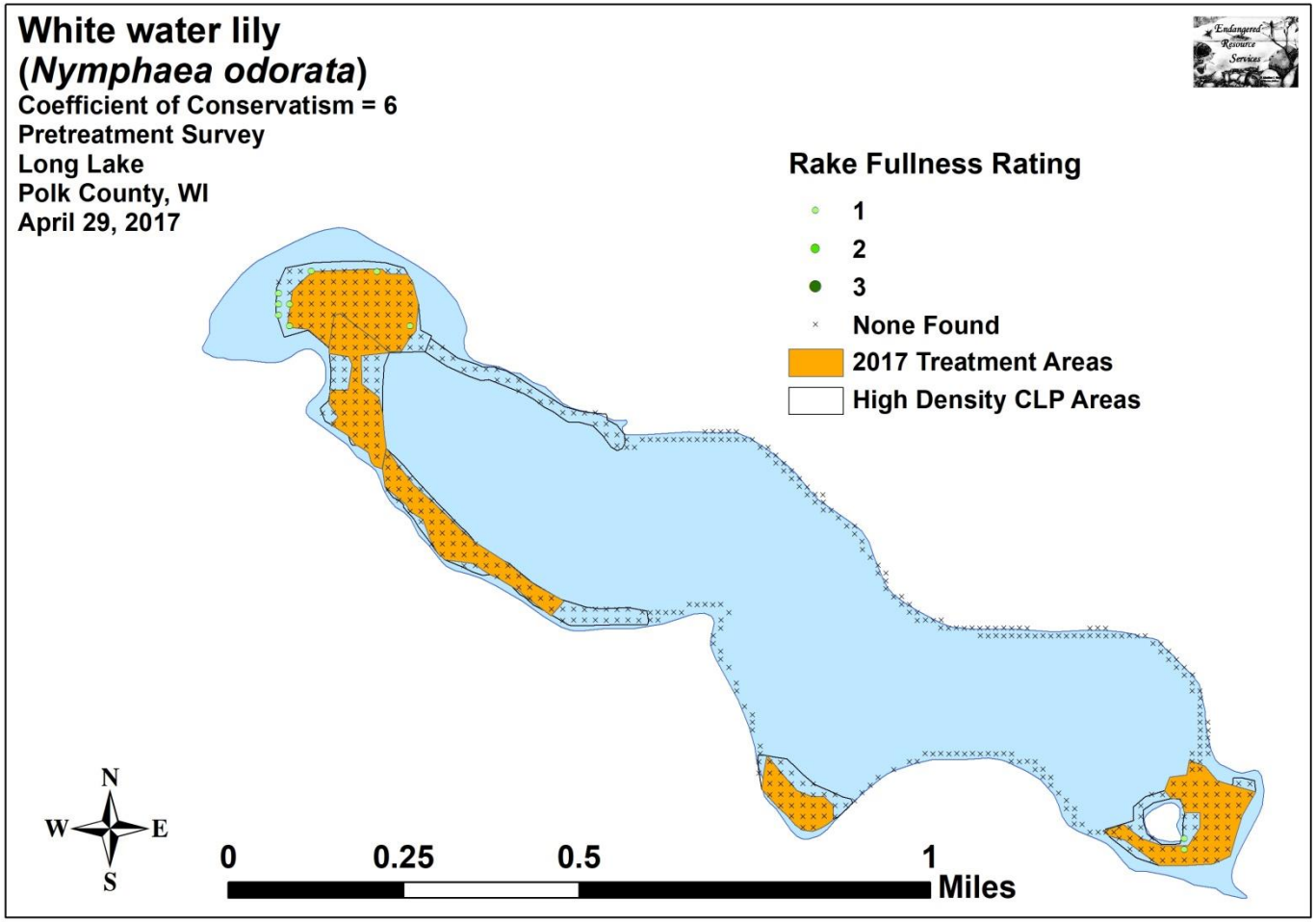

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Pretreatment Survey
Long Lake
Polk County, WI
April 29, 2017
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles


Filamentous algae
Pretreatment Survey
Long Lake
Polk County, WI
April 29, 2017
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

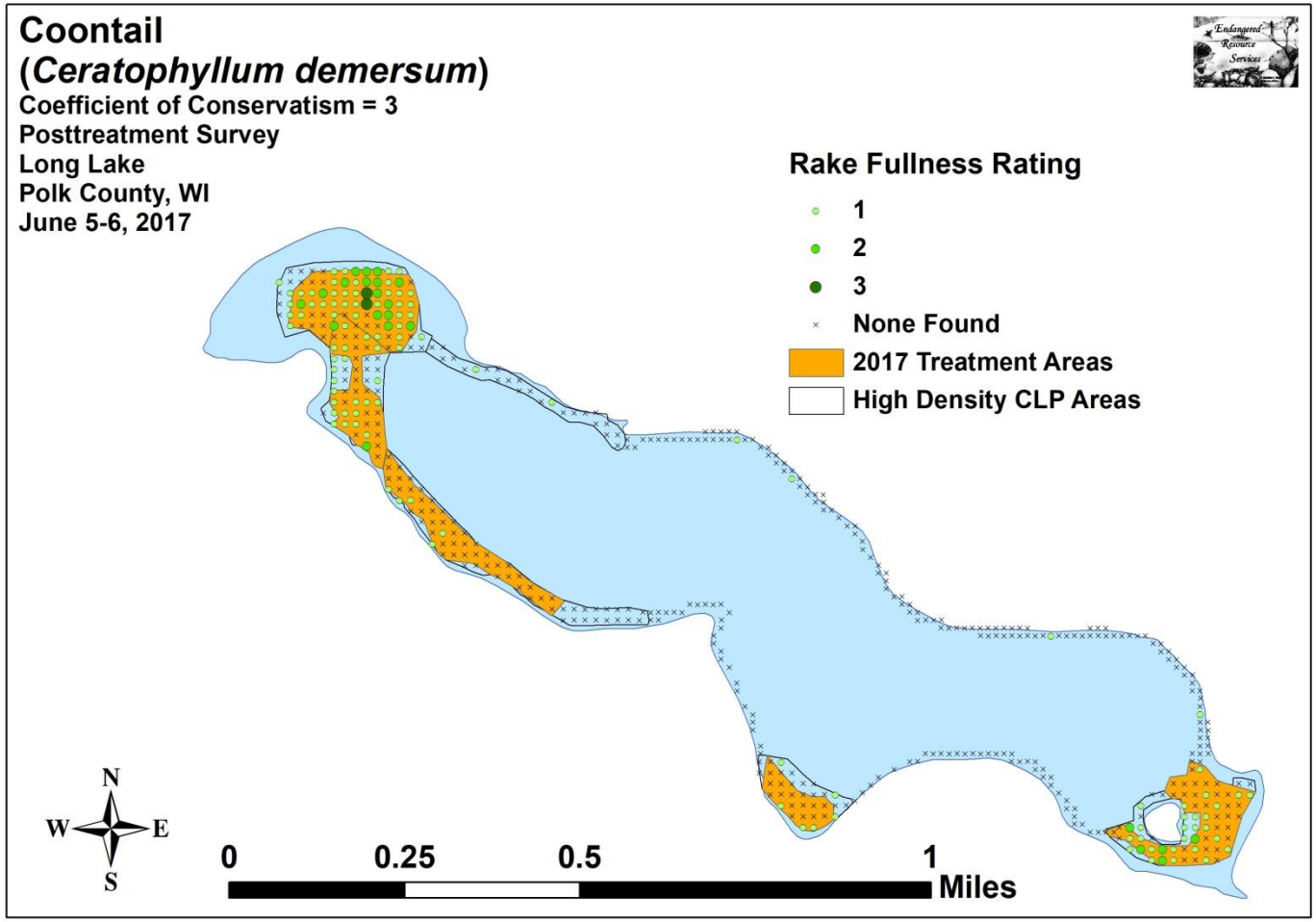

Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Pretreatment Survey
Long Lake
Polk County, WI
April 29, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

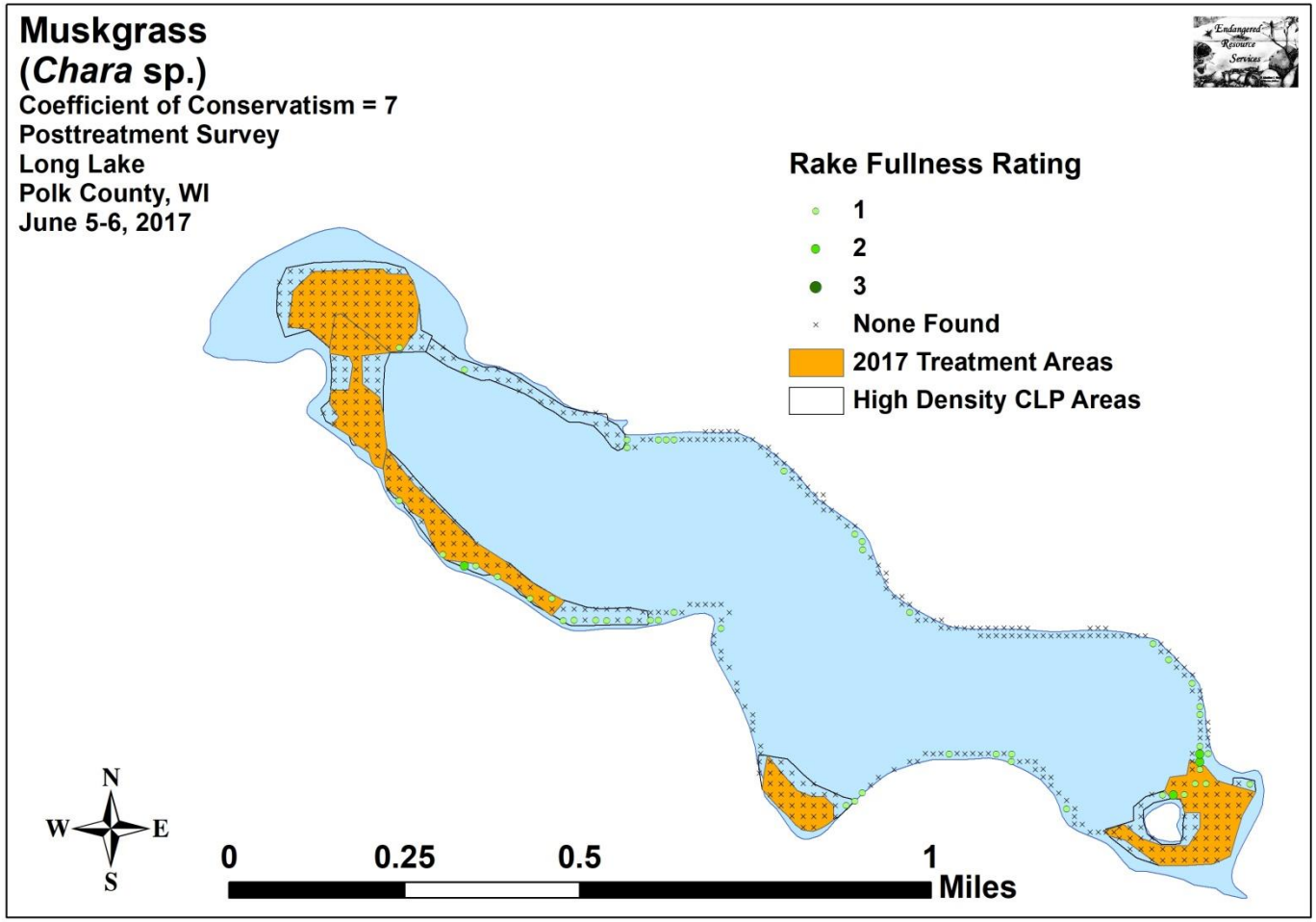

Forked duckweed
(Lemna trisulca)
Coefficient of Conservatism = 6
Pretreatment Survey
Long Lake
Polk County, WI
April 29, 2017
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

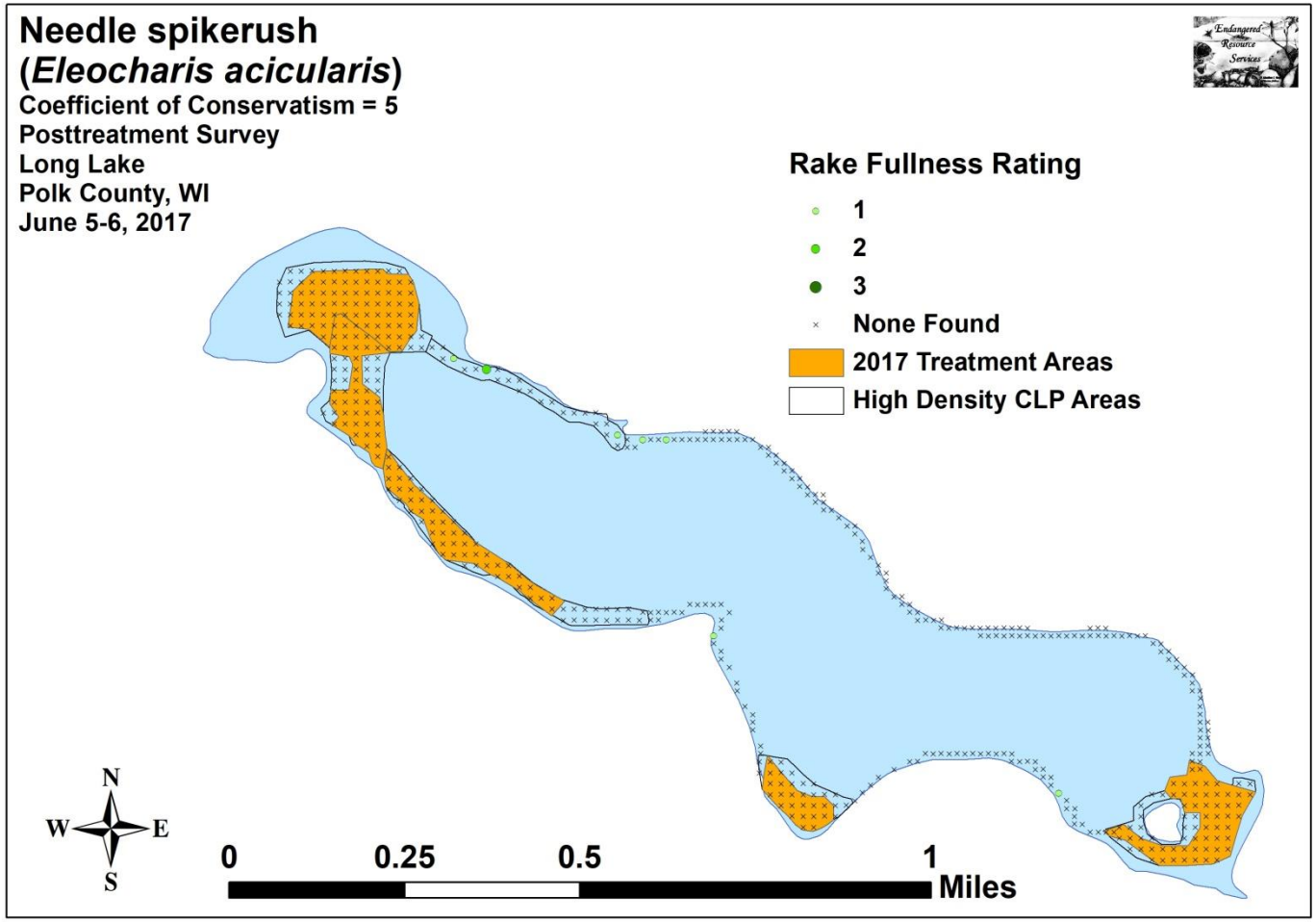

Northern water-milfoil
(Myriophyllum sibiricum)
Coefficient of Conservatism = 6
Pretreatment Survey
Long Lake
Polk County, WI
April 29, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

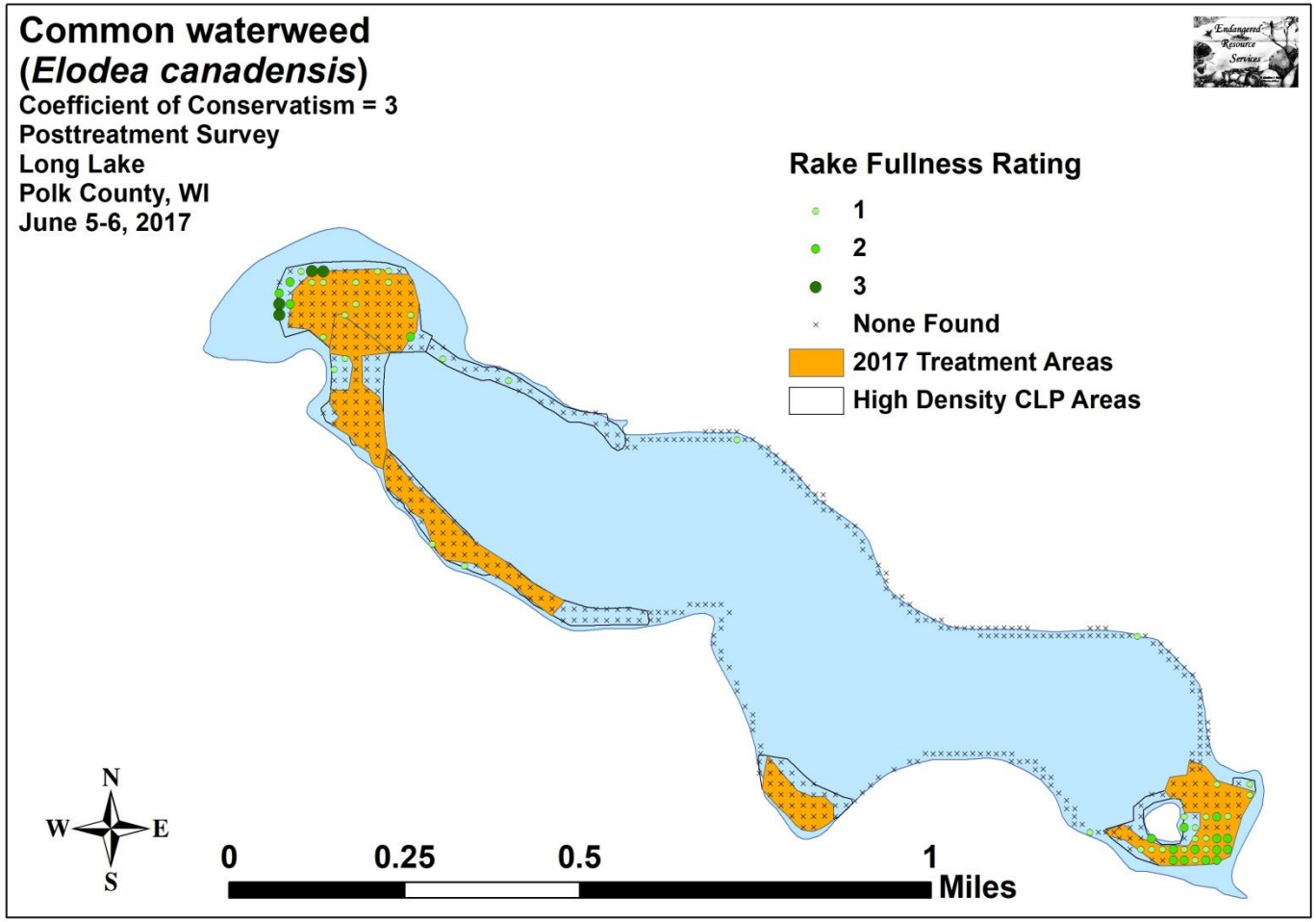

White water lily
(*Nymphaea odorata*)
Coefficient of Conservatism = 6
Pretreatment Survey
Long Lake
Polk County, WI
April 29, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

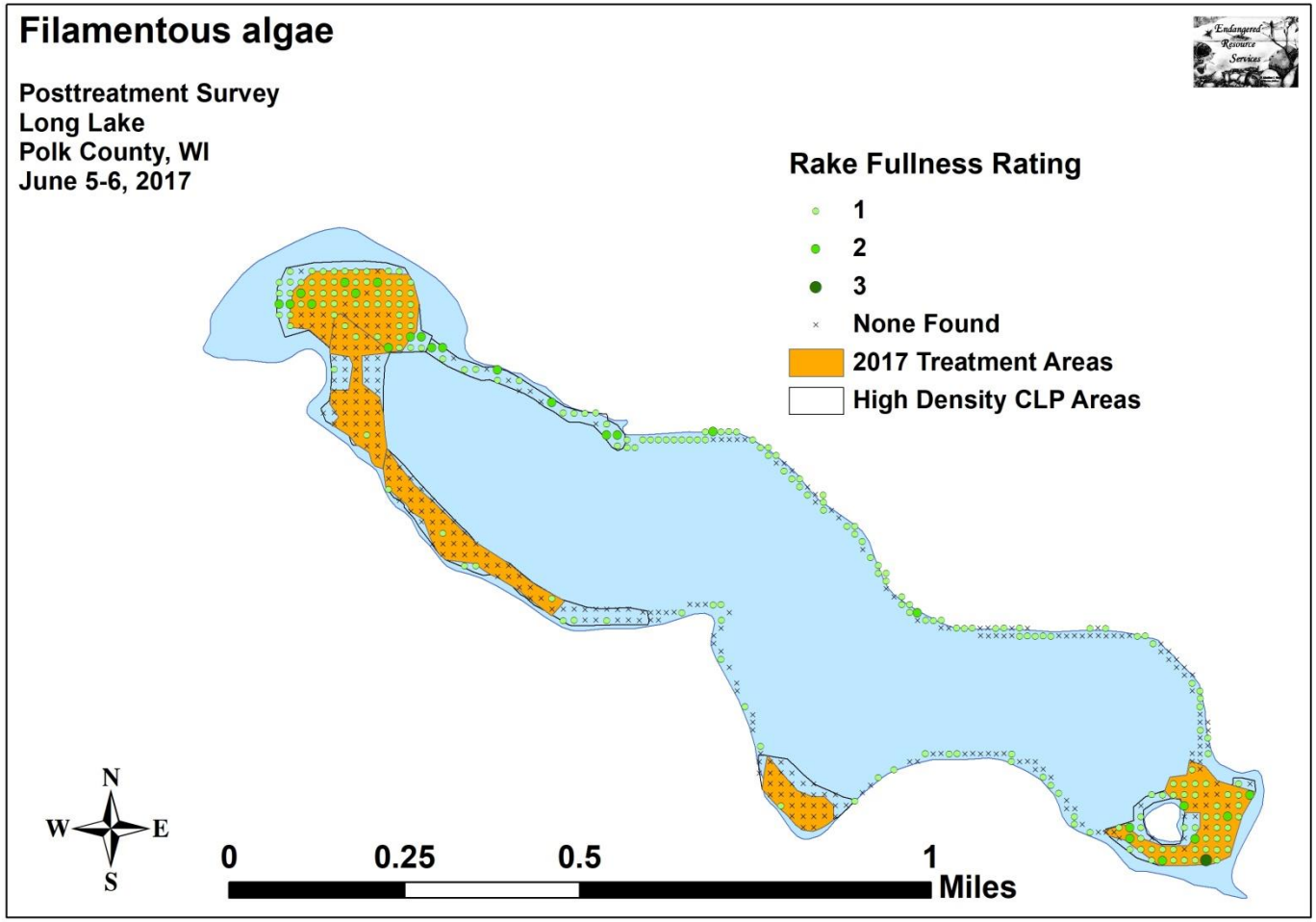
Appendix VII: Posttreatment Native Species Distribution

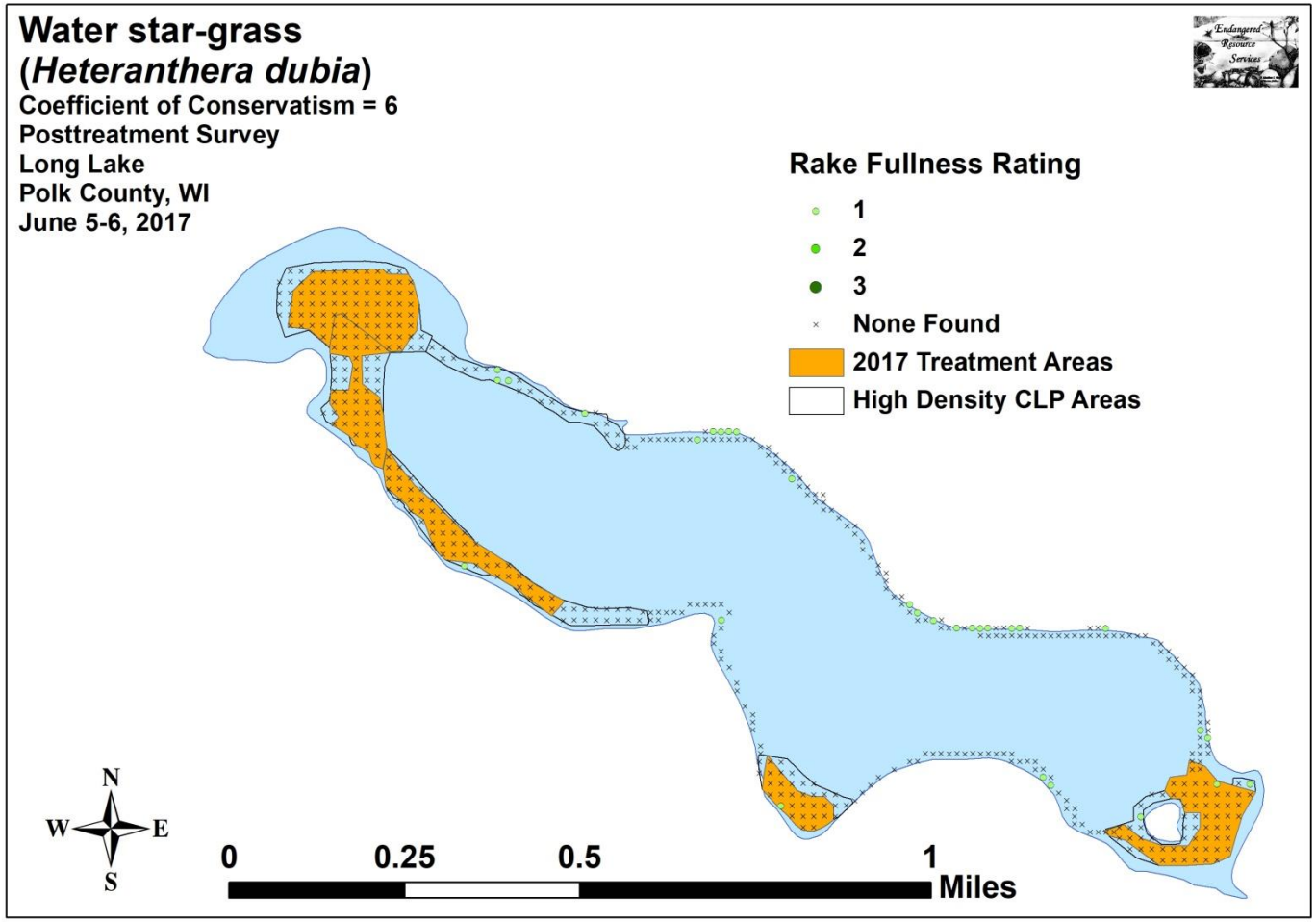

Coontail
(Ceratophyllum demersum)
Coefficient of Conservatism = 3
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

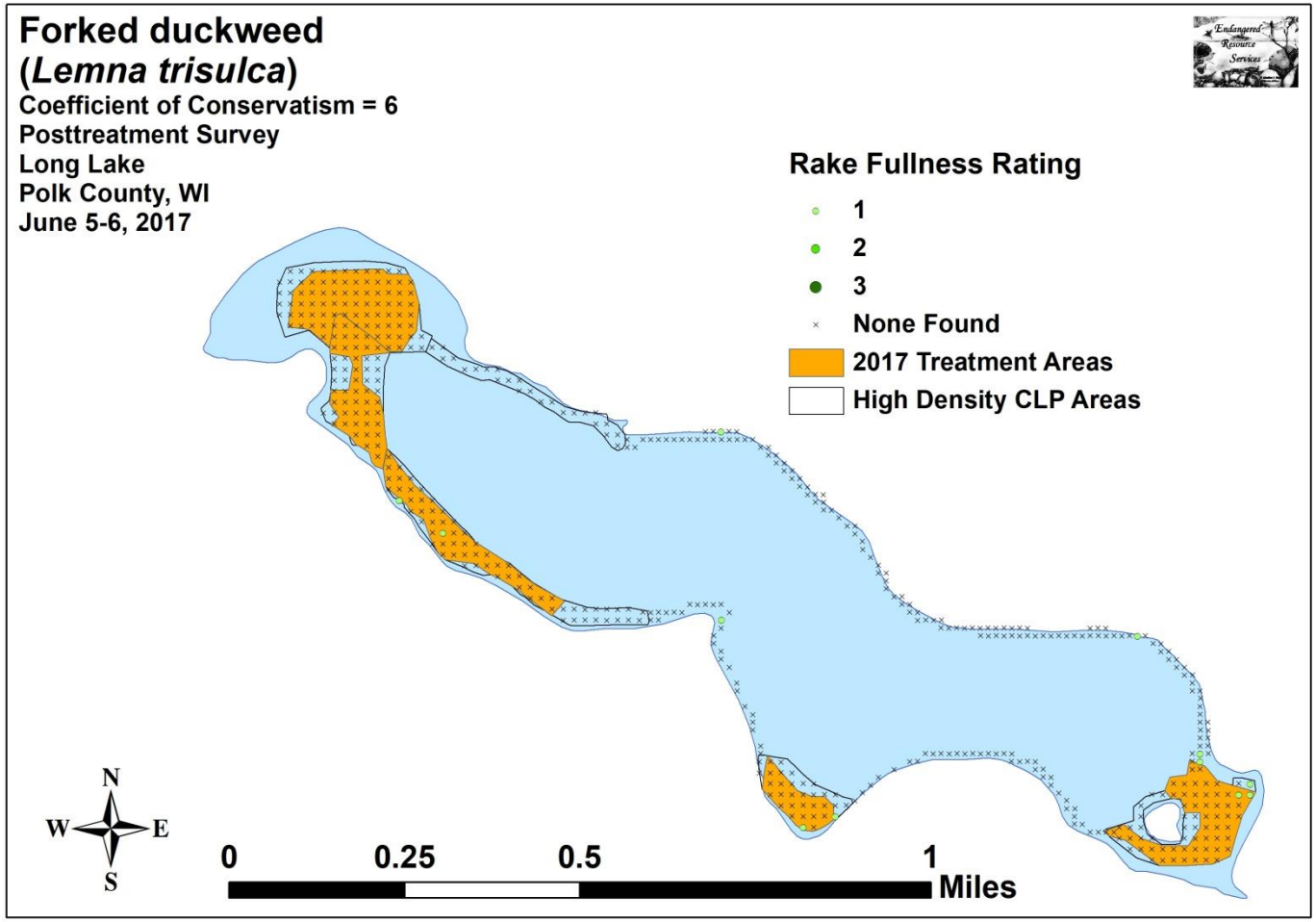

Muskgrass
(Chara sp.)
Coefficient of Conservatism = 7
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

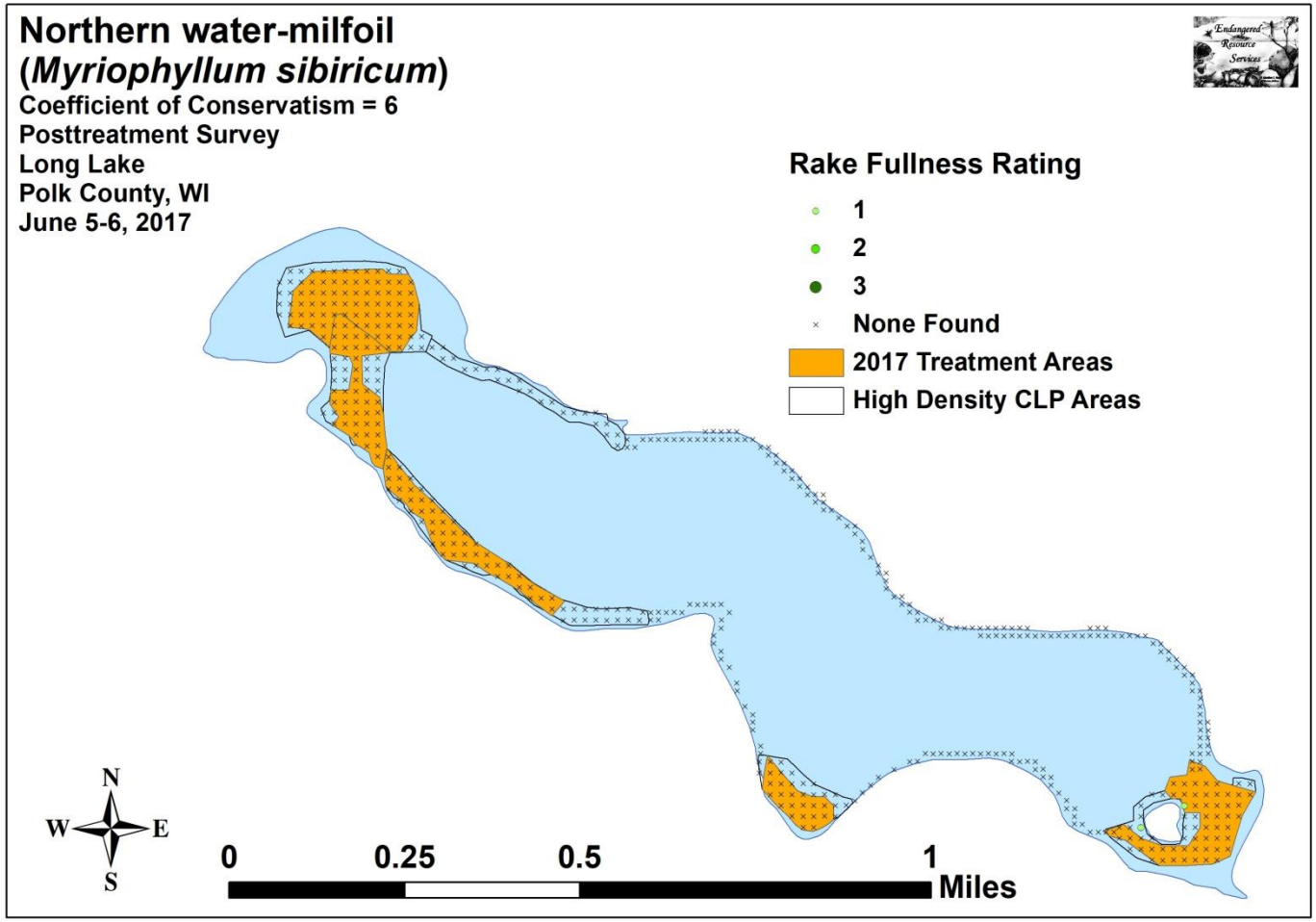

Needle spikerush
(Eleocharis acicularis)
Coefficient of Conservatism = 5
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

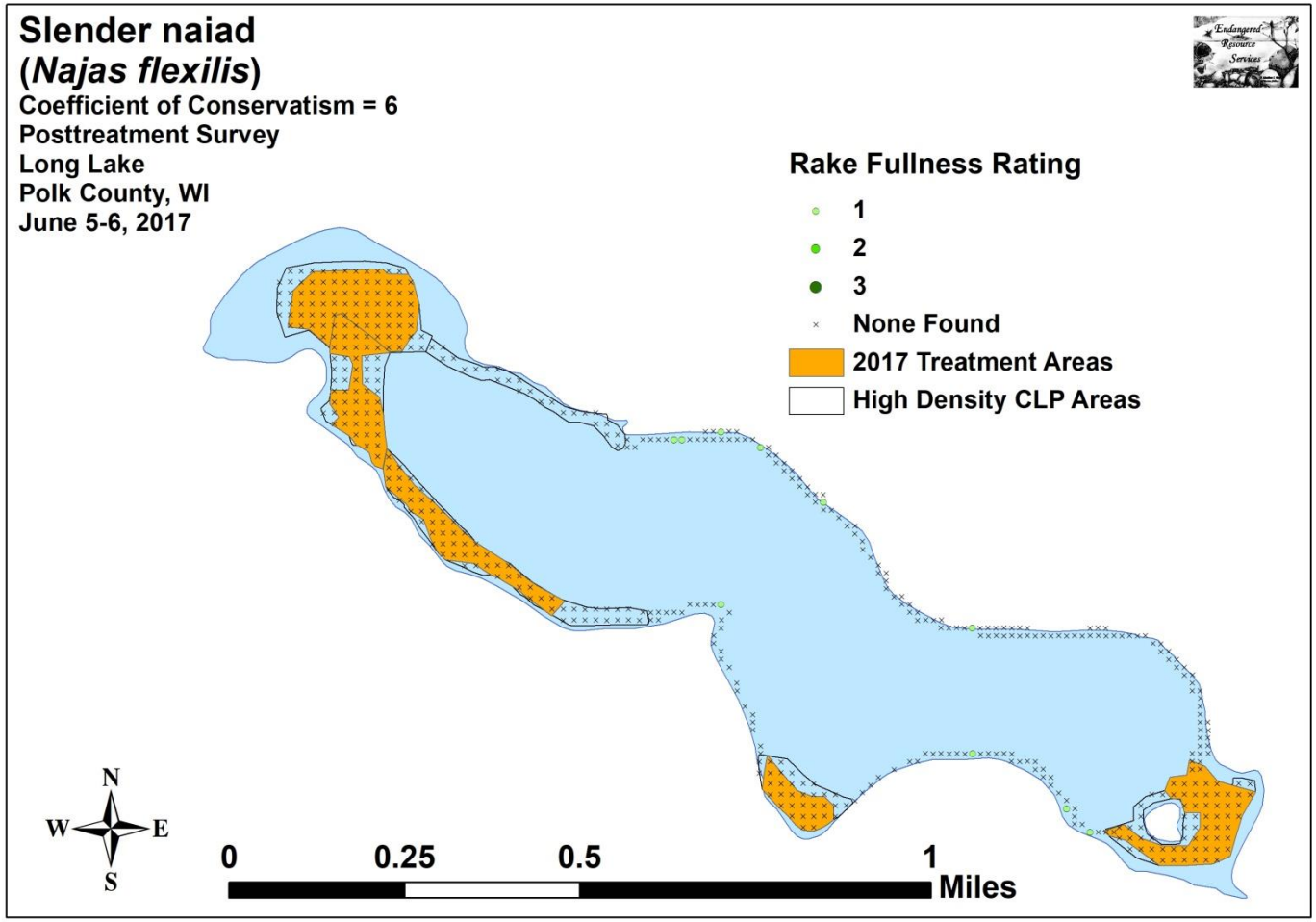

Common waterweed
(Elodea canadensis)
Coefficient of Conservatism = 3
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

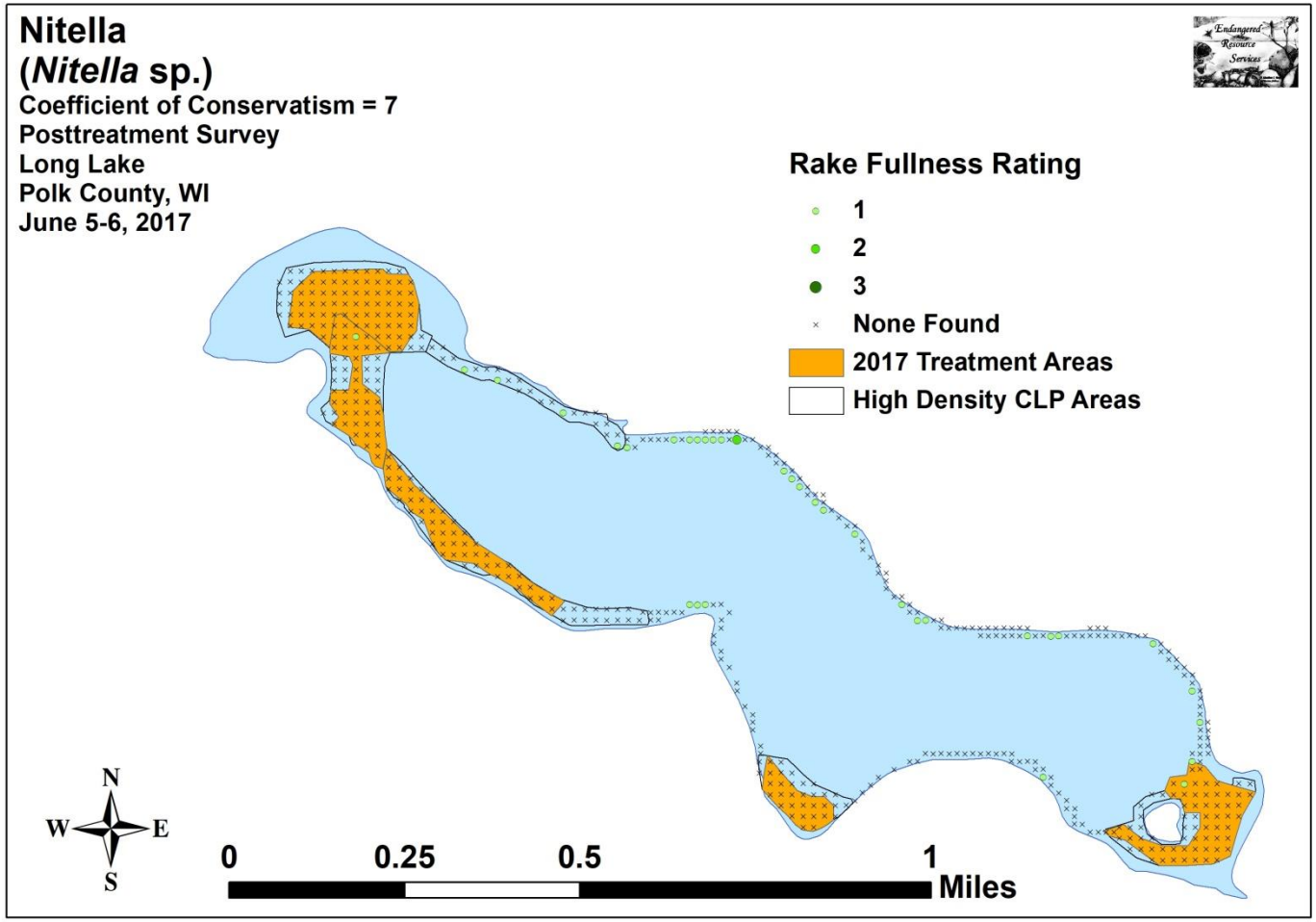

Filamentous algae
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles

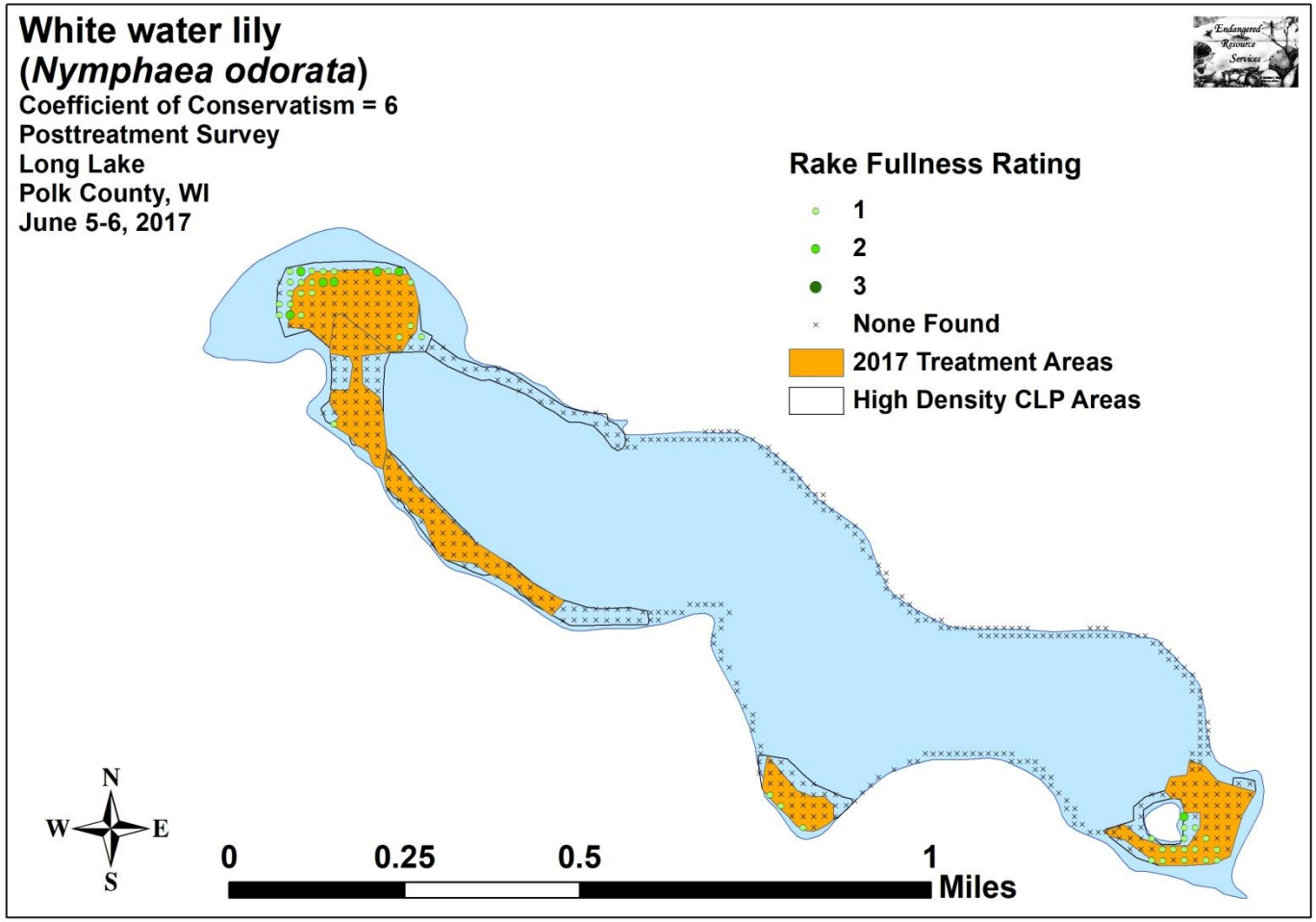

Water star-grass
(Heteranthera dubia)
Coefficient of Conservatism = 6
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles


Forked duckweed
(Lemna trisulca)
Coefficient of Conservatism = 6
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles


Northern water-milfoil
(Myriophyllum sibiricum)
Coefficient of Conservatism = 6
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles


Slender naiad
(Najas flexilis)
Coefficient of Conservatism = 6
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles


Nitella
(*Nitella* sp.)
Coefficient of Conservatism = 7
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
Endangered Resource Services
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles


White water lily
(Nymphaea odorata)
Coefficient of Conservatism = 6
Posttreatment Survey
Long Lake
Polk County, WI
June 5-6, 2017
Rake Fullness Rating
1
2
3
None Found
2017 Treatment Areas
High Density CLP Areas
N
W
E
S
0
0.25
0.5
1
Miles